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United States Nuclear Regulatory Commission
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NUREG-1910
Supplement 5

Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming

Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities

Final Report

Office of Federal and State Materials and
Environmental Management Programs

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

April 23, 2014

Report Number:	**NUREG-1910, Supplement 5**
Report Title:	Final Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities
Prepared by:	Office of Federal and State Materials and Environmental Management Programs U.S. Nuclear Regulatory Commission Washington, D.C. 20555-0001
Date Published:	February 2014
Instructions:	Please append the enclosed table of corrections to the text of NUREG-1910, Supplement 5.

On March 11, 2014, the U.S. Nuclear Regulatory Commission's (NRC) notice of availability of NUREG-1910, Supplement 5, *Final Environmental Impact Statement for the Ross ISR Project in Crook County, Wyoming, Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (FSEIS) was published in the Federal Register (79 FR 13683). Following publication of NUREG-1910, Supplement 5, the NRC staff was informed of and identified certain errors in the FSEIS.

In a motion filed on March 31, 2014, the Joint Intervenors for the hearing on the licensing action that is the subject of the FSEIS identified an error in Section 4.5.1.3 of the FSEIS related to the ground-water restoration concentrations of Wellfield 1 at the Crow Butte facility near Crawford, Nebraska. Section 4.5.1.3 of the FSEIS includes a discussion of historic approvals of aquifer restoration activities by the NRC. The FSEIS describes three facilities that received NRC's approval for aquifer restoration activities and the ground-water-quality parameters in those wellfields for which the NRC approved restoration. In the FSEIS's description of one of those facilities, Crow Butte Wellfield 1, the NRC states that "[t]he NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre- operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001)." Based upon the information in the source document, the relevant portion of that statement should instead describe the concentration for uranium as 18 *times* the post-licensing, pre-operational uranium concentration. The use in error of the term "18 percent" in the FSEIS was a drafting mistake that does not affect the NRC staff's analysis of the potential impacts of the proposed action on restored ground-water quality of the ore-zone and surrounding aquifers, or the staff's conclusion that such potential impacts would be SMALL.

In reviewing the statements in the FSEIS regarding restoration of Crow Butte Wellfield 1, the NRC staff identified additional errors regarding the number of parameters sampled. These errors in the description of ground-water quality in Crow Butte Resource's Wellfield 1 at the time of restoration approval do not affect the FSEIS's characterization of NRC-approved historic restoration values or its conclusion that the potential impacts of aquifer restoration to ground-water quality of the ore-zone and surrounding aquifers would be SMALL. It remains the case that most of the ground-water-quality parameters in wellfields for which the NRC has approved restoration, as described in the FSEIS, were either returned to post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few parameters that exceeded these standards, the concentrations in the ground water did not change the class of use and did not represent a potential impact to the ground water outside the aquifer-exemption boundary.

Additionally, by letter dated April 4, 2014, the U.S. Environmental Protection Agency (EPA) requested that the NRC clarify information provided in Table 1.2 of the FSEIS regarding the role of the EPA for the Underground Injection Control Program.

To address these matters, the NRC staff has prepared this errata to the FSEIS.

ERRATA

FSEIS SECTION	Page	Correction
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-10	Table 1.2 - Environmental Approvals for the Proposed Ross Project, Row 3 (Issuing Agency - U.S. Environmental Protection Agency), Column 2 (Description): • Insert "for Class III injection wells" after "(USDW)"
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-11	Table 1.2 - Environmental Approvals for the Proposed Ross Project (*Continued*), Row 5 (Issuing Agency - U.S. Environmental Protection Agency), Column 2 (Description): • Change "Aquifer Exemption Permit for Class I Injection Wells" to "Aquifer exemption approval required for Class I injection wells if receiving aquifer is a USDW" • Delete entire cell with "Aquifer Reclassification for Class III Injection Wells (WDEQ, Title 35-11)"
1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies	1-11	Table 1.2 - Environmental Approvals for the Proposed Ross Project (*Continued*), Row 5 (Issuing Agency - U.S. Environmental Protection Agency), Column 3 (Status): • Insert a cell next to "Aquifer Exemption Permit for Class I Injection Wells (40 CFR Parts 144 & 146)" with the following text: "Pending water quality data acquisition during well installations and EPA review"
4.5.1.3 Ross Project Aquifer Restoration	4-46	Second full paragraph, replace first and second sentence with the following: "Crow Butte's NRC license initially required the analysis of 35 ground-water constituents to determine pre-operational ground-water quality (Crow Butte Resources, 2000). The NRC amended Crow Butte's license in 2001 to modify the constituent list in License Condition 10.3B to duplicate the constituents contained in the Restoration Table in Crow Butte's Class III UIC permit issued by the Nebraska Department of Environmental Quality. Because of this amendment, several constituents that were originally discussed in Crow Butte's first restoration report were no longer considered restoration parameters by the NRC. The 27 constituents listed in Tables 2 and 3 in Crow

		Butte Resources (2001) are those in the modified parameter list contained in that license amendment (NRC, 2001). The average concentrations of 34 constituents (the initially required 35 constituents minus temperature) at the end of restoration compared to baseline concentrations are reported by the NRC in Table 5 of NUREG/CR-6870, which discusses the geochemical issues in ground -water restoration at ISR facilities (NRC, 2007). Of the 34 constituents, 23 were returned to post-licensing, pre-operational concentrations. The average concentrations of two constituents, arsenic and iron, were returned to levels lower than Wyoming's Class I Domestic Use standards, which, for these two constituents, are identical to the EPA's Drinking Water MCLs and Standards in the UIC Permit from the Nebraska Department of Environmental Quality held by Crow Butte (Crow Butte Resources, 2001). The average concentration of one constituent, vanadium, was returned to the Wyoming Class II standard for agricultural use, which is lower than the UIC Permit Standard. Concentrations of six constituents – alkalinity, bicarbonate, calcium, potassium, magnesium, and molybdenum – for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 65 percent."
4.5.1.3 Ross Project Aquifer Restoration	4-46	Second full paragraph, line 7, replace "18 percent" with "18 times"
4.5.1.3 Ross Project Aquifer Restoration	4-46	Last paragraph, line 7, delete "average"
4.15 References	4-122	Insert the following new reference (NRC, 2001) before the second-to-last reference entry on this page (NRC, 2003a): (US)NRC. "License Amendment 11/Crow Butte Resources In Situ Leach Facility/License No. SUA-1534." Washington, DC: USNRC. 2001. ADAMS Accession No. ML011830343.
4.15 References	4-123	Insert the following new reference (NRC, 2007) after the fourth reference entry on this page (NRC, 2006): (US)NRC. "Consideration of Geochemical Issues in Groundwater Restoration at Uranium In-Situ Leach Mining Facilities." NUREG/CR-6870. Washington, DC: USNRC. 2007. ADAMS Accession No. ML070600405.

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August 14, 2014
Errata No. 2

Report Number:	**NUREG-1910, Supplement 5**
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SECOND ERRATA

FSEIS SECTION	Page	Correction
3.5.3.3 Ground-Water Quality	3-38	Third full paragraph, lines 9 and 11, replace "Figure 3.14" with "Figure 3.15."
3.5.3.3 Ground-Water Quality	3-43	Figure 3.16, "Locations of 29 Water-Supply Wells within a 3-Kilometer [2-Mile] Radius of Ross Project Area," is the incorrect graphic. The graphic should be Environmental Report (ER) Figure 3.4-33, "Sampled Water Supply Wells," which can be found on ER Page 3-231 (ADAMS Accession No. ML110130342).
4.5.1.2 Ross Project Operation	4-37	Last paragraph, line 5, replace "GEIS Section 2.11.3" with "GEIS Section 2.11.4."
B.5.9.5 Monitoring	B-44	NRC response to "Comments: RP032-071; RP032-077; RP035-035," last line of the response, replace "*Figure 3.15*" with "*Figure 3.16.*"
B.5.15.1 Concerns about ISR and Ground-Water Contamination	B-82	NRC response to "Comment: RP035-034," line 6 of the response, replace "*Other maps indicating the locations*" with "*The locations.*"

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Final Report

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Office of Federal and State Materials and
Environmental Management Programs

ABSTRACT

The United States (U.S.) Nuclear Regulatory Commission (NRC) issues licenses for the possession and use of source and byproduct materials provided that facilities meet NRC regulatory requirements and will be operated in a manner that is protective of public health and safety and the environment. Under the NRC environmental-protection regulations in Title 10 *Code of Federal Regulations* (CFR) Part 51, which implement the *National Environmental Policy Act of 1969* (NEPA), issuance of a license to possess and use source and byproduct materials during uranium recovery and milling requires an environmental impact statement (EIS) or a supplement to an EIS (SEIS).

In May 2009, the NRC issued NUREG–1910, *Generic Environmental Impact Statement* (GEIS) *for In-Situ Leach Uranium Milling Facilities*. In the GEIS, the NRC assessed the potential environmental impacts from the construction, operation, aquifer restoration, and decommissioning of in situ recovery (ISR) facilities located in four specific geographic regions of the western U.S. As part of this assessment, the NRC determined which potential impacts would be essentially the same for all ISR facilities and which would result in varying levels of impacts for different facilities and would therefore require further site-specific information to determine potential impacts. The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities as well as for applications to amend or to renew existing ISR licenses.

By a letter dated January 4, 2011, Strata Energy Inc. (referred to herein as Strata or the "Applicant") submitted a license application to the NRC for a new Source and Byproduct Materials License for the proposed Ross Project. The Ross Project would be located in Crook County, Wyoming, which is in the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the GEIS. The NRC staff prepared this SEIS to evaluate the potential environmental impacts of the Applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an ISR facility at the Ross Project. This SEIS describes the environment that could be affected by the proposed Ross Project activities, estimates the potential environmental impacts resulting from the Proposed Action and two Alternatives, discusses the corresponding proposed mitigation measures, and describes the Applicant's environmental-monitoring program. In conducting its analysis for this SEIS, the NRC staff evaluated site-specific data and information to determine whether the site characteristics and the Applicant's proposed activities were consistent with those evaluated in the GEIS. The NRC staff then determined relevant sections, findings, and conclusions in the GEIS that could be incorporated by reference, and identified the areas that needed additional analysis. Based upon its environmental review, the final NRC staff recommendation is that, unless emerging safety issues mandate otherwise, a Source and Byproduct Materials License be issued to the Applicant as requested.

Paperwork Reduction Act Statement

This NUREG contains and references information collection requirements that are subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). These information collections were approved by the Office of Management and Budget (OMB), approval numbers 3150-0014, 3150-0020, 3150-0021, and 3150-0008.

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References

10 CFR Part 51. Title 10, *Energy*, *Code of Federal Regulations*, Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Washington, DC: U.S. Government Printing Office.

NRC. “Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities” NUREG–1910. Washington, DC: USNRC. May 2009. Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML091480244 and ML091480188.

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EXECUTIVE SUMMARY

BACKGROUND

By a letter dated January 4, 2011, Strata Energy Inc. (Strata) (also referred herein as the "Applicant") submitted an application to the United States (U.S.) Nuclear Regulatory Commission (NRC) for a new source and byproduct materials license for the proposed Ross Project, an in situ uranium-recovery (ISR) project to be located in Crook County, Wyoming. The proposed Ross Project includes a Central Processing Plant (CPP), injection and recovery wells, deep-disposal wells for liquid effluents, monitoring wells throughout the Ross Project area, as well as other various infrastructure (e.g., pipelines, roads, and lighting).

The *Atomic Energy Act of 1954* (AEA), as amended by the *Uranium Mill Tailings Radiation Control Act of 1978* (UMTRCA), authorizes the NRC to issue licenses for the possession and use of source material and byproduct materials. The NRC must license facilities, including ISR operations, in accordance with NRC regulatory requirements. These requirements were developed to protect public health and safety from radiological hazards and to protect common defense and security. The NRC's environmental-protection regulations are found at Title 10 of the *Code of Federal Regulations* (CFR), Part 51 (10 CFR Part 51); these regulations implement the *National Environmental Policy Act of 1969* (NEPA). 10 CFR Part 51 requires that the NRC prepare an environmental impact statement (EIS) or a generic EIS (GEIS), or a supplement to a GEIS (SEIS) for its issuance of a license to possess and use source and/or byproduct materials for uranium milling (see 10 CFR Part 51.20[b][8]).

In May 2009, the NRC issued NUREG–1910, *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities*. In this GEIS, the NRC assessed the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of ISR facilities located in four specified geographic regions of the western U.S. The proposed Ross Project is located within the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) identified in the GEIS. The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities. This Final *Supplemental Environmental Impact Statement* (SEIS) incorporates by reference information from the GEIS. This document also uses information from the Applicant's license application and subsequent environmental report and its responses to the NRC's requests for additional information as well as other publicly available sources of information.

This Final SEIS includes the NRC staff's analysis of the environmental impacts from the Proposed Action (i.e., for the NRC to license the Ross Project), the environmental impacts of two Alternatives to the Proposed Action (i.e., the "No-Action" Alternative and the "North Ross Project" Alternative), and the mitigation measures that are intended to either minimize or avoid adverse impacts. It also includes the NRC staff's final recommendation regarding the Proposed Action.

PURPOSE AND NEED OF THE PROPOSED ACTION

The NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The Applicant is seeking an NRC source and byproduct materials license to authorize commercial-scale in situ uranium recovery at the Ross Project area. The purpose of and need for this Proposed Action is to provide an option that allows the Applicant to recover uranium and to produce yellowcake at the Ross Project. Yellowcake is the uranium-oxide product of the uranium-recovery and uranium-milling processes that are the initial steps of the commercial nuclear fuel cycle. Yellowcake would be sent from the Ross Project area to a gaseous-conversion plant, which would produce uranium hexafluoride (UF_6) gas as the next step in the nuclear fuel cycle.

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the AEA, as amended, or findings in the associated environmental analysis conducted under 10 CFR Part 51 that would lead NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

THE PROJECT AREA AND FACILITY

Strata's Proposed Action, the Ross Project, would occupy 696 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District, where the Applicant is actively exploring for additional uranium reserves. Strata has identified four uranium-bearing areas that would extend the area of uranium recovery in the Lance District: to the north (the Ross Amendment Area 1) and to the south (the Kendrick, Richards, and Barber areas). These areas are not components of the Proposed Action in this Final SEIS.

The Lance District is located on the western edge in the northwest corner of the NSDWUMR. It is situated between the Black Hills uplift to the east and the Powder River Basin to the west. Both of these regional features are described in the GEIS. The environment of the Proposed Action is described in Section 3 of this SEIS.

The Proposed Action includes the ISR facility itself and its wellfields. The ISR facility consists of the following:

- A CPP that houses the uranium- and vanadium-processing equipment, drying and packaging equipment, and water-treatment equipment;
- A chemical storage area as well as other storage, warehouse, maintenance, and administration buildings; and
- Two double-lined surface impoundments, a sediment impoundment, and up to five Class I deep-injection wells.

The Proposed Action includes the option of the Applicant operating the Ross Project facility beyond the life of the Project's wellfields. The facility could be used to process uranium-loaded resin from satellite areas within the Lance District operated by the Applicant, or from other offsite uranium-recovery projects not operated by the Applicant (i.e., "toll milling"), or from offsite water-treatment operations. With that option, the life of the facility would be extended to 14 years or more.

The Ross Project would also host 15 – 25 wellfields and would consist of a total of 1,400 – 2,200 injection and recovery wells. The wellfields would be surrounded by a perimeter ring of monitoring wells.

THE IN SITU URANIUM RECOVERY PROCESS

During the in situ uranium-recovery process, an oxidant-charged solution, called a lixiviant, is injected into an ore-zone aquifer (or uranium "ore body") through injection wells. For lixiviant injection to take place, the ore zone must lie within that portion of the aquifer that has been permanently exempted by the U.S. Environmental Protection Agency (EPA) as an underground source of drinking water per the *Safe Drinking Water Act*. Typically, a lixiviant uses native ground water (from the ore-zone aquifer itself), carbon dioxide, and sodium carbonate/bicarbonate, with an oxygen or hydrogen peroxide oxidant. As this solution circulates though the ore zone, the lixiviant oxidizes and dissolves the mineralized uranium, which is present in a reduced chemical state. The resulting uranium-rich solution, the "pregnant" lixiviant, is drawn to recovery wells by a pump, and then transferred to the CPP via a network of pipes buried below the frost line to prevent freezing. At the CPP, the uranium is extracted from the solution using an ion-exchange (IX) process. The resulting "barren" solution (i.e., uranium-depleted) is then recharged with complexing and oxidizing agents before being re-injected to recover additional uranium from the particular wellfield.

During production, the uranium-recovery solutions continually move through the aquifer from outlying injection wells to internal recovery wells. These wells can be arranged in a variety of geometric patterns depending upon the ore-body's configuration, the aquifer's permeability, and the operator's selection based upon operational considerations. Wellfields are often designed in a five-spot or seven-spot pattern, with each recovery (i.e., production) well located inside a ring of injection wells. Monitoring wells tapping into the ore-zone aquifer would surround the wellfield. In addition, monitoring wells would tap in both the overlying and underlying aquifers. These monitoring wells would be screened in appropriate stratigraphic horizons to detect lixiviant, should it migrate out of the ore zone (i.e., production zone). Uranium that is recovered would be conveyed and processed in the CPP into dry yellowcake. The yellowcake would be packaged into NRC- and U.S. Department of Transportation (USDOT)-approved 208-L [55-gal] steel drums and trucked offsite to a licensed uranium-conversion facility.

Once uranium recovery is completed and aquifer restoration has been performed, the Applicant would seek ground-water-restoration approval from the NRC. NRC approval would be given when the ground-water quality at the point of compliance within the exempted aquifer does not exceed the ground-water protection standards as required by 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards require that the concentration of a given hazardous constituent must not exceed: 1) the Commission-approved concentration of that constituent in the ground water; 2) the respective value given in the table included in Paragraph 5C of Appendix A, if the constituent is listed in the table and if the level of the constituent is below the value listed; or 3) an Alternate Concentration Limit (ACL) established by the Commission for the constituent. The point of compliance is defined in 10 CFR Part 40, Appendix A, as the site specific location in the uppermost aquifer where the ground-water protection standard must be met. Historically, the NRC staff has assigned the point of compliance as defined in Appendix A as the boundary of the EPA-defined exempted aquifer. Per 10 CFR Part 40, Appendix A, Criterion 5B(6), ACLs that are established by the NRC must be as low as reasonably achievable (ALARA) and not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded. Following NRC approval of the ground-water restoration, the facility and wellfields would be decontaminated and decommissioned in accordance with NRC-approved rules as well as in accordance with an NRC-approved decommissioning plan and/or restoration action plan. Once all of the Applicant's decommissioning efforts have been completed, the NRC would affirm the decommissioning, and the site could then be released for unrestricted public use.

THE ALTERNATIVES

The NRC environmental review regulations in 10 CFR Part 51, which implement NEPA, require the NRC to consider reasonable alternatives, including the no-action alternative, to a Proposed Action. The NRC staff considered a range of alternatives to the Ross Project that would fulfill the underlying purpose and need for the Proposed Action as described in this SEIS. From this analysis, a set of reasonable alternatives was developed, and the impacts of the Proposed Action were compared to the impacts that would result if a given alternative were implemented. This SEIS evaluates the potential environmental impacts of the Proposed Action (Alternative 1) and two Alternatives, including the No-Action Alternative (Alternative 2) and the North Ross Project (Alternative 3). Under the No-Action Alternative, the Applicant would neither construct nor operate a uranium recovery facility or wellfields at the proposed Ross Project. In Alternative 3, the proposed Ross Project facility (i.e., the CPP, surface impoundments, and auxiliary structures) would be constructed at a site north of where it is proposed to be located in the Proposed Action, but the wellfields would remain in the same locations as in the Proposed Action. This alternative facility location would require additional, substantial earth-moving to construct the surface impoundments, but a containment barrier wall (CBW) (described later in this SEIS) would not be required. Alternatives considered and eliminated from detailed analysis include conventional mining and milling, conventional mining and heap leach processing, and alternate lixiviants. These alternatives were eliminated from detailed study because they either do not meet the purpose and need of the proposed Ross Project or would cause greater environmental impacts than the Proposed Action.

SUMMARY OF THE ENVIRONMENTAL IMPACTS

This Final SEIS includes the NRC staff's analysis, which considers and weighs the environmental impacts resulting from the construction, operation, aquifer restoration, and decommissioning of an in situ uranium recovery facility at the proposed Ross Project area and the two Alternatives. This SEIS also describes mitigation measures for the reduction or avoidance of potential adverse impacts that either: 1) the Applicant has committed to in its NRC license application, 2) would be required under other State or Federal permits or processes, or 3) are additional measures that the NRC staff identified as having the potential to reduce environmental impacts, but the Applicant did not commit to in its license application. The SEIS uses the assessments and conclusions reached in the GEIS in combination with site-specific information to assess and categorize impacts.

As discussed in the GEIS and consistent with NUREG–1748 (NRC, 2003b), the significance of potential environmental impacts is categorized as follows:

SMALL: The environmental impacts are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental impacts are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

Table ExS.1 provides a summary of the NRC's evaluation of the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of the Ross Project, followed by a brief summary of impacts by environmental resource area and lifecycle phase. These potential impacts are more fully described in Section 4 of this Final SEIS, where the magnitude of impacts by phase of the Ross Project is provided for each resource area.

Table ExS.1
Summary of Environmental Impacts

Resource Area	Alternative 1: Proposed Action				Alternative 2:	Alternative 3: North
	Construction	Operation	Aquifer Restoration	Decommissioning	No-Action	Ross Project
Land Use	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Transportation	SMALL to MODERATE to LARGE With Mitigation: SMALL to MODERATE	SMALL to MODERATE to LARGE With Mitigation: SMALL to MODERATE	SMALL to MODERATE	SMALL to MODERATE to LARGE With Mitigation: SMALL to MODERATE	SMALL	SMALL to MODERATE to LARGE With Mitigation: SMALL to MODERATE
Geology and Soils						
▪ Geology	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
▪ Soils	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Water Resources						
▪ Surface Water						
Water Quantity	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
▪ Wetlands	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
▪ Ground Water	SMALL	SMALL to MODERATE See OZ Aquifer Below	SMALL to MODERATE See OZ Aquifer Below	SMALL	SMALL	SMALL to MODERATE See OZ Aquifer Below
Shallow Aquifers						
Water Quantity	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

Table ExS.1
Summary of Environmental Impacts (*Cont.*)

Resource Area	Alternative 1: Proposed Action Construction	Alternative 1: Proposed Action Operation	Alternative 1: Proposed Action Aquifer Restoration	Alternative 1: Proposed Action Decommissioning	Alternative 2: No-Action	Alternative 3: North Ross Project
▪ **Ground Water** (Continued)						
Ore-Zone Aquifers						
Water Quantity	SMALL	SMALL	SMALL (Long Term) SMALL to MODERATE (Short-Term Drawdown)	SMALL	SMALL	SMALL (Long Term) SMALL to MODERATE (Short-Term Drawdown)
Water Quality	SMALL	SMALL (Long-Term) SMALL to MODERATE (Short-Term Excursion)	SMALL	SMALL	SMALL	SMALL (Long-Term) SMALL to MODERATE (Short-Term Excursion)
Deep Aquifers						
Water Quantity	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Ecology					SMALL	SMALL
▪ Vegetation	SMALL	SMALL	SMALL	SMALL		
▪ Wildlife	SMALL	SMALL	SMALL	SMALL		
▪ Aquatic	SMALL	SMALL	SMALL	SMALL		
▪ Protected Species	SMALL	SMALL	SMALL	SMALL		
Air Quality	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
Noise	SMALL to MODERATE (Nearest Neighbors/ Short Term)	SMALL to MODERATE (Nearest Neighbors/ Short Term)	SMALL	SMALL to MODERATE (Nearest Neighbors/ Short Term)	SMALL	SMALL to MODERATE (Nearest Neighbors/ Short Term)

Table ExS.1
Summary of Environmental Impacts (*Cont.*)

Resource Area	Alternative 1: Proposed Action Construction	Alternative 1: Proposed Action Operation	Alternative 1: Proposed Action Aquifer Restoration	Alternative 1: Proposed Action Decommissioning	Alternative 2: No-Action	Alternative 3: North Ross Project
Historical, Cultural, and Paleontological Resources	SMALL to LARGE (Construction only)	SMALL	SMALL	SMALL	SMALL	SMALL to LARGE (Construction only)
Visual and Scenic Resources	SMALL (Long-Term) MODERATE (Short-Term/First Year) (Nearest Residents)	SMALL	SMALL	SMALL	SMALL	SMALL (Long-Term) MODERATE (Short-Term/First Year) (Nearest Residents)
Socioeconomics	SMALL (Employment, Demographics, Income, Housing, Education, Health and Social Services) to MODERATE (Taxes Paid to Crook County)	SMALL to MODERATE (Taxes Paid to Crook County)	SMALL	SMALL	SMALL	SMALL (Employment, Demographics, Income, Housing, Education, Health and Social Services) to MODERATE (Taxes Paid to Crook County) (Construction and Operation)
Environmental Justice	N/A No Minority or Low-Income Groups	N/A No Minority or Low-Income Groups	N/A No Minority or Low-Income Groups	N/A No Minority or Low-Income Groups	N/A No Minority or Low-Income Groups	N/A No Minority or Low-Income Groups
Public and Occupational Health and Safety	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

Table ExS.1
Summary of Environmental Impacts (*Cont.*)

Resource Area	Alternative 1: Proposed Action				Alternative 2: No-Action	Alternative 3: North Ross Project
	Construction	Operation	Aquifer Restoration	Decommissioning		
Waste Management						
▪ Liquid	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL
▪ Solid	SMALL	SMALL	SMALL	SMALL	SMALL	SMALL

THE IMPACTS BY RESOURCE AREA AND PROJECT PHASE

Land Use

Construction: Impacts would be SMALL. The Ross Project area comprises a total of 696 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District. This area is currently used for livestock grazing, wildlife habitat, some agriculture, and some oil production. A total of 114 ha [282 ac] of land, which represents 16 percent of the Ross Project area, would be disturbed during the construction of a CPP, surface impoundments, and other auxiliary structures such as storage areas and parking lots. The wellfields would be sequentially developed over the Ross Project lifecycle. Most disturbed areas would be fenced so that grazing by livestock, access by wildlife, and recreational opportunities would be limited.

Operation: Impacts would be SMALL. Land-use impacts during the operations phase would be similar to, or less than, those during the construction phase because the buildings, surface impoundments, and infrastructure would be in place. Areas where Ross Project uranium-production activities would take place would remain fenced, somewhat limiting grazing and some crop production. No new land disturbance would occur at or near the main facility (i.e., near the CPP and the surface impoundments), although well drilling and wellfield development would continue, as the wellfields are proposed to be sequentially brought online.

Aquifer Restoration: Impacts would be SMALL. Land-use impacts would be similar to, or less than, those during the construction and operation phases. Wellfield access would continue to be restricted from other uses such as livestock grazing and crop production, as described for the Ross Project's operation phase. No new facilities (e.g. no new structures or buildings) would be constructed that would result in additional land disturbance.

Decommissioning: Impacts would be SMALL. Land-disturbing activities would increase from operation to decommissioning, due to the dismantling and removal of Ross Project components such as the CPP, surface impoundments, and wellfields. In addition, the reclamation of the site would involve significant earth moving, land disturbance, and access restrictions. However, these impacts would occur in land that had previously been impacted during the construction and operation of the Ross Project, and no additional land uses would be impacted. At the end of the Ross Project's decommissioning and site reclamation phase, preconstruction land uses would be restored.

Transportation

Construction: Impacts would be MODERATE TO LARGE on local and county roads, but would be SMALL on the Interstate-highway system of the U.S. With the identified mitigation measures, the transportation impacts on local and county roads would lessen and they would be SMALL to MODERATE. The highest traffic volume resulting from the Ross Project would occur during its construction phase, because of the large workforce (200 workers) and frequent supply, building material, and equipment shipments. The increased traffic is expected to be 400 passenger cars and 24 trucks per day, which, when compared to 2010 volumes, represents a traffic increase of approximately 400 percent on the New Haven Road south of the Ross Project area. This significant increase in traffic could result in more traffic accidents as well as potentially significant wear and tear on the road surfaces.

Operation: Impacts would be MODERATE to LARGE on local and county roads, but SMALL on the Interstate-highway system; however, with mitigation, the transportation impacts during the Ross Project's operation on local and county roads would be SMALL to MODERATE. Impacts such as the local road's deterioration would be less than during construction, because of a smaller workforce (i.e., approximately 60 workers); however, the traffic volume associated with facility and wellfield operation would still be double that of 2010. The effective mitigation measures taken during the construction phase would continue through the operation phase.

***Aquifer Restoration*:** Impacts would be SMALL to MODERATE on local roads, and with the mitigation measures that would be implemented throughout the Ross Project's lifecycle, the transportation impacts of aquifer restoration would remain SMALL to MODERATE on local and county roads; however, the impacts to the Interstate highway system would be SMALL. Transportation impacts during this phase would be similar to those during the operation phase, although the workforce would be smaller (20 workers), but similar volumes of truck traffic would occur as during operation, especially if the CPP is used for recovery of uranium-loaded IX resin from four potential satellite areas as well as for toll milling.

***Decommissioning*:** Impacts would be MODERATE to LARGE on local and county roads and SMALL on the Interstate-highway system; thus, with the continuing mitigation measures of the other lifecycle phases as well as the declining workforce, the impacts would be SMALL on the Interstate-highway system and SMALL to MODERATE on local and county roads. The traffic volume during the decommissioning phase would be dominated by waste shipments for offsite disposal. Because of the reduced traffic volumes associated with this phase compared to the operations phase, there would be a reduced risk of transportation accidents. However, once the Ross Project has been fully decommissioned, all transportation impacts would be eliminated.

Geology and Soils

***Construction*:** Impacts to both geology and soils would be SMALL. Although the Ross Project's design for its CPP would include a CBW, the impacts of the wall's construction would be SMALL due to the relatively small and localized effects on the bedrock below it. The impacts on soils would occur largely during this phase of the proposed Ross Project, when most of the ground disturbance takes place. Potential soils impacts include soils loss (by wind and water erosion), soils compaction, increased salinity, soils-productivity loss, and soils contamination. Surface-disturbing activities would expose the soils and subsoils at the Ross Project area and would temporarily increase the potential for soil loss because of wind and water erosion. The Applicant, however, has proposed to remove vegetation only where necessary and would stockpile soils for reclamation during decommissioning. The Applicant has proposed to mitigate erosion by minimizing the required land disturbances, ensuring timely re-vegetation and reclamation of affected soils, and installing drainage controls. Finally, the Applicant has proposed to mitigate wind erosion by limiting traffic speeds, spraying unpaved roads and other disturbed areas, and implementing timely disturbed-area reclamation.

***Operation*:** Impacts to local geology and soils would be SMALL. The removal of uranium from the target sandstone (aquifer) during ISR operation would change the mineralogical composition of uranium-bearing rock formations. However, no significant matrix compression or ground subsidence would be expected during in situ uranium recovery. Because the proposed operation would result in small changes in the reservoir pressure, the operation would be unlikely to activate any geologic faults. The potential for spills during transfer of uranium-bearing lixiviant to and from the CPP would be mitigated by implementing onsite best management practices (BMPs), standard operating procedures, and compliance with its Source and Byproduct Materials License as well as its Wyoming Department of Environmental Quality (WDEQ)-permit requirements. The potential impacts from soil loss would be minimized by proper design and operation of surface-runoff features and implementation of BMPs.

***Aquifer Restoration*:** Impacts would be SMALL. During aquifer restoration, the process of ground-water sweep, ground-water transfer, ground-water treatment, and recirculation would not remove rock matrix or structure. The formation pressure would be managed during restoration to ensure that the direction of ground-water flow is into the wellfields to reduce the potential for lateral migration of constituents. The change in pressure would not be significant enough to result in matrix compression, ground subsidence, or to reactivate the fault. The spill-response and leak-detection activities would be the same as described during the operation phase.

***Decommissioning*:** Impacts would be SMALL. The potential impacts to the geology depend upon the density of plugged and abandoned drillholes and wells. At the end of decommissioning, the wellfields (whether recently operated or decommissioned some time ago) would contain approximately 3,000 drillholes and wells; these would include those drillholes from Strata's ore-zone delineation efforts and geotechnical investigations, ground-water monitoring wells used for site characterization, the injection and recovery wells from uranium-recovery activities, and Nubeth Joint Venture (Nubeth) drillholes and wells. Although the wells would not be evenly distributed across the Project area, the number of wells and drillholes would represent an average density of approximately 4.3 wells/ha [1.7 wells/ac], which would be a low density with SMALL geological impact. All areas of the Ross Project would be reclaimed, restored, and released for unrestricted use, so the Project's impacts on area soils would be SMALL as well.

Water Resources (Surface Water and Wetlands)

***Construction*:** Impacts would be SMALL to both surface water quantity and quality as well as to wetlands. The Applicant intends to use surface water from either the Oshoto Reservoir or the Little Missouri River for dust control and construction. This equates to an annual use that is significantly less than the currently permitted annual appropriation for Oshoto Reservoir. Thus, the potential impacts of the Proposed Action's construction to surface-water quantity would be SMALL. Suspended-sediment concentrations in storm water at the Ross Project area could be increased due to vegetation removal and soil disturbance during construction of the Proposed Action. However, given the site-specific mitigation measures to be implemented by the Applicant, the potential impacts of the Ross Project's construction to surface-water quality would be SMALL. The potential impacts of the proposed Ross Project's construction to wetlands would be mitigated by permit requirements and would be SMALL.

***Operation*:** Impacts would be SMALL. Surface water use during operation would be less than that used during construction and therefore impacts to water quantity would be SMALL. Release of process solutions from uranium-recovery wellheads, pipelines, module buildings, or process vessels; accidental discharge from surface impoundments; or release of yellowcake or IX resin during a transportation accident could result in surface-water contamination if the release(s) reached a surface-water body. Given mitigation measures that the Applicant would employ, however, the potential impacts to surface-water quality during the operation of the Ross

Project would be SMALL. The potential impacts during operations to the wetlands on the Ross Project area would be the same as discussed for construction and they would be SMALL.

Aquifer Restoration: Impacts would be SMALL. Surface water use would be comparable to the use during the Proposed Action's construction and operation phases. Potential risk of surface-water contamination associated with releases of process solutions and/or waste liquids as well as spills of other materials during aquifer restoration would be comparable to the operation phase of the Ross Project, but the uranium concentrations in such solutions would decline. Thus, the potential impacts of aquifer restoration to surface-water quality would be SMALL. The potential impacts during aquifer restoration to the wetlands on the Ross Project area would be the same as discussed under the Ross Project's construction and they would be SMALL.

Decommissioning: Impacts would be SMALL. Surface water use during decommissioning would be less than that used during construction and therefore impacts to water quantity would be SMALL.. Potential surface-water contamination could occur from spilled or leaked fuel or lubricants from construction equipment and passenger vehicles that would be operated during decommissioning activities, although the equipment would generally be located away from surface-water bodies. The potential impacts from the Ross Project's decommissioning to surface-water quality would be SMALL. As during all of the earlier phases, the potential impacts to wetlands from the Ross Project's decommissioning would be SMALL.

Water Resources (Ground Water)

Construction: Impacts would be SMALL. Any changes in ground-water levels of the shallow aquifer due to water usage from Oshoto Reservoir would be small and restricted to the area around the Reservoir. Effects on the shallow aquifer by the installation of the CBW would be localized. Thus, the potential impacts during construction of the Ross Project to ground-water quantity in the shallow aquifers would be SMALL. Also, the potential impacts of the Proposed Action's construction to ground-water quality in the shallow aquifers would be SMALL.

Based upon yields from regional and other wells, ground-water modeling indicates that the ore-zone and surrounding aquifers could support the projected withdrawal with little drawdown. Thus, the potential construction impacts on the ground-water quantity available from the confined aquifers (ore-zone, overlying, and underlying aquifers) would be SMALL. The potential for the shallow ground water to be impacted by drilling fluids and muds during construction of wells is minimal because of the small volume of fluids used, the nature of the material, and because the fluids would be contained within a mud pit in accordance with WDEQ/LQD and EPA requirements. Consequently, the potential impacts during construction on the ground-water quality in the confined aquifers would be SMALL. The potential impacts of construction on both the quantity and quality of ground water available from the deep aquifers would be SMALL.

Operation: The potential short-term impacts to water quantity would be SMALL. The potential impacts during operations to the shallow aquifers would be the same as discussed for construction and they would be SMALL. The lower ground-water levels in the ore-zone aquifer that would result from operations would be replaced by normal recharge over time. The Applicant would minimize water usage from that aquifer by using BMPs for water management, such as a two-phase reverse-osmosis (RO) unit to maximize the amount of permeate that would be re-injected into the aquifer. In addition, the Applicant's Source and Byproduct Materials License would require cessation or significant reduction of the water used for oil recovery within the Project area.

The potential impact to water quality would range from SMALL to MODERATE (depending upon whether excursions occur). To reduce the risk of pipeline failure and impact the shallow aquifer, the Applicant would hydrostatically test all pipelines prior to use and install leak-detection devices in manholes along the pipelines. The Applicant's implementation of BMPs during Ross Project operation would reduce the likelihood and magnitude of spills or leaks and facilitate expeditious cleanup. The potential impacts from the Ross Project's operation to ground-water quantity in the shallow aquifers would be SMALL.

The potential impacts of uranium-recovery operation to ground-water quality in the confined aquifers above and below the ore zone would be SMALL. However, the short-term potential impacts from uranium-recovery operation to the ore-zone aquifer itself, outside of the wellfields, would be SMALL to MODERATE, depending upon whether excursions occur. With respect to the deep aquifers into which injection of liquid byproduct materials would occur, the WDEQ/WQD determined by way of its issuance of the UIC Class I Permit to Strata that, at the depths and locations of the injection zones specified in the UIC Permit, the use of ground water from the Flathead and Deadwood Formations is economically and technologically impractical (WDEQ/WQD, 2011b). In addition, Strata projected from regional water quality data from that the TDS in the Deadwood/Flathead Formations will likely be greater than 10,000 mg/L and therefore would not be suitable as a USDW (Strata, 2011b). Monitoring of lixiviant-injection pressures and water quality of the injected brine are required by the UIC Class I Permit; thus, the potential impacts of the Ross Project's operation to ground-water quantity and quality in the deep aquifers would be SMALL.

***Aquifer Restoration*:** Impacts would be SMALL to MODERATE (due to potential short-term drawdown in the ore-zone and confined aquifers, which would reduce ground-water quantity). The potential impacts to water quality would be reduced when compared to the Ross Project's operation because no lixiviant would be injected, and the concentration of chemicals in the recovered ground water would be significantly less than during uranium recovery. In fact, rather than impact the water quality of the ore-zone aquifer, the water quality would improve during aquifer restoration. At the close of the aquifer-restoration phase, the water quality within the exempted aquifer would meet the ground-water protection standards required by 10 CFR Part 40, Appendix A, which would ensure that the aquifer's water quality would not pose a substantial present or future hazard to the human health or the environment.

The Applicant's implementation of BMPs during aquifer restoration would continue, and the other ground-water mitigation measures would be the same as those described for the operation of the Ross Project. Thus, the potential impacts of aquifer restoration to ground-water quantity of the shallow aquifers would be SMALL. A conservative regional ground-water modeling analysis predicts a reduction in the available head in wells used for stock, domestic, and industrial use. These effects would be localized and short-lived. Consequently, the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE. In the deep aquifers, the volume of wastes injected would be greater during the aquifer-restoration phase than during the Ross Project's operation phase, but the potential impacts would be similar. The impacts of aquifer restoration to ground-water quantity and quality of the deep aquifers would, therefore, be SMALL.

Decommissioning: Impacts would be SMALL. After uranium-recovery operation is complete, since most if not all of the historic, improperly abandoned wells (i.e., from previous subsurface explorations not associated with the Applicant or its activities) would have been properly plugged, the impacts to shallow aquifers during the Proposed Action's decommissioning would be SMALL. As decommissioning proceeds at the Ross Project area, and the concomitant land reclamation and restoration activities proceed, all monitoring, injection, and production wells would be plugged and properly abandoned as noted above. The wells would be filled with cement and/or bentonite and then cut off below plow depth to ensure ground water does not flow through the abandoned wells. Proper implementation of these procedures would isolate the wells from ground-water flow. Thus, the impacts to the ore-zone and adjacent confined aquifers would be SMALL. The Applicant estimates that very little brine and other liquid byproduct material would be disposed in the UIC Class I deep-injection wells during the decommissioning phase (i.e., most wastes that would be generated during this phase would be solid). This small quantity would minimize potential impacts to ground-water quantity and quality during Ross Project's decommissioning, and the impacts to the deep aquifers would be SMALL.

Ecology

Construction: Impacts would be SMALL. Potential environmental impacts to ecology of the Ross Project area, including both flora and fauna, could include removal of vegetation from the Ross Project area; reduction in wildlife habitat and forage productivity, and an increased risk of soil erosion and weed invasion; the modification of existing vegetative communities as a result of uranium-recovery activities; the loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, pollution from fuel spills, and habitat reduction. However, construction of the Ross Project would be phased over time, reducing the amount of surface area disturbed at any one time. Thus, the impacts to terrestrial vegetation and terrestrial wildlife would be SMALL. Because aquatic habitats would be avoided if at all possible during construction, impacts to reptiles, amphibians, and fish during the Ross Project's construction would also be SMALL.

Operation: Impacts would be SMALL. Impacts would be similar to but less than those experienced during the construction phase because fewer earth-moving activities would occur and traffic would be less. Due to the Applicant's implementation of mitigation measures, such as wellfield perimeter and surface-impoundment fencing, leak-detection protocols, and wildlife protection and monitoring plans, the operation of the Ross Project would cause SMALL impacts to terrestrial vegetation and wildlife, including protected species, and to aquatic wildlife.

Aquifer Restoration: Impacts would be SMALL. The potential impacts to ecological resources from aquifer-restoration activities would be similar to those experienced during the Ross Project's operation phase; therefore, the potential impact to vegetation and wildlife would be SMALL.

Decommissioning: No loss of vegetative communities beyond that disturbed during the construction phase would occur. Pipeline removal would impact vegetation that could have re-established itself, although this, too, would be temporary as the disturbed areas are reseeded. Thus, the impacts of the Ross Project's decommissioning would not be expected to be greater than those experienced during its construction and would consequently be SMALL.

Air Quality

Construction: Impacts would be SMALL. Combustion-engine emissions from diesel- and gas-powered equipment operation would occur during all phases of the Ross Project. The heaviest use of such equipment, however, would be the construction and decommissioning phases of the Ross Project. Fugitive dusts would also be generated by both construction, land-clearing activities as well as by commuters and delivery trucks. The largest workforce of the Ross Project's lifecycle would be employed on the Project's construction, and their respective commutes increase local traffic quite significantly. Combustion-engine emissions and fugitive dust would be generated by all of this traffic. However, the predominant winds (in terms of both speed and direction) in the region, the remote location of the Ross Project area, and the air-quality control systems and the BMPs that would be implemented by the Applicant would all minimize the air-quality impacts of the Ross Project's construction. In addition, the requirements of the Applicant's Air Quality Permit would require the Applicant to implement other specified mitigation measures as well, moderating the air emissions of the Ross Project. All anticipated gaseous-emission and fugitive-dust impacts would be limited in duration during the construction phase. Thus, the impacts of the Ross Project on air quality during construction would be SMALL and short-term.

Operation: Impacts would be SMALL. Air-quality impacts during the Ross Project's operation phase would potentially include the same as those identified earlier for its construction phase (i.e., combustion-engine and fugitive-dust emissions). However, the quantity of the released air emissions would be reduced due to the reduced number of workers during ISR operation. Also, construction-equipment operation would decrease because most of the Ross Project area would have been cleared and graded during construction, so little earth movement would occur during operation; only the installation of wellfields would continue to generate fugitive dust. During uranium-recovery operation, several point sources of non-radioactive gaseous emissions would be located at the CPP. These would include process-pipelines, process-vessel, and storage-tank vents; emergency generators and space heaters; and other sources such as storage vessels and tanks containing acids and bases. However, these would all be very small point sources.

Aquifer Restoration: Impacts would be SMALL. The emissions associated with the use of combustion-engine equipment would be limited in duration and result in small, short-term effects during the aquifer-restoration phase of the Ross Project. Vehicular traffic would be limited to delivery of supplies and commuting personnel; however, the workforce at the Ross Project would decrease to only 20 workers during aquifer restoration and, thus, the vehicular emissions of commuting traffic would substantially decrease. A significant decrease in the frequency of offsite yellowcake shipments would also occur as aquifer restoration proceeds.

Decommissioning: Impacts would be SMALL. In the short term, emissions could increase somewhat, especially particulates because decommissioning activities would generate particulate emissions such as fugitive dust. For example, the Applicant's dismantling and demolition of buildings, structures, surface impoundments, and process equipment; removing contaminated soils; moving construction equipment to the different areas where decommissioning activities would take place; and the grading and re-contouring during site reclamation and restoration could all generate air emissions, particularly fugitive dust. Combustion-engine emissions would also be produced by heavy equipment as well as vehicles transporting workers to and from the Ross Project, where the workforce would increase at the initiation of the decommissioning phase.

Noise

***Construction*:** Impacts would be SMALL to MODERATE. Noise would be generated during construction activities as well as by vehicle traffic. Approximately 85 percent of the construction workforce (i.e., 200 workers) would commute to the Ross Project area during daytime hours. Heavy-equipment operation within the Ross Project area would peak during the Applicant's construction of the CPP, surface impoundments, wellfields, and associated infrastructure. In addition, the relocation of construction equipment to and from the Ross Project area and to and from different locations at the Ross Project area would generate noise. Impulse or impact noises from certain equipment, such as impact wrenches and pneumatic attachments on rock breakers, could be particularly loud as well. All of this noise could occasionally be annoying to the closest nearby residents. The overall noise impacts during the Proposed Action's construction would be SMALL to the general population, but the four closest residences to the Ross Project would experience MODERATE, but short-term, impacts as a result of increased noise. The Applicant's compliance with the Occupational Safety and Health Administration's (OSHA's) noise regulations would minimize impacts to onsite workers, and such impacts would be SMALL.

***Operation*:** Impacts would be SMALL to MODERATE, with noise generated by construction activities greatly diminishing. The truck traffic associated with yellowcake, vanadium, and waste shipments would begin during the operation phase of the Ross Project; however, commuter-traffic noise would decrease due to the smaller workforce required during ISR operations (60 vs. 200 workers during construction). However, because the county roads to and from the Ross Project area currently have very low average daily and annual traffic counts, there would be a continuing high relative increase in vehicular traffic and, thus, noise impacts to nearby residents would be MODERATE, but short term; the more distant local communities would experience only SMALL impacts. As during construction, the impacts of noise on workers present at the Ross Project would be SMALL, due to the Applicant's compliance with OSHA's noise regulations.

***Aquifer Restoration*:** Impacts would be SMALL. During the Ross Project's aquifer-restoration phase, potential noise impacts would diminish to SMALL and would be only temporary for nearby residences. The workforce employed during aquifer restoration would be smaller (i.e., 20 workers) than during construction and operation phases of the Ross Project and, thus, there would be fewer workers, less traffic, and fewer noise-producing activities. The Applicant's continued compliance with OSHA's noise regulations would minimize impacts to workers.

***Decommissioning*:** Impacts would be SMALL to MODERATE. Noise levels during the decommissioning phase of the Ross Project would be similar to those identified for the construction phase, for both onsite and offsite receptors. Most potential impacts to nearby residential receptors would occur as a result of the anticipated significantly increased commuter and truck traffic to and from the Ross Project area during decommissioning (i.e., 90 workers and additional waste shipments). At the Ross Project, despite the temporary nature of the decommissioning activities onsite, the short distance to the closest residences would make the noise impacts MODERATE to the nearest neighbors, but SMALL for all other receptors such as onsite workers and offsite populations.

Historical and Cultural Resources

Construction: Impacts would be SMALL to LARGE. This assessment reflects the fact that the highest potential for adverse effects to historical and cultural resources would take place during the construction phase as well as the fact that efforts to evaluate historic and cultural properties and to determine adverse effects and mitigation measures are incomplete. Construction impacts beyond MODERATE would not be anticipated because every effort would be made to avoid, minimize, and mitigate adverse effects to historic properties in accordance with the Ross Project Programmatic Agreement (PA) that is currently being developed. However, a LARGE impact is not impossible, depending upon the significance and integrity of, and the extent of adverse effects on, previously identified historic properties or those potentially inadvertently discovered.

Within the area of potential effect at the proposed Ross Project, 2 sites have a consensus determination of eligible for listing on the National Register of Historic Places (NRHP) , 8 sites have a consensus determination of not eligible, and 18 sites have a consensus determination of unevauated. Based on the information gathered during Tribal field surveys of the Ross Project area, the NRC staff is seeking concurrence from the Wyoming State Historic Preservation Office (Wyoming SHPO) on a determination of eligible for 13 sites, including 4 sites that currently have a consensus determination of unevaluated, a determination of not eligible for 3 sites, and a determination of unevaluated for 2 sites.

Prior to a Source and Byproduct Materials License being granted, an PA between the NRC, the Wyoming SHPO, U.S. Bureau of Land Management (BLM), interested Native American Tribes, the Advisory Council on Historic Preservation, and the Applicant will be established that will delineate the requirements for completing Section 106 for the Project, including determining Project effects and developing mitigation of adverse effects. Additionally, the PA would outline the steps required if unexpected historical and cultural resources were to be encountered.

Operation: Impacts would be SMALL. Mitigation measures to avoid, minimize, and resolve adverse impacts to historical, cultural, and paleontological resources would be implemented prior to Ross Project construction and would be expected to continue during operation. The impacts of the Ross Project's operation would be generally limited to previously disturbed areas (except continuing wellfield installation).

Aquifer Restoration: Impacts would be SMALL. Impacts to historical and cultural resources during the aquifer restoration phase would be similar to operations. These impacts would primarily result from the surface disturbance associated with operation, maintenance, and repair of existing wellfields as part of the aquifer-restoration process.

Decommissioning: Impacts would be SMALL. Ground-disturbing activities would temporarily increase during the Ross Project's decommissioning. As during the construction phase, ground disturbance in excess of a few feet during facility decommissioning would have an impact on the geologic units themselves, including the Lance Formation, which has the potential to contain a variety of fossils. However, most of the decommissioning activities would focus on previously disturbed areas and, therefore, most of the historic, cultural, and paleontological resource materials would already be known as a result of the investigations that would be conducted prior to facility construction and wellfield construction.

Visual and Scenic Resources

Construction: Impacts would be SMALL to MODERATE. The largest visible surface features of the Ross Project that would emerge during the construction phase would include wellhead covers and module buildings; electrical and other utility distribution lines, which are mounted on 6-m [20-ft] wooden poles; more roads; the CPP; and the surface impoundments. There are protected visual resources near the Ross Project; the nearest such area is the Devils Tower National Monument, which is approximately 16 km [10 mi] east of the Ross Project. Although the Project itself would not be visible at the lower park portion of the Tower, climbers ascending to the top of the Tower may be able to see some of the Project’s largest attributes as well as, in the night sky, the lights of the Project. These lights would also be visible at residences near the Ross Project. The short-term visual contrasts with the characteristic landscape of the Ross Project area would result from construction activities. However, the construction activities proposed for the Ross Project would be consistent with the BLM visual classification of this area. The management objective of Visual Resource Management (VRM) Class III is to partially retain the existing character of the landscape so that the level of change to the characteristic landscape can be moderate. Also, prior to construction of the Ross Project, the Applicant would monitor potential light pollution and develop a light-pollution monitoring plan that would finalize the locations for both continuous and intermittent light sources. The short-term construction activities at the proposed Ross Project would result in MODERATE visual impacts to the nearest four residences, as each of which has a view of the Ross Project area. For other nearby residences the visual impacts would be SMALL.

Operation: Impacts would be SMALL. The overall visual impacts of an operating wellfield and the ISR facility itself would be small. In addition, the Ross Project would be located in gently rolling topography, where the visibility of aboveground infrastructure would vary and would be relative, depending upon the location and elevation of an observer as well as on nearby topography, total distance, and lighting characteristics. Lighting from the Ross Project would be visible from five of the residences to the east and from various locations directly to the west, north, and southeast. Mitigation measures for local light-pollution impacts would be the same as those described above for the construction phase of the Ross Project.

Aquifer Restoration: Impacts would be SMALL. Aquifer restoration activities would take place sequentially in the wellfields and last approximately two years per wellfield. There would be no modifications to either scenery or topography during aquifer restoration. Much of the same equipment and infrastructure used during operation would be employed during aquifer restoration, so that impacts to the visual landscape would be expected to be similar to or less than the impacts during the Proposed Action’s operation phase. The mitigation measures presented above for both the Proposed Action’s construction and operation phases would continue to be implemented during the aquifer-restoration phase, and these would continue to limit potential visual impacts.

Decommissioning: Impacts would be SMALL. The Ross Project would not result in significant impacts to the landscape that would persist after facility decommissioning and site restoration are completed. Most visual impacts during decommissioning would be temporary and diminish as structures, equipment, and other facility components are removed; the disturbed land surface is reclaimed and restored; and the vegetation is re-established.

Socioeconomics

Construction: Impacts would be SMALL to MODERATE. The Ross Project would employ approximately 200 people during construction, and this influx of workers would be expected to result in socioeconomic impacts, the greatest for communities with small populations. However, due to the short duration of construction, these workers would have only a limited effect on public services and community infrastructure. The Applicant is also committed to hiring locally—90 percent of the construction workforce would be local hires—so the overall socioeconomic impacts during the construction phase of the Ross Project would be SMALL. However, the tax revenues paid to Crook County would be significant and, thus, that benefit would be a MODERATE impact of the Ross Project.

Operation: Impacts would be SMALL to MODERATE. If the majority of the operation workforce is local, the potential impacts to population and public services would continue to be SMALL. Because the Applicant is committed to hiring locally—80 percent of the operation workforce is expected to be local hires—the overall socioeconomic impacts during the Ross Project's operation phase would continue to be SMALL, with MODERATE impacts associated with the additional tax revenues that would accrue to Crook County.

Aquifer Restoration: Impacts would be SMALL. The Applicant indicates that there would be a smaller workforce of only approximately 20 workers during the aquifer-restoration phase, without concurrent operations. The need for regulatory, management, and health and safety personnel would continue throughout aquifer restoration, but this need would be met by personnel transitioning from operation-phase work to aquifer restoration and no new personnel would necessarily be required. Thus, the impacts of the Ross Project's aquifer-restoration phase would likely be at most the same, or, more likely, less than those noted above for the Ross Project's operation phase.

Decommissioning: Impacts would be SMALL. Because the size of the workforce during the Ross Project's decommissioning phase would be initially be higher, but would subside as the decommissioning proceeds, there would be no significant socioeconomic impacts. In addition, socioeconomic impacts would no longer include tax revenues to Crook County during the decommissioning phase of the Ross Project and, thus, the earlier phases' moderate impacts would be eliminated.

Environmental Justice

All Phases: No minority or low-income populations were identified in the vicinity of the proposed Ross Project. Therefore, there would be no disproportionately high and adverse impacts to minority and low-income populations from the construction, operation, aquifer restoration, and decommissioning of the Ross Project.

Public and Occupational Health and Safety

Construction: Impacts would be SMALL. Construction activities, including the use of construction equipment and vehicles, would disturb the topsoil and create fugitive dust emissions. Fugitive dust generated from construction activities would be short term (1 to 2 years), and the levels of radioactivity in soils at the proposed Project area are low; therefore direct exposure, inhalation, and ingestion of fugitive dust would not result in a significant radiological dose to workers or the public. Construction equipment would be diesel powered and would exhaust particulate diesel emissions. The potential impacts and potential human exposures from these emissions would be SMALL because of the short duration of the release and because the emissions would be readily dispersed into the atmosphere.

Operation: The radiological impacts from normal operations would be SMALL. Public and occupational exposure rates at ISR facilities during normal operations have historically been well below regulatory limits. Dose assessments using the MILDOS computer code indicate that the 10 CFR Part 20 public dose limit of 1 mSv/yr [100 mrem/yr] would not be exceeded at any property boundary. The remote location of the proposed Ross Project site and the use of the proposed ISR technology coupled with the Applicant's proposed procedures to minimize exposure would cause the potential impact on public and occupational health and safety from facility operation to be SMALL. The radiological impacts from accidents would be SMALL for workers (if the Applicant's radiation safety and incident response procedures in an NRC-approved radiation protection plan are followed) and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health and safety impacts from normal operations and accidents, due primarily to risk of chemical exposure, would be SMALL if handling and storage procedures are followed.

Aquifer Restoration: Impacts would be SMALL. Impacts would be similar to, but less than, those during the operations phase. The reduction or elimination of some operational activities would further reduce the magnitude of potential worker and public health impacts and safety hazards.

Decommissioning: Impacts would be SMALL. Impacts would be similar to those experienced during construction. Soil and facility structures would be decontaminated, and lands would be restored to pre-operational conditions.

Waste Management

Construction: Impacts would be SMALL. No significant liquid wastes would be generated during the construction of the Ross Project. Most of the solid wastes expected to be generated during the construction phase would be general construction debris including paper, wood, plastic, and scrap metal. These nonhazardous solid wastes would be disposed of at a permitted solid-waste facility. Hazardous wastes, such as organic solvents, paints, and paint thinners, would be disposed of in accordance with the requirements in the *Resource Conservation and Recovery Act* (RCRA). No byproduct wastes would be generated during the operation phase at the Ross Project; however, technologically enhanced naturally occurring radioactive material (TENORM) wastes would be generated during well drilling, and these wastes would be managed onsite. No other types of wastes would be disposed of onsite.

Operation: Impacts would be SMALL. Wastes generated during the operation of the Ross Project would primarily be liquid waste streams consisting of 1) process bleed, where, after RO treatment, some excess permeate would be produced early in the Project's operation, and 2) brine would be disposed of onsite in the permitted UIC Class I deep-injection wells. In addition, other liquid byproduct material would be generated as spent eluate, process-drains liquids, contaminated reagents, filter-backwash liquids, wash-down water, and decontamination shower water. State permitting actions, Source and Byproduct Materials License Conditions, and the NRC's inspections would ensure that proper waste-management practices are implemented by the Applicant to comply with safety requirements to protect workers and the public. Nonhazardous solid waste such as facility trash, tires, piping, valves, and instrumentation, would be reused, recycled, or disposed of at a nearby landfill or other waste-disposal facility, each of which has available disposal capacity. Domestic wastes would be treated and disposed of in an onsite domestic waste-water system.

Aquifer Restoration: Impacts would be SMALL. Water from aquifer restoration would be treated through a combination of IX and RO and then would be re-injected into the ore-zone aquifer to limit the volume of water permanently withdrawn. Concentrated liquid effluents generated by these activities would be disposed of via deep well disposal. Ordinary trash would continue to be shipped offsite for disposal.

Decommissioning: Impacts would be SMALL. The goal of decommissioning is to reduce potential impacts by removing contaminants to allowable (regulatory) levels and restoring the land of the Ross Project area to pre-uranium-recovery conditions (i.e., available for unrestricted use). The Applicant proposes to decontaminate and recycle much of the process equipment or to reuse it at other uranium-recovery facilities. For example, the Applicant would remove sludge from the surface impoundments as well as the impoundment liners, and then it would dispose of these materials as currently dicussed in Condition No. 9.9 of the Draft Source and Byproduct Materials License at a disposal facility licensed (by the NRC or an Agreement State) to receive such byproduct material (NRC, 2014b). Pre-operational agreements with appropriately licensed disposal facilities (i.e., those that are licensed to accept byproduct material) would ensure the availability of sufficient disposal capacity for decommissioning activities. If hazardous waste is generated by decommissioning activities, it would be handled in accordance with applicable requirements.

SUMMARY OF THE CUMULATIVE IMPACTS

The cumulative impacts on the environment that would result from the incremental impact of the proposed Ross Project, when added to other past, present, and reasonably foreseeable future actions, was also considered. The NRC staff determined that the SMALL to LARGE incremental impacts of the Ross Project would not contribute perceptible increases to the SMALL to LARGE cumulative impacts, due primarily to the extensive exploration taking place in the area for uranium, oil, and gas supplies as well as from coal mining.

SUMMARY OF THE COSTS AND BENEFITS OF THE PROPOSED ACTION

The implementation of the Proposed Action would generate primarily regional and local costs and benefits. The regional benefits of building the proposed Ross Project would be increased employment, economic activity, and tax revenues to the region around the proposed Ross Project area (i.e., Crook County). Costs associated with the Ross Project are, for the most part, limited to the area immediately surrounding the Ross Project area and include small visual, air-quality, and noise impacts. The NRC staff determined that the benefit from constructing and operating the uranium-recovery facility would outweigh the environmental and social costs.

COMPARISON OF THE ALTERNATIVES

Under the No-Action Alternative, Alternative 2, the NRC would not approve the license application for the proposed Ross Project and it would not issue a source and byproduct materials license. The No-Action Alternative would result in the Applicant not constructing, operating, restoring the aquifer of, or decommissioning the proposed Ross Project. However, even if the Ross Project is not licensed, the Applicant has already accomplished certain preconstruction activities (those activities that do not require a NRC license) at the Ross Project area. These previously completed preconstruction activities are evaluated as part of Alternative 2: No Action.

Under Alternative 3, the NRC would issue the Applicant a source and byproduct materials license for the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project, except that the entire ISR facility, including all buildings, other auxiliary structures, and the surface impoundments would be located north of where it would be situated for the Proposed Action. This alternate location for the ISR facility, referred as the “north site” by the Applicant (and referred to herein as the “North Ross Project”), was considered, but eliminated, by the Applicant in its license application. The north site is about 900 m [3,000 ft] northwest of where the facility would be located in the Proposed Action (referred to by the Applicant as the “south site”). An unnamed surface-water drainage feature generally divides the north site. To avoid the floodplain of the drainage the Applicant would likely place the CPP and other buildings on one side of the drainage and the surface impoundments on the other side.

FINAL RECOMMENDATION

After weighing the impacts of the Proposed Action and comparing the Alternatives, the NRC staff, in accordance with 10 CFR Part 51.91(d), sets forth its final NEPA recommendation regarding the Proposed Action. Unless safety issues mandate otherwise, the final recommendation of the NRC staff to the Commission related to the environmental aspects of the Proposed Action is that a source and byproduct materials license for the Proposed Action be issued as requested. This recommendation is based upon 1) the license application, including the ER the Applicant submitted, and the Applicant’s supplemental letters and responses to the NRC staff’s requests for additional information; 2) consultation with Federal, State, Tribal, and local agencies; 3) the NRC staff’s independent review; 4) the NRC staff’s consideration of comments received on the DSEIS; and 5) the assessments discussed in this FSEIS.

REFERENCES

10 CFR Part 51. Title 10, “Energy,” *Code of Federal Regulations* (CFR), Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” Washington, DC: Government Printing Office (GPO).

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(US)NRC. "Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming, Materials License No. SUA-1601, Docket No. 040-09091, Strata Energy, Inc." Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

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WDEQ (Wyoming Department of Environmental Protection (WDEQ)/Water Quality Division (WQD). *Strata Energy*, *Inc. – Ross Disposal Injection Wellfield*, *Final Permit 10-263*, *Class I Non-hazardous, Crook County*, *Wyoming*. Cheyenne, WY: WDEQ/WQD. April 2011b. ADAMS Accession No. ML111380015.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

ABBREVIATIONS/ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ACHP	Advisory Council on Historic Preservation
ACL	Alternate Concentration Limit
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954
ALARA	As Low As Reasonably Achievable
APE	Area of Potential Effect
APLIC	Avian Power Line Interaction Committee
AQD	Air Quality Division (Wyoming Department of Environmental Quality)
ARPA	Archaeological Resources Protection Act of 1979
ASLB	Atomic Safety Licensing Board
ASTM	ASTM International (formerly American Society for Testing and Materials)
BACT	Best Available Control Technology
BCC	USFWS's Birds of Conservation Concern
bgs	Below Ground Surface
BIA	Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management (U.S. Department of the Interior)
BLMSS	USBLM's Sensitive Species
BLS	Bureau of Labor Statistics (U.S. Department of Labor)
BMP	Best Management Practice
B.P.	Before Present
CAA	Clean Air Act
CBM	Coal-Bed Methane
CBW	Containment Barrier Wall
CCS	Center for Climate Strategies
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CO	Carbon monoxide
CO_2	Carbon dioxide
CPP	Central Processing Plant
CR	County Road
CVM	Contingent Valuation Method
CWA	Clean Water Act
dBA	A-Weighted Decibels
DFP	Decommissioning Funding Plan
DM	Deep-Monitoring Zone or Unit
DOC	U.S. Department of Commerce
DOI	U.S. Department of the interior
DP	Decommissioning Plan

ABBREVIATIONS/ACRONYMS

EC	Electrical Conductivity
EIA	Energy Information Administration (U.S. Department of Energy)
EIS	Environmental Impact Statement
EMR	Emergency Medical Responder
EMT	Emergency Medical Technician
EO	Executive Order
EOR	Enhanced Oil Recovery
EPA	U.S. Environmental Protection Agency
ER	Environmental Report
ESA	Endangered Species Act of 1973
FWS	U.S. Fish and Wildlife Service
FHWA	Federal Highway Administration (U.S. Department of Transportation)
GCM	GCM Services, Inc.
GCRP	U.S. Global Change Research Program
GEIS	*Generic Environmental Impact Statement*
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
HDPE	High-Density Polyethylene
HEC	Hydrologic Engineering Center
HMS	Hydrologic Modeling System
ISL	In situ Leach
ISR	In situ Recovery
IX	Ion Exchange
LOI	Letter of Intent
LQD	Land Quality Division (Wyoming Department of Environmental Quality)
LSA	Low Specific Activity
MARSSIM	Multi-Agency Radiation Survey & Site Investigation Manual
MCL	Maximum Contaminant Level
Merit	Merit Oil Company
MIT	Mechanical Integrity Testing
MMP	Materials Management Plan
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MSDS	Material Safety Data Sheet
NAAQS	National Ambient Air Quality Standards
NAC	Noise Abatement Criteria
NAGPRA	Native American Graves Protection and Repatriation Act
NEPA	National Environmental Policy Act of 1969

ABBREVIATIONS/ACRONYMS

NHPA	National Historic Preservation Act of 1966
NMSS	Nuclear Material Safety and Safeguards
NOA	Notice of Availability
NOI	Notice of Intent
NPS	National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service (U.S. Department of Agriculture)
NRDC	National Resources Defense Council
NRHP	National Register of Historic Places
NSDWUMR	Nebraska-South Dakota-Wyoming Uranium Milling Region
Nubeth	Nubeth Joint Venture
NWI	National Wetlands Inventory
NWIS	National Water Information System
NWP	Nationwide Permit (U.S. Army Corps of Engineers)
NWS	National Weather Service
OMB	Office of Management and Budget
OSHA	Occupational Safety & Health Administration (U.S. Department of Labor)
OSLI	(Wyoming) Office of State Lands and Investments
OZ	Ore Zone (Unit, Interval, or Aquifer)
PA	Programmatic Agreement
PABFh	Palustrine, Aquatic Bed, Seasonally Flooded
Pb	Lead
PCB	Polychlorinated Biphenyl
PFYC	Potential Fossil Yield Classification System
pH	Hydrogen Ion Activity
PM_{10}	Particulate Matter 10 Microns or Less
$PM_{2.5}$	Particulate Matter 2.5 Microns or Less
POO	Plan of Operations
PPE	Personal Protective Equipment
PRB	Powder River Basin
PSD	Prevention of Significant Deterioration
PSHA	Probabilistic Seismic Hazard Analysis
PVC	Polyvinyl Chloride
R	Range or Roentgens
RAI	Request for Additional Information
RAP	Restoration Action Plan
RCRA	Resource Conservation and Recovery Act
rem	Roentgen Equivalent Man
RFFA	Reasonably Foreseeable Future Actions
RFP	Request for Proposals
RMP	Resource Management Plan

ABBREVIATIONS/ACRONYMS

RO	Reverse Osmosis
ROI	Region of Influence
RPP	Radiation Protection Program or Plan
SA	Surficial Aquifer
SAR	Sodium Adsorption Ratio
SDWA	Safe Drinking Water Act
SGCN	Wyoming's Species of Greatest Conservation Need
SHWD	Solid and Hazardous Waste Division
SEIS	*Supplemental Environmental Impact Statement*
SEO	State Engineer's Office
SER	Safety Evaluation Report
SGCN	(Wyoming) Species of Greatest Conservation Need
SHPO	State Historic Preservation Office
SM	Shallow-Monitoring Zone or Unit
SMC	USFWS's Migratory Bird Species of Management Concern in Wyoming
SOP	Standard Operating Procedure
SOW	Scope of Work
SRP	Standard Review Plan
SRST	Standing Rock Sioux Tribe
Strata	Strata Energy, Inc. (Applicant)
s.u	Standard Units
SWPPP	Storm Water Pollution Prevention Plan
TCP	Traditional Cultural Property
TDS	Total Dissolved Solids
TEDE	Total Effective Dose Equivalent
TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
THPO	Tribal Historic Preservation Office
TLD	Thermo-Luminescent Dosimeter
TR	Technical Report
TSCA	Toxic Substances Control Act
TWG	Tribla Working Group
UCL	Upper Control Limit
UIC	Underground Injection Control
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
U.S.	United States
USACE	U.S. Army Corps of Engineers
USCB	U.S. Census Bureau (U.S. Department of Commerce)
USDA	U.S. Department of Agriculture
USDOT	U.S. Department of Transportation
USDW	Underground Source of Drinking Water
USFS	U.S. Forest Service

ABBREVIATIONS/ACRONYMS

USFWS	U.S. Fish and Wildlife Service
USGCRT	U.S. Global Change Research Team
USGS	U.S. Geological Survey
UW	University of Wyoming
VRI	Visual Resource Inventory
VRM	Visual Resource Management
WAAQS	Wyoming Ambient Air Quality Standards
WARMS	Wyoming Air Resources Monitoring System
WDAI	Wyoming Department of Administration and Information
WDEQ	Wyoming Department of Environmental Quality
WDWS	Wyoming Department of Workforce Services
WEUMR	Wyoming East Uranium Milling Region
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission
WOSLI	Wyoming Office of State Lands and Investments
WQD	Water Quality Division (Wyoming Department of Environmental Quality)
W.S.	Wyoming Statute
WSEO	Wyoming State Engineer's Office
WSGS	Wyoming State Geological Survey
WTP	Willingness-To-Pay
WWC	WWC Engineering, Inc.
WWDC	Wyoming Water Development Commission
WYCRO	Wyoming Cultural Records Office
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database
WYPDES	Wyoming Pollutant Discharge Elimination System
WYSHPO	State of Wyoming State Historic Preservation Office

SI* (MODERN METRIC) UNIT CONVERSIONS

Approximate Conversions From SI Units				
Symbol	**When You Know**	**Multiply By**	**To Find**	**Symbol**
Length				
cm	centimeters	0.39	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
Areas				
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
Ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
Volume				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
m^3	cubic meters	0.0008107	acre-feet	acre-feet
Mass				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or “t”)	Megagrams (or “metric ton”)	1.103	short tons (2,000 lb)	T
Temperature (Exact Degrees)				
°	Celsius	1.8 °C + 32	Fahrenheit	°

*SI is the symbol for the International System of Units. Appropriate rounding should be performed to comply with Section 4 of ASTM International’s “Standard for Metric Practice Guide.” West Conshohocken, Pennsylvania: ASTM International. Revised 2003.

1 INTRODUCTION

1.1 Background

The United States (U.S.) Nuclear Regulatory Commission (NRC) has prepared this *Final Supplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) in response to an application Strata Energy, Inc. (Strata) (also referred to herein as the "Applicant") submitted on January 4, 2011, to develop and operate the proposed Ross In Situ Uranium Recovery (ISR) Project (herein referred to as the "Ross Project"), located in Crook County, Wyoming (Strata, 2011a; Strata, 2011b). The Applicant is a wholly owned subsidiary of Peninsula Energy, Ltd. Figure 1.1 depicts the geographic location of the proposed Ross Project.

This site-specific SEIS supplements the *Final Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (herein referred to as the "GEIS") and was prepared in accordance with the process described in GEIS Section 1.8 (NRC, 2009b) and as detailed in Section 1.4.1 of this SEIS. The NRC's Office of Federal and State Materials and Environmental Management Programs prepared this SEIS as required by Title 10, "Energy," of the *U.S. Code of Federal Regulations* (CFR) Part 51 (10 CFR Part 51). These regulations implement the requirements of the *National Environmental Policy Act of 1969* (NEPA), as amended (Public Law 91-190), which requires the Federal government to assess the potential environmental impacts of major Federal actions that may significantly affect the human environment.

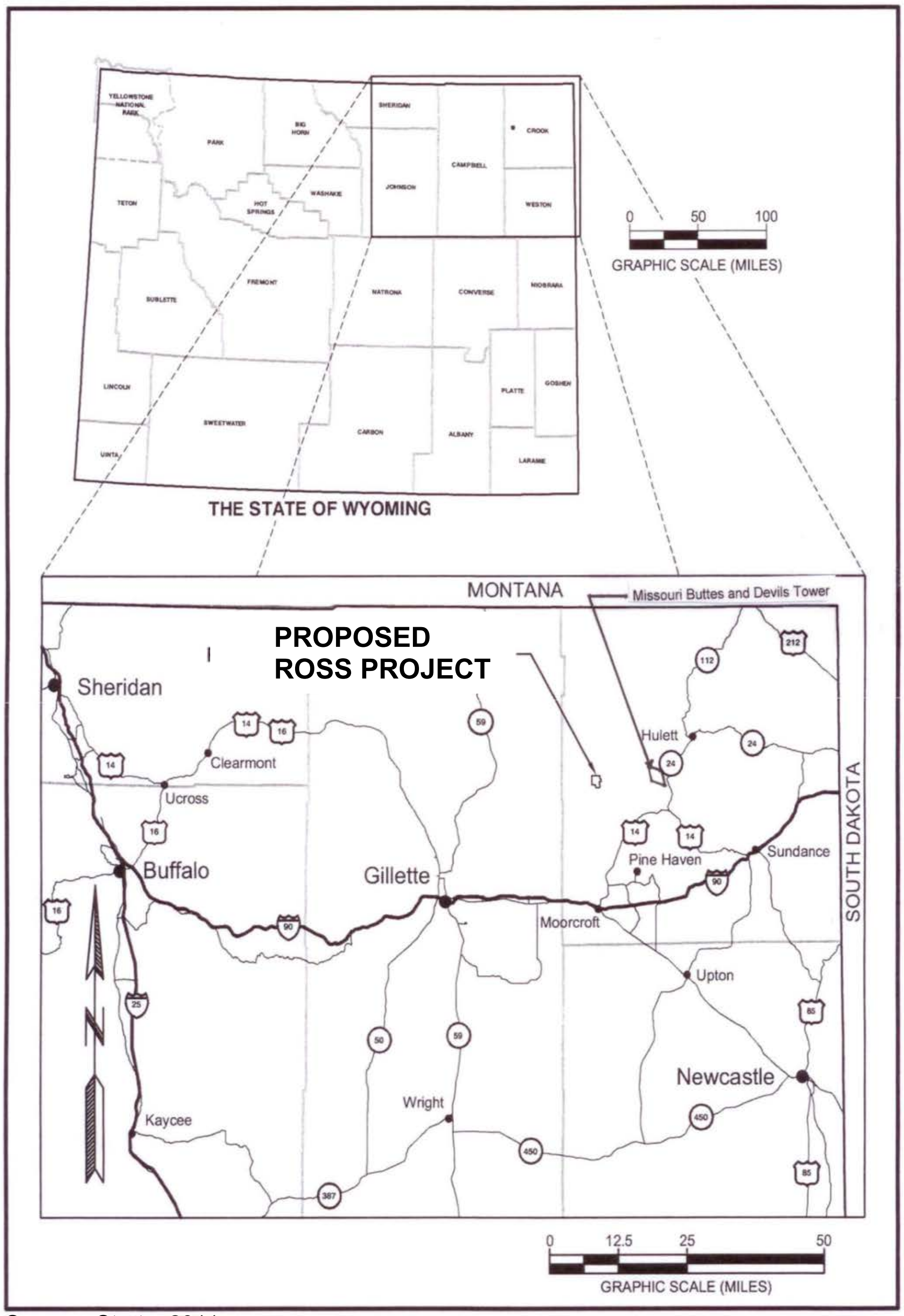
The GEIS uses the terms "*in-situ* leach (ISL) process" and "11e.(2) byproduct material" to describe this uranium-milling technology and the primary waste stream generated by this process. For the purposes of this SEIS, ISR is synonymous with ISL. This SEIS also uses the term "byproduct material" instead of "11e.(2) byproduct material" to describe the largest-by-volume waste stream generated by this uranium-milling process to be consistent with the definition in 10 CFR Part 40.4.

1.2 Proposed Action

On January 4, 2011, Strata submitted an application for an NRC source and byproduct materials license to construct and operate an ISR facility and wellfields at the proposed Ross Project area and to conduct aquifer restoration, facility decommissioning, and site reclamation. Based upon Strata's application, the NRC's Federal action is the decision to either grant or deny a license. The Applicant's proposal is described in detail in SEIS Section 2.1.1.

1.3 Purpose and Need of the Proposed Action

The NRC regulates uranium milling, including the ISR process, under 10 CFR Part 40, "Domestic Licensing of Source Material." The Applicant is seeking an NRC source and byproduct materials license to authorize commercial-scale ISR at the proposed Ross Project area. The purpose and need for the Proposed Action is to provide an option that allows the Applicant to recover uranium and to produce yellowcake at the Ross Project. Yellowcake is the semi-solid, uranium-oxides product of the uranium-milling process. Yellowcake is subsequently processed and later made into fuel for commercially operated nuclear power reactors.



Source: Strata, 2011a.

Figure 1.1
Ross Project Location

This definition of purpose and need reflects the Commission's recognition that, unless there are findings in its safety review required by the *Atomic Energy Act of 1954* (AEA), as amended, or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location.

1.3.1 BLM's Purpose and Need

The U.S. Bureau of Land Management's (BLM's) Federal action is either to approve the Applicant's *Plan of Operations* (POO), subject to mitigation as included in the license application and this SEIS, or deny approval of the POO. The BLM's responsibility to respond to the Applicant's POO establishes the need for the action. The purpose and need for the BLM is to provide for orderly, efficient, and environmentally responsible recovery of uranium resources. Uranium resources are needed to fulfill market demands for this product for power generation and other needs. The proposed Ross Project area contains 16 ha [40 ac] of BLM-administered public lands open to mineral entry, and the Applicant has filed mining claims on them. The mining claimant (i.e., Strata) has the right to mine and to develop the claims as long as such activities can be accomplished without causing unnecessary or undue degradation of the environment and as such activities are in accordance with pertinent laws and regulations under 43 CFR Part 3800.

1.4 Scope of the SEIS

The NRC staff has prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the proposed undertaking (i.e., to grant an NRC license) and of reasonable alternatives to the Proposed Action. The scope of this SEIS considers both radiological and nonradiological (including chemical) impacts associated with the Proposed Action and its Alternatives. This SEIS also considers unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and the irreversible and irretrievable commitments of resources.

1.4.1 Relationship to the GEIS

As described in Section 1.1, this SEIS supplements the GEIS, which was published as a final report in May 2009 (NRC, 2009b). The GEIS serves as the starting point for environmental reviews of site-specific ISR license applications. The final GEIS assessed the potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning of an ISR facility that could be located in four specific geographic regions of the western U.S. The NRC "tiers" an SEIS from the GEIS by incorporating applicable GEIS discussions by reference and by adopting relevant GEIS environmental impact conclusions.

This SEIS was prepared to fulfill the requirement at 10 CFR Part 51.20(b)(8) to prepare either an environmental impact statement (EIS) or supplement to an EIS (SEIS) for the issuance of a source and/or byproduct material(s) license for an ISR facility (NRC, 2009b). The GEIS provides a starting point for the NRC's NEPA analyses for site-specific license applications for new ISR facilities as well as for applications to amend or to renew existing ISR licenses. The GEIS provides criteria for each environmental resource area to be used in the assessment of levels of impact significance (i.e., SMALL, MODERATE, or LARGE). The NRC staff applied these criteria to the site-specific conditions at the proposed Ross Project. This SEIS tiers from, and incorporates by reference, the GEIS's relevant information, findings, and conclusions concerning environmental impacts. The extent to which the NRC staff incorporated the GEIS's

Table 1.1 Range of Expected Impacts in the GEIS's Nebraska-South Dakota-Wyoming Uranium Milling Region				
Resource Area	**Construction**	**Operation**	**Aquifer Restoration**	**Decommissioning**
Land Use	S	S	S	S to M
Transportation	S to M	S to M	S to M	S
Geology and Soils	S	S	S	S
Surface Water	S to M	S to M	S to M	S to M
Ground Water	S	S to L	S to M	S
Terrestrial Ecology	S to M	S	S	S
Aquatic Ecology	S	S	S	S
Threatened and Endangered Species	S to L	S	S	S
Air Quality	S	S	S	S
Noise	S to M	S to M	S to M	S
Historical and Cultural	S to L	S	S	S
Visual and Scenic	S	S	S	S
Socioeconomics	S to M	S to M	S	S to M
Public and Occupational Health and Safety	S	S to M	S	S
Waste Management	S	S	S	S

Source: NRC, 2009b.

Notes:
S: SMALL Impact
M: MODERATE Impact
L: LARGE Impact

impact conclusions depend upon the consistency between: 1) the Applicant's proposed facilities and activities as well as the conditions at the Ross Project area, and 2) the reference facility description, activities, and information in the GEIS. The NRC staff determinations regarding potential environmental impacts and the extent to which the GEIS's impact conclusions were incorporated by reference are described in Section 4 of this SEIS. GEIS Section 1.8.3 described the relationship between the GEIS and a site-specific SEIS (NRC, 2009b).

1.4.2 Public Participation Activities

The NRC staff conducted scoping activities to define the scope of the GEIS and any future supplements to the GEIS. The staff accepted public comments on the scope of the GEIS from July 24, 2007, to November 30, 2007, and held three public scoping meetings, one of which was in the State of Wyoming (Wyoming). Additionally, the NRC staff held eight public meetings to receive comments on the Draft GEIS, published in July 2008. Three of these meetings were held in Wyoming and one in nearby Spearfish, South Dakota. Comments on the Draft GEIS were accepted between July 28, 2008, and November 8, 2008. Comments received during the scoping meetings as well as the comments received on the Draft GEIS were made available on the NRC website (http://www.nrc.gov/reading-rm/adams.html). Transcripts of the scoping meetings and Draft GEIS-comment meetings are available at http://www.nrc.gov/materials/uranium-recovery/geis/pub-involve-process.html. A scoping summary report was provided in Final GEIS Appendix A, and Final GEIS Appendix G provided responses to the public comments on the Draft GEIS (NRC, 2009b).

The NRC is not required to conduct a scoping process when a supplement to an EIS is prepared. Nevertheless, the NRC staff has the discretion to decide whether to conduct scoping when preparing a SEIS. For the Ross Project SEIS, in addition to the scoping activities conducted by NRC during preparation of the GEIS, NRC published ads, soliciting scoping comments on the Ross Project SEIS, in four local newspapers (Moorcroft Leader, Casper Star Tribune, Gillette News Record, and Sundance Times). The newspaper advertisements were published on December 2, 2011, in the *Casper Star Tribune* and December 1, 2011, in the other three newspapers. Scoping comments were received until December 30, 2011. In total, 19 scoping-comment letters were received containing a total of 53 individual comments.

As part of the preparation of this SEIS, the NRC staff also met with Federal, State, and local agencies and authorities as well as public-interest groups during a visit to the proposed Ross Project area and surrounding vicinity in August 2011 (NRC, 2011a). The purpose of these meetings was to gather additional site-specific information to assist the NRC's environmental review.

The NRC staff published a "Notice of Opportunity for Hearing" on the proposed Ross Project license application in the *Federal Register* (FR) on July 13, 2011 (76 FR 41308). A hearing request from Natural Resources Defense Council (NRDC) and Powder River Basin Resource Council (PRBRC) (herein collectively referred to as the "Petitioners") was received on October 27, 2011. The NRC staff published a "Notice of Intent" (NOI) to prepare both a DSEIS and then this FSEIS on November 16, 2011 (76 FR 71082).

On March 29, 2013, the NRC staff published a "Notice of Availability" (NOA) for the DSEIS in 78 FR 19330. This NOA stated that public comments on the DSEIS should be submitted by May 13, 2013. Members of the public were invited and encouraged to submit related comments electronically, by mail, or by facsimile. The 45-day period for public comments (i.e., from March 29, 2013, to May 13, 2013) met the minimum 45-day comment period required under NRC regulations.

The NRC staff identified 1,120 comments from the 43 documents commenting on the Ross Project DSEIS. This FSEIS's Appendix B details how the NRC staff systematically identified and responded to each comment. A response has been provided in Appendix B for each comment or group of comments, and each response indicates whether the SEIS was modified in response to the respective comment.

In addition to the opportunities provided through the NEPA process, the NRC provided multiple opportunities for public involvement during the NRC staff's safety review. Specifically, the NRC staff held 10 publicly noticed meetings and teleconferences with the Applicant from 2010 through 2012, including 3 meetings prior to Strata's submittal of the license application. For those meetings and teleconferences, the NRC staff provided opportunities for public participation.

1.4.3 Issues Studied in Detail

To meet its NEPA obligations related to its review of the Ross Project license application, the NRC staff conducted an independent, detailed, comprehensive evaluation of the environmental impacts that would result from the construction, operation, aquifer restoration, and decommissioning of an ISR facility at the proposed Ross Project area and from reasonable alternatives. As described in Section 1.8.3, the GEIS: 1) evaluated the types of environmental impacts that may occur from ISR uranium-milling facilities; 2) identified and assessed generic impacts (i.e., the same or similar) at all ISR facilities (or those with specified facility or site characteristics); and 3) determined the scope of environmental impacts that needed to be addressed in site-specific environmental reviews. Therefore, although all of the environmental resource areas identified in the GEIS would be addressed in site-specific reviews, certain resource areas would require a more detailed site-specific analysis because the GEIS determined that a range in the significance of impacts (e.g., SMALL to MODERATE, SMALL to LARGE) could result depending upon site-specific conditions (see Table 1.1).

Based upon the GEIS analyses, this SEIS provides site-specific analyses of the following resource areas:

- Land Use
- Transportation
- Geology and Soils
- Water
  - Surface Water
  - Ground Water
- Ecology
  - Vegetation
  - Wildlife
  - Threatened, Endangered, and Sensitive Species
- Air Quality
- Noise
- Visual and Scenic Resources
- Historic, Cultural, and Paleontological Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety
- Waste Management

Furthermore, certain site-specific analyses not conducted in the GEIS, such as an assessment of cumulative impacts, are considered in this SEIS. The NRC staff has also considered the potential effects of the Applicant's implementing the Proposed Action on global climate change by estimating the Project's greenhouse gas emissions; conversely, this SEIS also describes the potential effects of global climate change on the Proposed Action.

1.4.4 Issues Outside the Scope of the SEIS

Some issues and concerns raised during the scoping process for the GEIS were determined to be outside the scope of the GEIS (NRC, 2009b). These issues and concerns include comments indicating general support or opposition for uranium milling, comments regarding the impacts associated with conventional uranium milling, specific comments regarding alternative sources of uranium-feed material, comments regarding alternative energy sources, requests for compensation for past mining impacts, and comments regarding the credibility of the NRC are all outside of the scope of this SEIS.

1.4.5 Related NEPA Reviews and Other Related Documents

A number of NEPA documents (environmental assessments [EAs] and EISs) and other documents were reviewed and used in the development of this SEIS. These related documents are described below:

- **NUREG–1910, Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Final Report (NRC, 2009b).** As described previously, this GEIS was prepared to assess the potential environmental impacts of the construction, operation, aquifer restoration, and decommissioning of an ISR facility located in one of four different geographic regions of the western U.S., including the NSDWUMR where the proposed Ross Project would be located. The environmental analyses in this Ross Project SEIS both tier from this GEIS and incorporate it by reference. NUREG–1910 has four published Supplements at this time; this SEIS is Supplement 5. The four earlier Supplements concern the Moore Ranch Project, the Nichols Ranch Project, the Lost Creek Project, and the Dewey-Burdock Project. (This GEIS herein referred to as "the GEIS" without any additional identifiers.)

- **NUREG–0706, Final Generic Environmental Impact Statement on Uranium Milling (NRC, 1980).** This GEIS provided a detailed evaluation of the impacts and effects of anticipated conventional uranium-milling operations in the U.S. through the year 2000, including an analysis of mill-tailings-disposal programs. NUREG–0706 concluded the environmental impacts from underground mining and conventional milling would be more severe than from the ISR process. As SEIS Section 2.2.1 describes, conventional mining and milling were considered, but eliminated from detailed analysis, in this SEIS. (This GEIS, when discussed in this SEIS, is always modified as "Uranium-Milling GEIS.")

- **NUREG–1508, Final Environmental Impact Statement To Construct and Operate the Crownpoint Uranium Solution Mining Project, Crownpoint, New Mexico (NRC, 1997).** This EIS evaluated the use of the ISR process at the Church Rock and Crownpoint sites at Crownpoint, New Mexico. Alternative uranium-mining methods were not evaluated because the uranium ore located at the proposed sites was too deep to be extracted (i.e., mined) economically, and the Final EIS concluded underground uranium mining would result in more significant environmental impacts than ISR uranium recovery.

- **Safety Evaluation Report for the Strata Energy, Inc. ISR Project, Crook County, Wyoming, Materials License No. SUA-1601 (NRC, 2014a)**. The NRC staff has prepared a *Safety Evaluation Report* (SER) for the proposed Ross Project that assesses the Applicant's proposed facility design, operational procedures, and radiation-protection programs and evaluates whether the Applicant's Proposed Action can be accomplished in accordance with the applicable provisions in 10 CFR Part 20, 10 CFR Part 40, and 10 CFR Part 40, Appendix A. The SER also provides the NRC staff's analysis of the Applicant's initial funding estimate to complete Ross Project facility decommissioning and site reclamation.

- **Final Environmental Impact Statement for the Newcastle Resource Management Plan (BLM, 2000).** The BLM's *Newcastle Resource Management Plan EIS* (the "BLM EIS" in this SEIS) included comprehensive analyses of alternatives for the planning and management of public land and resources administered by the BLM in Crook, Weston, and Niobrara Counties, Wyoming. The BLM EIS identified activities occurring in the region surrounding the Ross Project area that could either affect or be affected by the proposed Ross Project.

1.5 Applicable Regulatory Requirements

NEPA established national environmental policy and goals to protect, maintain, and enhance the environment and provided a process for implementing these specific goals for those Federal agencies responsible for an action. This SEIS was prepared in accordance with the NRC's NEPA-implementing regulations at 10 CFR Part 51 and other applicable regulations that were in effect at the time the SEIS was being written. The GEIS's Appendix B summarized other Federal statutes, implementing regulations, and Executive Orders that are potentially applicable to environmental reviews for the construction, operation, aquifer restoration, and decommissioning of an ISR facility. GEIS Sections 1.6.3.1 and 1.7.5.1 summarized Wyoming's statutory authority pursuant to the ISR process, relevant State agencies that would be involved in the permitting of an ISR facility, and the range of State permits that would be required (NRC, 2009b).

1.6 Licensing and Permitting

The NRC has statutory authority through the AEA and the *Uranium Mill Tailings Radiation Control Act of 1978* to regulate uranium-recovery facilities. In addition to obtaining an NRC license, uranium-recovery facilities must obtain the necessary permits from the appropriate Federal, State, local, and Tribal governmental agencies. The NRC licensing process for ISR facilities is described in GEIS Section 1.7.1. GEIS Sections 1.7.2 through 1.7.5 describe the role of the other Federal, State, local, and Tribal agencies in the ISR permitting process (NRC, 2009b). The information below in this section of the SEIS describes the NRC license-application review process and summarizes the status of the NRC licensing process at the proposed Ross Project and the status of the Applicant's permitting with respect to other applicable Federal, State, local, and Tribal requirements.

1.6.1 NRC Licensing Process for the Ross Project

With a letter dated January 4, 2011, the Applicant submitted a license application to the NRC for the proposed Ross Project (Strata, 2011a; Strata, 2011b). As described in GEIS Section 1.7.1, the NRC initially conducts an acceptance review of all of the license applications it receives in order to determine whether the respective application is complete enough to support a detailed technical review. The NRC accepted Strata's license application for the Ross Project by a letter dated June 28, 2011; the application was then subjected to a very detailed technical review and evaluation (NRC, 2011b).

The NRC staff's detailed technical review of Strata's license application was composed of both a safety review and an environmental review. These two reviews were conducted in parallel (see GEIS Figure 1.7-1). The focus of the safety review was to assess compliance with the applicable regulatory requirements at 10 CFR Part 20 and 10 CFR Part 40, Appendix A. The environmental review has been conducted in accordance with the regulations at 10 CFR Part 51.

The NRC's hearing process (10 CFR Part 2) applies to licensing actions and offers stakeholders a separate opportunity to raise concerns associated with proposed licensing actions. The NRC published a "Notice of Opportunity for Hearing" related to Strata's license application for the Ross Project on July 13, 2011 (76 FR 41308). The NRC later received a combined request for a hearing from the NRDC and the PRBRC on October 27, 2011 (NRDC and PRBRC, 2011).

Regulations in 10 CFR Part 2 specify that a petition for review and a request for hearing must include a showing that the petitioner(s) has(ve) standing and that the Atomic Safety and Licensing Board (ASLB) would rule on a petitioner's standing by considering: 1) the nature of the petitioner's right under the AEA or NEPA to be made a party to the proceeding; 2) the nature and extent of the petitioner's property, financial, or other interest in the proceeding; and 3) the possible effect of any decision or order that may be issued in the proceeding on the petitioner's interest. The two Petitioners based their claim of standing on the possibility that the Ross Project would jeopardize the economic and environmental interests of at least one of their members (NRDC and PRBRC, 2011).

On February 10, 2012, the ASLB ruled that the NRDC and the PRBRC had demonstrated standing to be parties to the Ross Project licensing proceeding. The ASLB granted the Petitioners' request for a hearing and admitted four contentions (ASLB, 2012).

1.6.2 Status of Permitting With Other Federal, State, Local, and Tribal Agencies

In addition to Strata's obtaining a source and byproduct materials license from the NRC prior to conducting uranium-recovery operations at the proposed Ross Project area, the Applicant is also required to obtain all necessary permits and approvals from other Federal and State agencies to address: 1) the underground injection of solutions and liquid effluents from the ISR process; 2) the specific exemption of all or a portion of the ore-zone aquifer from regulation under the *Safe Drinking Water Act*; and 3) the surface discharge of storm water during the construction and operation of the Ross Project facility and wellfields. SEIS Table 1.2 lists the status of the permits and approvals required for Strata to conduct uranium recovery at the Ross Project.

1.7 Consultations

As a Federal agency, the NRC is required to comply with the consultation requirements in Section 7 of the *Endangered Species Act of 1973* (ESA), as amended, and Section 106 of the *National Historic Preservation Act of 1966* (NHPA), as amended. As noted above, the GEIS programmatically reviewed the environmental impacts of ISR uranium milling within four distinct geographic regions and acknowledged that each site-specific review would need to include its own consultation process with relevant agencies. Section 7 (ESA) and Section 106 (NHPA) consultations that have been conducted for the proposed Ross Project are summarized in SEIS Sections 1.7.1 and 1.7.2, below. A list of related consultation correspondence is provided in Appendix A of this SEIS. Finally, SEIS Section 1.7.3 describes the NRC's coordination with other Federal, State, local, and Tribal agencies conducted during the development of this SEIS.

Table 1.2
Environmental Approvals for the Proposed Ross Project

Issuing Agency	Description	Status
U.S. Environmental Protection Agency	Approval of the exemption of an aquifer as an underground source of drinking water (USDW)	Approval received May 15, 2013 (ADAMS Accession No. ML13144A108).
Wyoming Department of Environmental Quality	Underground Injection Control (UIC) Class III Permit (Injection and Recovery Wells) (WDEQ, Title 35-11)	Approval received as part of Permit No. 802 (see below, under "Permit to Mine").
	UIC Class I Permit (Deep-Disposal Wells) (WDEQ, Title 35-11)	Application submitted June 2010 to UIC Program at WDEQ/WQD, Cheyenne, Wyoming, TFN No. WYS-011-00031. Approval received April 2011: Permit No. 10-263.
	Permit to Construct Domestic Waste Water System	To be prepared by Strata.
	Storm Water Discharge Permit (Industrial/Mining)	To be prepared by Strata.
	Storm Water Discharge Permit (Construction)	Approval received January 2013: Permit No. WYR104738.
	Waste Water Discharge Permit (Discharges during Well Installation)	Approval received April 2012: Permit No. WYG720229. Renewal received 2013 for a term through December 31, 2013.
	Permit to Mine	Application submitted January 2011 to WDEQ/LQD, Sheridan, Wyoming, TFN No. 56/110. Approval received November 2012: Permit No. 802.
	Mineral Exploration Permit (WDEQ, Title 35-11)	Approved: Permit No. 384DN.
	Air Quality Permit	Approval Received September 2011: Permit No. CT-12198.
	Waste-Water Surface Impoundment Construction Permit (Surface Impoundments)	To be prepared by Strata.
	Public Water Supply System Permit to Construct	To be prepared by Strata.

Table 1.2
Environmental Approvals for the Proposed Ross Project
(*Continued*)

Issuing Agency	Description	Status
U.S. Bureau of Land Management	Plan of Operations	Application submitted to BLM, January 2011. Application accepted for review July 2011: Case File No. WYW170151.
	Right of Way (Roads)	To be prepared by Strata.
	Notice of Intent to Explore	To be prepared by Strata.
U.S. Nuclear Regulatory Commission	Source and Byproduct Materials License (10 CFR Part 40)	Application submitted January 2011; Application accepted June 2011; Application currently under review.
U.S. Environmental Protection Agency	Aquifer Exemption Permit for Class I Injection Wells (40 CFR Parts 144 & 146)	See WDEQ Permits. (Wyoming has primacy for the UIC Program.)
	Aquifer Reclassification for Class III Injection Wells (WDEQ, Title 35-11)	
	Permit Application to Construct Surface Impoundments (40 CFR Part 61.07)	
	Public Water Supply System	To be prepared by Strata.
U.S. Army Corps of Engineers	Verification of Preliminary Wetlands Delineation	Application submitted September 2010; Verification received December 2010.
	Nationwide Permit Coverage Authorization	Preconstruction notification submitted January 2013.
Wyoming State Land & Farm Loan Office	Uranium Minerals Mining Lease	Approved: Lease No. 0-40979.
Wyoming Department of Environmental Quality and State Engineer's Office	Permit to Appropriate Ground Water for ISR Wellfield	Application submitted December 2012; Application currently under review.
	Permit to Appropriate Ground Water for Mine Wells	Approved: Permit Nos. 191679 – 191702; 192703 – 192705 (for regional monitoring wells). To be prepared by Strata (for ISR monitoring wells).
	Permits to Appropriate Surface Water and/or Surface Impoundments	To be prepared by Strata.

Table 1.2 Environmental Approvals for the Proposed Ross Project (*Continued*)		
Issuing Agency	**Description**	**Status**
Crook County	County Development Permits (Access Road Approach and Emergency-Services Agreement)	Memorandum of Understanding between Crook County and Strata executed April 2011.

Source: WWC Engineering, 2013a.

1.7.1 Endangered Species Act of 1973 Consultation

The ESA was enacted to mitigate further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the ESA requires consultation with the U.S. Fish and Wildlife Service (USFWS) to ensure that actions it authorizes, permits, or otherwise carries out would not jeopardize the continued existence of any listed species or adversely modify designated critical habitats.

By a letter dated August 12, 2011, the NRC staff initiated consultation with the USFWS and requested information on endangered or threatened species and critical habitats present at the proposed Ross Project area. The NRC received a response dated September 13, 2011, from the USFWS's Ecological Services in the Cheyenne, Wyoming, Field Office that: 1) listed the threatened and endangered species that could occur in the Project area; 2) provided recommendations for protective measures for threatened and endangered species; and 3) conveyed recommendations concerning migratory birds (USFWS, 2011).

The NRC staff also met with the Wyoming Game and Fish Department (WGFD), at its Sheridan, Wyoming, office on August 23, 2011, to discuss site-specific issues (NRC, 2011a). The WGFD/Sheridan Office staff expressed concern regarding the potential impacts to water fowl, migratory birds, big game, and small mammals as well as sage-grouse, a USFWS wait-list species for consideration as either threatened or endangered. The WGFD staff also expressed concern about invasive vegetation species and wildlife impacts due to powerlines, surface impoundments, and increased traffic. Related mitigation measures were also discussed. By a letter dated September 22, 2011, the WGFD provided the NRC staff with comments regarding the above concerns as a follow-up to the meeting in Sheridan (WGFD, 2011).

1.7.2 National Historic Preservation Act of 1966 Consultation

Section 106 of the NHPA requires that Federal agencies take into account the effects of their undertakings on historic properties and afford the Advisory Council on Historic Preservation (ACHP) an opportunity to comment on such undertakings. The Section 106 process seeks to consider the views of all consulting parties, including the Federal agency, the State Historic Preservation Office (SHPO), Native-American Tribes and Native Hawaiian organizations, Tribal Historic Preservation Offices (THPO), local government leaders, the Applicant, cooperating agencies, and the public.

The goal of consultation is to identify historic properties potentially affected by the undertaking, assess the effects of the undertaking on these properties, and seek ways to avoid, minimize, or mitigate any adverse effects on historic properties. As detailed in 36 CFR Part 800.2(c)(1)(i), the role of the WYSHPO (WYSHPO) in the Section 106 process, in the case of the Ross Project in Crook County, Wyoming, is to advise and assist Federal agencies in carrying out their Section 106 responsibilities. The NRC initiated consultation with the WYSHPO by a letter dated August 19, 2011, requesting information from the WYSHPO to facilitate the identification of historic and cultural resources that could be affected by the proposed Ross Project (NRC, 2011c).

In developing its license application to the NRC, Strata contracted with GCM Services, Inc. (GCM) to conduct a Class I literature search, two Class III cultural-resource inventories, and a paleontological survey. The Class I literature search, the original Class III cultural-resource inventory ("Class III Inventory"), and the paleontological survey were conducted in 2010. GCM's corresponding report was dated October 2010 and was included as Appendix 3.8-A to Strata's *Environmental Report* (ER), which was submitted to the NRC in January 2011. Strata has also provided an update to Appendix 3.8-A, dated October 2011. A Supplement to Appendix 3.8-A, submitted by Strata in August 2012, documented the findings of additional survey work conducted by GCM in November 2011, May 2012, and June 2012. Finally, Strata provided errata to the Supplement to Appendix 3.8-A in October 2012.

By a letter dated August 19, 2011, the NRC notified the ACHP of its intent to prepare this SEIS and to use the NEPA process to comply with its obligations under Section 106, in accordance with 36 CFR Part 800.8. The ACHP responded by a letter dated September 13, 2011, which stated that in using the NEPA process to comply with its obligations under Section 106, the NRC must also meet the standards set out in the ACHP's regulations at 36 CFR Part 800.8(c)(1)(i – v) for the following:

- Identifying historic properties
- Involving the public
- Assessing the Project's effects on historic properties
- Consulting regarding the Project's effects on historic properties with the WYSHPO, the Tribes that might attach religious and cultural significance to the affected properties, other consulting parties, and the ACHP, where appropriate, during the NEPA scoping process, the related environmental analyses, and the subsequent NEPA-document preparation

By a letter dated December 12, 2011, after receiving a letter from the Standing Rock Sioux Tribe (SRST) THPO, the ACHP requested a status update from the NRC on the Ross Project Section 106 consultation with Native-American Tribes and a summary of the steps the NRC had taken to comply with the ACHP's regulations. Particularly, the ACHP requested a summary of the NRC's efforts to notify relevant Tribes and to provide them with appropriate information to facilitate their participation in the Section 106 review process. The NRC provided a response to the ACHP's letter by a letter dated January 31, 2012. After receiving a letter from SRST's THPO, the ACHP again contacted the NRC by a letter dated May 3, 2013, forwarding the concerns of the SRST THPO and requesting that the NRC provide the status of its Section 106 consultation for the Ross Project (as well as other ISR projects in the region). The NRC provided a response to the ACHP with a letter dated August 13, 2013.

After reviewing the information provided by Strata between January 2011 and October 2012, the NRC staff concluded that Strata would need to provide additional information to allow the NRC staff to make determinations on the eligibility of the sites identified in the Class III Inventory. Strata, in a letter to the NRC dated January 8, 2013, addressed the outstanding information needs that were identified by the NRC and BLM staff. On January 10, 2013, the WYSHPO discussed Strata's letter with the NRC staff and suggested that the NRC recommend as "UNEVALUATED, pending further testing or consultation" those sites for which the NRC staff required additional information from Strata and provide the information for the WYSHPO to review. By a letter dated March 8, 2013, the NRC submitted to WYSHPO its preliminary determination on the effects on historic properties of its granting a license to the Applicant to construct and operate the proposed Ross Project.

The WYSHPO provided a response to the NRC by a letter dated March 28, 2013. In this letter, the WYSHPO documented its determination regarding the eligibilities of the identified sites and recommended a strategy to move the consultation process forward. The WYSHPO recommended that the NRC develop a testing plan in consultation with the SHPO, and any other parties that the NRC wished to include, that would not only determine Ross Project effects on the two "ELIGIBLE" properties, but the plan would also test the affected "UNEVALUATED" sites for National Register of Historic Properties (NRHP) eligibility and Project effects at the same time. In a subsequent discussion, the WYSHPO indicated that it would be appropriate to delay consultation on a testing plan until the NRC staff determined whether the testing plan would need to be modified due to information that could result from the Tribal field survey that had been proposed at the time.

Following two Tribal field surveys held in May and June of 2013, which are described in SEIS Section 1.7.3.8, the NRC staff by a letter dated September 20, 2013, provided to WYSHPO its final eligibility determinations for the properties identified by GCM, its findings regarding Strata's testing plan, and its findings regarding the NRHP eligibilities of four properties that were identified during the Tribal field surveys. The WYSHPO provided a response in a letter dated October 22, 2013.

The NRC is also consulting with potentially affected Native-American Tribes as part of the Section 106 consultation process according to 36 CFR Part 800.2(c). These interactions are detailed in SEIS Section 1.7.3.8.

The NRC staff, in consultation with the WYSHPO, also determined that a programmatic agreement (PA) should be developed. The Ross Project-specific PA, a draft of which included in this SEIS as Appendix E, defines the consultation process to be undertaken when an unevaluated site is to be tested is deferred until such time as the NRC determines that the areas where these sites are located would be impacted by the proposed Project activities as well as the mitigation planning for any eligible sites later identified. The NRC staff held six webinars to develop a draft Ross Project PA and distributed that draft to those who have participated in its composition. The draft was provided by the NRC on January 17, 2014, for a 30-day comment period. By letters dated September 19, 2013, the NRC staff invited the BLM, the WYSHPO, the ACHP, the Ross Project Consulting Tribes, the Crook County Museum District, and the Alliance for Historic Wyoming to participate in the development of the PA. Webinar participants included the NRC, the WYSHPO, the Applicant, the BLM, ACHP, National Park Service (NPS) (Devils Tower), the Cheyenne and Arapaho Tribes of Oklahoma THPO, the Chippewa Cree Tribe THPO, the Northern Cheyenne Tribe THPO, the Fort Peck Assiniboine and Sioux Tribes THPO, and the Cheyenne River Sioux Tribe THPO.

1.7.3 Coordination with Other Federal, State, Local, and Tribal Agencies

The NRC staff interacted with Federal, State, local, and Tribal agencies during preparation of this SEIS to gather information on potential issues, concerns, and environmental impacts related to the proposed Ross Project. The consultation and coordination process has included discussions with the BLM, the NPS, the Wyoming Department of Environmental Quality (WDEQ), the WGFD, the Wyoming State Engineer's Office (SEO), local organizations (e.g., PRBRC, City of Moorcroft's First Responders, and Crook County) as well as Tribal governments.

1.7.3.1 Coordination with the U.S. Bureau of Land Management

In its letter dated January 27, 2011, the BLM indicated its intent to serve as a cooperating agency in the NEPA evaluation and licensing process for the proposed Ross Project, with the NRC serving as the lead agency. The proposed Ross Project area contains approximately 16 ha [40 ac] of BLM-administered surface land. The BLM also has jurisdiction over 65 ha [160 ac] of subsurface mineral rights under privately owned land within the proposed Project area. As discussed in SEIS Section 1.3, the BLM's responsibility for the proposed undertaking is to fulfill its statutory responsibilities to regulate mining on Federal lands as described in 43 CFR Part 3809. A Memorandum of Understanding (MOU) between the NRC and the BLM (75 FR 1088), signed by the BLM on October 16, 2009, and by NRC on November 30, 2009, provides the framework for the cooperating-agency relationship. A new MOU was signed by the BLM on February 12, 2013 and by the NRC on February 4, 2013.

The BLM is responsible for administering the National System of Public Lands and the Federal minerals underlying these lands. The BLM is also responsible for managing so-called "split estate" situations, where Federal minerals underlie a surface that is privately held or owned by State or local government(s). In these situations, operators on mining claims, including uranium-recovery facilities, must submit a POO and obtain the BLM's approval before beginning operations beyond those for casual use (for surface disturbance of more than 2 ha [5 ac]).

The NRC has coordinated with the BLM during its preparation of this SEIS. Regular conference calls and meetings have been held. The NRC staff met with the staff of the BLM's Newcastle, Wyoming, Field Office on August 24, 2011, to discuss the Applicant's POO for the proposed Ross Project. The BLM staff has familiarized the NRC staff with the POO review process and has shared some of the comments and concerns that the BLM staff had received from individuals commenting on the POO.

1.7.3.2 Coordination with the U.S. National Park Service

The NRC staff met with NPS staff at Devils Tower National Monument ("Devils Tower" or "Bear Lodge") on August 25, 2011 (NRC, 2011a). The NPS staff discussed the use of Devils Tower by various Native-American Tribes for cultural activities, prayers, and other religious and spiritual purposes. The NPS staff shared its concerns about the night-sky viewshed and noise as well as potential impacts to ground-water quality. The NPS is a commenting agency for this SEIS and, as such, was provided a copy of the DSEIS and an opportunity to comment during the public-comment period. The NPS at Devils Tower is also participating in the development of the Ross Project PA.

1.7.3.3 Coordination with the Wyoming Department of Environmental Quality

The NRC staff met with the WDEQ staff in Sheridan, Wyoming, on August 23, 2011, to discuss the WDEQ's role in the NRC's environmental-review process for uranium-recovery facilities (NRC, 2011a). The WDEQ staff participating in this meeting included representatives from the Land Quality Division (LQD), Water Quality Division (WQD), and the Air Quality Division (AQD). Topics discussed during the meeting included the WDEQ air-quality review and permitting as well as other required WDEQ permits. The WDEQ staff expressed concern regarding the proposed location of the Central Processing Plant and the surface impoundments in addition to fugitive-dust and gaseous emissions.

The NRC staff also met with personnel from the WDEQ in Casper, Wyoming, on August 24, 2011 (NRC, 2011a). The WDEQ staff participating in this meeting included representatives from the WQD as well as the Solid and Hazardous Waste Division (SHWD). The WDEQ explained the permitting process for land application of waste water and discussed solid-waste management.

1.7.3.4 Coordination with the Wyoming Game and Fish Department

The WGFD is responsible for controlling, propagating, managing, protecting, and regulating all game and nongame fish and wildlife in Wyoming under Wyoming Statute (W.S.) 23-1-301-303 and 23-1-401. Regulatory authority given to the WGFD allows for the establishment of hunting, fishing, and trapping seasons as well as the enforcement of rules protecting nongame and State-listed species.

The NRC staff met with a representative of the Sheridan Regional WGFD office on August 23, 2011 (NRC, 2011a). As discussed in SEIS Section 1.7.1, the WGFD staff expressed concerns about migratory birds, raptors, big game, and small mammals that could be affected by the proposed Ross Project and suggested mitigation strategies to minimize or eliminate impacts.

1.7.3.5 Coordination with the City of Moorcroft's First Responders

The NRC staff met with the City of Moorcroft's First Responders on August 25, 2011 (NRC, 2011a). The First Responders briefed the NRC staff on the availability of local emergency equipment, personnel, and medical facilities. The First Responders discussed their need for additional training with respect to, especially, radioactive materials. The availability of land-use plans and socioeconomic data was also discussed.

1.7.3.6 Coordination with the Powder River Basin Resource Council

The NRC staff met with PRBRC representatives on August 23, 2011 (NRC, 2011a). The PRBRC representatives shared several concerns regarding the proposed Ross Project, including concerns about the Applicant's uranium-recovery experience; potential direct and cumulative impacts to water quality, air quality, and ecology from the Project's operation; the potential for accidents and long-term effects; and aquifer restoration and excursion monitoring.

1.7.3.7 Coordination with Localities

The NRC staff also met with Crook County officials and staff on August 25, 2011, including representatives from the Crook County Sheriff's Office, Crook County District Attorney's Office, Crook County Road and Bridge Department, Crook County Natural Resource District, Crook

County Weed & Pest Manager, Crook County Commissioners, Crook County Community Development Department, and Crook County Emergency Management Department (NRC, 2011a). The Crook County officials and staff shared several concerns and asked many questions about the proposed Ross Project. Topics discussed included the chemical and radiological hazards associated with the Ross Project, the management of drillholes and wells, the potential for drinking-water contamination, the use of ground-water supplies, financial assurance, the management of solid wastes, the mitigation of invasive vegetation species, the decommissioning of the facility and the reclamation of the site itself, and the cumulative environmental impacts.

1.7.3.8 Interactions with Tribal Governments

Pursuant to Section 106 of the NHPA, the NRC staff initiated discussions with potentially affected Native-American Tribes that possess potential religious, spiritual, and cultural interests at the proposed Ross Project area. On November 19, 2010, the NRC sent a letter to 14 Tribes, notifying them of Strata's intent to submit an application for a license for the Ross Project and soliciting input from these Tribes (NRC, 2010). The NRC then sent letters, dated February 9, 2011, to the following 24 Tribes, inviting the Tribes to participate in formal consultations for the proposed Ross Project (NRC, 2011d):

- Apache Tribe of Oklahoma
- Blackfeet Tribe
- Cheyenne and Arapaho Tribes of Oklahoma
- Cheyenne River Sioux Tribe
- Crow Tribe
- Crow Creek Sioux Tribe
- Eastern Shoshone Tribe
- Flandreau Santee Sioux Tribe
- Fort Belknap Community
- Fort Peck Assiniboine/Sioux Tribe
- Kiowa Tribe of Oklahoma
- Lower Brule Sioux Tribe
- Northern Arapaho Tribe
- Northern Cheyenne Tribe
- Oglala Sioux Tribe
- Rosebud Sioux Tribe
- Salish, Pend d'Oreille, and Kootenai Tribes (Confederated Salish and Kootenai Tribes)
- Santee Sioux Nation
- Sisseton-Wahpeton Sioux Tribe
- Spirit Lake Tribe
- Standing Rock Sioux Tribe
- Three Affiliated Tribes (Mandan, Hidatsa, and Arikara Nation)
- Turtle Mountain Band of Chippewa Indians
- Yankton Sioux Tribe

The NRC staff continued its efforts to engage in consultation with the Tribes that might be affected by the Ross Project with follow-up telephone calls and by e-mail.

On April 15, 2011, the Rosebud Sioux Tribe notified the NRC via e-mail that it was interested in consultation and had concerns about the proposed Project (Rosebud Sioux Tribe, 2011). On April 29, 2011, the SRST notified the NRC via e-mail of its desire to consult (Standing Rock

Sioux Tribe, 2011). On May 5, 2011, the Northern Cheyenne Tribe notified the NRC via e-mail of its interest to consult (Northern Cheyenne Tribe, 2011). On May 17, 2011, the Cheyenne River Sioux Tribe notified the NRC via e-mail of its interest to consult on the proposed Project (Cheyenne River Sioux Tribe, 2011).

By a letter dated April 14, 2011, the THPO for the Turtle Mountain Band of Chippewa Indians informed the NRC that it does not likely have any traditional cultural properties that would be of National-Register significance in the Ross Project area (Turtle Mountain Band of Chippewa Indians, 2011). The NRC was notified by e-mail on August 19, 2011, that the Apache Tribe of Oklahoma was not interested in consultation on the Ross Project (Apache Tribe of Oklahoma, 2011). The Salish, Pend d'Oreille, and Kootenai Tribes notified the NRC by e-mail on December 29, 2011, that these Tribes would defer to Tribes which are nearer to the Project area for consultation on the Ross Project (Salish, Pend d'Oreille, and Kootenai Tribes, 2011). In an attachment to an e-mail dated October 11, 2013, and in response to an invitation from the NRC to participate in the preparation of the Ross Project PA, the Flandreau Santee Sioux Tribe notified the NRC that it has no objections to the Ross Project. However, the correspondence also requested that construction stop immediately and the appropriate persons (State and Tribal Native American Graves Protection and Repatriation Act [NAGPRA] representatives) be notified if human skeletal remains and/or any objects falling under NAGPRA are uncovered during Project construction.

By a letter dated September 2, 2011, the Tribal Archaeologist for the SRST responded to the NRC's February 9, 2011, Section 106 consultation-initiation letter and provided comments on the Class III Inventory by GCM dated December 2010. The letter stated that the SRST does not agree with the determination of "INELIGIBLE" for Sites 48CK2070, 48CK2076, and 48CK2087. The SRST Archaeologist also stated that Site 48CK2082 should be evaluated by Tribal representatives to determine whether the outcropping of sandstone is cultural in origin and that sites which contain ortho-quartzite fire-cracked rock, particularly Sites 48CK2089, 48CK2090, and 48CK2091, should also be evaluated by Tribal representatives. The letter included other general comments as well, including a comment that site-identification efforts should include a survey of the Ross Project area to identify properties of traditional and religious significance to the SRST. By an e-mail dated October 6, 2011, the THPO for the Yankton Sioux Tribe informed the NRC that the Yankton Sioux's THPO concurs with the findings and concerns of the SRST as indicated in the SRST's September 2, 2011, letter.

The NRC staff, along with BLM staff and the Applicant, conducted a site visit with representatives from the Northern Arapaho, the Northern Cheyenne, and the Fort Peck Assiniboine Sioux Tribes on September 13, 2011. The NRC and BLM staffs participated in a consultation meeting with the Northern Arapaho and the Northern Cheyenne Tribes on September 14, 2011, after the site visit. On November 2, 2011, the NRC and BLM staffs as well as the NPS staff for Devils Tower and the Applicant conducted a second site visit with representatives from the Chippewa Cree, Crow Creek Sioux, and the Fort Peck Assiniboine Sioux Tribes and the Santee Sioux Nation. On November 3, 2011, the NRC, BLM, and NPS staffs participated in a consultation meeting with representatives from the Crow Creek Sioux and the Fort Peck Assiniboine Sioux Tribes as well as the Santee Sioux Nation. The Chippewa Cree Tribe, not formerly invited, expressed interest in consulting during planning for the second consultation meeting.

During the September 2011 and November 2011 consultation meetings, the Tribes requested that a survey for properties of religious and cultural significance (or a traditional cultural property [TCP] survey) of the Ross Project area be conducted. By a letter dated February 1, 2012, the

THPO for the Rosebud Sioux Tribe expressed concern for potential adverse effects to the cultural resources within the Project area as well as adverse effects to the viewshed of Matotipila (Devils Tower or Bear Lodge) and the Missouri Buttes. The THPO for the Rosebud Sioux Tribe also indicated that the Tribe supported a TCP survey of the Project area. During the November 2011 site visit, Strata indicated that it would be willing to support such a Tribal field survey. On December 6, 2011, the NRC sent a letter to Strata requesting a written proposal to acquire TCP information. Strata responded with a letter, dated January 12, 2012, in which it stated that in lieu of submitting a proposal for a TCP survey of the Ross Project area, Strata would like to issue a Request for Proposal (RFP) from consultants to conduct the TCP survey, identification, and evaluation. During conversations with several THPOs, the NRC staff was informed that the Tribes did not wish to work with a third-party consultant hired by the Applicant. Therefore, the NRC staff enlisted support from its own third-party consultant to work with the Tribes to obtain information on potential TCPs in the Project area.

At this time, the NRC staff was also working with many of the same Tribes to obtain TCP information for other uranium-recovery projects under the NRC staff's review. The Tribes consulting on the Ross Project suggested using a Scope of Work (SOW) that was being prepared for one of the other ISR projects under NRC review and revising it to be applicable for the Ross Project. The Tribes requested introductory information on the Ross Project area to assist them in developing a draft SOW for a TCP survey of the Ross Project area. This information was provided to the Tribes via e-mail on July 25, 2012. In August 2012, the NRC's third-party consultant began contacting the Tribes via telephone and e-mail to invite them to meet in Bismarck, North Dakota, in early September to discuss the SOW (many of the Tribes were planning to be in Bismarck at that time for a meeting with another agency). Strata provided a draft SOW to the NRC to be shared with the Tribes during the meeting. Sixteen Tribal representatives indicated that they would attend the meeting.

On September 4, 2012, the NRC's third-party consultant met with representatives from the SRST and the Three Affiliated Tribes in Bismarck, North Dakota. The SRST representative indicated during this meeting that the Tribes did not wish to use the SOW developed by Strata and would develop a draft SOW for the Ross Project on their own. The Tribal representatives also indicated that a separate cost proposal would need to be developed for the TCP field survey. In October and November 2012, the NRC staff worked with the representatives from the SRST to revise a SOW provided to the NRC by the Tribes for another uranium-recovery project that was currently under NRC review. The Tribes indicated that this latter SOW could be made to be applicable to the Ross Project. Also, on October 23, 2012, Strata hosted three representatives from Makoche Wowapi (a separate company) at the Ross Project area to facilitate that company's preparation of a cost proposal for a TCP survey. Makoche Wowapi had submitted a cost proposal for a TCP survey for another uranium-recovery project that was also currently under NRC review, and many of the THPOs had been discussing naming that company as the preferred consultant to conduct a TCP survey at the Ross Project area.

On November 13 and 14, 2012, the NRC staff provided the draft SOW for the TCP survey to the THPOs and Strata, respectively, via e-mail for review and comment. The THPOs held a teleconference to discuss the draft SOW on November 14, 2012, and invited the NRC staff to participate and to answer questions. During the November 14, 2012, teleconference several THPOs indicated that the draft SOW was acceptable and indicated that Makoche Wowapi should be made their preferred consultant to conduct the TCP survey.

The NRC staff shared the final SOW with the consulting THPOs via an e-mail on November 30, 2012. After no comments were received, the NRC staff also shared the final SOW with

Makoche Wowapi on December 4, 2012. On December 12, 2012, Makoche Wowapi submitted a cost proposal for the TCP survey to the NRC. Strata notified the NRC staff, by an e-mail dated February 15, 2013, that its negotiations with Makoche Wowapi had come to an end and an agreement had not been reached.

The Ross Project Section 106 consultation is the third in a series of consultations, including those for the Crow Butte and Dewey-Burdock Projects, during which the NRC staff attempted to follow this process, which the staff calls the “SOW approach.” As with the Dewey-Burdock Project, the SOW approach came to an end for the Ross Project when the Applicant and the Tribes’ preferred contractor, Makoche Wowapi, could not reach an agreement on the cost proposal.

The NRC staff considered other alternatives for the Ross Project after the SOW approach had proven unsuccessful for the Crow Butte and Dewey-Burdock Projects, recognizing that it might likely prove unsuccessful for the Ross Project as well. The NRC staff anticipated that resolving cost differences would be time consuming and delay the field-survey work (which is limited in time to late spring, summer, and early fall—approximately six months—due to the harsh winters in Wyoming). However, because of differences between the Projects, such as the total Project area, and because the Ross Project’s consulting parties worked toward the SOW approach, the NRC staff remained optimistic and continued in this manner until the process eventually came to the same end.

At that point, the NRC staff had become aware that an alternative approach could be successful. This alternative approach, which the NRC staff calls the “open-site approach,” involves a project area being made available for a specific time period, during which each consulting Tribe may send representatives to the project site to conduct a field survey. The respective license applicant would provide compensation to the Tribe(s) and reimburse the individual Tribal representatives for expenses, and the Tribe would provide a subsequent survey report. This approach was being used for the Crow Butte and Dewey-Burdock Projects and had been used successfully by another Federal agency. Therefore, after Strata informed the NRC that it had not reached an agreement with Makoche Wowapi, the NRC staff requested that Strata provide a compensation plan and dates that the Ross Project area could be open to the Tribes. The NRC staff requested this information from Strata in order to recommend the open-site approach to the Ross Project Consulting Tribes.

The NRC staff incorporated many key aspects of the former SOW into an open-site-approach proposal that was sent to the Tribes with a letter from the NRC staff dated March 11, 2013. Specifically, the SOW described the methodology of the field survey and the required contents of the survey report. Below are the aspects of the SOW that also appeared in the open-site-approach proposal offered to the Tribes:

- Survey of the entire 696-ha [1,721-ac] Ross Project area
- Compensation provided to the Tribes by the Applicant
- Field-survey representatives and monitors to make up the field-survey crew provided by the Consulting Tribes
- Field-survey participants reimbursed for lodging, meals, mileage, and incidental expenses by the Applicant
- Consulting Tribes to provide a written summary of the field survey after a certain drafting period following completion of the survey, including an identifying label (e.g., TCP-1), location, and description of all identified sites of Tribal significance

- Provisions for confidentiality of TCP sites and other information
- Recommendations concerning the NRHP eligibility of identified sites by the Consulting Tribes

Several Consulting Tribes expressed interest in conducting a survey after reviewing the open-site-approach proposal provided by the NRC; however, this proposal was not put forth as a last and final option. The NRC staff intended to be responsive to continuing consultation with any Tribes that did not wish to follow the open-site approach. As such, the NRC staff communicated with the SRST THPO in March 2013 regarding alternative approaches, and, in April 2013, the SRST's THPO provided an alternative-approach template to the NRC staff. The NRC staff and the SRST call this alternative approach the "Tribal-working-group (TWG) approach." This approach uses a work plan that allows several Tribes to form a TWG to conduct a field survey. The TWG approach differs from the open-site approach in its compensation and reimbursement specifications and in its reporting requirements, including the stipulation that the NRC staff would be responsible for initially drafting and distributing a "Tribal field survey report" to the TWG following the field survey.

The NRC staff revised the work-plan template that was provided by the SRST's THPO to make it appropriate for the Ross Project and shared it with the SRST THPO and with Strata. The NRC staff, the SRST THPO, and Strata agreed on all aspects of the work plan except the requirement that the Tribal field-survey participants be hired by either Strata or the NRC as temporary employees. This requirement was included in the work plan by the TWG in order to ensure that Tribal field-survey participants, who are not necessarily employees of a specific Tribe, would be insured against any injuries that could potentially occur or damage that they might cause to private property during a survey. Instead of being hired as temporary employees, the NRC staff recommended that the Tribal field-survey participants obtain insurance to protect themselves from the costs that could be associated with these types of incidents. Unfortunately, after extensive back and forth negotiation between the parties, the NRC staff and the SRST were not able to resolve this issue, and the SRST notified the NRC staff that the Tribe declined to participate in a Ross Project field survey.

The Tribal field survey of the Ross Project area was conducted by 27 Tribal members representing 10 Tribes. Tribes that elected to participate in a field survey had the option to participate in either the open-site approach or the TWG approach. The first Tribal Field Survey was conducted during the period of May 13 – 17, 2013, and included 6 Tribes, 4 of which conducted the Survey according to the TWG approach. The second Tribal Field Survey was conducted during the period of June 3 – 7, 2013, and included 4 Tribes, all of which conducted that Survey in accordance with the open-site approach. Certain aspects of the TWG approach, such as Strata's providing lodging and transportation to and from the Project area each day, were incorporated into the open-site approach during the second Survey as well because these aspects worked well during the first Tribal Field Survey. Each multi-Tribe field-survey crew worked together with the support of the NRC and Strata staffs to plan the site-specific survey methodology used in addition to the approach provided in the open-site and TWG proposals. Strata provided compensation and *per diem* in accordance with the two approaches as well as maps, work space, and transportation in the field. The NRC Project Managers, with an NRC third-party subconsultant, provided global positioning system (GPS) support for both field-survey crews as well as planning and oversight. The NRC staff and its third-party subconsultant prepared and distributed a preliminary *Tribal Field Survey Report* to the TWG Tribes for their input. The NRC staff also received *Field Survey Reports* from the Cheyenne and Arapaho Tribes of Oklahoma and the Northern Arapaho Tribe. The NRC staff and its subconsultant prepared a final *Tribal Field Survey Report*, which documents the NRC staff's eligibility determinations for the identified TCPs. This *Report* will be provided to the WYSHPO for concurrence. Any sites of Tribal interest that are determined to be eligible TCPs by the NRC in consultation with the WYSHPO will be addressed in accordance with the final PA for the Ross Project.

1.8 Structure of the SEIS

As noted in SEIS Section 1.4.1, the GEIS evaluated the broad impacts of ISR projects in a four-state region where such projects are anticipated (NRC, 2009b), but it did not reach site-specific decisions for new ISR projects. The NRC staff has evaluated the extent to which the information and conclusions in the GEIS could be incorporated by reference into this SEIS. The NRC staff also determined whether any new and significant information existed that would change the expected environmental impacts beyond those evaluated in the GEIS.

SEIS Section 2 describes the Proposed Action and the reasonable Alternatives considered for the proposed Ross Project; Section 3 presents the affected environment (i.e., as the Ross Project area is today); and Section 4 evaluates the environmental impacts of the Applicant's implementing the Proposed Action and two Alternatives. Section 5 presents the potential cumulative impacts of the Ross Project, while Section 6 describes the environmental measurement and monitoring programs proposed for the Ross Project. A cost-benefit analysis is provided in Section 7, and the environmental consequences as a result of the Proposed Action and Alternatives are summarized in Section 8.

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2 IN SITU URANIUM RECOVERY AND ALTERNATIVES

This section describes the Proposed Action, which is to issue a United States (U.S.) Nuclear Regulatory Commission (NRC) source and byproduct materials license to Strata Energy, Inc. (Strata or the "Applicant"), for the proposed Ross Project in northeastern Wyoming. Strata would use its license in connection with the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project. This section also discusses alternatives to the Proposed Action, including the No-Action alternative as required under the *National Environmental Policy Act of 1969* (NEPA).

> **What is source material?**
>
> "Source material" means either the element thorium or the element uranium, provided that the uranium has not been enriched with the radioisotope uranium-235.
>
> **What is byproduct material?**
>
> "Byproduct materials" are tailings or wastes generated by extraction or concentration of uranium or thorium processed ores, as defined under Section 11e.(2) of the Atomic Energy Act (AEA).

Figure 2.1 indicates the proposed location of the Ross Project. Section 2.1 of this Final Supplemental Environmental Impact Statement (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) describes the Alternatives that are included for detailed analysis, including the Proposed Action; Section 2.2 describes those alternatives that were considered but eliminated from detailed analysis; Section 2.3 summarizes the potential environmental impacts of the Proposed Action and the two Alternatives; and Section 2.4 discusses the NRC staff's final recommendation that the NRC issue a source and byproduct materials license for the Proposed Action unless safety issues mandate otherwise.

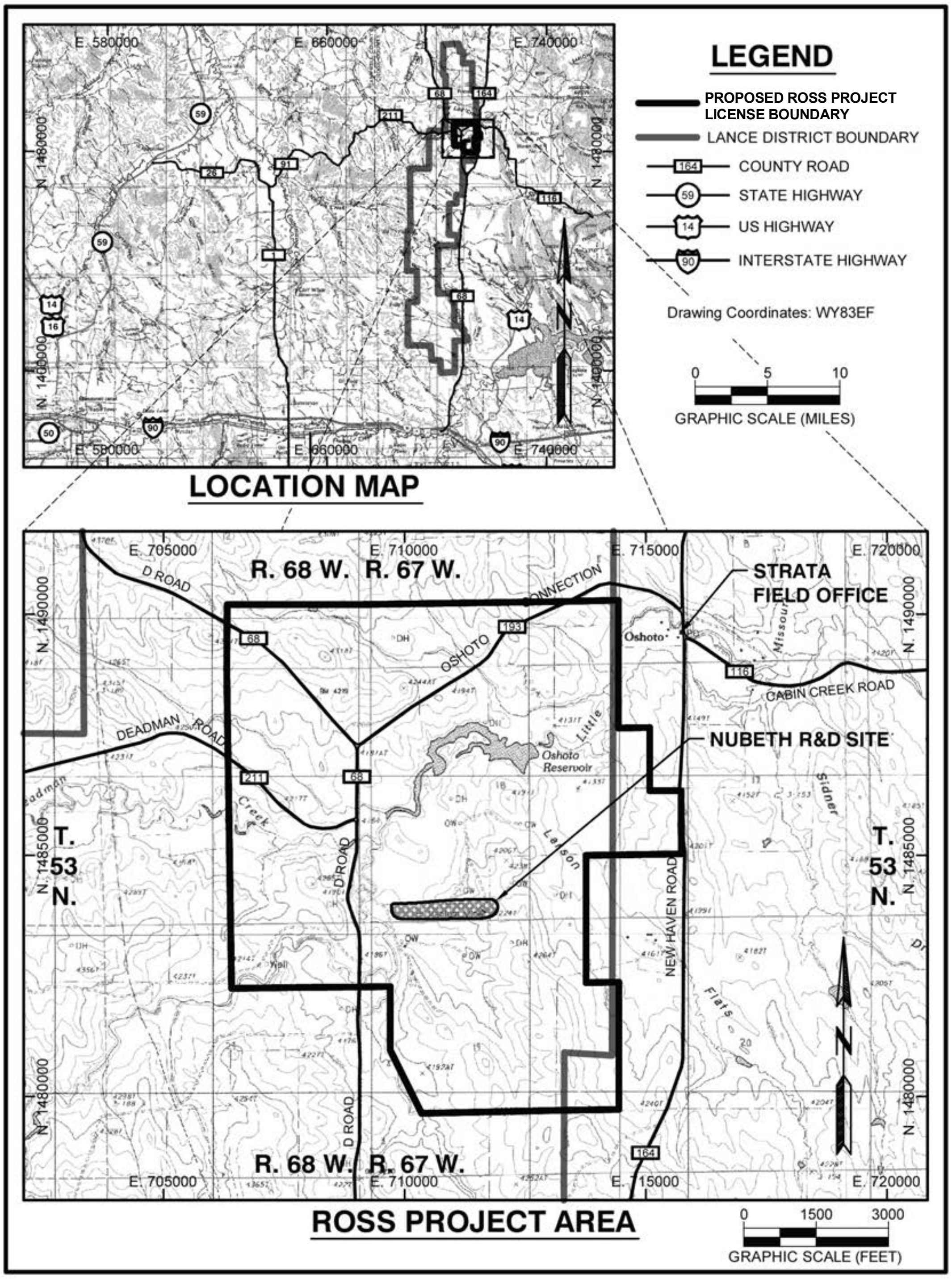
2.1 Alternatives Considered for Detailed Analysis

In addition to the Proposed Action, two alternatives to the Ross Project are also considered in this SEIS. All alternatives are evaluated with regard to the four phases of a uranium-recovery operation: construction, operation, aquifer restoration, and decommissioning. The range of alternatives has been established based on the purpose and need statement as described in Section 1.3 of this SEIS. In addition, this SEIS adopts many of the conclusions reached in the GEIS that was prepared for in situ recovery (ISR) projects (NRC, 2009b).

Alternatives examined in this SEIS are:

- Alternative 1 is the Proposed Action, as described in the Applicant's license application. The Proposed Action is described in SEIS Section 2.1.1.
- Alternative 2 is the No-Action Alternative, as required by NEPA, where the Applicant would not construct, operate, restore the aquifer, or decommission the Ross Project. Alternative 2 is described in SEIS Section 2.1.2.
- Alternative 3 is the same as the Proposed Action, except that the Ross Project facility (i.e., the central processing plant [CPP], auxiliary and support buildings and structures, and the surface impoundments) would be situated at a different location to the north of the Proposed Action (i.e., at the "north site"). Alternative 3 is identified in this SEIS as the "North Ross Project" and is described in SEIS Section 2.1.3.

The sources of information used in the development of this SEIS include the following: the Applicant's license application, including its *Environmental Report* (ER) (Strata, 2011a) and its *Technical Report* (TR) (Strata, 2011b) as well as its Responses to Requests for Additional



Source: Strata, 2011a.

Figure 2.1
Ross Project within the Lance District

Information (RAIs) (Strata, 2012a; Strata, 2012b); the information and scoping comments gathered during the NRC staff's and NRC consultants' site visit in August 2011 (NRC, 2011); information independently researched by the NRC staff from publicly available sources; multidisciplinary discussions held among NRC staff and various stakeholders; and the *Generic Environmental Impact Statement* (GEIS) itself (NRC, 2009b).

2.1.1 Alternative 1: Proposed Action

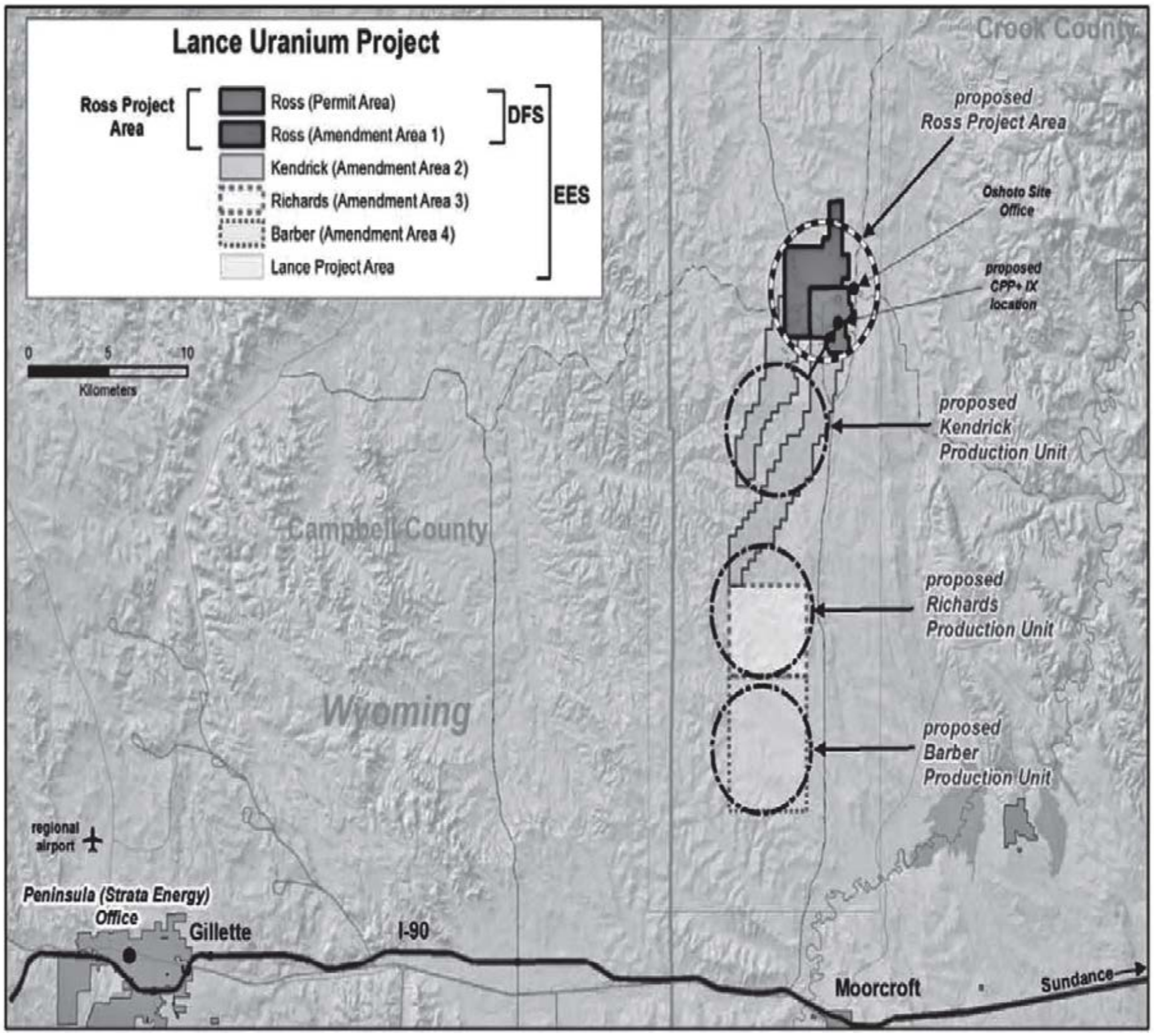
Under the Proposed Action, the NRC would issue the Applicant a source and byproduct materials license. The Applicant would use its license to construct, operate, restore the respective aquifers, and decommission the Ross Project facility and wellfields as described in its license application (Strata, 2011a; Strata, 2011b). Also, under the Proposed Action, the U.S. Bureau of Land Management (BLM) would approve the Applicant's Plan of Operations (POO). The Ross Project would occupy 696 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District, an area where the Applicant is actively exploring to determine whether there are additional uranium deposits. As Figure 2.2 shows, Strata has identified four other uranium-bearing areas that would potentially extend the area of uranium recovery in the Lance District itself to the north (the potential Ross Amendment Area 1) and to the south (the potential Kendrick, Richards, and Barber areas) (Strata, 2012a).

The Lance District is located on the western edge in the northwest corner of the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) (see Figure 2.3). It is situated between the Black Hills uplift to the east and the Powder River Basin to the west (Strata, 2011a). Both of these regional features are described in the GEIS (NRC, 2009b). However, the Powder River Basin has been described as part of the Wyoming East Uranium Milling Region (WEUMR) and the Black Hills uplift as part of the NSDWUMR. The uranium ore zone at the Ross Project is situated in the Upper Cretaceous Fox Hills and Lance Formations. Although these stratigraphic units are not specifically described in the GEIS, they share key attributes that are important for ISR with the uranium-hosting Wasatch Formation in the Powder River Basin described for the WEUMR and the Inyan Kara Group described for the NSDWUMR (NRC, 2009b). These key attributes include alternating layers of permeable sandstone, which allow hydraulic connection within an ore zone, and shale layers, which prevent fluid migration outside of an ore zone. The present-day environment of the Proposed Action is described in SEIS Section 3, Affected Environment.

The Proposed Action includes the uranium-recovery facility itself and its wellfields (see Figures 2.4 and 2.5). The ISR facility consists of the following:

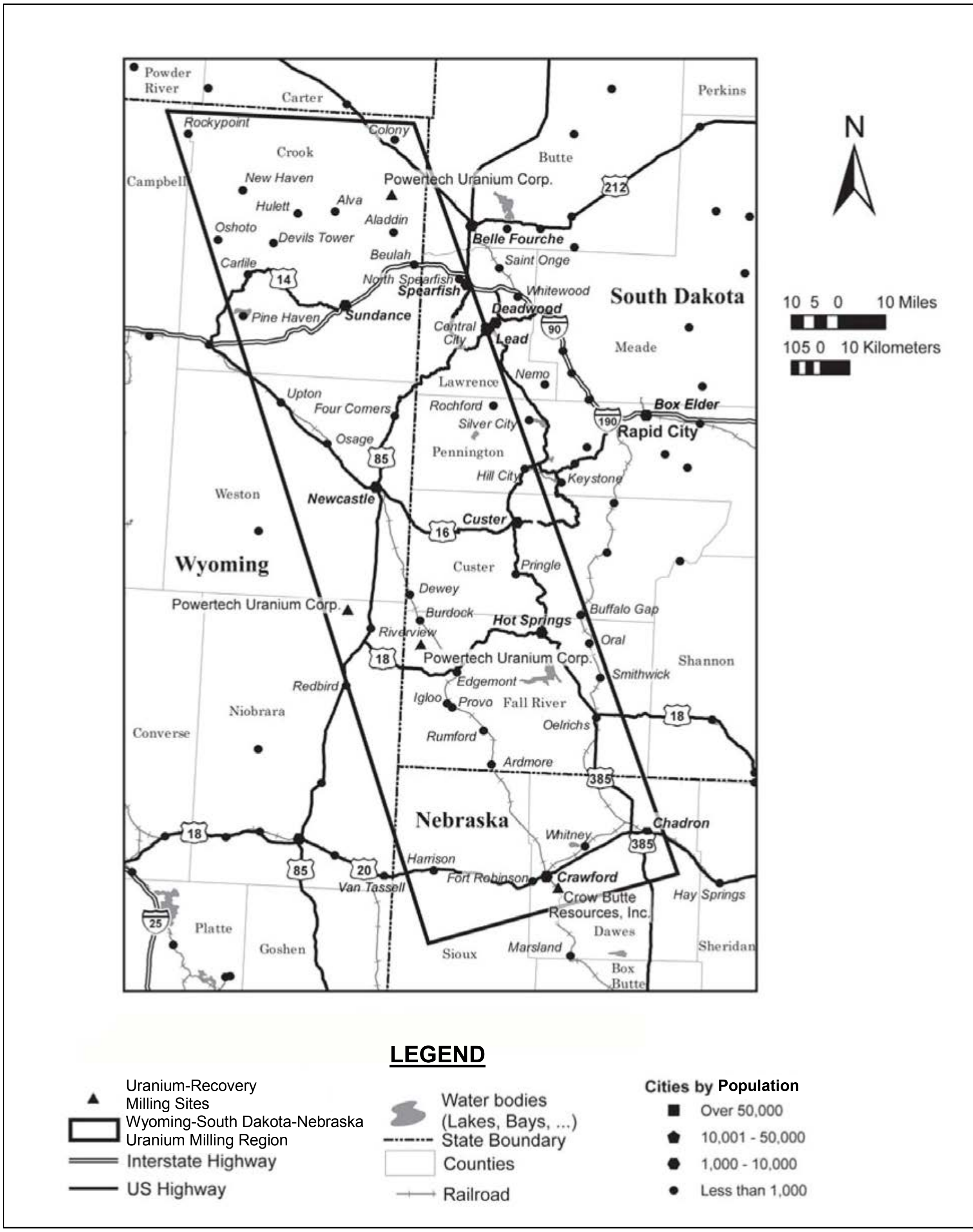
- A CPP that houses the uranium- and vanadium-processing equipment, drying and packaging equipment, and water-treatment equipment.
- A chemical storage area as well as other storage, warehouse, maintenance, and administration buildings.
- Two double-lined surface impoundments, a sediment impoundment, and up to five Class I deep-injection wells.

The schedule for the Proposed Action is shown in Figure 2.6. The Proposed Action includes the option of the Applicant's operating the Ross Project facility beyond the life of the Project's wellfields.



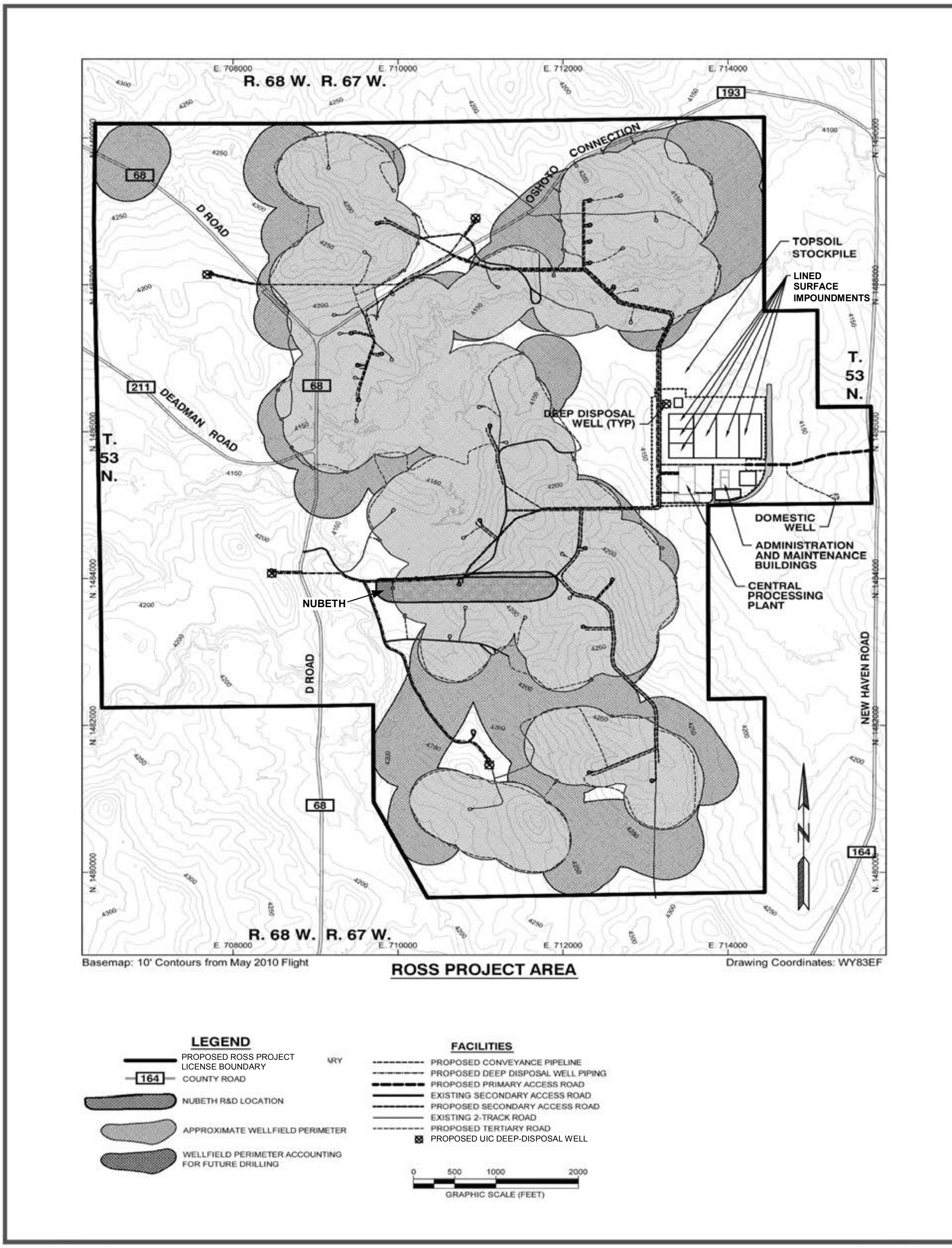
Source: Strata, 2012a.

Figure 2.2
Potential Satellite Areas in the Lance District



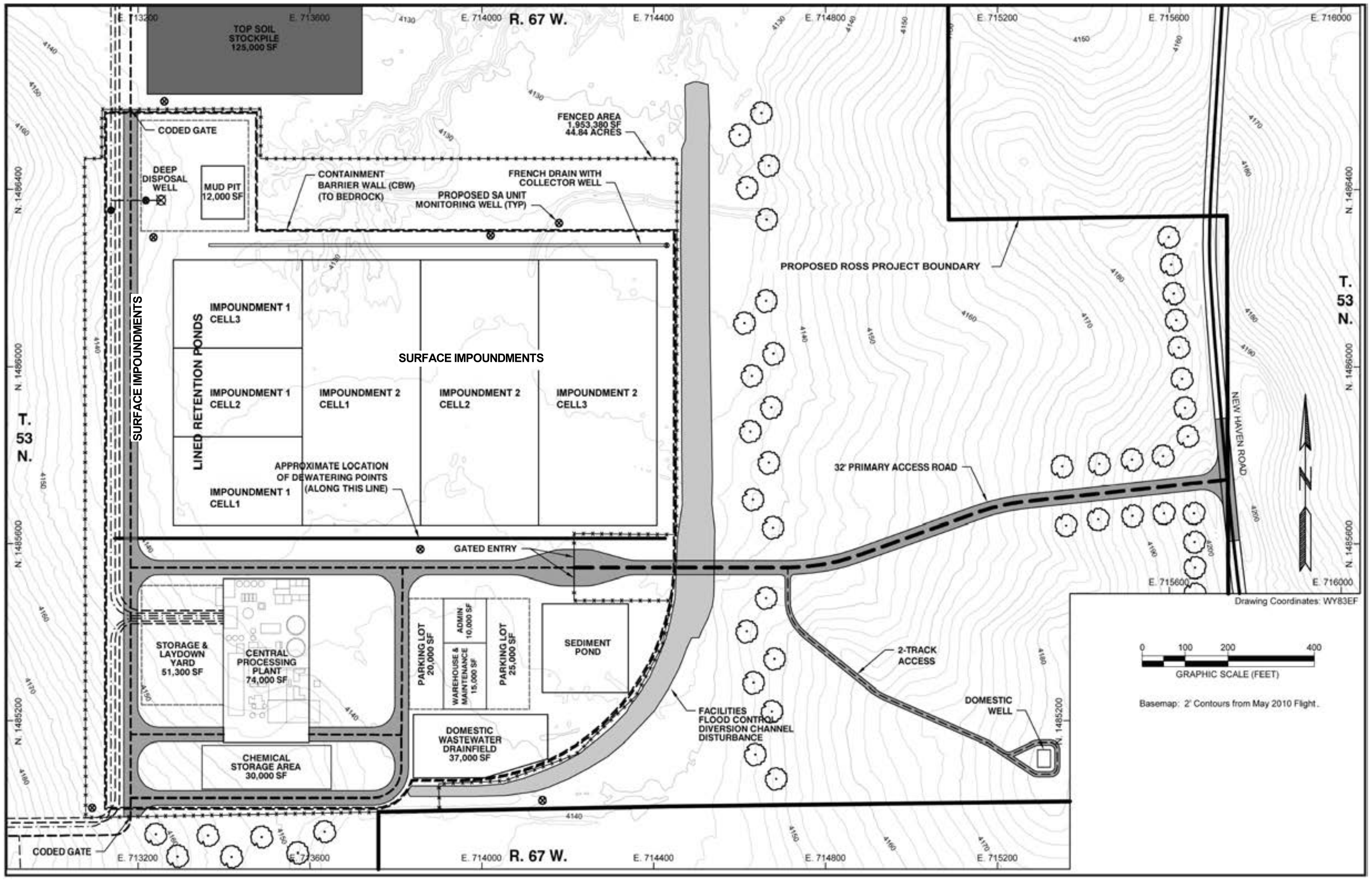
Source: NRC, 2009b.

Figure 2.3
Nebraska-South Dakota-Wyoming Uranium Milling Region



Source: Strata, 2011b.

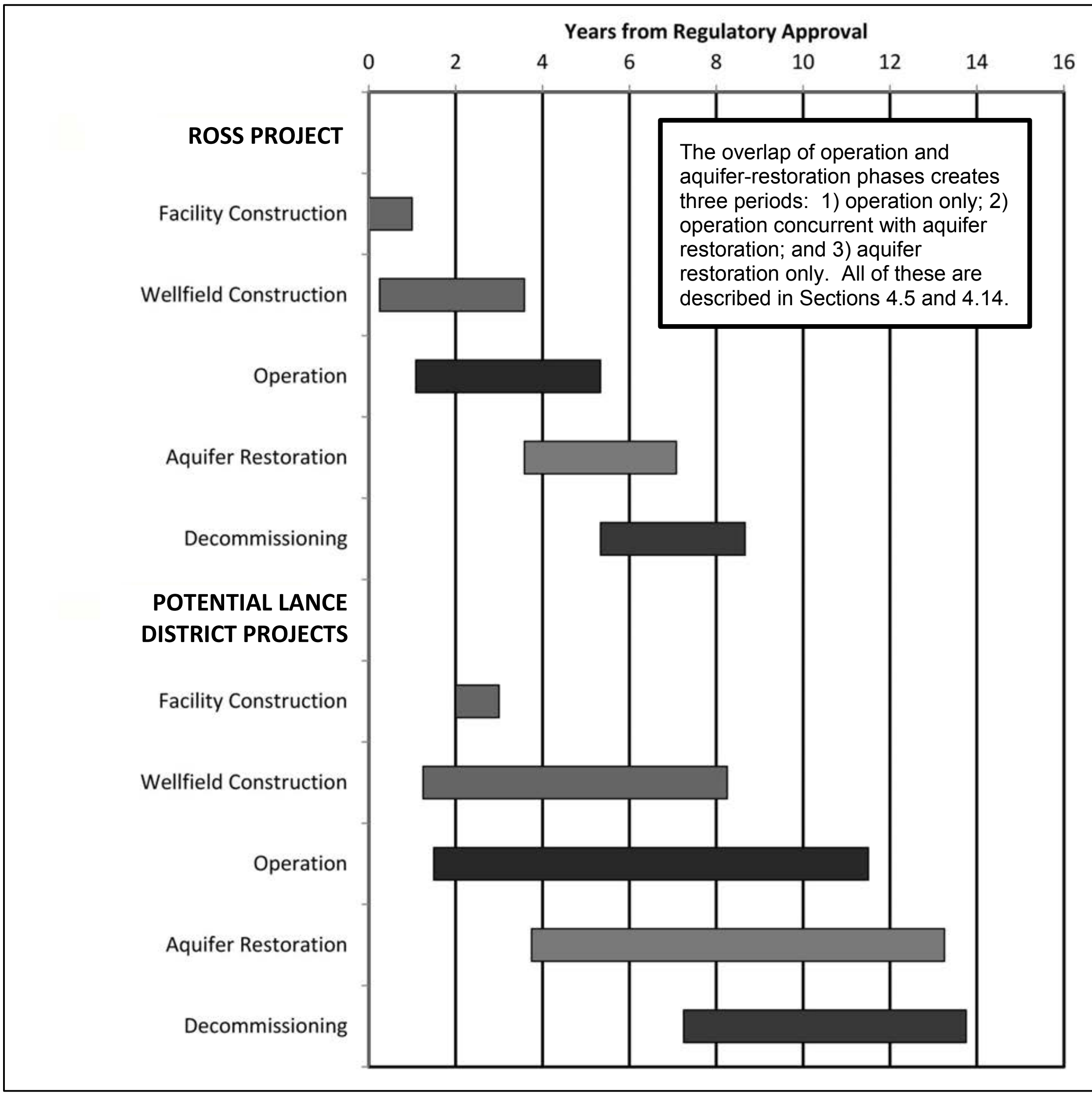
Figure 2.4
Proposed Ross Project Facility and Wellfields



Source: Strata, 2011b.

Note: Strata has proposed a modification of the facility design. The configuration would be revised to construct the CBW only along the south boundary of the facility itself (Strata, 2013b).

Figure 2.5
General Layout of Proposed Ross Project Facility



Source: Strata, 2012a.

Note: Decommissioning of the Ross Project's CPP would be completed after the last of the uranium from the Ross Project wellfields and satellites that may be developed within the Lance District are processed or after approximately 14 years from the time that all regulatory approvals are in place. Although Strata considers this schedule to be a "reasonably foreseeable development scenario," the actual development plans would depend upon a number of factors, including the results of ongoing exploration drilling, surface- and mineral-acquisition efforts, environmental pre-licensing, site-characterization studies for potential license-amendment areas, and the time required to acquire the necessary permits and licenses (Strata, 2012a).

Figure 2.6
Schedule for Potential Lance District Development

The facility could be used to process uranium-loaded resin from satellite projects within the Lance District operated by the Applicant, or from other offsite uranium-recovery projects not operated by the Applicant, or from offsite water-treatment operations. In this case, the life of the facility would be extended to 14 years or more (Strata, 2012a).

The Ross Project would host 15 – 25 wellfield modules and would consist of a total of 1,400 – 2,200 recovery and injection wells (Strata, 2011a). Groups of specific wells within a wellfield are called "wellfield modules." The wellfield modules would be connected with piping to a central collection facility called a "module building," or a "header house." The wellfields would be surrounded by a perimeter ring of monitoring wells.

This type of uranium extraction, in situ uranium recovery, consists of native ground water to which chemicals have been added, referred to as "lixiviant," that is injected into the aquifer bearing the uranium ore (the "ore zone" or "ore body") (see Section 2.1.1.2). The chemicals in the lixiviant dissolve the uranium from the rock within the aquifer. Ground water containing dissolved uranium is then pumped from the ore-zone aquifer, processed through ion-exchange (IX) columns to remove the uranium from the lixiviant, and then the uranium is precipitated into a solid material called "yellowcake" (U_3O_8). Most of the water is then reused for uranium recovery.

What is lixiviant?

A solution composed of native ground water and chemicals added during the ISR operations. Lixiviant is then pumped underground to mobilize (dissolve) uranium from a uranium-bearing ore zone, or the ore body.

ISR is not hydraulic fracturing or "hydrofracking." Hydrofracking is a technique that is used by oil companies to increase the production of petroleum and natural gas by creating cracks in tight rocks containing oil and gas. A hydraulic fracture is formed by a fracturing fluid that is pumped into a well at a rate sufficient to increase pressure in the well, so that it exceeds the in situ pressure of the rock. The fracturing fluid is a slurry of water, chemicals to aid in cracking, and a proppant, a material such as sand grains or ceramic particulates that keep the fractures open when the injection is stopped and oil recovery occurs. In contrast, ISR operates at much lower pressure in an injection well. In-situ pressures in ISR injection wells are maintained at less than the fracture pressures of the formations in which uranium-recovery is occurring. In addition, ISR is only used in aquifers with sufficient porosity and permeability to allow water flow from an injection well with a slightly positive pressure to the recovery well with a slightly negative pressure. This difference in pressure causes the ground water to move toward the recovery well. Finally, the chemicals in the water injected in ISR are for the purpose of dissolving the uranium, not to affect the porosity or permeability of the rock as are those during hydrofracking.

The Ross Project would be located in Crook County, Wyoming, 35 km [22 mi] north of the town of Moorcroft and Interstate-90 (see Figure 2.1). Other nearby towns and approximate direct distances to the Ross Project area include Pine Haven (27 km [17 mi] southeast), Gillette (53 km [33 mi] southwest), and Sundance (48 km [30 mi] southeast). The Ross Project area is adjacent to the unincorporated ranching community of Oshoto. The Oshoto community includes 11 residences within 3 km [2 mi] of the Proposed Action's boundary. Access to the Ross Project area is by either County Road (CR) 68 (D Road) or CR 164 (New Haven Road), both of which proceed north.

The Ross Project encompasses approximately 696 ha [1,721 ac] in portions of Sections 7, 17, 18, and 19, Township 53N, Range 67W, and portions of Sections 12, 13, and 24, Township 53N, Range 68W.

Table 2.1
Surface Ownership at Ross Project Area

Surface Ownership	Total Acres within Ross Project Area	Acres Disturbed During Year Preceding Operation	Acres Disturbed Over Life of Proposed Action
U.S. Bureau of Land Management	40.0	1.3	1.3
State of Wyoming	314.1	40	80
Private	1,367.2	69	199
TOTAL	**1,721.3**	**110.3**	**280.3**

Source: Table 1.2-1 in Strata, 2011a.

Surface ownership within the Ross Project area is primarily private, with small tracts of land owned by the State of Wyoming (Wyoming) and the BLM (Strata, 2011a). Approximately 16 ha [40 ac] are BLM land. The Wyoming Office of State Lands and Investments (WOSLI) administers 127 ha [314 ac]. In addition to the surface ownership, the BLM manages the subsurface mineral rights under 65 ha [160 ac] of privately owned land. Table 2.1 indicates the respective landowners of the Ross Project area. Current land uses are discussed in Section 3.2.

The Ross Project area is located in the upper reaches of the Little Missouri River, which flows northeasterly into southeastern Montana, through northwest South Dakota, and into North Dakota where it empties into the Missouri River at Lake Sakakawea. The area is characteristic of northeastern Wyoming: It is sparsely populated rangeland used primarily for grazing and some dryland agricultural production. Oil development from the Minnelusa Formation in western Crook County began in the 1970s. There are three oil-recovery wells within the Ross Project area; oil production from these wells peaked in 1985 – 1986, but production has generally declined since then (Strata, 2011a). The current status of oil and gas production is fully described in SEIS Section 5.2.1.2.

As noted earlier, uranium targeted for production within the Ross Project is located in permeable sandstones of the Upper Cretaceous Lance and Fox Hills Formations. The uranium in the Oshoto area resides in roll-front deposits typical of those across the Powder River Basin as described in the WEUMR (NRC, 2009b). Roll fronts are formed in sandstone formations when uranium-bearing ground water, moving down-gradient, encounters changing conditions. As the aquifer changes from oxygenated to oxygen-deficient, uranium precipitates as a coating on sand grains. The precise geometry of the uranium-ore deposits is controlled by the site-specific characteristics of the host sandstones. At the Ross Project area, the ore zones are generally thicker and more massive in the deeper Fox Hills compared to the deposits in the Lance Formation (Strata, 2011a). The top of the ore zone is approximately 76 m [250 ft] deep at the eastern edge of the Project area and 200 m [650 ft] deep at the Project's western edge (Strata, 2011a). The thickness of the ore zone ranges from 30 m [100 ft] to 55 m [180 ft].

Exploration of uranium deposits in the Lance Formation began in late 1970 (Strata, 2011a). The Nubeth Joint Venture (Nubeth), a joint venture between Nuclear Dynamics (later named ND Resources, Inc.) and Bethlehem Steel, received a License to Explore (No. 19) from the Wyoming Department of Environmental Quality's (WDEQ's) Land Quality Division (LQD) in August 1976, with subsequent modifications to accommodate research and development activities in 1978 (Strata, 2011a). ND Resources, Inc. filed for an NRC source material license in November 1977, and that license was approved in April 1978. Nubeth constructed a research and development operation in Section 18 of Township 53 North, Range 67 West, which is located within the Ross Project area (see Figure 2.1).

The research and development operation consisted of a single five-spot well pattern, with four injection wells and one recovery well, and a small facility with an IX column, elution, and precipitation circuit capable of producing yellowcake slurry (Nubeth, 1977). The research and development facility could process 340 L/min [90 gal/min] of uranium-bearing lixiviant. Hydraulic control during the operation was accomplished with "buffer" wells, which were meant to form a hydraulic barrier to keep the lixiviant within the well pattern. Nubeth operated from August 1978 through April 1979 and recovered small amounts of uranium. No precipitation of a uranium product took place, and all of the recovered uranium was stored as a solution. The operation was shutdown prematurely because of difficulties in operation's not being able to achieve desired injection rates (Strata, 2011a). The limitations on injection rates were attributed to the build-up of fines and organic material in the wellfield.

After uranium-recovery tests were completed, the single five-spot used in the test was restored. Restoration was completed in February 1983 and Nubeth was notified by the WDEQ on April 25, 1983 that the restoration was satisfactory. Final approval for the research and development operation's final decommissioning was granted by the NRC and WDEQ/LQD during the time period from 1983 through 1986 (Strata, 2011b; ND Resources, 1985a; ND Resources, 1985b).

A summary report on production feasibility estimated that uranium production could average about 360 kg/d [800 lb/d] in a facility sized to process 11,000 – 15,000 L/min [3,000 – 4,000 gal/min] (Strata, 2011a). However, due to the declining price of uranium at the time, commercial-scale licensing, construction, and operation did not occur. Two of Nubeth's wells (Well 789V and 19XX) have been used by oil companies since 1980 as water-supply wells (Strata, 2011b); currently, the Merit Oil Company (Merit) is operating these two wells in addition to one more on the Ross Project area to withdraw approximately 169 L/min [44.6 gal/min] from the aquifer in the Fox Hills Formation for enhanced oil recovery (Strata, 2012c).

The Applicant notes that information obtained from the Nubeth research and development operation was used in its decision to develop the Ross Project at the location described in this SEIS (Strata, 2011a). Nubeth's operation contributed the following information:

- Demonstration of the probability of an aquifer exemption of the mineralized zone.
- Determination of strong geologic confinement above and below the identified ore body(ies).
- Confirmation of fundamental hydrogeologic hypotheses regarding ground-water flow and behavior.
- Validation of information on potential regulatory and operational technical issues.
- Determination of site geology, hydrology, soils, ecology, climate, and Project area radiological conditions.

- Decrease of disturbance to both the surface and subsurface based upon data collected in the past.
- Demonstration of successful ground-water restoration and site reclamation.

Peninsula Energy, Ltd. (formerly Peninsula Minerals, Ltd.) initiated acquisition of mineral rights in the Lance District in 2007 and 2008 (Peninsula, 2011). Exploration drilling programs, which were conducted in 2008 and 2009, confirmed significant uranium resources in the Ross Project area. Strata was then incorporated in 2009, and by a letter dated January 2011, Strata then submitted a two-volume license application for a source and byproduct materials license to the NRC. It also submitted an application for a Permit to Mine to the WDEQ/LQD and a POO to the BLM. The WDEQ/LQD approved Strata's Permit to Mine application in November 2012, and the BLM is currently reviewing Strata's POO. The BLM is also participating as a cooperating agency to the NRC under a Memorandum of Understanding (MOU) for the Ross Project.

The Underground Injection Control (UIC) Program administered by the WDEQ/LQD regulates the design, construction, testing, and operation of all injection and recovery wells (WDEQ/LQD, 2005a). The WDEQ has primary regulatory authority for such actions as delegated by the U.S. Environmental Protection Agency (EPA). Wells for uranium extraction (i.e., uranium recovery) are classified under the WDEQ's UIC program as Class III wells. As part of its Permit to Mine issued by the WDEQ/LQD, the Applicant also acquired a UIC Permit to use Class III injection wells. The Permit to Mine would include maximum and average injection volumes and/or pressures necessary to ensure that fractures are not initiated in the confining zones; injected fluids do not migrate into any unauthorized zone; and formation fluids are not displaced into any unauthorized zone. Operating requirements of the WDEQ Permit-to-Mine would, at a minimum, specify that fluid and fracture pressures in the production zone be calculated to ensure that the pressure in the production zone during injection would not initiate new fractures or propagate existing fractures. In no case, would injection pressure initiate fractures in the confining zone, if confinement is present, or cause the migration of injection or formation fluids into an unauthorized zone. In addition, License Condition No. 10.14 would require that, during wellfield operations, injection pressures would not exceed the maximum operating pressures as specified in the Applicant's license application (Strata, 2011b; NRC, 2014b).

Before uranium-recovery operation can begin at any wellfield, however, the Applicant will also be required by license condition to provide the NRC with documents clearly delineating the approved aquifer-exemption areas (NRC, 2014b), as the portions of an aquifer designated for uranium recovery must be exempted as an underground source of drinking water (USDW) by the EPA and reclassified by the WDEQ/Water Quality Division (WQD) in accordance with the *Safe Drinking Water Act* (SDWA). Outside of the aquifer-exemption boundary, the aquifer is still protected as a source of drinking water because the governing regulations regarding underground injection found at 40 CFR Part 144.12 prohibit the movement of any contaminant into the underground source of drinking water which is located outside the aquifer-exemption boundary. In these regulations, a "contaminant" is defined broadly to include "any physical, chemical, biological, or radiological substance or matter in water." Therefore, groundwater at the aquifer-exemption boundary must meet 10 CFR Part 40, Appendix A, Criterion 5B(5) water-quality requirements. Wyoming's rules for "in situ mining" require that the exempted aquifer be restored to its premining class of use after operations are complete (WDEQ/LQD, 2005). The requirement by the WDEQ at "Noncoal In Situ Mining," *Rules and Regulations*, Chapter 11 for restoration of the area within the boundary of the exempted aquifer is more stringent than the EPA's regulations (at 40 CFR Part 144.12) that require that ground-water protection standards be met only at the aquifer-exemption boundary.

In Section 2 of the GEIS, the four stages in the life of an ISR facility are described: 1) construction, 2) operation, 3) aquifer restoration, and 4) decommissioning (NRC, 2009b). The decommissioning phase would include facility decontamination, dismantling, demolition, and disposal as well as site reclamation and restoration. Although the NRC recognizes that these four phases could be performed concurrently, and in practice early wellfields would undergo aquifer restoration while other wellfields are being installed, the GEIS determined that describing the ISR process in terms of these stages aids in the discussion of the ISR process and in the evaluation of potential environmental impacts from an ISR facility.

2.1.1.1 Ross Project Construction

Construction of the Ross Project would be consistent with the general construction activities described in Section 2.3 of the GEIS (NRC, 2009b). The Applicant discusses certain preconstruction activities that could be performed prior to its receiving its source and byproduct materials license from the NRC (Strata, 2011a; NRC, 2014b); however, for the purposes of this evaluation of environmental and other impacts, this SEIS assumes that these preconstruction activities would occur at the same time as the Proposed Action such that the impacts of the preconstruction activities are considered as part of Alternative 1: Proposed Action. These preconstruction activities could include site excavation and preparation, such as clearing, grading, and constructing design components intended to control drainage and erosion as well as other mitigation measures; erection of fences and other access control measures that are not related to the safe use of, or security of, radiological materials; support-building construction; infrastructure construction, such as paved roads and parking lots, exterior utility and lighting systems, domestic waste-water facilities, and transmission lines; and other activities which have no measurable relationship to radiological health and safety nor common defense and security. In addition, the Applicant has indicated its intent to construct one Class I deep-injection well to better characterize the hydrologic and geochemical properties of the targeted geologic formation (i.e., Deadwood and Flathead Formations) (Strata, 2011a; NRC 2011b). No radioactive material would be present at the Ross Project during preconstruction activities. As described in SEIS Section 3.13.1, drilling fluids and muds as well as soil cuttings from drilling during preconstruction activities are defined and regulated by the EPA as technologically enhanced naturally occurring radioactive materials (TENORM).

After some or all of these activities, actual construction of the Proposed Action would begin and include: 1) the ISR facility that would consist of the CPP as well as administration, warehouse, and maintenance buildings, including storage and other structures, and lined surface impoundments; 2) wellfields including piping and module buildings; and 3) deep-disposal wells (see Figure 2.5) (Strata, 2011b; Strata, 2012b).

The Applicant anticipates construction of the facility and initial wells within one year of receiving its Source and Byproduct Materials License (see Figure 2.6). Main access roads would be constructed at the same time as the facility (Strata, 2011a). Secondary wellfield access roads would be constructed as necessary, as each wellfield is developed. It is estimated that the facility would encompass 21 ha [51 ac] (Strata, 2011b). A total of 45 ha [110 ac] would be disturbed by construction activities during the year preceding ISR facility operation and 114 ha [282 ac] over the life of the Proposed Action (see Table 2.1) (Strata, 2011a).

The Ross Project would employ approximately 200 people during construction. The Applicant anticipates that most employees would be from Crook and Campbell Counties (Strata, 2011a). Further information on employment and other socioeconomic issues are described in Section 3.11.

Ross Project Facility

The Applicant proposes to construct and operate a single facility to serve the Ross Project as well as other potential ISR satellites (i.e., wellfields) within the Lance District. It could also process uranium-loaded resin from other ISR and water-treatment operations, which would be trucked into the facility (Strata, 2011a). The facility would include an administration building of 900 m^2 [10,000 ft^2], 1,400 m^2 [15,000 ft^2] of warehouse and maintenance space, 4,200 m^2 [45,000 ft^2] of parking, and a 3,400 m^2 [37,000 ft^2] for a domestic waste-water drainfield as well as the CPP.

The proposed CPP would be a large, 6,900 m^2 [74,000 ft^2] pre-engineered metal building. The size of the CPP is about twice the size of a typical processing facility described in the GEIS (NRC, 2009b). Adjoining the CPP would be 2,800 m^2 [30,000 ft^2] of chemical storage space and 4,770 m^2 [51,300 ft^2] of storage and work space (see Figure 2.5). The CPP would contain a control room housing the master-control system to allow remote monitoring and control of ISR process operations, wellfield operations, and deep-well disposal (Strata, 2011b). Operators in the CPP control room, who would be present 24 hours a day, would use a computer-based station to command the control system.

What is yellowcake?

Yellowcake is the product of the uranium-recovery and milling process; early production methods resulted in a bright yellow compound, hence the name "yellowcake." The material is a mixture of uranium oxides that can vary in proportion and in color from yellow to orange to dark green (blackish) depending upon the temperature at which the material was dried (level of hydration and impurities). Higher drying temperatures produce a darker, less soluble material. Yellowcake is commonly referred to as U_3O_8 and is assayed as pounds U_3O_8 equivalent. This fine powder is packaged in 210-L [55-gal] drums and sent to a conversion plant that uses yellowcake to produce uranium hexafluoride (UF_6) as the next step in the manufacture of nuclear fuel.

Proposed operations in the CPP would be generally consistent with typical processing involving three primary stages as described in the GEIS (NRC, 2009; Strata, 2011b):

- Uranium would be mobilized by the distribution of "barren" (containing no uranium) lixiviant from the CPP to injection wells and return of "pregnant" (containing dissolved uranium) lixiviant from the recovery wells to the CPP for processing.
- Dissolved uranium would be processed to yellowcake through a multi-step process involving uranium-loaded IX resin, elution, precipitation, washing, drying, and packaging which would produce waste water.
- Waste water would be treated as necessary and then recirculated as lixiviant.

This uranium-recovery process would be continued in a particular wellfield until the uranium concentration in the recovered solution becomes uneconomical.

The IX circuit proposed by the Applicant would be designed for a maximum of 28,400 L/min [7,500 gal/min] of pregnant lixiviant from Ross Project wells (Strata, 2011a). The elution and the precipitation circuits as well as the drying and packaging circuits within the CPP would be designed to process approximately 1.4 million kg/yr [3 million lb/yr] of yellowcake (Strata, 2011b), which is about four times the capacity necessary to recover uranium from only the Ross Project. The proposed yellowcake capacity of 1.4 million kg/yr [3 million lb/yr] would be the same as the licensed capacity at the Moore Ranch uranium-recovery facility (NRC, 2010). The excess capacity in the yellowcake-production process would allow processing of uranium-loaded IX resin delivered to the Ross Project from other uranium-recovery or water-treatment facilities. As described in SEIS Section 2.1.1 (Figure 2.6), the Ross Project's CPP could be used to process source material from other areas within the Lance District only if Strata were to seek an appropriate license amendment, and if that amendment were approved by the NRC. The estimated yellowcake-production quantities from the potential satellites in the Lance District are discussed in SEIS Section 5.2.1.1, and the respective potential environmental impacts of the increased yellowcake production at the CPP after a license amendment are examined as cumulative impacts in the same section.

The Applicant also proposes a vanadium-recovery circuit within the CPP to recover vanadium from uranium-depleted solutions (Strata, 2011b). The GEIS did not include vanadium recovery in its discussion of a typical uranium-recovery operation (vanadium recovery is discussed in Section 2.1.12 of this SEIS). However, the recovery of vanadium would not alter any of the components of the Ross Project.

In addition to the uranium- and vanadium-recovery circuits, the CPP would house the water-treatment circuit for ground-water reuse. Water treatment would utilize an IX column to remove the uranium, followed by two reverse-osmosis (RO) units in series. The circuit would be designed for a maximum flow rate of 4,200 L/min [1,100 gal/min]. Operation of the first RO stage is expected to return approximately 70 percent of the flow as "permeate" (relatively clean water) and 30 percent of the flow as "brine" (water containing high concentrations of salts, which would have been mostly introduced to water to form the lixiviant, and contaminants, which were picked up during the lixiviant's residence time in the aquifer). When the remaining brine is run through the second RO stage, it would generate 50 percent permeate and 50 percent brine. Only 15 percent of waste water would be brine after the two-stage RO circuit.

The ISR process requires chemical storage and feeding systems to introduce chemicals at various stages in the lixiviant extraction and processing as well as during the waste-treatment processes. Space for chemical storage would be built adjacent to the CPP (see Figure 2.5) (Strata, 2011a). The chemical-storage area would be constructed with secondary containment, which would consist of a concrete berm as part of the floor area that would be able to contain at least 110 percent of the volume of the largest tank (Strata, 2011b). The space would be divided into two areas, one inside the CPP and one outside. Chemicals stored outside would include oxygen, ammonia, and carbon dioxide (CO_2). Chemicals stored inside would include some or all of the following: sulfuric acid, hydrochloric acid, sodium hydroxide, hydrogen peroxide, sodium chloride, and sodium carbonate.

The proposed location for the facility is currently on a relatively flat, currently used, dryland hayfield. To route surface storm-water runoff around the facility, a diversion structure consisting of a berm, concrete-box culvert, and drainage channel would be constructed east of the proposed ISR facility. This system would be designed to manage runoff from a 100-year, 24-hour runoff event (Strata, 2011b; Strata, 2012b).

The Applicant's design calls for paving the areas adjacent to the CPP. Paved areas would be sloped to direct runoff water to slot drains. From the slot drains, storm water would be conveyed through pipes to a smaller, sediment-settling surface impoundment also designed to contain the runoff from a 100-year, 24-hour runoff event. The sediment impoundment would be constructed with the same double-liner and leak-detection configurations as the larger surface impoundments that would be used to store permeate and brine. After a significant storm event, water in the sediment impoundment would be immediately routed to the deep-disposal well (Strata, 2011b).

The facility is proposed to be located in an area of shallow ground water (Strata, 2012b). Shallow ground water directly beneath the facility could present construction and operational issues and create a higher risk of ground-water contamination in the event of a spill. To mitigate these concerns, the Applicant's proposed facility design would include a containment barrier wall (CBW). The CBW and associated dewatering system would be designed to prevent contaminated liquids from entering and contaminating shallow ground water outside of the facility, in the event of a process solution spill, hazardous-chemical spill, or a disposal-system failure. The CBW would restrict the flow of ground water from traveling beneath the facility and any water that seeps or flows into the area would be drained away. The CBW design calls for the wall to be constructed along the south end of the facility's boundary (Strata, 2013b). The CBW would be 0.6 m [2 ft] wide and extend from the ground surface to a minimum of 0.6 m [2 ft] into the bedrock; it would be constructed of a soil-bentonite mixture. The configuration of the CBW is shown in Figure 2.5 and is described in Addendum 3.1-A of the TR (Strata, 2012b). Three French drains (i.e., trenches filled with very porous material, such as gravel) would be installed to drain the area within the CBW, when needed (Strata, 2011b; Strata, 2012b). The Applicant proposes approximately eight wells to monitor water levels and water quality inside and outside the CBW (Strata, 2012b). Any seepage and/or spillage collected on the facility side of the CBW would be discharged to the surface impoundments for storage or disposal with excess permeate and brine (Strata, 2011b). Construction of a CBW to mitigate impacts to shallow ground water beneath impoundments is not included in the GEIS's description of a typical ISR facility design (NRC, 2009b).

The Proposed Action would also include the construction of two double-lined surface impoundments (a.k.a "retention ponds" or "ponds") over a 6.5 ha [16 ac] area; these impoundments would be used for process-solution and waste-water management (Strata, 2011b). Each surface impoundment would include three cells, built with common containment berms. At full capacity the two impoundments' surface area would be about 5.3 ha [13.2 ac]. Interconnected pipes between the cells would allow the controlled transfer of solutions or water between cells. The impoundments would have double geomembrane liners and a leak-detection system. The design for the impoundments, including the liners, leak-detection systems, freeboard requirements, reserve capacities, and average size of an individual impoundment are in accordance with the GEIS (NRC, 2009b).

The surface impoundments would be designed to meet the requirements of NRC Regulatory Guide 3.11 (NRC, 1980a), all conditions established by the NRC in the Source and Byproduct Materials License, and all requirements found in *Wyoming Water Quality Rules and Regulations*, Chapter 11, for lined waste-water surface impoundments (Strata, 2011b; Strata, 2012b; WDEQ/WQD, 1984). Condition No. 12.16 of the Draft Source and Byproduct Materials License would require the Applicant to submit, for NRC's review and approval, a ground-water detection monitoring plan for the impoundments that meets the requirements of Criteria 5 and 7A of 10 CFR Part 40, Appendix A, prior to construction of the surface impoundments (NRC, 2014b).

The Applicant's surface-impoundment design calls for rectangular cells with maximum internal slopes of 3 horizontal to 1 vertical (Strata, 2011b; Strata, 2012b). The impoundments would be 4.6 m [15 ft] deep with 1 m [3 ft] of freeboard and a maximum hydraulic depth of 3.6 m [12 ft]. The primary liner would be impermeable high-density polyethylene (HDPE) or polypropylene, with a minimum thickness of 36 mils (0.9 mm [0.036 in]). The secondary liner would be a geosynthetic material with a minimum thickness of 36 mils (0.9 mm [0.036 in]). The leak-detection system would be installed between the primary and secondary liners. The system would consist of a permeable drainage layer such as sand and perforated collection pipes.

The primary purpose of the surface impoundments would be to manage liquid, byproduct material (i.e., the permeate and brine described above) to optimize disposal techniques, and to provide capacity for liquid-waste storage in the event of “upset,” or accident, conditions. In addition, the impoundments would provide some evaporation of stored brine. Under normal operating conditions, the water levels in the surface-impoundment cells would be maintained such that the volume of liquid in any one cell can be transferred to one of the other two cells to facilitate leak repair.

Ross Project Wellfields

Wellfields are the areas over the ore zone(s) where the injection and recovery wells for uranium recovery would be located. The proposed wellfields of the Ross Project are expected to encompass approximately 65 ha [160 ac] in portions of Sections 7, 17, 18, and 19, in Township 53N, Range 67W and in portions of Sections 12 and 13 in Township 53N, Range 68W. The Applicant notes that the final areal extent of the constructed wellfields is expected to be greater as additional ore-zone delineation occurs (Strata, 2011b). However, the maximum area of the wellfields would not exceed the total area of the exempted aquifer; this area has been approved as 150 m [500 ft] from the outer edges of the wellfields indicated in SEIS Figure 2.4 (EPA, 2013).

The proposed wellfields would consist of 1,400 – 2,200 recovery and injection wells in addition to 140 – 250 monitoring wells. The wellfields would be organized into two uranium-recovery units (Strata, 2011b). Each unit would be divided into 15 – 25 modules with approximately 40 recovery wells per wellfield module (Strata, 2011b). The flow capacity of each wellfield module would range from 2,300 L/min [600 gal/min] to 3,800 L/min [1,000 gal/min]. The wellfields would be fenced to exclude livestock.

Condition No. 10.19 in the Draft Source and Byproduct Materials License would not allow wellfields to be installed south of the Little Missouri River until Merit’s use of the oil-field water-supply wells have ceased or diminished to an acceptable level (NRC, 2014b). In addition, Strata has amended its Permit to Mine application with WDEQ to specify that, if necessary, Strata would provide Merit with an alternative water source (WWC, 2012).

Wells would be constructed to recover uranium from ore deposits found in permeable sand zones in stacked roll fronts and tabular ore zones described as “stratabound” deposits in the GEIS (NRC, 2009b). The geology of the ore zone at the Ross Project area is described in SEIS Section 3.4.1. The average depth to the top of the ore zone ranges from less than 90 m [300 ft] to more than 210 m [700 ft] with an average depth of 149 m [490 ft] (Strata, 2011b). The ore-zone thickness averages 2.7 m [8.9 ft]. The sand units hosting uranium are saturated with ground water and are confined aquifers (Strata, 2011b). The hydrogeology of this area is described in SEIS Section 3.5.3.

The features and design of the wellfields proposed by the Applicant are generally consistent with the wellfields described in the GEIS (NRC, 2009b).

The primary components of a wellfield module are illustrated in Figure 2.7; these are:

- Injection wells to introduce lixiviant into the ore zone.
- Production (or “recovery”) wells to recover the uranium-enriched (or “pregnant”) lixiviant for subsequent processing at the CPP.

- Module buildings (or “header houses”) to manage the pipes (or “flow lines”) that route the lixiviant between the injection and recovery wells within a module and the “feeder lines” that carry fluids between the module building to a manhole containing a valve.
- Valve manholes to manage the pipes to the module buildings, to the CPP, and to other valve manholes (or “trunk lines”).
- Perimeter-monitoring wells to detect excursions of lixiviant outside the exempted portion of the aquifer from which uranium is recovered, should they occur.

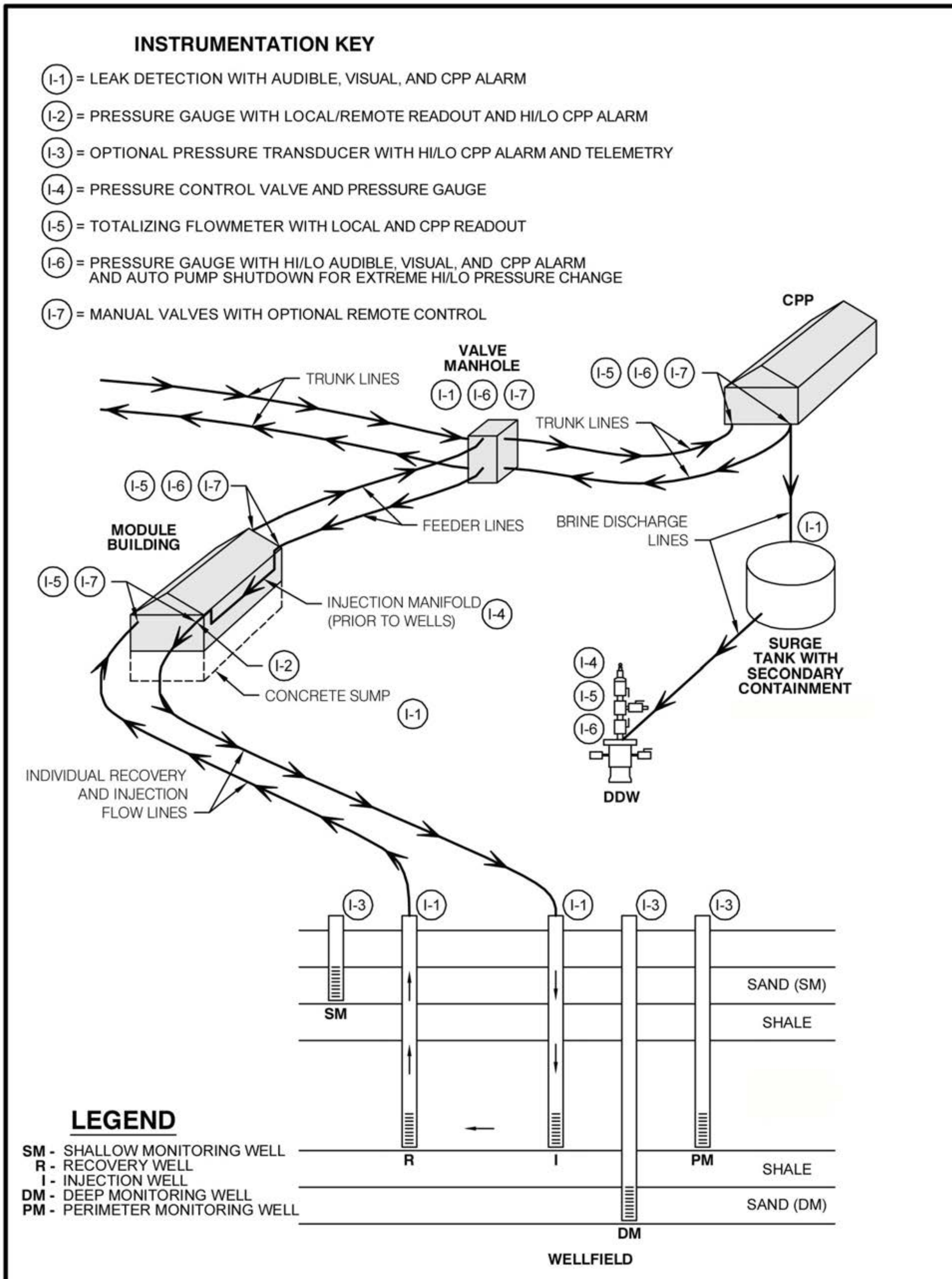
The Applicant proposes three well-construction methods that would each comply with WDEQ/LQD requirements (see Figures 2.8, 2.9, and 2.10) (Strata, 2011b).

These methods all conform to the typical well-completion standards described in the GEIS (NRC, 2009b). Wells would be constructed of polyvinyl chloride (PVC) or fiberglass with a sufficient pressure rating to withstand the maximum anticipated injection pressure, the maximum external collapsing pressure, and the maximum pressure of cementing; they would be constructed in accordance with WDEQ/LQD rules (WDEQ/LQD, 2005a). The casings would be joined using an O-ring and spline locking system. Well spacing would range from 15 – 46 m [50 – 150 ft]. The Applicant proposes that wells configured in a line-drive pattern would likely require increased aquifer-restoration efforts because the liklihood of lixiviant outside the recovery wells would be greater from a line-drive arrangement than from 5-spot or 7-spot patterns; therefore, the Applicant would make limited use of line-drive patterns. Where it is not possible to avoid the use of line-drive patterns, the Applicant would perform additional computer modeling to determine the most efficient well spacing so as to facilitate aquifer restoration.

Consistent with the typical design described in the GEIS (NRC, 2009b), the Applicant proposes that each wellhead would be covered by an insulated fiberglass box in order to provide freeze protection and spill containment (Strata, 2011b). The protective box would include a solid base with access tunnels for well casing, electrical, and water-flow lines as well as a leak-detection system. Each recovery well would contain a submersible pump properly sized to carry solutions from the well to the module building. Injection wells would be equipped with air-release valves to permit relief of any excess pressure that could occur in the wells.

In the event that recovery, injection, and/or monitoring wells must be located within a floodplain, engineered controls and instrumentation would act to prevent leakage to the environment or contamination to the wells from a flood event (Strata, 2011b). The well seals would prevent inflow of flood waters down the well casing, while the fiberglass structure and bottom containment feature would limit exposure of the well to the environment. Erosion-control measures, such as rip-rap, grading, contouring, and water bars, would be utilized where appropriate in order to reduce sediment mobilization and runoff velocities.

Following installation, the well would be “developed” by pumping, air lifting, jetting, and/or swabbing to clean it and improve its hydraulic efficiency. The goal of these activities would be to remove drilling fluids and any small, fine particulates from the well-completion zone, to provide good hydraulic communication, and to maintain the natural geochemical conditions. To avoid the situation encountered by Nubeth, in which fine particles settled into the aquifer and reduced the rate of injection, the Applicant has proposed an improved design of the filter pack that would be installed in wells as well as improved well-development methods to ensure removal of fine particles prior to operation.

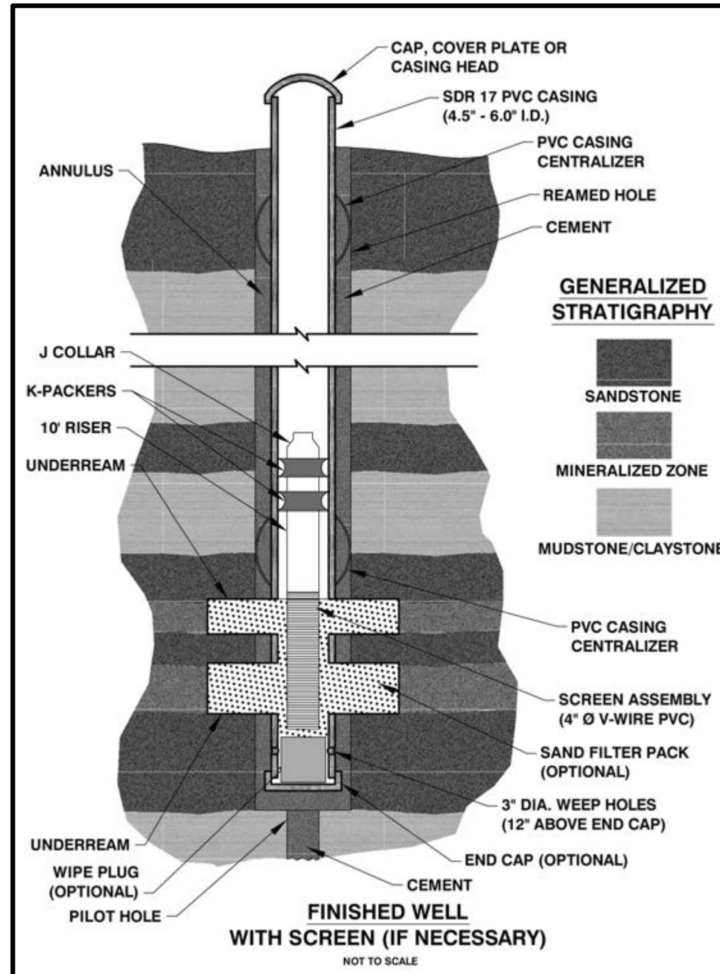


Source: Strata, 2011a.

Figure 2.7
Primary Components of a Ross Project Wellfield Module

Step	Description of Activity
1	A pilot hole 5 to 6.5 inches in diameter is drilled through the projected mineralization zone. Geophysical logs consisting of gamma, resistivity, spontaneous potential, and deviation are then completed. From the geophysical logs, the grade of each mineralized intercept is calculated.
2	If, after geophysical logging, it is determined that the mineralization is not of sufficient quality or that the ore continuity is inadequate to warrant completion, the hole is sealed from the bottom to the top with neat cement slurry. An Abandonment Record is then completed for each sealed hole.
3	Assuming the decision is reached to complete the well, the hole is reamed to a diameter of 8 to 10 inches (a minimum of 3 inches larger than the casing OD) to a depth approximately 15 feet below the bottom of the mineralization. Alternatively, in areas where the geologist is more confident in intercepting mineralization, the initial hole may be drilled at the final diameter of 8 to 10 inches in one pass followed by the geophysical logging. Fiberglass or PVC casing (minimum rating of SDR 17) with an outside diameter (OD) of 5 to 6.5 inches is placed in the reamed hole to a depth approximately 10 feet below the mineralization. PVC centralizers are placed on the casing string at a maximum spacing of one per 40 feet.
4	A calculated amount of neat cement slurry mixed to the required specifications (approximate unit weight of 15 lbs/gallon) is placed inside the casing through a cementing or pump-down head. A calculated volume of displacement water is then pumped into the casing forcing the cement slurry out the bottom of the casing and up the annulus between the casing and the reamed hole until cement reaches the surface. After displacement, the valve on the cementing head is closed which holds the cement in place while hardening occurs.
5	After a minimum of four days, the well is underreamed through the mineralized zones to a diameter of 10 to 14 inches. The well annulus will be topped off with cement to the surface prior to reentry by the drilling rig. The underreaming is completed by a specialized tool utilizing retractable blades. The blades are closed for the trip down the well and are opened by pressure from the rig mud pump. The blades are held open by the weight of the drill string. After underreaming the designated zone through the casing and cement, the blades are again retracted for the trip out of the well. The well may be caliper logged as necessary to verify the correct interval has been opened. If deemed necessary, to support sand zones that are not competent, PVC screen is telescoped into the casing using a J-collar hooked to the drill pipe. The uppermost screen openings will be placed below the top of the underreamed interval and below the bottom of the annular seal. A PVC riser pipe is extended from the top of the screen approximately 10 feet. One or more k-packer(s) will provide a seal between the riser pipe and the casing. Filter sand may be placed between the screen and the underreamed hole.
6	The well is developed to remove contaminants and fines from the drilling and completion process and maximize the flow rate. A Well Installation Record is completed which contains all the details on drilling, geophysical logging, completion materials, casing depth, completion interval, and the cement mix.
7	After drying, the drill cuttings contained in the pits are covered with subsoil and the stockpiled topsoil. The ground surface is then recontoured and reseeded.
8	The well is integrity tested as discussed in Section 3.1.2.3 below.

Source: Strata, 2011b.

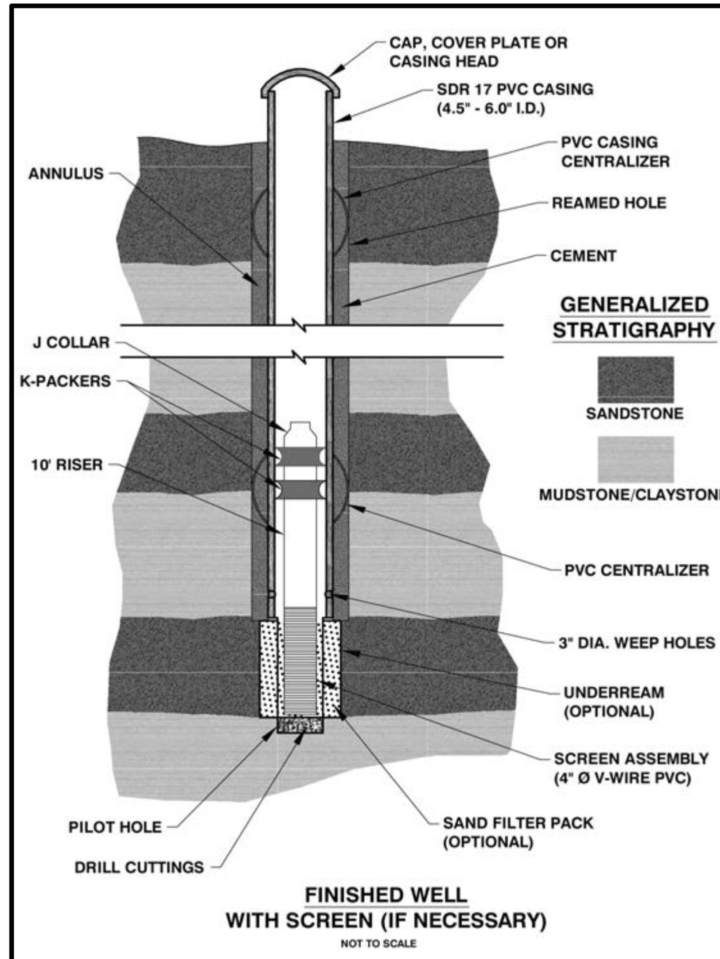


Source: Strata, 2011b.

Figure 2.8
Proposed Well Installation Method 1 for Ross Project Injection and Recovery Wells

Step	Description of Activity
1	A pilot hole 5 to 6.5 inches in diameter is drilled to the top of the projected completion interval. Geophysical logs consisting of a minimum of gamma, resistivity, and self potential are then completed.
2	The hole is reamed to a diameter of 8 to 10 inches (a minimum of 3 inches larger than the casing OD). An option for this method is to drill to the final hole diameter of 8 to 10 inches in one pass followed by the geophysical logging.
3	Fiberglass or PVC casing (minimum rating of SDR 17) with an OD of 5 to 6.5 inches is placed in the reamed hole. PVC centralizers are placed on the casing string at a maximum spacing of one per 40 feet.
4	A calculated amount of neat cement slurry mixed to the required specifications (approximate unit weight of 15 lbs/gallon) is placed inside the casing through a cementing head. A calculated volume of displacement water is then pumped into the casing forcing the cement slurry out the bottom of the casing and up the annulus between the casing and the reamed hole until cement reaches the surface. After displacement, the valve on the cementing head is closed which holds the cement in place while hardening occurs.
5	After a cement-hardening period of at least two days, the designated completion interval is drilled below the casing with a bit that is smaller than the casing inside diameter (ID). The well annulus will be topped off with cement to the surface prior to reentry by the drilling rig. Geophysical logs consisting of gamma, resistivity, spontaneous potential, and deviation are then completed in the newly drilled hole. If the sand zone is competent, the completed interval may be left open and unsupported. If PVC screen is necessary, the completion interval may be underreamed to a larger diameter prior to the installation of the screen. The uppermost screen openings will be placed below the bottom of the casing and the annular seal. A PVC riser pipe is extended from the top of the screen approximately 10 feet. A seal between the riser pipe and the casing is provided by one or more k-packer(s). Filter sand may be placed between the screen and the underreamed hole.
6	The well is developed to remove contaminants and fines from the drilling and completion process and maximize the flow rate. A Well Installation Record is completed which contains all the details on drilling, geophysical logging, completion materials, casing depth, completion interval, and the cement mix.
7	After drying, the drill cuttings contained in the pits are covered with subsoil and the stockpiled topsoil. The ground surface is then recontoured and reseeded.
8	The well is integrity tested as discussed in Section 3.1.2.3 below.

Source: Strata, 2011b.

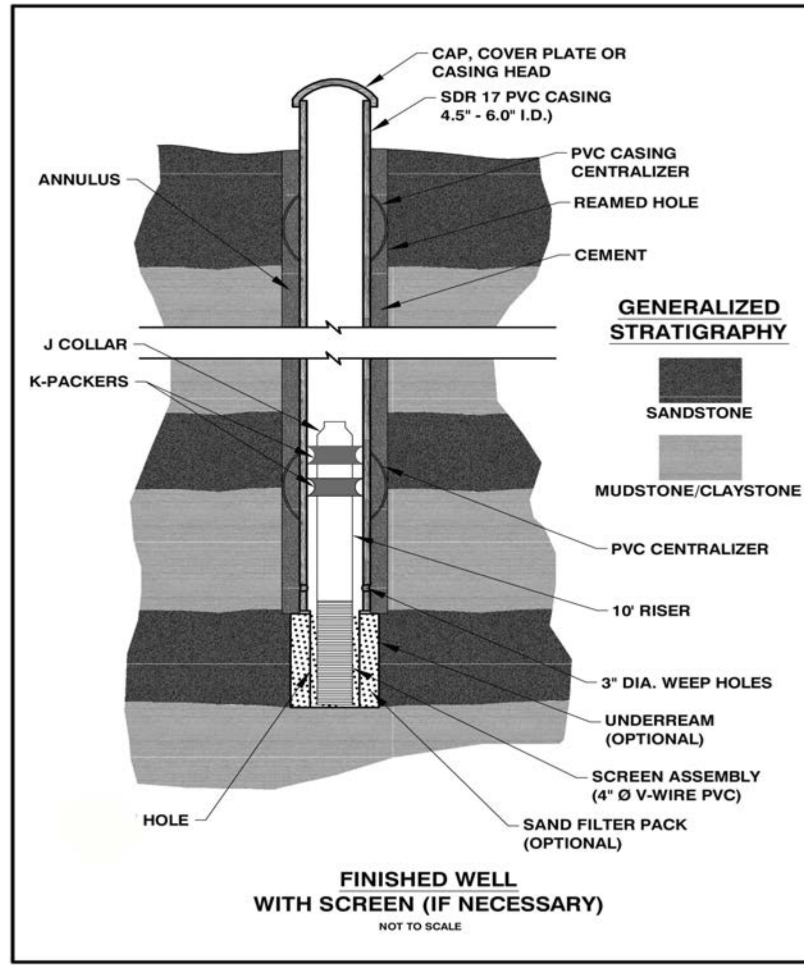


Source: Strata, 2011b.

Figure 2.9
Proposed Well Installation Method 2 for Ross Project Injection and Recovery Wells

Step	Description of Activity
1	A pilot hole 5 to 6.5 inches in diameter is drilled to the top of the projected completion interval. Geophysical logs consisting of a minimum of gamma, resistivity, and self potential are then completed.
2	The hole is reamed to a diameter of 8 to 10 inches (a minimum of 3 inches larger than the casing OD). An option for this method is to drill to the final hole diameter of 8 to 10 inches in one pass followed by the geophysical logging.
3	Fiberglass or PVC casing (minimum rating of SDR 17) with an OD of 5 to 6.5 inches is placed in the reamed hole. PVC centralizers are placed on the casing string at a maximum spacing of one per 40 feet.
4	A calculated amount of neat cement slurry mixed to the required specifications (approximate unit weight of 15 lbs/gallon) is placed inside the casing through a cementing head. A calculated volume of displacement water is then pumped into the casing forcing the cement slurry out the bottom of the casing and up the annulus between the casing and the reamed hole until cement reaches the surface. After displacement, the valve on the cementing head is closed which holds the cement in place while hardening occurs.
5	After a cement-hardening period of at least two days, the designated completion interval is drilled below the casing with a bit that is smaller than the casing inside diameter (ID). The well annulus will be topped off with cement to the surface prior to reentry by the drilling rig. Geophysical logs consisting of gamma, resistivity, spontaneous potential, and deviation are then completed in the newly drilled hole. If the sand zone is competent, the completed interval may be left open and unsupported. If PVC screen is necessary, the completion interval may be underreamed to a larger diameter prior to the installation of the screen. The uppermost screen openings will be placed below the bottom of the casing and the annular seal. A PVC riser pipe is extended from the top of the screen approximately 10 feet. A seal between the riser pipe and the casing is provided by one or more k-packer(s). Filter sand may be placed between the screen and the underreamed hole.
6	The well is developed to remove contaminants and fines from the drilling and completion process and maximize the flow rate. A Well Installation Record is completed which contains all the details on drilling, geophysical logging, completion materials, casing depth, completion interval, and the cement mix.
7	After drying, the drill cuttings contained in the pits are covered with subsoil and the stockpiled topsoil. The ground surface is then recontoured and reseeded.
8	The well is integrity tested as discussed in Section 3.1.2.3 below.

Source: Strata, 2011b.



Source: Strata, 2011b.

Figure 2.10
Proposed Well Installation Method 3 for Ross Project Injection and Recovery Wells

The Applicant expects that the water produced during well development would meet Wyoming's temporary Wyoming Pollutant Discharge Elimination System (WYPDES) standards, which would allow well-development water to be discharged directly to the ground surface (WDEQ/WQD, 2007). The ground water the Applicant discharged during its earlier well-testing activities, which it accomplished for its license application and for site characterization, did meet the standards for Strata's temporary WYPDES Permit at that time and, thus, additional discharges during well development would be expected to meet the same discharge standards. Additional information on expected discharges of ground water under Strata's WYPDES Permit is provided in SEIS Section 2.1.1.5.

What is mechanical integrity testing (MIT)?

After each well is completed, and before the well is brought into service, all injection, extraction, and monitoring wells are tested for mechanical integrity. A "packer" is set above the well screen and near the ground surface, and the well casing is filled with water. At the surface, the well is pressurized with either air or water to 125 percent of the maximum operating pressure, which is calculated based upon the strength of the casing material and depth. The well pressure is monitored to ensure significant pressure drops do not occur through drillhole leaks. A pressure drop of no more than 10 percent in a period of 10 – 20 minutes indicates that the casing and grout are sound (i.e., do not leak) and that the well is fit for service. Well-integrity tests are also performed if a well has been damaged by nearby surface or subsurface activities or has been serviced with equipment or procedures that could damage the well casing, such as insertion of a drill bit or cutting tool. Additionally, each well is retested periodically (once each five years or less) to ensure its continued integrity. If a well casing fails an MIT, the well is taken out of service, repaired, and retested. If an acceptable test result cannot be obtained after repairs, the well is plugged and properly abandoned.

As indicated by Condition No. 10.5 of the Draft Source and Byproduct Materials License (NRC, 2014b), prior to well operation, the integrity of each well would be verified by a pressure-based mechanical-integrity test (MIT) that conforms to the procedure described in the GEIS and required by the WDEQ (NRC, 2009; Strata, 2011b; WDEQ/LQD, 2005a). After initial testing by the Applicant, each well would be retested at five-year intervals. In addition, the MIT would be repeated if any well were to be entered by a drilling bit or an under-reaming tool, or if well damage were to be suspected for any reason. The well-integrity test results would be documented and filed onsite as well as provided to WDEQ/LQD on a quarterly basis. During the intervening time between the initial MIT test and the retesting in five years, any leak in a well would be detected by the daily measurements of pressure and flow rate of the injection wells, as indicated by Condition No. 10.14 of the Draft Source and Byproduct Materials License (NRC, 2014b). Moreover, all monitoring wells designed to detect fluid excursions would also identify leaks in the wells themselves.

The Applicant proposes that MIT be conducted by placing inflatable packers or a comparable device near the top of the casing and above the screened interval (Strata, 2011b). The packers are inflated, and the interval between the packers is pressurized with water to the designated test pressure (maximum allowable injection pressure plus a safety factor of 25 percent). This pressure must be maintained within 10 percent for 10 minutes in order for the well to pass the MIT. A well-integrity record would be completed for each tested well. If a well demonstrates an unacceptable pressure drop during the MIT, the packers would be reset, the equipment checked for leaks, and the test repeated. If in subsequent tests the well passes the integrity requirements, the well would be deemed acceptable for use as an injection, recovery, or monitoring well. If a well continues to fail the MIT, it would be plugged and properly abandoned

(Strata, 2011b). Any well excluded due to MIT failure, or any that have arrived at the end of their useful life, would be properly abandoned. A well-abandonment record would be included in the wellfield data package, as would be required by License Condition 10.12 (NRC, 2014b).

The Applicant's proposed design for pipes and module buildings is consistent with the industry standard described in the GEIS (NRC, 2009b). Module buildings (referred to as pump and header houses in the GEIS) would be located throughout the wellfield and would be approximately 4.6 m x 12 m [15 ft x 40 ft] in size (see Figure 2.7) (Strata, 2011b). Piping from the module building to the CPP is referred to as feeder lines and trunk lines. Flow to injection wells and from recovery wells would be conveyed through 2.5 – 5 cm [1 – 2 in] HDPE pipelines (flow lines) that are connected through a manifold in the module building. Pipes inside the module buildings would be HDPE, PVC, or stainless steel rated for an operating pressure greater than the proposed maximum injection pressure. Feeder-line and trunk-line junctions would be contained in valve manholes located along the trunk lines. Each module building would have the capability of being isolated from the trunk lines by manually operated butterfly valves contained in the valve manholes. Piping would be buried below the frost line.

Each well flow line would have a meter to record the total flow passing through each flow line, pressure transmitter, and manual valve to control the flow rate. A small sample-collection valve for each well would be included on the recovery flow lines. The recovery-well flow lines would enter a manifold on one side of the module building, and the injection well lines would enter a manifold on the other side. A manifold building would house: 1) electrical equipment required to control the recovery pumps; 2) a pressure-limiting valve, a pressure transmitter, and equipment to add the oxidant to lixiviant on the injection manifold; and 3) flow meters that would indicate rate and totalizer readings on the trunk lines (Strata, 2011b). Each module building would have a manhole to access flow lines and feeder lines (see Figure 2.7). The manholes would also contain leak-detection systems.

The Applicant would test for leaks with fresh water on the pipelines prior to their burial, in order to ensure the pipelines' mechanical integrity (Strata, 2011b). The tests would be conducted in accordance with the manufacturer's recommendations or industry standards during construction. In the event of leakage from pipelines or fittings, the defective component would be replaced. Prior to backfilling the trench dug to install a pipeline, the Applicant would perform a final inspection of all pipes and valves, the quality of the pipe embedment material, and the suitability of the backfill. Pipeline installation and trench backfilling would follow standard procedures that would be designed to ensure the quality of the installation and backfilling (Strata, 2011b). These procedures include the Applicant's:

- Laying of pipe at required grades and lines.
- Minimizing accumulation of water during laying or backfilling.
- Limiting lateral displacement with use of embedment material.
- Preventing contamination of the trench with foreign, unsuitable material.
- Covering pipe with at least 0.6 – 2 m [2 – 6 ft] of material.
- Using insulated tracer wire and warning tape.
- Using properly sized and placed bedding material.

- Using proper backfill material, which would not impose undue shock or unbalance to the pipe (i.e., frozen soils, mud, or snow).
- Using trench plugs at the appropriate spacing, particularly at or near areas of shallow ground water.

What is pre-licensing, site-characterization vs. post-licensing, pre-operational ground-water monitoring?

As described in the NRC's *Standard Review Plan for In-Situ Leach Uranium Extraction License Applications*, NUREG–1569 (NRC, 2003a), a license applicant, in support of its application, must provide information regarding the area or site proposed for uranium recovery. This requires an applicant to collect environmental-media samples and have those samples analyzed for certain constituents, or parameters. As part of what are called in this SEIS "pre-licensing, site-characterization" efforts, ground-water monitoring wells are installed and ground-water samples are obtained for at least four quarters of the one year prior to license-application submission. These samples are analyzed for certain water-quality constituents that are important to the characterization of existing conditions at a particular site.

After the NRC has issued a license to an applicant, the licensee begins construction of its facility as well as installation of its uranium-recovery wellfields. A single wellfield consists of many ground-water wells; when all of these wells have been installed, water-quality samples are obtained from these new wells and are analyzed for the constituents that the NRC specifies in the license, before any uranium-recovery may occur. These sampling and analysis efforts, and the data values that are established as a result of these efforts, are called in this SEIS, "post-licensing, pre-operational." These post-licensing, pre-operational data, after some statistical analysis, are the values to which excursion-detection and/or aquifer-restoration monitoring are compared.

Condition No. 11.3 of the Draft Source and Byproduct Materials License would require the Applicant to install a monitoring-well ring around the perimeter of each wellfield as well as monitoring wells in the underlying and overlying aquifers (NRC, 2014b); this monitoring-well ring would be used to detect horizontal and vertical excursions of uranium-recovery solutions during uranium-recovery operation (see SEIS Section 2.1.1.2) (Strata, 2011b). Prior to commencing ISR operations, these wells would allow sampling and analysis of ground water—in this SEIS, this type of monitoring is called "post-licensing, pre-operational." The resulting post-licensing, pre-operational concentration-based levels would be used to calculate, using robust statistical procedures, groundwater protection standards called the Ross Project's upper control limits (UCLs). These post-licensing, pre-operational values and the calculated UCLs would be established for each separate uranium-recovery unit (these will be specified in the Source and Byproduct Materials License). During uranium-recovery wellfield operation, the Applicant would then sample ground water from the monitoring wells and compare the analytical values to the NRC-specified UCLs to determine whether an excursion of any solution (such as lixiviant) into the surrounding aquifers has occurred. The Applicant would use Methods 2 or 3 (shown in Figures 2.9 and 2.10) to install these ground-water monitoring wells.

The Applicant's site-characterization efforts, which were conducted prior to its license-application submittal to the NRC, established "pre-licensing, site-characterization" values of certain ground-water constituents; these values represent the constituent concentrations currently present in the ground water under the Ross Project area (Strata, 2011a; Strata, 2011b). (See the text box above.) Later, prior to actual uranium-recovery wellfield operation, but after the Source and Byproduct Materials License is issued for wellfield construction, the ground water in each wellfield would be analyzed for the post-licensing, pre-operational concentrations of constituents specified by the NRC (NRC, 2003a; NRC, 2014b).

In addition to the perimeter-well ring and the wells monitoring the aquifers above and below the uranium-recovery aquifer, the Applicant would sample representative wells in the ore zone (which may be also used for production) before they are put into operation in order to collect post-licensing, pre-operational water-quality data from the ore-zone aquifer. Within each wellfield, the well spacing that the Applicant proposes is in accordance with the basic requirements described in the GEIS for wellfield design including monitoring wells (NRC, 2009b). Typical well spacing for a five-spot or seven-spot pattern is between 12 – 46 m [40 – 150 ft] apart. As indicated in Condition No. 11.3 of the Draft Source and Byproduct Materials License, a minimum of 1 injection or recovery well per 0.8 ha [2 ac] would be required to be sampled for post-licensing, pre-operational water quality in the ore-zone aquifer of each wellfield prior to its operation (NRC, 2014b). Wells completed in the aquifer underlying the ore zone and wells completed in the aquifer overlying the ore zone would be installed at an density of 1 well per 1.6 ha [4 ac] of wellfield to detect vertical migration (Strata, 2011b). The Applicant also proposes a spacing of the perimeter-monitoring wells of 120 m [400 ft] apart and at a distance of approximate 120 [400 ft] from the edge of the respective wellfield to allow the Applicant to detect potential horizontal excursions. As indicated in Condition No. 11.3B of the Draft Source and Byproduct Materials License, wells would not be allowed to be installed outside the exempted aquifer (NRC, 2014b). Computer modeling by the Applicant has demonstrated that the proposed spacing would detect hydraulic anomalies as manifested by unexpected water-level changes (see SEIS Section 4.5.1.2) before the lixiviant has moved beyond the active uranium-recovery area.

To reduce the possibility of excursions, Condition No. 10.12 of the Draft Source and Byproduct Materials License and WDEQ/LQD indicates that all previously drilled exploration and/or ore-body delineation drillholes that can be located within a monitoring-well ring would be re-drilled to the total depth of the drillhole and sealed with cement slurry or bentonite grout (NRC, 2014b; Strata, 2011b). These historical exploration and/or delineation drillholes would be located through the use of a hand-held metal detector that would locate the brass cap associated with each drillhole, usually with its identification number. After a drillhole is located, to properly abandon it, a small drilling rig would be set up over the drillhole to ream it out to its total depth. A cement slurry or bentonite grout would then be introduced from the bottom up to the ground surface along the entire drillhole length. Details of each drillhole's abandonment would be documented in a record (examples in Strata, 2011b, Addendum 2.7-F). These would be filed at Strata's Oshoto Field Office in the appropriate drillhole file and would be provided with the respective "hydrologic-test data package" (NRC, 2014b).

Deep-Injection Wells

The Applicant plans to dispose of liquid effluent generated during uranium-recovery operations via UIC Class I deep-injection disposal wells. The Applicant has received a ten-year permit (UIC Permit No. 10-263), dated April 4, 2011, for up to five UIC Class I deep-disposal wells from WDEQ (WDEQ/WQD, 2011b). This Permit authorizes the injection of non-hazardous liquids into the Flathead and Deadwood Formations within specified intervals at depths of about 2,488 – 2,669 m [8,163 – 8,755 ft] below ground surface (bgs); these formations are at least 150 m [500 ft] below the lowermost potential USDW (i.e., the Madison Formation).

> **What are underground injection control permits?**
>
> The U.S. Environmental Protection Agency (EPA) has delegated authority to the State of Wyoming (the Wyoming Department of Environmental Quality [WDEQ]) to administer its own Underground Injection Control (UIC) Permits. State's with delegated authority from EPA have regulations that meet or are more stringent than those of the EPA. Class I and III wells under the UIC program are most applicable to in situ uranium recovery.
>
> - **Aquifer Exemption:** UIC criteria for the exemption of an aquifer that might otherwise be defined as an underground source of drinking water are found at 40 CFR Part 146.4. These criteria include whether the aquifer is currently a underground source of drinking water (USDW), whether the water quality is such that it would be economically or technologically impractical to use the water to supply a public water system, and whether the aquifer contains minerals that are expected to be commercially producible. An aquifer exemption is granted by the WDEQ and requires EPA approval. Wyoming's rules for In-Situ Mining require that the exempted aquifer be restored to its pre-mining class of use after the operations are complete (WDEQ/LQD, 2005). This requirement is more stringent than EPA's rules which only require that ground-water protection standards be met at the aquifer-exemption boundary (i.e. contaminants cannot migrate from an exepted aquifer to the surrounding USDW).
> - Industrial and Municipal Waste Disposal Wells (UIC Class I): Wells in this Class are used for the deep disposal of industrial, commercial, or municipal waste below the deepest USDW. This type of well uses injection and requires applied pressure. For in situ uranium recovery, this type of UIC permit is necessary to use deep-well injection for disposal of non-hazardous liquid wasteswaste. The WDEQ is responsible for Wyoming's UIC Program and, therefore, it is the agency that approves Class I permits for UIC wells.
> - Mining Wells (UIC Class III): This type of UIC permit governs the injection wells used in the recovery of minerals. They include experimental-technology wells; underground coal-gasification wells; and wells for the in situ recovery of materials such as copper, trona, and uranium. For in situ uranium recovery, this type of UIC permit applies to wells that inject lixiviant into a uranium-bearing aquifer. The corresponding monitoring and recovery wells are regulated through the WDEQ by both its Water Quality Division (WQD) and Land Quality Division (LQD), which cooperate through a Memorandum of Understanding (MOU) which facilitates in situ uranium-recovery oversight by the WDEQ/LQD.

Under the terms of the UIC Class I Permit, the Applicant is allowed to inject into the Class I deep-disposal wells the following: operation bleed streams, yellowcake wash water, sand-filter and IX-resin wash water, onsite laboratory waste water, RO brine, aquifer-restoration ground water, facility wash-down water, wash waters used in cleaning or servicing waste-disposal-system equipment, and storm water—all generated during uranium-recovery activities—as well as fluids produced during the drilling, completion, testing, or stimulation of wells or test drillholes related to uranium-recovery operations, or during the work-over or abandonment of any such well, and drilling-equipment wash water. Under the terms of the UIC Permit, the Applicant is also prohibited from injecting certain materials into these wells. For example, hazardous wastes as defined by EPA or WDEQ cannot be injected into these wells (WDEQ/WQD, 2011b). Well construction, operation, MIT inspection, and proper well abandonment techniques and requirements, are defined in this Permit as well. The Applicant would need to obtain written acceptance of financial-assurance methods from WDEQ prior to construction of each of the proposed wells.

The Applicant proposes that each well location would consist of a 76 m x 76 m [250 ft x 250 ft] pad with a storage tank (Strata, 2011b; Strata, 2012b). Surface equipment for the deep-disposal wells would include storage tanks, pumps, filtration systems, instrumentation and control systems, and equipment for injection of process chemicals (Strata, 2011b). Pads would either be asphalt pavement or gravel and would be retained through the life of the disposal well in order to conduct maintenance. Access roads to well sites with widths up to 4.3 m [14 ft] would be constructed on existing roads where possible. The supply pipelines to the wells would be 15 – 25 cm [6 – 10 in] HDPE plastic.

Pressures and flow rates for the pipes and disposal wells would be constantly monitored at the CPP. Instrumentation details for the deep-disposal wells are provided in Addendum 4.2-A of the TR (Strata, 2011b). System instrumentation would provide the necessary measures to ensure safe operation of the disposal system. At a minimum, instrumentation would include a flow totalizer, flow meter, pressure regulator, pressure indicator, pressure switch, annular tank level indicator, and injection pressure chart recorder. Water quality, fluid quantity, and injection rates would be reported to the WDEQ/LQD UIC program as required by the UIC Permit.

Injection rates up to the maximum are controlled by surface-injection pressures that are limited to the fracture pressure. Exceeding the limiting surface pressure set forth in the permit or creating or propagating fractures within the receiving zone would be a permit violation. The permit requires the installation of a kill switch on the injection tubing to preclude violation of the pressure limits.

2.1.1.2 Ross Project Operation

As shown by the proposed schedule in Figure 2.6, uranium recovery during the proposed Ross Project would follow a "phased" approach, where one group of wellfield modules could be in operation, while preceding wellfield modules are being engaged in aquifer restoration (Strata, 2011b). During the operation phase, three major phases would occur involving the wellfields: an operation-only phase, a concurrent operation- and aquifer-restoration phase, and an aquifer-restoration-only phase. All three operating phases are discussed in further detail in SEIS Section 4.5.1.

Uranium Mobilization

The Applicant proposes the use of an alkaline lixiviant to dissolve the uranium as described in GEIS Section 2.4 (NRC, 2009; Strata, 2011b). Gaseous oxygen (O_2) or hydrogen peroxide (H_2O_2) is used as the oxidant and sodium bicarbonate ($NaHCO_3$) or CO_2 is added to aid in keeping uranium in its dissolved state. Native ground water would be fortified with sodium bicarbonate at the CPP and then pumped to the module buildings where the oxidant and, potentially, CO_2 would be added at the injection manifolds located inside the module buildings (see Figure 2.7).

What are the basic steps of uranium mobilization?

- **Ground-Water Injection**

  Uranium mobilization is accomplished by the injection of a non-uranium-bearing ("barren") solution, or "lixiviant," through "injection" wells into the uranium-bearing ore zone. The lixiviant moves through pores in the ore-zone aquifer, dissolving uranium and other metals.
- **Ground-Water Extraction**

  Recovery, or "production," wells extract the now "pregnant" lixiviant, which contains uranium and other dissolved metals, and the solution is then pumped to a central processing plant (CPP) for further uranium recovery and purification.

The Applicant proposes the carbonate/bicarbonate lixiviant because of its compatibility with minerals within the ore zone. In addition, carbonate/bicarbonate lixiviants are generally considered more amenable to aquifer restoration than acidic lixiviants (NRC, 2009b). Preliminary leach testing performed by the Applicant in 2010 demonstrated that this type of lixiviant successfully mobilized uranium into solution. Comparison of the Applicant's expected concentration ranges of chemical constituents in the pregnant lixiviant with the typical lixiviant chemistry presented in Table 2.4-1 of GEIS Section 2.4.1.1 shows the two as consistent, except for higher concentrations of uranium and vanadium that could be present in the pregnant lixiviant at the Ross Project (Strata, 2011b; NRC, 2009b).

As described in Section 2.4.3 of the GEIS, the recovery wells extract slightly more water than is injected into the ore-containing aquifer, which creates a "cone of depression" within the respective wellfield and, thus, maintains an inward flow of ground water. This inflow prevents migration of lixiviant toward the perimeter-monitoring wells. The excess water, referred to as "production bleed," is a byproduct material that must be properly managed and disposed (NRC, 2009b). For the Ross Project, the Applicant proposes a production-bleed range from 0.5 percent to 2 percent, and averaging 1.25 percent of the injection volume (Strata, 2011b). At the maximum flow rate, approximately 360 L/min [94 gal/min] of production bleed would be generated.

The Applicant proposes to use actual wellfield data and reservoir-engineering software to predict a sufficient bleed rate to minimize water consumption while the potential for hydraulic anomalies outside of the uranium-recovery area is minimized (Strata, 2011b). The wellfield flows would be balanced to produce appropriate bleed based upon the module-injection and recovery feeder-line meters. The individual well-flow targets would be determined on a per-pattern basis to ensure that local wellfields are balanced on at least a weekly basis.

The Applicant proposes a maximum injection pressure of 970 kPa [140 lb^2/in] measured at the injection manifold. This pressure is less than the formation-fracture pressure, which is approximately 2,240 kPa [325 lb^2/in] at the Ross Project and less than the pressure rating for operation of the pipes and other equipment (Strata, 2011b). Although injection pressures are initially expected to be relatively low, pressure requirements within a specific wellfield generally tend to increase with time. The Applicant suggests that, in order to maintain flow rates and wellfield balance, some wells would require flexibility in their allowable injection pressure. To specifically avoid the injection-restriction problems that plagued the Nubeth operation, the Applicant has proposed several improvements to well design, well development, and filtration (Strata, 2011a; Strata, 2011b).

Flows and pressures for the injection and recovery pipeline network would be monitored continuously at the module building, valve manhole, and CPP; the pressures would also be displayed in the CPP's control room (Strata, 2011b). Changes in flow or pressure that are outside of normal operating ranges would result in the activation of visual and audible alarms in the CPP, and eventual automatic sequential shutdown of pumps and control valves, if the condition is not corrected promptly.

In addition, the leak-detection sensors that would be located in the module-building sumps and the valve manholes would trigger audible and visual alarms at that location and in the CPP if fluid is detected (Strata, 2011b). The Applicant could also utilize dual leak detection in these areas, which would consist of two sensors at high and low levels within a module building. If fluid is detected by the low-level sensor, an audible and visual alarm would be triggered at that location and in the CPP. If fluid is detected by the high-level sensor, automatic pump shutdown would occur to prevent the fluid from overflowing the containment system and contaminating the surrounding environment.

Pipe and fitting leaks at the wellheads would be detected by sensors located in the wellhead sumps. In addition, a system would be instituted in the facility's operating plan for personnel to inspect the interior of each wellhead sump on a weekly basis. Minor leaks or other problems would be detected in this manner and then promptly repaired to reduce the likelihood of major releases.

As noted in SEIS Section 2.1.1, NRC regulations at 10 CFR Part 40, Appendix A, as well as in Condition Nos. 11.3, 11.4, and 11.5 in the Draft Source and Byproduct Materials License, would require Strata to institute an operational monitoring-well system to detect excursions (NRC, 2014b). NRC guidance defines an excursion as occurring when two or more excursion indicators or parameters in a monitoring well exceed their UCLs or if one excursion parameter exceeds its UCLs by 20 percent (NRC, 2009b). GEIS Section 2.4.1.4 describes how ISR operations can potentially affect the ground-water quality near an ISR facility when, during an excursion, lixiviant escapes the zone where uranium-recovery is underway and is not recovered by the intended recovery wells (NRC, 2009b). This would result in either a vertical or horizontal excursion. Excursions can be caused by an improper water balance between injection and recovery wells, undetected high-permeability geological strata or faults, improperly plugged or abandoned drillholes, discontinuity within the confining layers, poor well integrity, or unintended fracturing in the uranium-recovery zone or surrounding geological strata (NRC, 2009b). The monitoring of water levels in the perimeter-monitoring wells would be performed by the Applicant as indicated in Condition No. 10.7 of the Draft Source and Byproduct Materials License to ensure that a net inward hydraulic gradient is maintained (NRC, 2014b). A continual inward gradient would serve to reduce the potential of an excursion. Concentrations of water-quality indicators in the ground water from monitoring wells would be used to establish initial excursion indicators (i.e., post-licensing, pre-operational concentrations), and these indicators would be used to detect whether an excursion has occurred.

The NRC will require that the Applicant conduct sampling of its monitoring wells twice each month and analyze those samples for the excursion indicators, chloride, conductivity, and total alkalinity (NRC, 2014b, License Condition 11.4), so it can be determined whether an excursion has occurred. The Applicant has proposed such an operational ground-water monitoring program (Strata, 2011b). Water levels would be routinely measured during the sampling of the perimeter, overlying, and underlying monitoring wells in order to provide an early warning for impending wellfield problems. An increasing water level in a perimeter-monitoring well has been shown to be an indication of a local flow imbalance within the wellfield, which could result in an excursion (Strata, 2011b). An increasing water level in an overlying or underlying monitoring well could be caused by the migration of fluid from the ore zone or by an injection well-casing failure. As stated above, samples would also be collected from the appropriate monitoring wells twice monthly and would be analyzed for the License-established excursion parameters.

In addition, the Applicant expects that dedicated pressure transducers and/or in situ water-quality instruments could be used in the perimeter-monitoring wells to provide the earliest detection of potential excursions or hydraulic anomalies. The Applicant anticipates that this monitoring effort would allow corrective action to be immediately taken to balance locally the injection and recovery flows or to shut down individual injection well(s), as necessary (Strata, 2011b).

What are excursion indicators and upper control limits?

Prior to the commencement of injection of lixiviant into a wellfield and actual uranium recovery, an Applicant must propose excursion indicators (which are water-quality parameters, such as chloride, that are measured to describe the quality of the ground water) as well as upper control limits (UCLs) per 10 CFR Part 40, Appendix A, and as per the license the NRC would issue (10 CFR Part 40). The selection of the excursion indicators would be based upon post-licensing, pre-operational ground-water-quality (i.e., chemical constituents occurring in the ground water) and lixiviant chemistry.

Only after a wellfield and its monitoring-well ring are installed would several ground-water samples be obtained and analyzed by the Applicant. The results of these analyses provide post-licensing, pre-operational values for the respective ground-water-quality parameters that would be used to calculate UCLs for the excursion indiators. If, during ISR operations, the UCL for two excursion indicators are exceeded in a monitoring well, or if one UCL is exceeded by 20 percent, then an excursion of lixiviant would be defined as occurring.

UCLs are set for each uranium-recovery unit and the constituent concentrations for selected excursion indicators are set so as to provide early warning if uranium-bearing fluids (e.g., lixiviant) are moving away from a particular wellfield. The UCLs would be established by a licensee according to the methodology set forth in its source and byproduct materials license, followed by review and approval by NRC staff. As described by the NRC (2003a), the best excursion indicators are easily measurable parameters that are found in higher concentrations during uranium recovery than in the natural ground water.

At most in situ uranium-recovery operations, for example, chloride is selected because it does not interact strongly with the minerals in the ore zone; it is easily measured; and chloride concentrations are significantly increased during ISR operations. Conductivity, which is correlated to total dissolved solids (TDS), is also considered a good excursion indicator because of the high concentrations of dissolved constituents in the lixiviant as compared to the surrounding aquifers (Staub et al., 1986, and Deutsch et al., 1985, as cited in NRC, 2009b). Total alkalinity (carbonate plus bicarbonate plus hydroxide) is used as an indicator in wellfields where sodium bicarbonate or carbon dioxide is used in the lixiviant.

At least three excursion indicators are selected to be monitored in each wellfield, and the UCLs are determined using statistical analyses of the post-licensing, pre-operational water quality in the respective wellfield. The NRC staff has identified several statistical methods that can be used to establish UCLs. For example, in areas with good water quality (TDS less than 500 mg/L), the UCL could be set at a value of 5 standard deviations above the mean of the measured concentrations. Conversely, if the chemistry or a particular excursion indicator is very consistent, a specific concentration could be specified as the UCL. If post-licensing, pre-operational data indicate that the ground water is homogeneous across the wellfield, the same UCLs could be used for all monitoring wells. Alternatively, if the water chemistry in the wellfield is highly variable, unique UCLs could be set for individual wells.

As indicated by Condition No. 11.5 of the Draft Source and Byproduct Materials License (NRC, 2014b), the Applicant will be required to notify the NRC within 24 hours if an excursion were confirmed in the Project's ground-water monitoring wells. If a vertical excursion occurs, then the Applicant's injection of lixiviant into the uranium-recovery, or production, area surrounding the monitoring well will cease and, for any excursion, corrective action would be initiated (the GEIS documented that vertical excursions tend to be more difficult to recover than horizontal excursions) (NRC, 2014b; NRC, 2009b). The NRC would require that verification and progress ground-water samples are collected by the Applicant weekly until the excursion indicators are at or below their respective UCLs (i.e., the excursion is "recovered") as indicated by three consecutive weekly samples.

The Applicant would also be required to provide to the NRC within 60 days a confirmation of an excursion, a description of the excursion, a discussion of the corrective actions taken, and an analysis of the results of those corrective actions. According to Condition No. 11.5 of the Draft

Source and Byproduct Materials License, an excursion will be considered corrected when concentrations of all indicator parameters defining the excursion are at or below the UCLs that would be defined in License Condition No. 11.4 for three consecutive weekly samples (NRC, 2014b). If an excursion cannot be recovered within 60 days of confirmation, the Applicant will be required either to terminate lixiviant injection within the wellfield or a portion of the wellfield until the excursion is corrected, or to increase the surety established for the Ross Project by an amount sufficient to cover the full third-party costs for the correction and remediation of the excursion. As described by GEIS Section 2.11.4, the NRC licensees typically retrieve horizontal excursions back into the uranium-recovery zone by their repairing and reconditioning respective wells as well as adjusting the pumping rates in the wellfield where an excursion has occurred.

Uranium and Vanadium Processing

Uranium and vanadium in pregnant lixiviant would be extracted from solution by IX resin, stripped from the uranium-loaded (or “uranium-bearing”) IX resin (“eluted”), precipitated into a slurry, thickened, dewatered, dried, and packaged as yellowcake (Strata, 2011b). Prior to introduction to the IX columns, pregnant lixiviant could be passed through a de-sanding filtration system (Strata, 2011b). CO_2 could also be added to the pregnant lixiviant to optimize the IX resin-loading capacity. The filtered, pregnant lixiviant would then be passed through two-stage, pressurized, downflow IX columns, where the uranium and the vanadium dissolved in the lixiviant would be selectively adsorbed onto the IX resin beads. In exchange of uranium and vanadium, the resin releases chloride, bicarbonate, or sulfate ions into the lixiviant. The barren lixiviant exiting the second IX column would be monitored and would normally contain less than 2 mg/kg (“parts per million” or “ppm”) of uranium. When the resin beads in the IX column become saturated with uranium and vanadium, the columns would be taken offline for resin elution.

Prior to elution (“elution” is the process whereby the resin beads are “washed” with salt water to remove uranium and vanadium), the uranium-loaded resin would be transferred to vibrating screens to wash away sand, silt, broken resin, scale, and other process contaminants. The solid material recovered during this step would be collected, stored, and disposed of as a byproduct material. The elution process would then consist of four stages. The first three sequential stages are where a single batch of resin is contacted with a volume of eluant (water containing approximately 10 percent sodium chloride and 2 percent sodium carbonate) three times the volume of the batch of uranium-loaded resin. The fourth stage is a final rinse where the batch of resin is contacted with four bed volumes, or pore volumes, of fresh water (i.e., four bed volumes is equal to four times the amount of pore space [i.e., empty space] in the resin) (Strata, 2011b). In addition to processing resin from the Ross Project wellfields, the elution circuit would have the capacity to process uranium-loaded resin from other uranium-recovery operations owned either by the Applicant or another company as well as from water-treatment facilities that use IX resin to filter or condition water (Strata, 2011b).

The precipitation circuit produces a slurry of uranium solids from the eluant. The Applicant proposes a design consisting of multiple precipitation tanks plumbed in series, with mechanical agitation. The sequential addition of chemicals to bring about precipitation would be as follows: 1) sulfuric acid, 2) sodium hydroxide (caustic soda), 3) hydrogen peroxide, and 4) sodium hydroxide. The slurry containing the uranium precipitate would then be pumped to a yellowcake thickener, which separates the solid particulates from the liquid. The “underflow” from this thickener (i.e., the still-wet separated solids) would then undergo a second stage of dissolution and precipitation to remove any impurities entrained in the first precipitate (the underflow). The "overflow" (i.e., the liquid with few solid particulates remaining after precipitation) from both thickener stages would then go to the vanadium-recovery circuit.

After precipitation, the yellowcake slurry would be washed in a filter press to remove excess chloride and other soluble contaminants. After multiple washings, the filter cake would be dried and packaged (Strata, 2011b). Drying would be accomplished in completely enclosed low-temperature vacuum dryers. The GEIS describes the type of dryer proposed by the Applicant as the standard for newer ISR facilities (NRC, 2009b). The off-gases generated during the drying cycle would be filtered and scrubbed to remove entrained particulates (see SEIS Sections 4.7.1.2 and 4.13.1.2 as well as the NRC's Ross Project SER). The GEIS noted that the drying, filtration, and scrubber process proposed by the Applicant is designed to capture all escaping particulates (NRC, 2009b).

The dryers would be batch type, and drying would typically take 16 hours per batch. Batch dryers create the potential for the escape of yellowcake during loading and unloading of the dryer. The Applicant proposes to reduce this potential by the design of the equipment. A water-sealed vacuum pump would provide ventilation during loading of the yellowcake slurry into the dryer and transferring the dried product into 210-L [55-gal] drums by facility personnel (Strata, 2011b). Transfer equipment would be located directly below the dryer and would include a discharge chute, rotary airlock valve, ventilated drum hood, and a drum conveyor. A drum would be placed beneath the dryer discharge chute; the ventilation hood would be secured over the drum opening to prevent escape of yellowcake into the surrounding environment. After a drum is in place and securely covered, the rotary airlock valve would be activated to start the loading process. A viewport in the hood would allow personnel to determine when the drum is full. The loaded drum would be weighed and labeled, and then moved to the side to cool and off-gas before it is sealed and stored for offsite shipment.

The uranium-depleted solutions from the uranium thickeners would be pumped to a vanadium precipitation tank (Strata, 2011b). Steam, facility air, ammonia, and ammonium sulfate would be added to cause precipitation of crystals containing vanadium. The precipitate slurry would be pumped to a horizontal belt filter, where the solution is removed from the crystals. The filter cake would be washed and transferred to a batch vacuum rotary dryer similar to the dryer that would be used to dry uranium yellowcake. Off-gas from the precipitation tanks and dryer would be filtered to remove particulates and directed to a wet scrubber to capture ammonia for reuse. The dried product would then be packaged for offsite shipment. The Applicant estimates that 0.1 – 2 kg [0.2 – 4.4 lb] of V_2O_5 would be produced for every 1 kg [2.2 lb] of U_3O_8.

Air-effluent discharge points from the uranium-recovery processes would be the precipitation-tank vents, filtration-unit exhaust points, and off-gas vents from the dryers as well as the vapor-return lines on the acid storage tanks and the vents, tanks, and silos used to manage sodium carbonate, sodium bicarbonate, and sodium chloride. Acid fumes from precipitation-tank vents and filtration-unit exhaust points would be ducted through a common system to a wet scrubber and then discharged to the atmosphere. The scrubber proposed by the Applicant in its application to WDEQ/AQD for its Air Quality Permit is rated at 99 percent removal efficiency for sulfuric acid. The scrubber that would be on the vapor-return lines on the acid-storage tanks would remove 99 percent of the moisture containing the acid vapors. The emissions from handling sodium carbonate, sodium bicarbonate, and sodium chloride would be vented to a dust bag or fabric filter which would remove particulate emissions. The Applicant determined for its application to WDEQ/AQD for its Air Quality Permit that, based upon the specification for emissions removal by the type of filtration equipment that it would implement, the total emissions at maximum yellowcake production would be 1.1 kg/yr [2.4 lb/yr] for sodium chloride, 0.23 kg/yr [0.5 lbs/yr] for sodium carbonate, and 1.4 kg/yr [3.2 lb/yr] for sodium bicarbonate.

The waste water would be treated by RO (Strata, 2011b). The water quality of permeate that is anticipated by the Applicant is provided in Table 2.2. Most of the permeate from the RO circuit would be recycled back to the wellfield as lixiviant. The lined surface impoundments within the facility would be used to store and manage excess permeate and brine. Permeate and brine would be managed as byproduct material. Brine would be disposed in the UIC Class I deep-injection wells.

Table 2.2
Permeate Water Quality

Parameter	Unit	Typical Value	Minimum Value	Maximum Value
EC	μS/cm	300	180	400
TDS	mg/L	200	100	250
pH	s.u.	6.5	6	8
Alkalinity as $CaCO_3$	mg/L	100	50	200
Sulfate	mg/L	15	10	20
Bicarbonate	mg/L	150	50	200
Chloride	mg/L	15	5	25
Calcium	mg/L	0	0	1
Sodium	mg/L	50	20	100
Manganese	mg/L	0	0	0.1
Selenium	mg/L	0	0	0.1
Arsenic	mg/L	0	0	0.1
Uranium	mg/L	0	0	0.1
Radium	pCi/L	30	5	100

Source: Table 4.2-2 in Strata, 2011b; Strata, 2013b.

2.1.1.3 Ross Project Aquifer Restoration

After uranium recovery in a wellfield has ended, the aquifer would contain ground-water constituents mobilized by the lixiviant during uranium recovery. The purpose of aquifer restoration is to restore the ground-water quality in the wellfield to the ground-water-protection standards specified at 10 CFR Part 40, Appendix A, Criterion 5B(5) (see SEIS Section 2.1.1.2), so as to ensure no hazard to human health or the environment (NRC, 2014b). Water quality is measured at the point of compliance that coincides with the established boundary of the exempted aquifer. During uranium-recovery operation, the point-of-compliance wells would be those in the perimeter ring as well as those in the overlying-and underlying-aquifers, as required by the ground-water monitoring program (see SEIS Section 6). During aquifer restoration, however, the group of point-of-compliance wells would be expanded to include the representative wells in the exempted aquifer. The Applicant would be required to provide a financial-surety instrument that would cover anticipated and delayed aquifer-restoration costs (as well as facility decontamination and decommissioning) to comply with 10 CFR Part 40, Appendix A, Criterion (9). The NRC would review the adequacy of this instrument annually (see SEIS Section 2.1.1.7) (10 CFR Part 40).

As discussed in SEIS Sections 2.1.1 and 2.1.1.1, under the Federal UIC program and the authority delegated to Wyoming, the permanently exempted production, or uranium-bearing, aquifer would no longer be a USDW under the SDWA (40 CFR Part 145) (EPA, 2013). In accordance with the requirements applicable to a Class III well under 40 CFR Part 146.4, the exempted aquifer does not currently serve as a source of drinking water and cannot now and would not in the future be classified as a source of drinking water (40 CFR Part 146).

The aquifer-restoration activities proposed for the Ross Project are the same as those methods described in GEIS Section 2.5: 1) ground-water transfer, 2) ground-water sweep, 3) RO treatment with permeate injection, 4) ground-water recirculation, and 5) stabilization monitoring (Strata, 2011a; NRC, 2009b). The GEIS Section 2.5.4 discusses the need in some cases to add chemicals to the aquifer that would reduce the solubility of dissolved constituents such as uranium, arsenic, and selenium and re-establish the pre-operational chemical environment. As described in the GEIS this would be done by putting an oxygen scavenger or a reducing agent, such as hydrogen sulfide (H_2S) or a biodegradable organic compound such as ethanol, into the production zone during the later stages of recirculation (NRC, 2009b).

The Applicant proposes that concurrent ISR operations and aquifer restoration would occur when several of the first wellfield modules have been depleted and are ready for restoration activities (Strata, 2011b). As aquifer restoration occurs in depleted wellfield modules, uranium-recovery operation would be ongoing in subsequent wellfield modules. The Applicant would base the actual sequence of restoration activities on its operating experience, the capacity of the ground-water treatment system, and the brine disposal capacity. The Applicant has proposed a ground-water restoration schedule that is benchmarked to production schedules and waste-water disposal capacity, and it estimates that aquifer restoration for each wellfield would take approximately eight months (Strata, 2011b).

Not all five aquifer-restoration activities would be used for restoration of a specific wellfield if determined by the Applicant to be unnecessary to achieve the applicable ground-water protection standards; however, should Strata submit a request for application of an Alternate Concentration Limit (ACL) at a designated wellfield, the NRC staff will review the aquifer-restoration activities to ensure that an approriate level of effort has been performed. Based upon the NRC staff's review of the Applicant's commitments in the license application coupled with Condition No. 10.6 in the Draft Source and Byproduct Materials License pertaining to ground-water restoration, the NRC staff is reasonably assured that the Applicant would restore ground water to the ground-water-protection standards of 10 CFR Part 40, Appendix A, Criterion 5B(5) and would provide the information for the NRC's determination required per 10 CFR Part 40, Appendix A, Criterion 5D (NRC, 2014a; NRC, 2014b).

Ground-water transfer would be the first step of restoration (Strata, 2011a). Ground-water transfer moves water between a wellfield entering restoration and another wellfield where uranium recovery is beginning, or between areas within the same wellfield that are in different stages of restoration. The objective of ground-water transfer is to blend ground-water compositions and generally does not generate liquid effluents (NRC, 2009b).

Ground-water transfer is followed by ground-water sweep (Strata, 2011a). During ground-water sweep, water is pumped from injection and recovery wells to the CPP without reinjection, as the GEIS described in Section 2.5.2. In response to this pumping, water from outside the wellfield flows into the ore zone, flushing contaminants from areas that have been affected by the horizontally spreading lixiviant in the respective aquifer during uranium recovery (NRC, 2009b). Ground water produced during the sweep phase would contain uranium and other contaminants mobilized during uranium recovery as well as residual lixiviant. The initial concentrations of these constituents would be similar to those during uranium recovery, but the concentrations would decline with time. The water removed from the aquifer during the sweep would first be passed through the IX system to recover the uranium, then it would be treated by RO, followed by reuse or disposal as excess permeate. The pumping rates used would depend on the hydrologic conditions at the Ross Project, and the duration of the aquifer sweep and the volume of water removed would depend on the volume of the aquifer affected by the ISR process.

Aquifer volume typically is described in terms of “pore volumes,” a term used by the ISR industry to represent the volume of water that fills the void space in a given volume of rock or sediment. The Applicant’s aquifer-restoration plan calls for removing up to one-half pore volume of water during ground-water sweep (Strata, 2011b). Additional pumping would occur in select areas that would be identified during facility operation. The pumping rate is estimated at 280 L/min [75 gal/min] from wellfield modules in the ground-water sweep stage. The Applicant proposes to use ground-water sweep selectively (for example, around the perimeter of the wellfield) rather than throughout the entire wellfield module to minimize the consumptive use of ground water (Strata, 2011a).

The Applicant proposes to use RO treatment and permeate injection after the ground-water sweep and ground-water transfer processes, as described in GEIS Section 2.5.3 (Strata, 2011b). This phase would return water-quality parameters in the ore-zone aquifer to the respective ground-water-protection standards specified by 10 CFR Part 40, Appendix A, Criterion 5B(B) (NRC, 2009b; NRC, 2014b). Ground water pumped from the wellfields during this phase of restoration would be treated with sulfuric acid or other chemicals to prevent scaling on the RO circuit (see Addendum 6.1-A in Strata, 2011b). Low concentrations of uranium in the ground water would be removed by passing the water through IX, as during uranium-recovery operation. Following IX, other chemical constituents are removed by passing the ground water through the RO circuit that is described in Section 2.1.1.1. of this SEIS. The permeate (approximately 85 percent of the withdrawn ground water) would be re-injected into the aquifer.

The pumping and injection rates during this process would be similar to those during the sweep phase, but, depending upon site hydrology, many pore volumes (often more than 10) could be circulated to achieve aquifer-restoration goals (NRC, 2009b). For the Ross Project, the Applicant estimates that 8.5 pore volumes of treated permeate would be injected during the sweep as well as the pumping and injection phases of aquifer restoration (Strata, 2011b). The rate of injection would average 3,880 L/min [1,025 gal/min] of permeate (Strata, 2011b). During aquifer restoration (except during ground-water sweep), all permeate would be used as lixiviant or injected into the aquifer for restoration.

The ground-water recirculation process would begin after completion of the permeate-injection process. In this phase, ground water from the production zone would be pumped from recovery wells and re-circulated into injection wells in the same wellfield module. This process homogenizes the ground water within the aquifer to minimize the risk of “hot-spots,” areas of the aquifer with unusually high concentrations of dissolved metal concentrations. The Applicant proposes that the only water treatments that would occur during recirculation are filtration and removal of uranium and vanadium (Strata, 2011a).

The purpose of stabilization monitoring as the last step of aquifer restoration is to ensure long term compliance of the ground water protection standards of 10 CFR Part 40, Appendix A, Criterion 5B(5) (NRC, 2009b). Following aquifer restoration, the Applicant will conduct stabilization monitoring consisting of 8 samples during a 12-month period to determine if the concentrations of water-quality parameters remain at constant levels according to Condition No. 10.6 in the Draft Source and Byproduct Materials License (Strata, 2011b; NRC, 2014b). Stabilization monitoring would include selected recovery wells and monitoring wells (perimeter wells and wells completed in the underlying and overlying aquifer). Further analysis and evaluation would be conducted in the event that water-quality parameters exhibit a statistically significant increasing trend or areas of ground water not meeting the water quality protection standards are identified within the aquifer (Strata, 2011b). This analysis may include additional monitoring and flow and transport modeling. If the evaluation reveals that ground water outside the exempted aquifer could potentially be affected, the Applicant may repeat a previous phase of active restoration. In the event that the Applicant proposed the use of a reducing agent to lower the concentrations of water quality parameters in the aquifer, the Applicant will submit to the NRC for review and approval plans for equipment and procedures prior to the use, storage, handling, and transport of biological or chemical materials for reductant injections during restoration (NRC, 2014b, License Condition 10.10). The Applicant would continue the stability monitoring until the data demonstrate, for all parameters monitored, that no statistically significant increasing trend exists that would lead to an exceedance of the ground water protection standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). When the monitoring results show that the water quality meets the standards and does not exhibit significantly increasing trends, the Applicant commits to submitting a restoration report with the supporting documentation to NRC for its review and approval (Strata, 2011a). Both the WDEQ and the NRC must review and approve all monitoring results before aquifer restoration would be considered to be complete.

The compliance period for which the ground-water-protection monitoring program would be performed is from the time the Commission sets the ground-water-protection standards until license termination. Thus, the ground-water-protection program is continuous throughout operation, aquifer restoration, and possibly the post-closure (post-reclamation) period as determined by the NRC.

All injection, recovery, and monitoring wells and drillholes would be plugged and abandoned in place according to applicable regulations after ground-water restoration is approved by the NRC and WDEQ (WDEQ/LQD, 2005b). To comply with these regulations, the Applicant proposes standard operating procedures (SOPs) of well abandonment that include plugging all wells with a cement slurry or a bentonite grout (Strata, 2011b).

2.1.1.4 Ross Project Decommissioning

Prior to the Ross Project's facility decontamination, dismantling, and decommissioning; the wellfields' aquifer restoration; and the Project site's reclamation and restoration; appropriate cleanup criteria for surfaces would need to be established in concert with NRC requirements, and a Ross Project-specific decommissioning plan (DP) and/or its Restoration Action Plan

(RAP) would need to be reviewed and accepted by the NRC (NRC, 2003b). The Applicant has committed to satisfying these NRC requirements for decontamination and decommissioning (Strata, 2011b).

To begin the Ross Project's decommissioning phase, the Applicant would conduct a series of radiation surveys to identify those areas at the Ross Project that would need decontamination to meet applicable cleanup criteria or those that cannot economically meet the criteria (Strata, 2011b). These surveys would include building, structural, and equipment surfaces as well as potentially contaminated environmental media such as soil and water (NRC, 1999; NRC, 2003a). The reclaimed mud pits used for the disposal of drilling fluids and muds (or "cuttings") during the installation of new wells, would be included in the survey to ensure no long-term radiological impacts (Strata, 2011a). In addition, records of radiation surveys and the entire cycle of decontamination, dismantling, decommissioning, and disposal activities will be maintained as indicated in Condition No. 10.3 of the Draft Source and Byproduct Materials License (NRC, 2014b).

Based upon the results of the radiation surveys, decontamination and dismantling of buildings, structures, and equipment would be conducted in accordance with the DP and/or RAP. Contaminated surfaces, including processing and water-treatment equipment such as tanks, filters, IX columns, pipes, and pumps, would be decontaminated (Strata, 2011b). High-pressure washing would be used to remove loose contamination from the surfaces. If required, secondary decontamination would consist of washing with dilute acid or equivalent compatible solution (Strata, 2011b). All successfully decontaminated buildings and equipment could be released for unrestricted use (NRC, 2003b).

The buildings, structures, and equipment that are not or no longer contaminated would be moved to a new location within the Ross Project for further use or storage, removed to another facility for either reuse or salvage, or taken to a properly permitted, permanent solid-waste disposal facility. Concrete flooring, foundations, and foundation materials, if uncontaminated, would be broken up and disposed of at an appropriately permitted solid-waste facility. All radioactively contaminated buildings and structural materials that cannot be successfully decontaminated would be dismantled and then disposed of at a properly licensed byproduct-material disposal facility (i.e., a facility licensed by the NRC or an Agreement State). Contaminated soils would also be disposed of at the same or similar licensed facility. A final-status radiation survey would then be performed to ensure that any residual contamination on the surfaces is below the cleanup criteria. All disturbed lands would be reclaimed (NRC, 1999). Section 2.6 of the GEIS describes the general process for decontamination, dismantling, and decommissioning of an ISR facility and the restoration and reclamation of the land itself (NRC, 2009b).

During decommissioning of the facility, all UIC Class III injection and recovery wells, monitoring wells, and the UIC Class I injection wells would be properly abandoned according to the DP. The total number of wells would number between 1,400 and 2,200 based upon the Applicant's estimate of 40 recovery wells per each of 15 – 25 wellfield modules plus monitoring wells (Strata, 2012a). Decommissioning of a wellfield would begin approximately five years after its construction (refer to Figure 2.6) (Strata, 2011a). However, at the Ross Project, complete decontamination, dismantling, and decommissioning of the CPP itself which includes the impoundments, and restoration and reclamation of the Ross Project area, could occur years after the wellfields begin to be decommissioned and the aquifer begins to be restored, in order to accommodate the Applicant's continuing recovery of uranium and production of yellowcake from its potential future satellite projects and/or from other uranium-recovery or waste-water-treatment operations (Strata, 2011a).

Wastes and equipment associated with impoundments such as accumulated sludge, the pond liners, and leak detection piping and materials will be surveyed for radiological contamination and disposed of or released for unrestricted use. The soil beneath the pond will be surveyed for radiological contamination, and any areas that exceed limits for unrestricted use will be excavated and disposed of at an NRC approved facility.

During the decommissioning phase, the Applicant proposes that all primary, secondary, and tertiary roads and other temporary access routes to and within the Ross Project would be removed and the land reclaimed, unless a request by the respective landowners or lessees to not do so is received by the Applicant. In this case, then, the landowners or lessees would assume responsibility for the long-term maintenance and ultimate reclamation of the roads and routes, after the Source and Byproduct Materials License has been withdrawn (Strata, 2011b).

All contaminated soil or gravel that is determined to be a byproduct material would be disposed at a facility appropriately licensed by the NRC or an Agreement State, as necessary, while petroleum-contaminated soil would be disposed at a WDEQ-permitted facility. Removal of roads would be accomplished by the Applicant removing excess road surfacing material, and then ripping the road and the underlying shallow subsoil to loosen the base. Culverts would be removed and preconstruction drainages would be re-established. The vicinity would be graded to a contour consistent with the surrounding landscape. Finally, topsoil would be applied in a uniform manner and the area seeded to achieve WDEQ/LQD reclamation standards.

The Class I deep-disposal wells would be plugged and properly abandoned in accordance with the requirements of the Applicant's UIC Class I Permit (Strata, 2011b). All wastes, equipment, and infrastructure associated with the surface impoundments, such as the gravel or asphalt pad, accumulated sludge, impoundment liners, and leak-detection pipes and lines, would be surveyed for radioactive contamination and then disposed of appropriately or released for unrestricted use (Strata, 2011b). The soil beneath the surface impoundments would be analyzed for radioactive contamination, and any areas that exceed the cleanup criteria for unrestricted release would be excavated and disposed of at a waste-disposal facility licensed to accept byproduct material.

The natural flow of shallow ground water beneath the facility and in the immediate vicinity outside of the CBW would also be re-established during decommissioning (Strata, 2011b). Flow through the CBW would be accomplished by the Applicant's creating a series of breaches, also known as finger drains, along the up-gradient and down-gradient reaches of the CBW. Each finger drain would consist of a 0.5 m [1.5 ft] wide by 7.6 m [25 ft] long trench that is cut through the CBW at a right angle and to a depth that is 0.6 m [2 ft] below the lowest historical ground-water level. Gravel would be placed in the trench from the bottom to a point 0.6 m [2 ft] above the highest recorded ground-water level such that a highly permeable flow path is created through the CBW. The remaining trench would be backfilled with native topsoil and seeded.

Selected monitoring wells that would have been used by the Applicant to characterize the shallow aquifer in the area, before installation of the CBW, would be retained. Water levels would be monitored following CBW reclamation to verify that the natural flow of shallow ground water through the CBW and beneath the facility has been restored.

The Applicant proposes to re-contour, as necessary, the disturbed areas within the Ross Project area to blend in with the natural terrain and to be consistent with the preconstruction topography (Strata, 2011b). Revegetation would be accomplished in accordance with the WDEQ/LQD Permit to Mine requirements and would be required by the Source and Byproduct Materials License. Topsoil that was salvaged prior to construction activities and stored in a stockpile would be used for reclamation to the extent possible (Strata, 2011b); the topsoil would be spread over the area to be reclaimed and would be seeded with a native seed mix.
During Project operation the topsoil stockpiles and as much as is practical of the disturbed wellfield, would be seeded to establish vegetative cover to minimize wind and water erosion. At the completion of decommissioning, the Applicant commits to restoring and reclaiming the entire area for unrestricted use (Strata, 2011b, Addendum 6.1-A). Reclaimed land would be capable

What types of wastes would be generated at the proposed Ross Project?

Liquid Wastes

Liquid Byproduct Material is all byproduct-material-containing liquids that would be generated by the Ross Project and are regulated by the NRC, except for sanitary waste water as well as well-development and some ground-water-sampling waste water (see below).

Liquid Technologically Enhanced Naturally Occurring Material (TENORM) at the Ross Project would include fluids, such as the drilling muds and other fluids brought to the surface during well drilling and installation. This waste is regulated by the U.S. Environmental Protection Agency (EPA). Such waste would be disposed of onsite very near the holes within which the muds and fluids are employed. They would be discharged to the “mud pits,” which are described in the adjacent SEIS text, and left for evaporation.

Liquid Hazardous Waste and Used Oil are regulated under the *Resource Conservation and Recovery Act* (RCRA), other Federal agencies (e.g., U.S. EPA), or are a State-defined hazardous waste that is not a-byproduct material. This waste includes so-called “universal” hazardous wastes.

Domestic Waste Water is ordinary domestic (i.e., “sanitary”) septic-system or sewer waste water.

Well-Development and Testing Waste Water is waste water generated during well development and well pumping. Such waste water does not require treatment before disposal, but its disposal onsite does require a permit.

Solid Wastes

Solid Byproduct Material is all solid-phase byproduct material generated by the Ross Project and regulated by the NRC.

Solid TENORM at the Ross Project would include solids, such as solid drill and soil cuttings, brought to the surface during well drilling and installation. Such waste would be disposed of onsite very near the holes from which the solid cuttings are excavated. Solid TENORM would be disposed of in the mud pits discussed above.

Hazardous Waste is regulated under RCRA and/or by another Federal agency, or is a State-defined hazardous waste, that contains no byproduct material. (So-called “toxic” waste may be regulated under the *Toxic Substances Control Act* [TSCA].) This type of waste also includes “universal” hazardous wastes.

Nonhazardous Solid Waste is domestic, office, and municipal waste (i.e., trash), construction and demolition debris, septic solids, and other materials, such as equipment and soils, that have been determined to meet applicable NRC criteria for of supporting livestock grazing, dryland farming, and wildlife habitat. The respective landowners and WDEQ would be consulted as the Applicant selects the seed mix. Seeding would be conducted by drill or broadcast methods depending upon the type of seed being used. Mulch could also be used to cover the seed (Strata, 2011b).

2.1.1.5 ISR Effluents and Waste Management

Section 2.7 of the GEIS describes the airborne effluents as well as the liquid and solid wastes that are typically generated at ISR facilities and corresponding waste-management practices (NRC, 2009b). The effluents and wastes expected from the proposed ISR Project and the waste-management practices the Applicant proposes are consistent with the industry standards reported in the GEIS. The types of liquid and solid wastes, the quantities of these wastes anticipated by the Applicant, and the Applicant's proposed management systems are provided in Strata (2011a; 2012a). (See also Table 4.9 in SEIS Section 4.14.) Impacts from liquid and solid waste management are described in SEIS Section 4.14.

Airborne Emissions

There would be both radioactive and non-radioactive airborne particulates and gases emitted during all phases of the Proposed Action (Strata, 2011b). As discussed below, the design features proposed by the Applicant to control all airborne effluents are consistent with the industry standards presented in the GEIS (NRC, 2009b).

Non-Radioactive Emissions

Emissions from internal combustion engines would be the primary source of non-radioactive gaseous effluents (i.e., emissions). Releases would be anticipated from drilling rigs, drilling support equipment (e.g., backhoes, water trucks, pipe trucks, and cement units), utility trucks employed for wellfield service, light vehicles used for personal transport through the wellfields, in addition to vehicles used by ISR facility personnel to and from the Ross Project area (Strata, 2011b). The emissions from these types of vehicles would include carbon monoxide (CO), CO_2, sulfur dioxide (SO_2), nitrogen species (NO_x), and total hydrocarbon (THC) as well as particulates less than 10 μm (microns) in diameter (PM_{10}) (Strata, 2011a). These emissions are consistent with those emitted from a generic ISR project described in the GEIS (NRC, 2009b).

Smaller sources of airborne non-radioactive gaseous and particulate emissions during operation would include gaseous emissions from process-pipeline, process-vessel, and storage-tank vents; emergency generators and space heaters; and other sources within the CPP such as storage vessels and tanks containing acids and bases. Gaseous emissions from the yellowcake dryer are not expected because of the dryer system's design; the vanadium precipitation, drying, and packaging would also present a potential for non-radioactive particulate emissions. Occasional small releases of salt and soda ash during delivery as well as fumes from laboratory chemicals could also occur, as explained in SEIS Section 4.7.1.2.

Fugitive dust would also be generated during all phases of the Proposed Action due to the mechanical disturbance of soil by heavy equipment, from transport vehicles traveling on access roads, and from wind blowing over disturbed areas and stockpiles. The Applicant has proposed to mitigate fugitive-dust emissions with its use of speed limits, strategic placement of water-loading facilities near access roads, suppression of dust with chemicals such as magnesium chloride, selection of road-surface materials that would minimize dust, and prompt revegetation of disturbed areas (Strata, 2011a).

Radioactive Emissions

Radon gas would be the primary radioactive gaseous effluent from the Ross Project. Radon is a radioactive, colorless, and odorless gas that occurs naturally as the decay product of radium, which is found where there is uranium as radium itself is a radioactive decay product of uranium. Radon would be found in the lixiviant solution that is extracted from the wellfields and piped to the CPP for processing. Radon gas could potentially be released in the CPP as a result of uranium-recovery fluid spills, filter changes, IX resin-transfer operations, and maintenance activities. Routine monitoring of radon progeny (i.e., the products of radon's own radioactive decay) within the CPP would identify exposure levels and would allow timely corrective actions to be initiated, if necessary (Strata, 2011b). The sources of radon described by the Applicant and the design features proposed by the Applicant to limit radon concentrations (e.g., the Applicant's use of pressurized downflow IX columns, proper ventilation systems, and radon detectors) are consistent with the industry standards described in the GEIS (NRC, 2009b). The use of pressurized, downflow IX columns would ensure that the majority of radon released to the recovery solution would stay in solution and not be released to the atmosphere.

All exhaust points in the CPP would be ducted through a common system to a wet scrubber and discharged to the atmosphere (Strata, 2011b). The Applicant has committed that its air discharges would meet all State requirements as contained in its Air Quality Permit as well as the NRC's 10 CFR Part 20 occupational health and safety requirements (Strata, 2012b). A fan-performance-monitoring station would be located at the CPP's exhaust fan's point of discharge at the roof. The ambient air within the facility would be gravity ventilated up through a ridge vent. The CPP and other buildings would also be passively ventilated by the opening and closing of doors during periods of time when radon could be released.

Radon gas could also be released outside of the CPP from wellheads, other auxiliary buildings such as wellfield modules, and the surface impoundments (Strata, 2011b). At the wellheads and the surface impoundments, radon would be released directly to the atmosphere, where it would rapidly disperse and decrease in concentration. Wellhead enclosures, such as the module buildings, would be vented to reduce radon buildup that could otherwise expose wellfield personnel to radon during inspection and maintenance activities. The Applicant proposes that, if vents are not installed on wellhead enclosures, SOPs would be developed for accessing wellheads to ensure radon exposures are below the regulatory limits of the EPA and the NRC. Such buildings would have ventilation systems consisting of a roof- or wall-mounted fan as well as a separate radon ventilation system with an intake located in the building's sump and an exhaust point on the building's roof.

Potential radioactive particulate emissions would consist primarily of airborne yellowcake in the uranium drying and packaging process (Strata, 2011b). This potential would be mitigated by design features specific to low-temperature vacuum dryer systems to prevent releases into the atmosphere as described in SEIS Section 2.1.1.2.

Liquid Effluents

GEIS Section 2.7.2 describes the liquid effluents generated during all phases of uranium recovery: construction, operation, aquifer restoration, and decommissioning. During most of these phases, liquid wastes could contain elevated concentrations of radioactive and chemical constituents. The composition and quantities of liquid waste from Ross Project processes related to uranium recovery are similar to those ranges provided in Table 2.7-3 of the GEIS (NRC, 2009b); however, representative water quality parameter(s) for permeate are not included in the GEIS for comparison. The methods that the Applicant proposes for treatment of liquid wastes, such as RO as well as its disposal and management practices, are similarly noted as industry standards in the GEIS (NRC, 2009b).

The Proposed Action would generate liquid effluents classified as byproduct material as well as other liquid effluents that are not (Strata, 2011b; Strata, 2012a). Liquid wastes would be categorized as follows:

- Brine and permeate from the RO treatment of lixiviant bleed and ground water from aquifer restoration. Most of the permeate would be reused as lixiviant in the wellfields, as aquifer-restoration water, or as process make-up water.
- Other liquids such as spent eluate, collected fluids from drains in the processing areas at the CPP, contaminated reagents, IX-resin wash water, filter back wash, facility wash-down water, decontamination water (e.g., employee showers), and fluids generated from work-over and enhancement operations on injection and recovery wells.
- Non-byproduct liquid wastes would include drilling fluids and ground water collected during construction and development of injection, recovery, and monitoring wells as well as during environmental sampling and aquifer testing; storm-water runoff; toxic and hazardous wastes such as petroleum products and spent chemicals; and domestic sewage.

The Applicant proposes the use of surface impoundments for the collection and management of byproduct waste liquids (Strata, 2011a). Production of liquid byproduct material would vary over the three phases of operation and aquifer restoration: 1) operation only; 2) concurrent operation and aquifer restoration; and 3) aquifer restoration (Strata, 2011b). Condition Nos. 10.8 and 12.12 of the Draft Source and Byproduct Materials License would allow the construction and operation of lined surface impoundments with regularly scheduled inspections as well as a ground-water monitoring program plan to detect releases from the impoundments (NRC, 2014b). In addition, Condition No. 10.11 would require verification of the CPP’s dewatering system before an impoundment would be used for storage of byproduct material (NRC, 2014b).

GEIS Section 2.7.2 described four disposal options for use at ISR facilities: evaporation, land application, deep-well injection, and surface-water discharge (NRC, 2009b). Of these disposal options, the Applicant proposes to rely on deep-well injection for disposal of brine and surface discharge of excess permeate, with supplemental disposal by evaporation of brine from the surface impoundments (Strata, 2011b; Strata, 2012a). Land application is not currently proposed as a method for permeate disposal by the Applicant (Strata, 2012b). The surface impoundments would primarily provide transient storage of liquids with little evaporation actually occurring during the liquids’ residence time.

Excess permeate could be produced during two relatively brief periods of operations (Strata, 2011b): the first two and one-half years of uranium production without reinjection of permeate into the aquifer for wellfield restoration and the two months when ground-water sweep is occurring in the first wellfield modules to undergo aquifer restoration. The Applicant proposes that excess permeate produced during the periods of uranium recovery and aquifer restoration not used as plant makeup water would be disposed of with brine by deep-well injection (WWC Engineering, 2013). As noted earlier, the Applicant would use Class I deep-well injection for disposal of brine and other liquid byproduct material. The Applicant expects that the capacity of each of the five UIC Class I wells would range between 130 – 300 L/min [35 – 80 gal/min]. The Applicant has also proposed a storage tank at the site of a Class I well that, with the lined surface impoundments, would provide surge capacity for management of all brine (Strata, 2012b).

The UIC Class I permit from the WDEQ sets a maximum limit on the injection pressure (2,570 psi) and sets a range for the annulus pressure (200 to 800 psi) (WDEQ/WQD, 2011b). Injection at pressures less than the injection limit ensures that the capacity of the target aquifers (Deadwood and Flathead) is not exceeded. The permit requires that the pressures as well as injection rate and volume are monitored and submitted to the WDEQ. In addition, the permit requires pressure fall-off tests to be conducted which provides data to calculate aquifer properties.

The production rates of brine and permeate that the Applicant estimates would require disposal during different periods of operation, aquifer restoration, and decommissioning are presented in Table 4.9. The Applicant’s estimated production rate of brine, permeate, and other liquid wastes for disposal would be less than noted in the GEIS Table 2.7-3 (NRC, 2009b).

The following liquid wastes, none of which are byproduct material, would be generated at the Ross Project:

- Storm water from the paved and graveled areas of the proposed Ross Project facility.
- Domestic sewage from the proposed facility.
- Drilling fluids from the Applicant’s construction of uranium-recovery wellfields and its development of associated injection and production wells.

Storm-water management would be controlled under a WYPDES permit from WDEQ. As part of this permit, best management practices (BMPs) would be developed to restrict contaminants from the surface water and storm drains. Runoff from the facility would be diverted by the storm-drain system to a sediment surface impoundment near the CPP (Strata, 2011b).

The Applicant estimates that the volume of domestic sewage would range between 1,100 L/d [300 gal/d] and 9,800 L/d [2,600 gal/d] depending upon the number of workers during each project phase (Strata, 2012a). Domestic waste water would be collected in a gravity-sewer collection system serving the administration building, CPP, maintenance building, and any other buildings or structures with restrooms. This system would be designed according to WDEQ/WQD standards and would include one or more septic tanks for primary treatment. Septic-tank effluent would be disposed in a drainfield or in an enhanced treatment system (Strata, 2011b).

Drilling fluids of ground water and drilling muds would be produced only during the construction phase from the drilling and development of injection, recovery, and monitoring wells. The Applicant estimates that a volume of 22,000 L [6,000 gal] of water and 11 m^3 [15 yd^3] of drilling muds would be produced per well. The fluid would be stored onsite in mud pits constructed adjacent to the respective drilling pad(s) and evaporated. The Applicant expects the production of ground water during operation and decommissioning from wells completed outside of the aquifer exempted for uranium recovery (Strata, 2011a). This ground water would be discharged under a temporary WYPDES Permit. Similarly, the Applicant was authorized to discharge these same fluids under a temporary WYPDES Permit (No. WYG720229) issued during installation and initial sampling of monitoring wells at the Ross Project (WDEQ/WQD, 2011a). This Permit was renewed in December 2012.

Solid Effluents

The Applicant describes the solid-phase wastes that would be generated during all phases of the Ross Project. The solid wastes would be non-byproduct material (hazardous or typical solid waste), or byproduct material similar to those solid phase wastes described in the GEIS as generated by the typical ISR facility during all phases of uranium-recovery operations. The Applicant provided a list of anticipated waste-disposal facilities with adequate capacity that could be used for Ross Project waste in the additional information it provided the NRC in 2012 (Strata, 2012a).

The estimates of solid-waste generation and waste-management methods proposed by the Applicant for the Ross Project are within the industry standards described in Section 2.7 of the GEIS (Strata, 2011b; Strata, 2012b; NRC, 2009b). The Applicant estimates the production of 19 L/mo [5 gal/mo] of used oil and less than 9 kg/mo [20 lb/mo] of used oil filters and oily rags. These wastes would be stored in a designated used-oil storage area and would be shipped to a commercial recycling facility for disposal, such as Tri-State Recycling Services, Newcastle, Wyoming (Strata, 2012a). Petroleum-contaminated soil, estimated as less than 1 m^3/wk [1 yd^3/wk], would be transported by a waste-disposal contractor to a permitted land farm in northeast Wyoming such as the Campbell County Landfill (Strata, 2012a).

Less than 100 kg/mo [220 lb/mo] of waste designated as hazardous by the EPA and WDEQ, such as used batteries, expired laboratory reagents, burnt-out fluorescent light bulbs, spent solvents, certain cleaners, and used degreasers, would also be generated (Strata, 2012a). The hazardous waste would be stored at the Ross Project in secure, specially designed containers inside the maintenance shop. The Applicant expects the Ross Project to be classified as a conditionally exempt small-quantity generator (known as a CESQG) of hazardous waste (Strata, 2011b). Hazardous waste would be transported by a hazardous waste contractor to an appropriately permitted commercial recycling facility outside Wyoming (Strata, 2012a). The Applicant proposes onsite disposal of contaminated laboratory reagents in the lined retention impoundments and deep-well injection (Strata, 2012a).

Byproduct material that would be generated at the Ross Project include filtrate and spent filter media from production and restoration circuits; general sludge, scale, etc. from maintenance operations; affected soil collected from any spill or leak areas; spent/damaged IX resin; well solids from injection/recovery well work-over operations; contaminated PPE; wellfield decommissioning waste, such as pipelines, pumps, and impacted soil; affected concrete floors, sumps, and berms in the CPP; equipment and piping in the CPP; surface-impoundment sludge, surface-impoundment liners, and leak detection systems; and disposal well piping and equipment (Strata, 2012a). Solid byproduct-material-containing waste would be generated during all Proposed Action phases, except construction. During Project operation and aquifer restoration, the Applicant estimates the production of 80 m^3/yr [100 yd^3/yr] of solid byproduct-material waste. The largest volumes of byproduct-material waste, including contaminated soil requiring licensed disposal, would be generated during facility decommissioning, which is estimated to be 3,000 m^3 [4,000 yd^3] (Strata, 2012a). The Applicant has identified four facilities with sufficient capability located in Wyoming, Utah, and Texas that are permitted to accept byproduct material from ISR facilities (Strata, 2012a). The NRC will require that an agreement with each facility that the Applicant would use to dispose of its wastes contaminated by byproduct material be formally executed before any uranium-recovery activities would begin at the Ross Project area.

During the latter three phases of the Proposed Action, when waste byproduct material would be generated, it would be stored inside a locked and posted room within the CPP (i.e., this area would be a restricted area) or, during the decommissioning phase, in a restricted storage area. The wastes would be placed inside 210-L [55-gal], lined drums, sealed and placed inside a 15-m^3 [20-yd^3] roll-off container. The sealed roll-off containers containing the waste would be transported by a licensed transporter to an appropriately permitted or licensed facility for disposal. The Applicant anticipates about five annual shipments of byproduct waste during the Project-operation and aquifer-restoration phases. During decommissioning, which is expected to last 12 – 18 months, up to 200 shipments per year would be expected (Strata, 2011b).

Non-byproduct-material solid wastes generated at the Ross Project include ordinary trash, petroleum-contaminated soil, construction debris, and decontaminated material and equipment. The Applicant estimates that 12 m^3/wk [15 yd^3/wk] of ordinary municipal solid waste such as office trash along with 4 m^3/wk [5 yd^3/wk] of recyclable wastes (plastic, glass, paper, aluminum, and cardboard) would be generated throughout the life of the Ross Project (Strata, 2012b). Small amounts (less than 0.8 m^3/wk [5 yd^3/wk]) of petroleum-contaminated soil would also be generated. The generation of solid waste consisting of construction debris and decontaminated materials and equipment would be less than 4 m^3/wk [5 yd^3/wk] during facility construction and operation, and aquifer restoration. During the decommissioning phase, the Applicant estimates up to 1,500 m^3 [2,000 yd^3] of such solid waste (Strata, 2012a).

During facility operation and aquifer restoration, non-hazardous solid wastes would be collected daily from work areas and disposed in trash receptacles located within the facility, but near a primary access road for convenient access for a waste-disposal contractor. Non-hazardous solid waste would be disposed offsite in the Moorcroft landfill or the Campbell County landfill in Gillette, Wyoming (Strata, 2011a). Solid waste of construction and demolition debris would be disposed in the municipal or country landfills in the three towns nearest the Ross Project: Moorcroft, Sundance, and Gillette.

2.1.1.6 Transportation

Primary transportation activities would involve truck shipping and personnel commuting. A variety of truck shipments are planned to support proposed activities during all phases of the Proposed Action. Light-duty trucks and automobiles would transport construction contractors and the operations workforce. Transportation conditions and impacts of the Ross Project are discussed in SEIS Sections 3.3 and 4.3, respectively.

Transportation routes within 80 km [50 mi] of the Proposed Action include interstate highways, other U.S. highways, Wyoming highways, county roads, and local roads (Strata, 2011a). The major transportation corridors that could be used to access the Ross Project area include Interstate-90, approximately 32 km [20 mi] south; U.S. Highway 14, approximately 16 km [10 mi] southeast; State Highway 59, approximately 32 km [20 mi] west; and U.S. Highway 212, approximately 64 km [40 mi] northeast. Regional and local transportation routes are shown on Figure 2.1.

The primary access to the Ross Project area is currently from D Road (CR 68) or from the New Haven Road (CR 164); the primary access road to the Ross Project's facility would be constructed to flow from New Haven Road (CR 164). The design of the road includes a 9 m [30 ft] top width with 5 horizontal to 1 vertical (5:1) side slopes. According to the American Association of State Highway and Transportation Officials (AASHTO), a 5:1 slope is traversable and recoverable; therefore, no guardrails would be used on the access road (AASHTO, 2002; Strata, 2011b).

2.1.1.7 Financial Surety

Prior to commencement of operations, the Applicant would be required to provide assurance that sufficient funds will be available to cover decontamination, dismantling, and decommissioning of the Ross Project. These funds will include the costs of: 1) aquifer restoration of all Ross Project wellfields, 2) site restoration and reclamation of all Project-disturbed land, 3) decontamination of all Project surfaces intended for subsequent unrestricted release (e.g., equipment and vehicles), as appropriate, and 4) disposal of all decontamination and decommissioning wastes (10 CFR Part 40, Appendix A, Criterion [9]). As indicated by Condition No. 9.5 of the Draft Source and Byproduct Materials License, the Applicant would be required to continuously maintain an approved financial-surety instrument for the Ross Project, in favor of Wyoming. The initial surety estimate would be submitted to the NRC within 90 days of Source and Byproduct Materials License issuance as well as 90 days prior to commencing operations for review and approval (NRC, 2014b).

Condition No. 9.5 of the Draft Source and Byproduct Materials License would require the Applicant to provide the NRC with copies of financial-assurance-related correspondence submitted to Wyoming, a copy of the State's financial-assurance review, and the final approved financial-assurance arrangement (i.e., the surety instrument). The Applicant would need to ensure that the surety instrument held by the State identifies the NRC-related portion of the instrument, which would cover the aboveground decontamination and decommissioning of the facility and equipment at the Ross Project, the costs of offsite disposal of solid byproduct material and contaminated soils, water-sample collection and analyses, and ground-water-restoration activities associated with the Project. The basis for the decommissioning cost estimate would be an NRC-approved DP and/or a RAP, or NRC-approved revisions to such a plan. The Applicant would be required to submit to the NRC its proposed annual updates to the cost estimate, consistent with 10 CFR Part 40, Appendix A, Criterion (9). At least 90 days prior to the Applicant's beginning any construction associated with a planned and an approved expansion or operational change that was not included in the annual cost-estimate update, the Applicant would be required to provide an updated estimate to cover the expansion or change for NRC approval.

Details of NRC's requirement for financial surety are provided in the *Safety Evaluation Report* (SER) for the Ross Project (NRC, 2014a); the surety amount and instrument would also be required by the Source and Byproduct Materials License. The Applicant would be required to maintain the surety arrangements until the NRC determined that the Applicant had complied with its decommissioning or restoration plan. For additional information on decommissioning funding plans and financial-surety requirements, see 10 CFR Part 40, Appendix A; GEIS Section 2.10; and the Draft Source and Byproduct Materials License for the Ross Project (NRC, 2009b; NRC, 2014b).

2.1.2 Alternative 2: No Action

Under the No-Action Alternative, the NRC would not issue a source and byproduct materials license for the proposed Ross Project, and BLM would not approve the Applicant's POO. The No-Action Alternative would result in the Applicant's not constructing, operating, restoring the aquifer of, or decommissioning the proposed uranium-recovery Project. However, even if the proposed Ross Project is not licensed, the Applicant has already accomplished certain preconstruction activities that do not require a license from the NRC. At no time would radioactive material be present at the Ross Project during any preconstruction activities. These previously completed preconstruction activities are evaluated as part of Alternative 2: No Action.

Preconstruction activities that have already been accomplished include the Applicant's locating and properly abandoning the former Nubeth's exploration drillholes (see SEIS Section 2.1.1.1). As of October 2010, the Applicant has located 759 of the 1,682 holes thought to exist from Nubeth exploration activities and has plugged 55 of them (Strata, 2011b). In addition, Strata has drilled and then properly abandoned (using a cement slurry or bentonite grout) 512 holes used to delineate the ore zone. The Applicant has also drilled and completed 51 wells for ground-water monitoring and testing as well as installed 3 surface-water monitoring stations and a meteorology station (Strata, 2011a). Data collection activities from the ground-water wells, surface-water stations, and the meteorological station are continuing. In August 2011, an additional 74 drillholes and 4 ground-water monitoring wells were installed to support a geotechnical investigation of the area proposed for the Ross Project (Strata, 2012b). These drillholes have also been properly plugged and abandoned, and the four ground-water monitoring wells are being used for ongoing ground-water monitoring. Finally, a ranch house that was adjacent to the Project area has been remodeled to serve as the Applicant's Field Office for the Ross Project's preconstruction activities.

In the No-Action Alternative, no uranium would be allowed to be recovered from the subsurface ore zone, and no injection, production, or monitoring wells would be installed. No lixiviant would be introduced to the subsurface, and no recovered uranium would be extracted and no facilities would be constructed to process extracted uranium or store chemicals. The No-Action Alternative is included to provide a benchmark for the NRC to compare and evaluate the potential impacts of the other alternatives, including the Proposed Action.

2.1.3 Alternative 3: North Ross Project

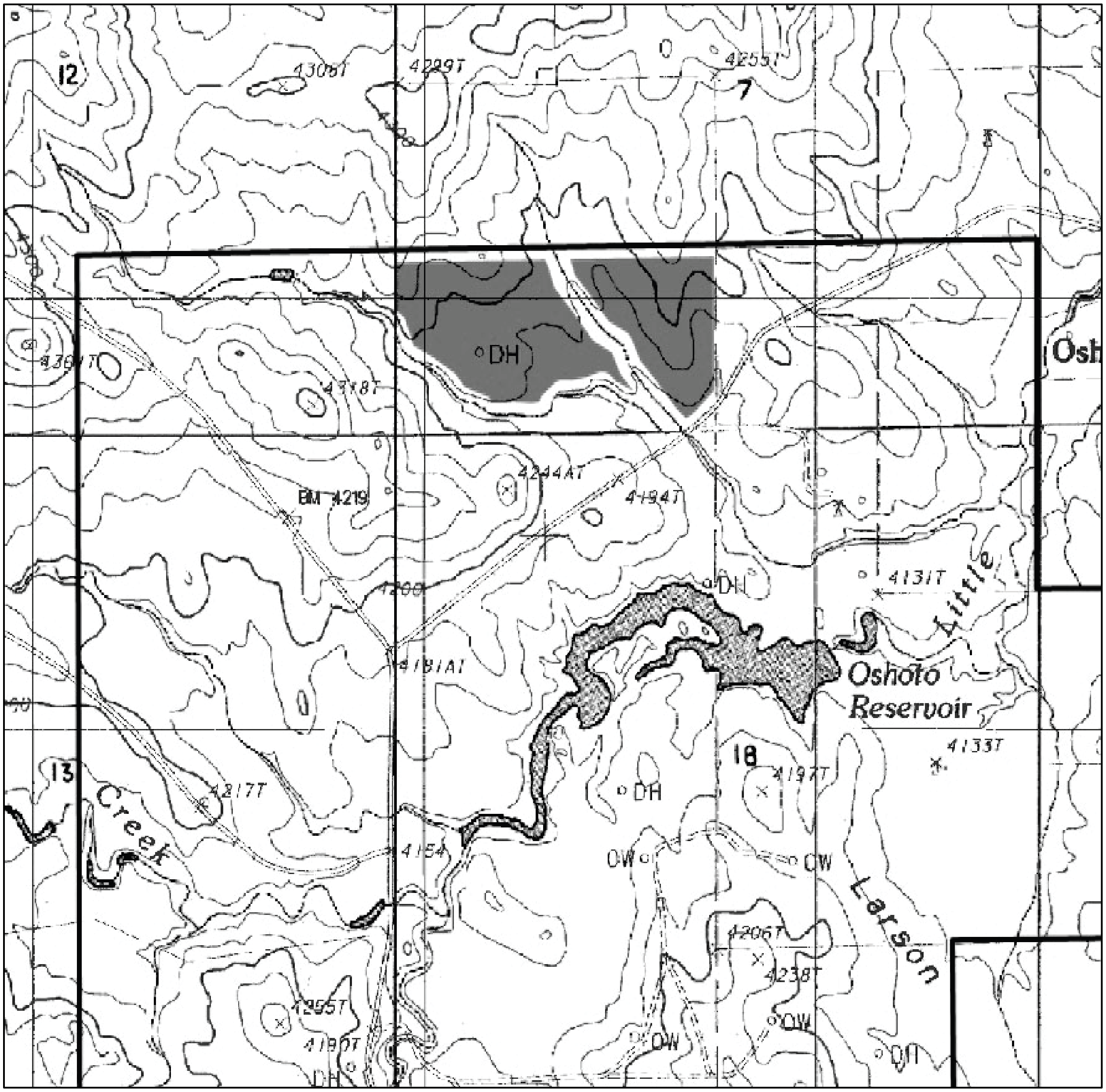
Under Alternative 3, the NRC would issue the Applicant a source and byproduct materials license for the construction, operation, aquifer restoration, and decommissioning of the proposed ISR Project, except that the entire ISR facility itself, which includes all buildings, other auxiliary structures, and the surface impoundments would be located north of where it is to be situated during the Proposed Action, but the locations of the wellfields would not change. This alternate location for the ISR facility, referred as the "north site" by the Applicant (and referred to herein as the "North Ross Project"), was considered, but eliminated, by the Applicant in its license application (Strata, 2011a). The north site is located about 240 m [800 ft] north of the Oshoto Reservoir in S½SW¼ Section 7, T53N, R67W (see Figure 2.11). It is about 900 m [3,000 ft] northwest of where the facility would be located in the Proposed Action (referred to by the Applicant as the "south site"). An unnamed surface water drainage feature generally divides the north site. To avoid the floodplain of the drainage an actual design of the facility at this site would likely place the CPP and other buildings on one side of the drainage and the surface impoundments on the other side.

The Applicant documents its decision to select the south site over the north site with the following comparisons (Strata, 2011a):

- The south site is situated on relatively flat topography, which would minimize the amount of earthwork and surface disturbance required to prepare the site for construction of the CPP, auxiliary buildings, surface impoundments, and parking areas.
- The south site's surface is entirely privately owned and onsite instrumentation is currently adequate for all required pre-operational environmental monitoring (see 10 CFR Part 40, Appendix A).
- The south site has little uranium mineralization beneath it, and what is there would be accessible without major modification of the wellfield- and monitoring-well layout.
- The preliminary geotechnical studies at the south site indicate that subsoils are relatively impermeable and have adequate strength for the proposed buildings and structures.
- The preliminary estimates of the radionuclide release rates from the entire Ross Project, including the south site, indicate that the average annual radiation dose to the nearest neighbor would be less than 5 percent of the NRC's 1 mSv/yr [100 mrem/yr] annual limit.
- The owner of the south site is also the owner of the Oshoto Reservoir, so a surface-use agreement, lease, or purchase of this area would afford Strata control over the Reservoir as well.

The North Ross Project is included as an Alternative in this SEIS because of the expected differences in the depth to ground water between the north and south sites. Based upon the water levels measured in a nearby well cluster, Well 12-18, and the surface topography, shallow ground water of the north site is likely to be greater than 15 m [50 ft] below the ground surface (Strata, 2011a). In contrast, shallow ground water beneath the south site ranges from 2 – 4 m [8 – 12 ft] below the ground surface and necessitates the construction of the CBW (Strata, 2011b).

Certain factors related to the north site as a location for the proposed Ross Project facility are considered in this SEIS's impact analyses. These factors include:



Source: Strata, 2012a.

Figure 2.11
Alternative 3: North Ross Project
(CPP on Right and Surface Impoundments on Left)

- The north site's deeper ground-water levels, which could eliminate the need for a CBW and dewatering in order to protect ground water.
- The north site's more pronounced topography, which could require more earthwork and surface disturbance for construction of the facility and surface impoundments.
- The north site's greater distance to the Little Missouri River, which could mitigate potential impacts on surface-water resources.
- The north site's natural screen provided by the ridges to the west, north, and east, which could decrease impacts on visual and scenic resources.
- The north site's increased uranium mineralization beneath it, which could potentially require a reconfiguration of the facility to allow uranium recovery.

2.2 Alternatives Eliminated from Detailed Analysis

This section describes alternatives to the Proposed Action that were considered for this SEIS, but were not carried forward for detailed analysis. Section 2.2.1 describes the recovery of uranium by conventional mining and milling; Section 2.2.2 discusses the use of a lixiviant with different chemistry; and Section 2.2.3 compares alternative methods of waste management.

2.2.1 Conventional Mining and Milling

The GEIS includes an evaluation of conventional mining and milling as an alternative to ISR (NRC, 2009b). Although the characteristics of the uranium deposits of the proposed Ross Project are amenable to ISR extraction, evaluating the Proposed Action against the conventional mining and milling allows comparison of impacts of the two uranium-recovery methods. Conventional mining practices (open-pit and underground) to recover uranium ore in addition to conventional milling were considered and eliminated as an alternative to ISR operations at the proposed Ross Project, as they were in the GEIS (NRC, 2009; Strata, 2011a).

Conventional mining refers to the physical removal of uranium ore by either underground mining methods or from an open pit. Uranium is extracted and converted to yellowcake in a processing facility; this process is referred to as uranium "milling." Open-pit mining is suitable for shallow ore deposits, generally deposits less than 170 m [550 ft] below ground surface (bgs), which includes only a portion of the ore deposits delineated under the Ross Project area.

Underground mining could be used for deeper deposits; however, the cost of underground mining and milling requires a higher grade of ore to be economically feasible compared to open pit-mining and ISR (EPA, 2008). Uranium-ore grade in the Lance District is low-grade (Strata, 2011a; Peninsula, 2011). The ore zone at the Ross Project is approximately 30 – 60 m [90 – 180 ft] thick (Strata, 2011b). The base of the ore is generally at depths of 150 – 200 m [500 – 700 ft], which is nearly the maximum depth for surface mining to practically recover uranium from an open pit.

In addition to the depths involved with open-pit mining, water consumption of open-pit mining likely would be greater than at an ISR facility because of the required dewatering down to the depth of the pit's floor. At the Ross Project, dewatering of several aquifers above the ore zone and the ore zone itself would be required for open-pit mining and large amounts of water would be produced (Strata, 2011a).

Far greater areas of land disturbance would occur from an open-pit mine compared with the Proposed Action, and the required restoration of the open pit would be far more extensive. Even though overburden could be backfilled into the pit, the pit would permanently impact the surface's appearance and its land use.

Conventional uranium milling requires construction of a facility that would be larger than the proposed facility at the Ross Project. As described in Appendix C of the GEIS (NRC, 2009b), ore processing at a conventional uranium mill involves a series of steps (handling and preparation, concentration, and product recovery). Uranium ore is crushed, ground, and classified to produce uniform-sized particulates (EPA, 2008). After grinding, the ore is added to a series of tanks for leaching by a lixiviant similar to that proposed by the Applicant for the Ross Project. The precipitation of uranium from the pregnant lixiviant, drying the product, and packaging the yellowcake follow the same processes as proposed for the Ross Project. Emissions containing radiological constituents generated by handling, grinding, and classifying the ores creates the potential for greater impacts to the health and safety of workers.

Although many wastes, such as water, spent resin, and filtrate, can be similar in extent and volume to wastes generated by the Applicant's proposed processing of pregnant lixiviant from ISR wellfields, conventional uranium mills generate substantially more solid waste, which is referred to as "tailings" and generally disposed of onsite. The volume of tailings is roughly 95 percent of the volume of ore brought to the mill for processing. After processing, liquid-saturated "wet tailings" are disposed in surface impoundments constructed with liners and covers to prevent escape of radionuclides to the environment by airborne effluent or fugitive dust. Although the chemical character depends upon the uranium ore and processing, the tailings and associated moisture generally contain soluble metals, radium, and high levels of dissolved solids. In addition, tailings generally contain high levels of radon progeny, including lead-210 and polonium-210, which remain in the subsurface during the ISR processing due to the affinity of those radionuclide particles for adhering to the aquifer's solid matrix.

Reclamation of a tailings pile generally involves evaporation of any liquid in the tailings, settlement of the tailings over time, and protection of the pile with a thick radon barrier and earthen material or rocks for erosion control. An area surrounding the reclaimed tailings piles would be fenced off in perpetuity, and the site transferred to either a State or Federal agency for long-term care (EIA, 1995).

As an alternative to conventional milling, uranium from low-grade ore that is recovered by open-pit mining can be recovered by heap leaching. Heap leaching occurs at or very near the mine site itself. The low-grade ore is crushed to a fine size and mounded above grade on a prepared pad. A sprinkler or drip system distributes lixiviant over the mound. The lixiviant trickles through the ore and mobilizes uranium into solution. The solution is collected at the base of the mound and processed to produce yellowcake. The processing to yellowcake of the pregnant lixiviant would be the same as for the Ross Project.

Given the uranium ore grade and depth to the ore, open-pit mining and conventional milling would be possible at the Ross Project; however, the costs, environmental impacts, and potential health and safety impacts to workers are more substantial than impacts from the ISR process (see SEIS Section 4).

As noted in the GEIS on uranium milling (NRC, 1980b), besides cost considerations, the environmental impacts of open-pit mining, and tailings impoundment would be greater than from an ISR project. Greater impacts such as those listed below would affect land use and soils as well as ecological, water, and air resources. Some of these potential impacts are:

- A larger area of surface disturbance for an open-pit mine and uranium mill, which could increase environmental impacts.
- A permanent tailings pile, which would require long-term care and maintenance to prevent impacts to air and water.
- A permanent mine pit, if open-pit mining were to be used, into which ground water would flow creating a lake of potentially poor water quality (if a pit lake were allowed to remain under WDEQ rules).
- A greater consumptive water use, which would result from the ground water's intruding into the mine and its needing to be pumped (i.e., dewatered) with the excess water then discharged to the environment.
- A greater surface discharge of water, which would result from the pumping and treatment of excess water from the mine pit.

The mine workers' excavating the uranium ore during the mining operation, through the uranium milling process itself, and the disposal of the tailings also increase the potential impacts to workers' health and safety.

Based upon these greater impacts, the alternatives of conventional uranium mining and milling have been eliminated from further analysis in this SEIS.

2.2.2 Alternate Lixiviant Chemistry

The lixiviant proposed for the Ross Project is consistent with the assumption in the GEIS that the ISR process would employ alkaline lixiviants (NRC, 2009b). Other lixiviants can be made with sulfuric acid or ammonia, and these have been shown to dissolve uranium (NRC, 2009b). However, the lixiviant that is selected for a specific ISR project must be able to dissolve uranium from the host rock while it maintains the permeability of the aquifer. In addition, the lixiviant and its reaction products must be amenable to ground-water restoration.

How do you select a proper lixiviant?

The geology and ground-water chemistry determine the proper ISR techniques and chemical reagents used for uranium recovery. For example, if the ore-bearing aquifer is rich in calcium (e.g., limestone or gypsum), alkaline (carbonate) lixiviant might be used (Hunkin, 1977, as cited in NRC, 2009b). Otherwise, an acid (sulfate) lixiviant might be preferable. The lixiviant chemistry chosen for ISR operations could affect the type of potential contamination and the vulnerability of aquifers during and after ISR operations.

Typical ISR operations in the U.S. use an alkaline sodium bicarbonate system to remove the uranium from ore-bearing aquifers. In addition, aquifers where an alkaline-based lixiviant was used were considered to be easier to restore than those where acid lixiviants were used (Tweeton and Peterson, 1981, and Mudd, 1998, as cited in NRC, 2009b).

Acidic lixiviant has been used most broadly in conventional milling. These acid-based fluids have generally achieved high yield and efficient, rapid uranium recovery, but they also dissolved other metals associated with the uranium in the host rock, and this dissolution can contribute to adverse environmental impacts. In Wyoming, acid lixiviants have been used for small-scale research and development operations, but they have not been used in commercial operations (NRC, 2009b). Tests with acid lixiviants have identified two major problems: 1) gypsum (a calcium mineral) precipitates on well screens and within the aquifer during uranium recovery, plugging wells and reducing the aquifer's permeability, which is critical for economic operation; and 2) the precipitated gypsum gradually dissolves after aquifer restoration, increasing the salinity and sulfate levels in the ground water. Because of the potential impacts of soluble metals and increased salinity in the aquifer as well as the potential for plugging of the aquifer by their use, acid-based lixiviants have been eliminated from further analysis in this SEIS.

Ammonia-based lixiviants have been used at some ISR operations in Wyoming. However, operational experience has shown that ammonia tends to adsorb onto clay minerals in the ore zone and then slowly dissolves from the clay during aquifer restoration, therefore requiring that a much larger volume of ground water be removed and processed during the aquifer restoration phase (NRC, 2009b). Traces of the ammonia from the lixiviant have remained in affected aquifers even after extensive aquifer restoration. Because of the greater consumption of ground water to meet aquifer-restoration requirements, the use of an ammonia-based lixiviant has been eliminated from further analysis in this SEIS.

2.2.3 Alternate Waste Management Methodologies

Liquid-effluent disposal practices that the NRC has previously approved for use at ISR facilities include waste evaporation from surface impoundments, application of waste on land, injection of waste into deep wells, and discharge of waste to surface water (NRC, 2009b).

The Proposed Action would utilize injection into a UIC-permitted Class I well as the primary method of disposal of brine, excess permeate produced during brief periods of uranium recovery and aquifer restoration, and other process waste waters. The Proposed Action would include surface impoundments located near the CPP to store and manage the brine and to allow the reuse of permeate as lixiviant or as process water. As discussed in Section 2.1.1.2 of this SEIS, most of the permeate from the RO circuit would be recycled back to the wellfield as lixiviant. Of the approximately 6.5 ha [16 ac] of the surface impoundments' surface area in the Proposed Action, 2.5 ha [6.3 ac] would be available for evaporation under normal operating conditions (Strata, 2011b). Table 4.9 of this SEIS provides additional information on the volume of brine "disposed of" through evaporation. The Applicant has predicted that the evaporation of brine during the time it is stored in the surface impoundments would reduce the volume needed via deep-well disposal by 17 percent during the operation-only phase and about 4 percent during the concurrent operation- and-aquifer-restoration phases (Strata, 2012b).

Reliance on evaporation to dispose of all the brine and other liquid byproduct material generated at the CPP, and thus eliminating the need for deep-well injection, would require a larger surface area of the impoundments. The maximum production of brine and other process waste occurs during the concurrent facility operation and aquifer-restoration phases. During this time, 859 L/min [227 gal/min] of byproduct liquid would be generated (Strata, 2011a). The remaining surface-impoundment volume in the Proposed Action would be used for permeate management and reserve capacity in the event of upset conditions.

The Applicant has estimated that the 2.5 ha [6.3 ac] available for evaporation in the Proposed Action would provide 33 L/min [8.8 gal/min] of average annual evaporation. Linear extrapolation suggests that 65 ha [160 ac] is the minimum surface area required for evaporation of all brine and other byproduct waste generated at the CPP. Considering the requirement to maintain reserve capacity to manage upset conditions and the natural fluctuations, the necessary surface impoundments would exceed 80 ha [200 ac]. Impoundments of sufficient size to eliminate the need for deep-well injection would nearly double the disturbed area. In the Proposed Action, approximately 114 ha [282 ac] would be disturbed during the entire Ross Project. The disturbed area required for only evaporation would be present throughout the entire construction, operation, aquifer restoration and decommissioning phases. It is likely that the CBW would need to be constructed around these large surface impoundments. Because the CPP and the surface impoundments would be expected to remain operational after the life of the proposed wellfields of the Ross Project, the surface impoundments would likely be in place for more than 10 years.

These large surface impoundments could potentially impact land use and soils as well as ecological, water, air, and visual resources. These impacts and related occupational health impacts could be mitigated but still the impacts could be MODERATE. In contrast, the GEIS concluded that the permit process required for a Class I injection well provides confidence that the impacts from deep-well disposal would be SMALL. For these reasons, the alternative of the elimination of waste disposal in Class I deep-injection wells in favor of surface impoundments over more than 12 times the area of impoundments in the Proposed Action has not been carried forward for impact analysis in this SEIS.

2.3 Comparison of Predicted Environmental Impacts

The GEIS categorized the significance of potential environmental impacts as described in the adjacent text box (NRC, 2009b). The large table, presented in the "Executive Summary" as Table ExS.1, summarizes the potential environmental impacts to each resource area for all four of the Ross Project's phases: construction, operation, aquifer restoration, and decommissioning. The levels of significance—SMALL, MODERATE, and LARGE—are noted for each resource area.

How is the significance of identified impacts classified?

- ***Small Impact*:** The environmental impacts are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.
- ***Moderate Impact*:** The environmental impacts are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.
- ***Large Impact*:** The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

The respective resource areas, as they currently exist at the Ross Project area, which is called the "affected environment," are described in Section 3 of this SEIS. The potential environmental impacts of the Ross Project are evaluated in Section 4 of this SEIS. The measures intended to mitigate any impacts are also discussed in Section 4 of this SEIS.

2.4 Final Recommendation

After weighing the impacts of the Proposed Action and comparing the Alternatives, the NRC staff, in accordance with 10 CFR Part 51.91(d), sets forth its final NEPA recommendation regarding the Proposed Action. Unless safety issues mandate otherwise, the final NRC staff recommendation to the Commission related to the environmental aspects of the Proposed Action is that a Source and Byproduct Materials License for the Proposed Action be issued as requested. This recommendation is based upon (i) the license application, including the environmental report the applicant submitted, and the applicant's supplemental letters and responses to the NRC staff requests for additional information; (ii) consultation with Federal, State, Tribal, and local agencies; (iii) the NRC staff independent review; (iv) the NRC staff consideration of comments received on the draft SEIS; and (v) the assessments discussed in this SEIS.

2.5 References

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3 DESCRIPTION OF AFFECTED ENVIRONMENT

3.1 Introduction

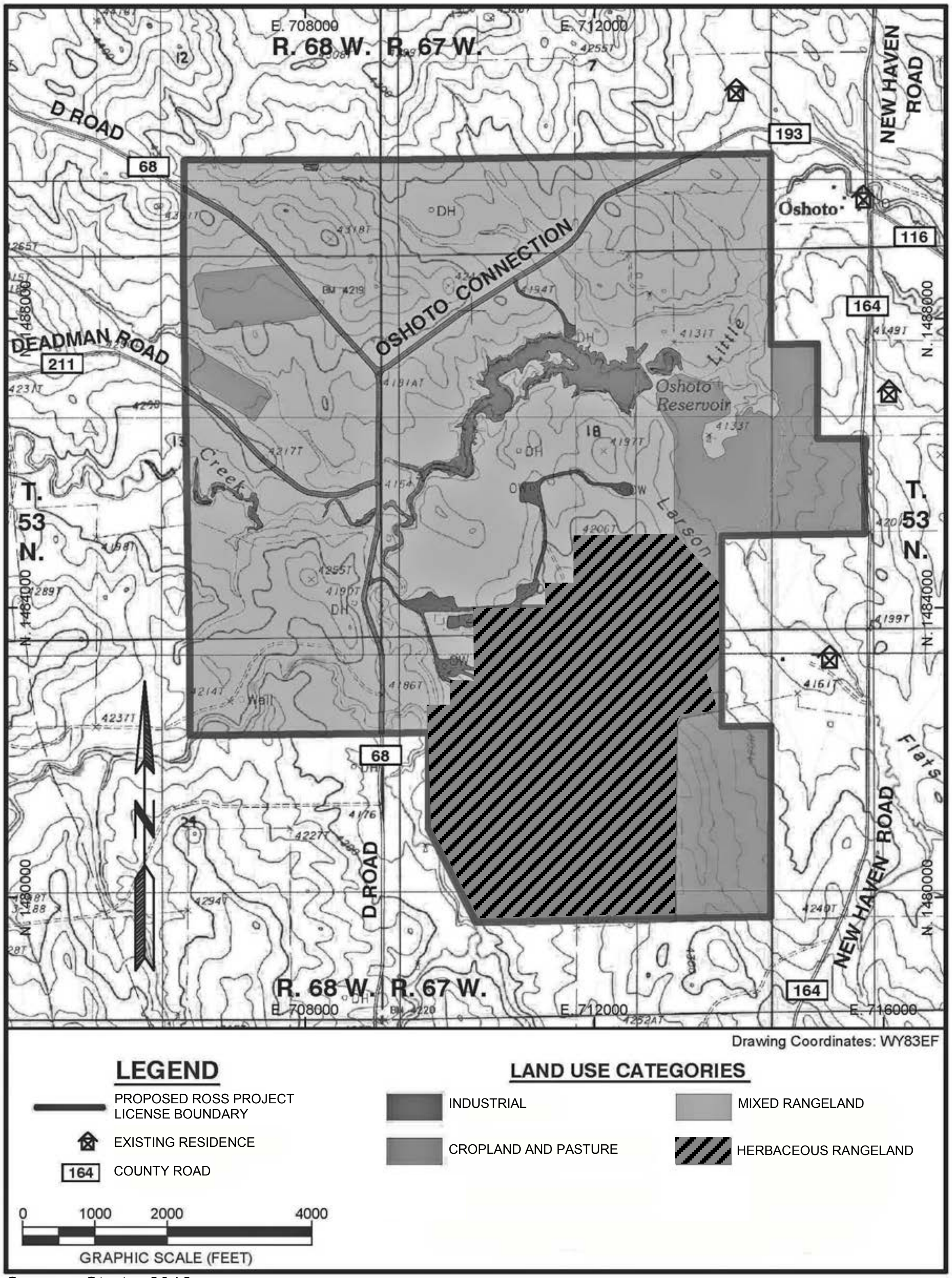
The Ross Project would be located in northeastern Wyoming, in a rural area of western Crook County, approximately 35 km [22 mi] north of the town of Moorcroft, Wyoming (see Figure 2.1 in SEIS Section 2). This section describes the existing conditions at the Ross Project area, the 696-ha [1,721-ac] area that is addressed in this *Final Supplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]), and its vicinity. The resource areas described in this section include land use; transportation; geology and soils; water, both surface water and ground water; ecology; noise; meteorology, climatology, and air quality; historical, cultural, and paleontological resources; visual and scenic resources; socioeconomics; public and occupational health and safety; and waste management. This description of the affected environment is based upon information provided in Strata Energy, Inc.'s (Strata) (herein also referred to as the "Applicant") license application and its Responses to the United States (U.S.) Nuclear Regulatory Commission's (NRC's) Requests for Additional Information (RAIs) and supplemented by additional information identified by the NRC and others in the public domain (Strata, 2011a; Strata, 2011b; Strata, 2012a; Strata, 2012b). The information in this section forms the basis for the evaluation discussed in Section 4, "Environmental Impacts and Mitigation Measures," which discusses the potential impacts of the Proposed Action and of each of the Alternatives in each resource area, as defined in SEIS Section 2.1.

3.1.1 Relationship between the Proposed Project and the GEIS

As shown in Figure 2.3 in SEIS Section 2.1.1, the Ross Project area is located in the northern end and on the western edge of the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR), as defined in the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), NUREG–1910 (NRC, 2009b). However, in defining the NSDWUMR, the GEIS focused on potential in situ uranium-recovery (ISR) sites located near the Black Hills area of South Dakota (the Black Hills are 64 km [40 mi] east of the Ross Project area). As a result, some of the affected environment discussion in the GEIS for the NSDWUMR does not reflect actual site conditions at the Ross Project area (in particular, the subsurface geology and water-resources information). However, the GEIS's discussion of the Wyoming East Uranium Milling Region (WEUMR), located west of the Ross Project site, does provide germane information with respect to the Ross Project area's subsurface geology and water resources.

3.2 Land Use

The Ross Project area encompasses approximately 696 ha [1,721 ac], as described in SEIS Section 2.1.1. Nearby towns include Pine Haven, 27 km [17 mi] southeast; Moorcroft, 35 km [22 mi] south; Sundance, 50 km [30 mi] southeast; and Gillette, 53 km [33 mi] southwest. The Ross Project area is adjacent to the unincorporated ranching community of Oshoto. There are 11 residences within 3 km [2 mi] of the Ross Project, but no residences within the Project area. The closest residence is approximately 210 m [690 ft] north-northeast of the Ross Project boundary (see Figure 3.1). Existing land uses, discussed in this section, include livestock grazing, oil production, crop agriculture, communication- and power-transmission infrastructure,



Source: Strata, 2012a.

Figure 3.1
Current Land Uses of Ross Project Area
(Includes Nearest Residences)

transportation infrastructure, limited recreational opportunities, stock and other reservoirs, and wildlife habitat (see Figure 3.1). The actual land ownership of the Ross Project area's surface differs from general land ownership in the region in that 97.6 percent is owned by private landowners or the State of Wyoming (Wyoming), and 2.3 percent is owned by the Federal Government (as described in Section 3.3.1 of the GEIS, 53.3 percent of Wyoming land is public land). The proposed Ross Project facility would be located on private property, and the wellfields would be located on private, State, and Federal lands.

Wyoming owns all of the mineral rights below State-owned land, and the Federal Government controls all of the mineral rights below U.S. Bureau of Land Management (BLM)-managed land. There are private lands where the Federal Government (through the BLM) controls the mineral rights below the Ross Project area, a situation known as a "split estate." Between land ownership and split estate, the Federal Government through the BLM therefore controls 11.7 percent of the total mineral rights under the Ross Project area (see Table 3.1), as opposed to 2.3 percent of the surface. All of the Federal rights are managed by the BLM.

Table 3.1
Distribution of Surface Ownership and Subsurface Mineral Ownership

Ownership	Surface Ownership		Subsurface Mineral Ownership	
	Ha / Ac	Percent	Ha / Ac	Percent
Private	553.3 / 1,367.2	79.4	488.2 / 1,206.3	70.1
State	127.1 / 314.1	18.2	127.1 / 314.1	18.2
Federal	16.2 / 40.0	2.3	81.3 / 200.9	11.7
TOTAL	696 / 1,721 (Rounded)	--	696 / 1,721 (Rounded)	--

Source: Strata, 2011a.

3.2.1 Pastureland, Rangeland, and Cropland

Approximately 95 percent of the Ross Project area is currently used for rangeland, cropland, or pastureland. The largest portion, over 80 percent, is rangeland, while 14 percent is used for agriculture. In Crook County, rangeland is primarily used for cattle, with some grazing of sheep. Crops grown in the vicinity include hay, oats, and wheat.

3.2.2 Hunting and Recreation

There are many hunting and recreational opportunities within Crook County. However, there are limited opportunities for hunting and recreation within the Ross Project area because the majority of the land is privately owned. The State-owned land within the Ross Project area is accessible from County Road (CR) 193, but the Federal (i.e., BLM) land is not served by public roads, so the public would only be able to access the BLM land by crossing the State land on foot. Large-game hunting in the area includes antelope (North Black Hills herd), mule deer (Powder River and Black Hills herds), and white-tailed deer (Black Hills herd). Other hunting opportunities in the vicinity include sage-grouse, wild turkeys, and small game such as cottontail rabbits and snowshoe hares as well as red, gray, and fox squirrels. There are hunting seasons specific to each type of game; however, because of the predominantly private ownership of the land, hunting within the Ross Project area is limited.

Recreational areas in the Ross Project vicinity include Devils Tower National Monument (Devils Tower or Bear Lodge), Black Hills National Forest, and Keyhole State Park. These areas offer access to hiking, camping, boating, biking, horseback riding, fishing, and hunting. The nearest of these is Devils Tower, approximately 16 km [10 mi] east of the Ross Project.

Although native fish have been observed in the Oshoto Reservoir, there are no fisheries in the Ross Project area because of the ephemeral or intermittent nature of the streams. The Oshoto Reservoir is partially located on State land; however, the Wyoming Game and Fish Department (WGFD) does not stock the Reservoir and it is not managed by any private agencies. Nonetheless, fishing has been reported downstream on the Little Missouri River, outside of the Ross Project area (Strata, 2011a).

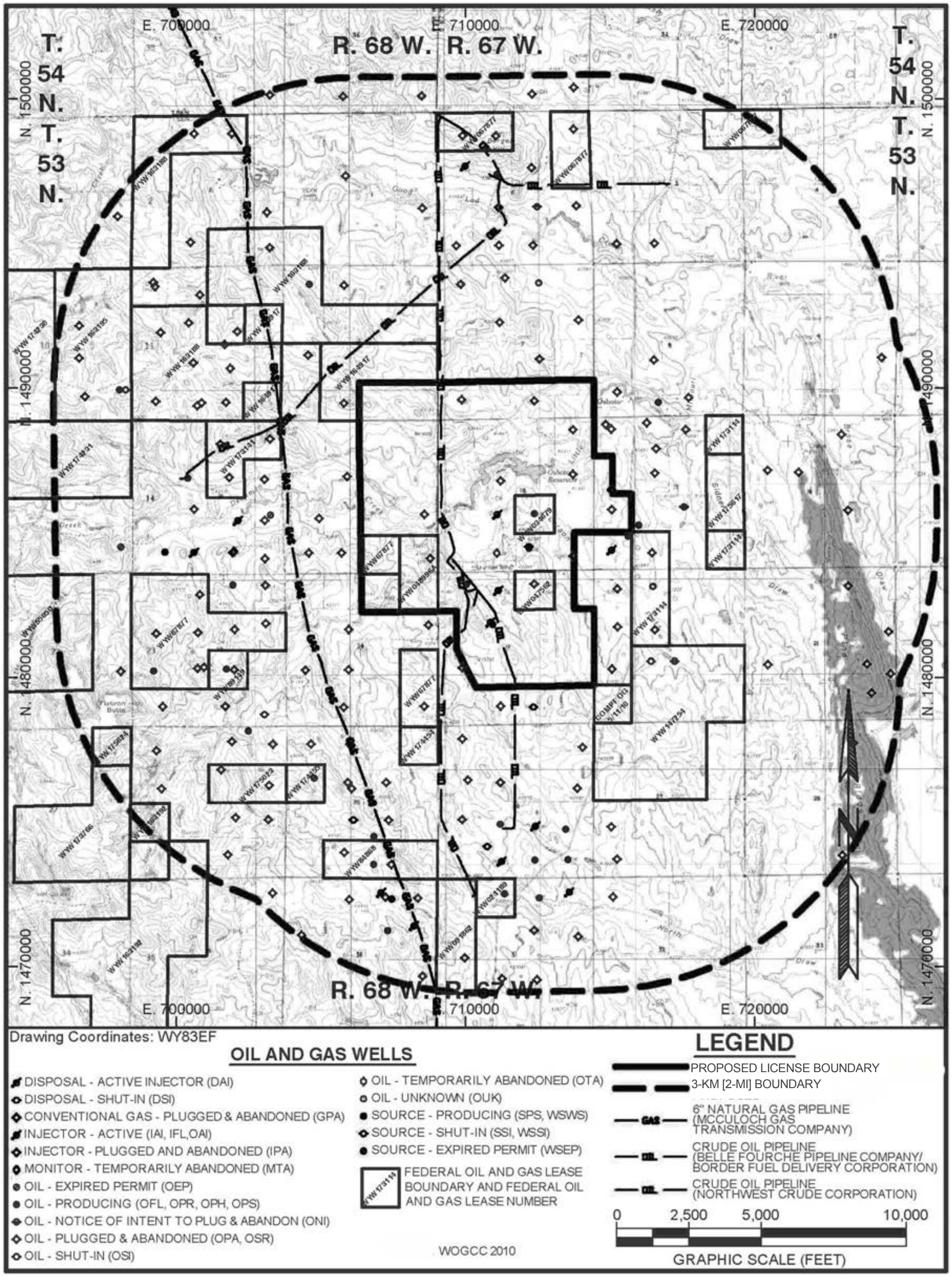
3.2.3 Minerals and Energy

There are three operating oil wells within the Ross Project area, producing from depths between 1,800 – 2,000 m [5,900 – 6,500 ft] below ground surface (bgs) (see Figure 3.2). Oil production is currently the only mineral extraction activity within the Ross Project area, although Crook County has other mineral resources which include coal, gas, bentonite (a bentonite mine is located 8 km [5 mi] to the northeast of the Project area), sand, gravel, gypsum, and limestone in addition to uranium and vanadium.

There are currently no licensed or operating uranium-recovery facilities within 80 km [50 mi] of the proposed Ross Project (see Figure 3.3).

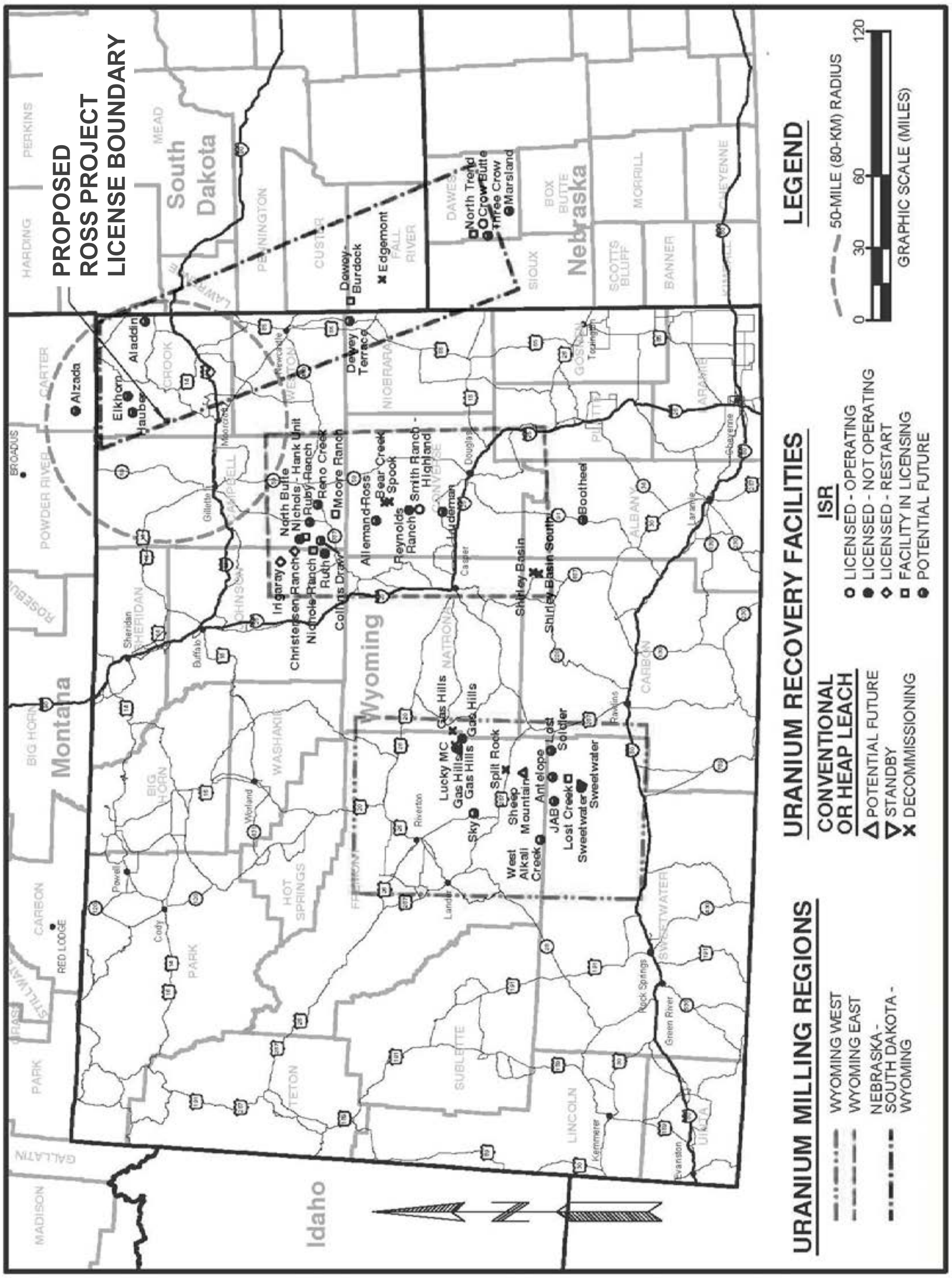
3.3 Transportation

The Proposed Action would rely on existing roads for supplies and materials transport, workforce commuting, and yellowcake and waste shipments to and from the Ross Project. The existing road network is discussed in this section; Figures 2.1 (in SEIS Section 2.1) and 3.4 depict this network. The primary access road to the Ross Project area is from Exit 153 on I-90. From that point the Ross Project is reached by a vehicle's travelling south on US 14/16, west on WY 51, north on Bertha Road, north on CR 68 (also known as D Road), and north on CR 164 (also known as New Haven Road). The distance from the I-90 exit to D Road is 2.6 km [1.6 mi]. D Road is a two-lane asphalt and gravel road approximately 9 – 11 m [30 – 35 ft] wide with posted speed limits of 89 km/hr [55 mi/hr] for cars and 72 km/hr [45 mi/hr] for trucks. The asphalt pavement extends to 4.8 km [3 mi] north of Bertha Road, where it changes to a reclaimed-asphalt pavement, which has been rotomilled and blended with crushed base and subgrade. This surface continues for 11.7 km [7.3 mi] after which D Road has only a gravel surface. New Haven Road is a two-lane, crushed-shale road approximately 7.6 – 9.1 m [25 – 30 ft] wide, with a posted speed limit of 72 km/hr [45 mi/hr]. CR 193, also known as the Oshoto Connection, is a two-lane, crushed-shale roadway that connects New Haven Road to D Road along the northern portion of the Ross Project area. Other county roads in the local vicinity that can be used to access the Ross Project area include CR 26 (Cow Creek Road), CR 91 (Spring Creek Road), and CR 211 (Deadman Road). Figure 2.1 shows the relative locations of these roads. Crook County conducts year-round routine maintenance of all CRs, including snow and debris removal, blading and grading, and miscellaneous repair.



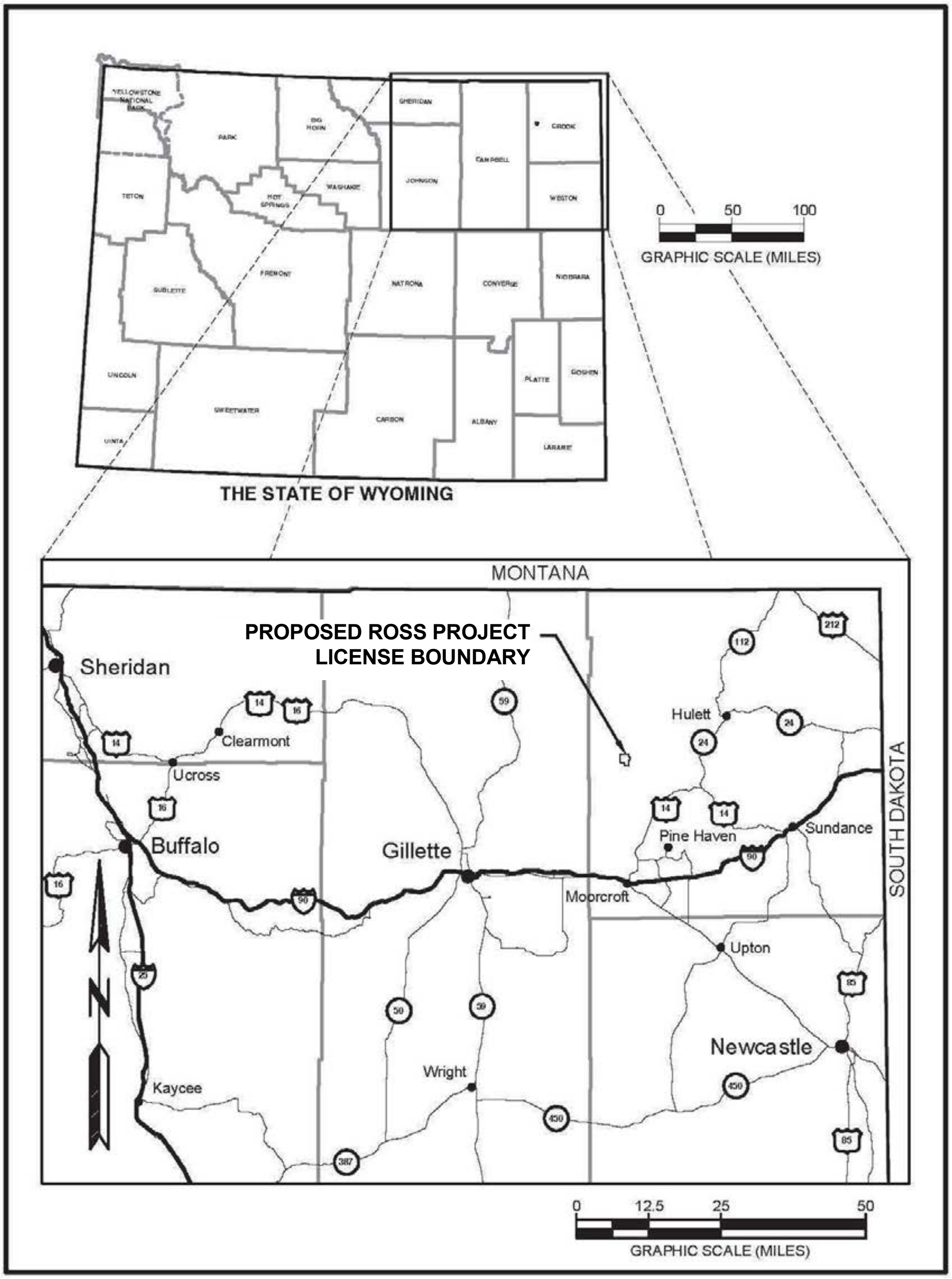
Source: WOGCC, 2010, as shown in Strata, 2011a.

Figure 3.2
Oil and Gas Wells
within Three Kilometers [Two Miles] of Ross Project Area



Sources: Bayswater, 2010a; NRC, 2009b; NRC, 2010a; NRC, 2010b; Powertech, 2010; and UR-Energy, 2010 as shown in Strata, 2011a.

Figure 3.3
Existing and Planned Uranium-Recovery Facilities



Source: Strata, 2012a.

Note: See Figure 2.1 for actual Ross Project area roads.

Figure 3.4
Existing Federal, State, and County Road Network in Northeast Wyoming

The Applicant has completed traffic studies on the county roads near the Ross Project area (Strata, 2011a), as has Wyoming for its highways (see Table 3.2). Much of the existing truck traffic on the CRs adjacent to the Ross Project is due to local oil- and gas-recovery activities as well as to a bentonite mine approximately 8 km [5 mi] northeast of the Project.

Table 3.2
Traffic Volumes on Roads and Highways in Vicinity of Ross Project Area (2010)

Road/Highway	Vehicles per Day	
	All Vehicles	Trucks
I-90 at Moorcroft	4,744	906
New Haven Road South of Ross Project Area	108	10.8
New Haven Road South of Oshoto Connection	138	11
On-Site Measurements		
D Road South of Deadman Road	25	1.5
D Road North of Deadman Road	49	2.3
D Road North of Oshoto Connection	62	6.2
Oshoto Connection between D Road and New Haven Road	87	11.3

Sources: Strata, 2011a, and Wyoming Department of Transportation (WYDOT), 2011.

3.4 Geology and Soils

The Lance District, which includes the Ross Project area (refer to Figure 2.1), is structurally situated between two major tectonic features: the Black Hills uplift to the east and the Powder River Basin to the west (Strata, 2011a). Both of these regional features are described in GEIS Sections 3.3.3 and 3.4.3.1 (NRC, 2009b). The Black Hills uplift is generally assigned to the NSDWUMR, and the Powder River Basin to the WEUMR. The Project area's structural geology, stratigraphy, uranium mineralization, and seismology as well as the types and characteristics of the soils present at the Project area are described in this section.

3.4.1 Ross Project Geology

The uranium-bearing geologic units targeted for uranium recovery within the Ross Project area are located in the permeable sandstones of the Late Cretaceous Lance and Fox Hills Formations. The uranium roll fronts deposited in the Oshoto area demonstrate patterns similar to those across the Powder River Basin. The Ross Project area's roll fronts were created by precipitation of uranium from ground water as a coating on sand grains primarily due to changes in aquifer conditions and ground-water flow (Buswell, 1982). The roll-front geometry at the

Project area can vary as a result of differences in the host sandstones. The deeper Fox Hills roll fronts are generally thicker and more massive due to the near-shore environment into which the sediments were deposited. The Lower Lance Formation sandstones were deposited in a fluvial environment (i.e., deposited by rivers or streams), resulting in narrower, often stacked channel systems containing uranium mineralization. Known uranium resources at the Ross Project area are likely to increase due to the variability of depositional environment and complexity of the roll-fronts. At this time, estimates of recoverable uranium within the Ross Project area exceed 2,500 t [5.5 million lb] of uranium and, based upon current projections, these estimates are likely to increase as more exploration and characterization results become available.

3.4.1.1 Structural Geology

The Black Hills uplift is a broad north-trending dome-like structure approximately 290 km [180 mi] long (north to south) and 120 km [75 mi] wide (west to east) whose core is composed of Precambrian basement rocks (NRC, 2009b). The western flank of the uplift is characterized by a monoclinal (a one-limbed or step-like flexure) break near the Ross Project area (Lisenbee, 1988). The eastern edge of the Ross Project area lies along the hinge of the Black Hills monocline. Because of the Black Hills monocline, the regional stratigraphic dip goes from essentially horizontal within the Powder River Basin, to steeply dipping along the eastern edge of the Ross Project area (see Figure 3.5). As indicated in the bedrock geologic map, Figure 3.6, the entire Ross Project area lies within the outcrop of the Lance Formation. The Cretaceous Formations below the Lance Formation all outcrop within roughly 3 km [2 mi] east of the Ross Project area.

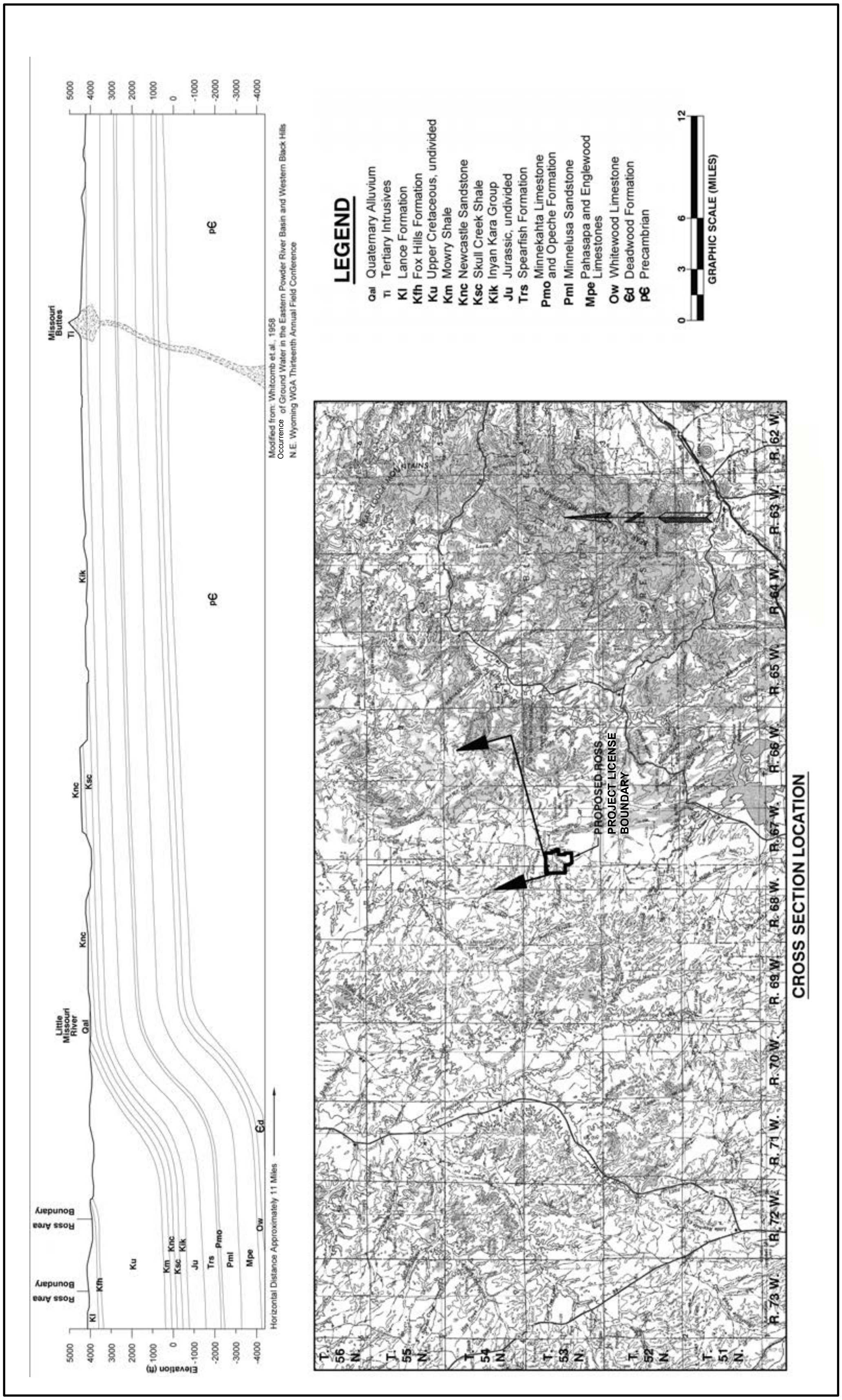
Devils Tower, which is discussed later in the visual and scenic resources section of this section (see Section 3.10), is located approximately 16 km [10 mi] east of the Ross Project area. Devils Tower and the Missouri Buttes (15 km [9.5 mi] northeast of the Ross Project) are geologic features formed by the intrusion of igneous material (i.e., magma) through the earth’s crust during the Tertiary Period (i.e., subsequent to the deposition of the Upper Cretaceous Formations hosting the Lance District’s uranium deposits) (Robinson et al., 1964).

With the exception of the Black Hills monocline, there are no significant structural features within the Ross Project area. No faults of major displacement are known to exist within the Ross Project area; however, minor localized slumps, folds, and differential compaction features that formed shortly after deposition are common (Strata, 2011a).

3.4.1.2 Stratigraphy

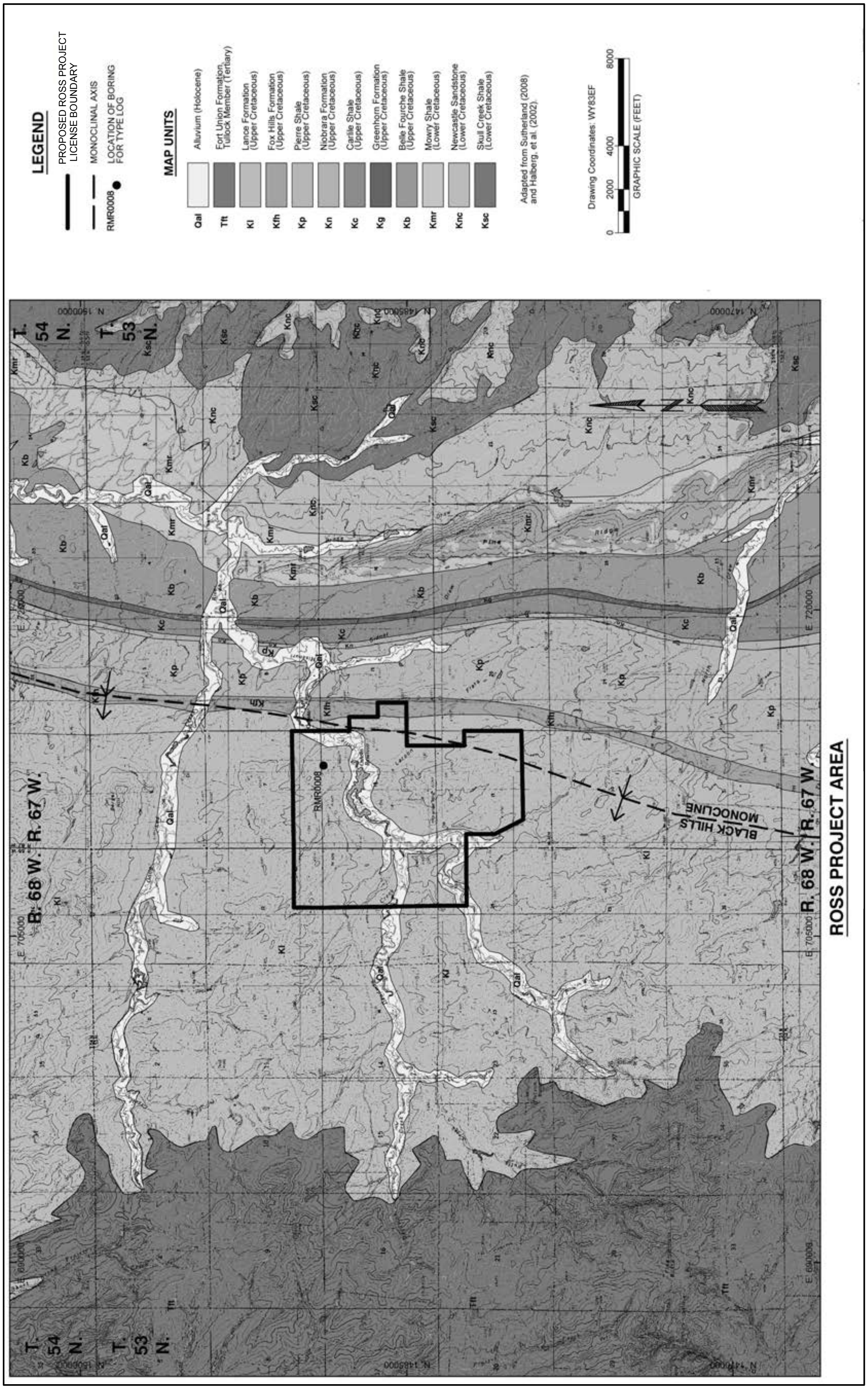
Stratigraphy describes the layers of rocks and soils below the ground’s surface (i.e., the subsurface) that host the ore zone (i.e., uranium mineralization) as well as the layers of rock that separate the ore zone from the aquifers above and below it. An analysis of the local stratigraphy is used in assessments of whether the ore zone is adequately confined above and below by rock layers of low permeability that would prevent vertical movement of water or lixiviant from the ore zone.

The regional stratigraphy of the Black Hills area is shown in Figure 3.7. The ore zone, which would be the “production zone” (i.e., the deposits from which uranium would be recovered) at



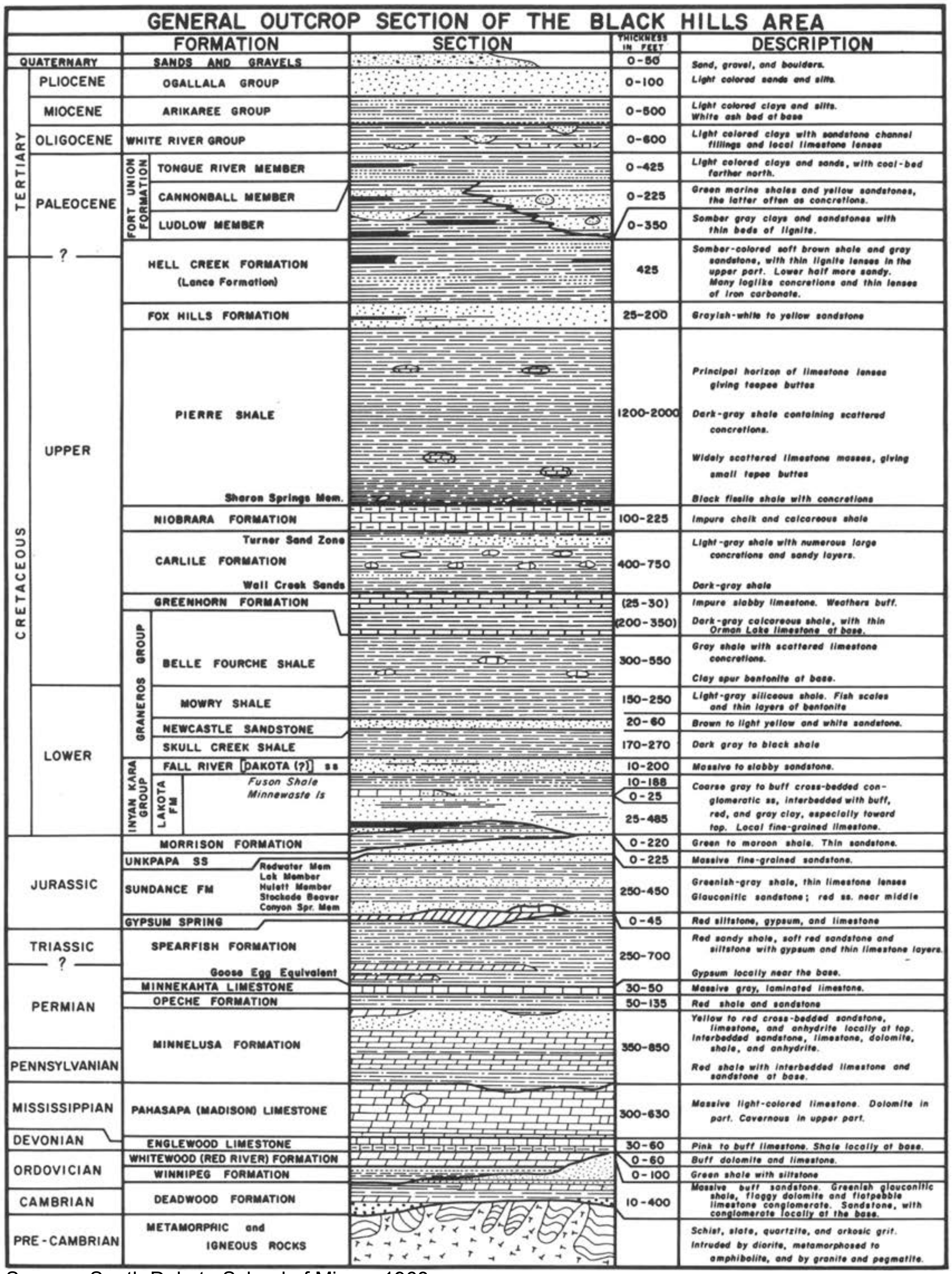
Source: Strata, 2011a.

Figure 3.5
Generalized Cross Section of Black Hills Monocline in the Oshoto Area



Source: Strata, 2011a.

Figure 3.6
Surface Geology of Ross Project Area



Source: South Dakota School of Mines, 1963.

Figure 3.7
Regional Stratigraphic Column of Area Containing the Lance District

the Ross Project, is within the Upper Cretaceous stratigraphic units, including the Lower Lance (Hell Creek) and Upper Fox Hills Formations.

Detailed analysis of the subsurface stratigraphy and mineralogy of the Ross Project area began with the first uranium exploration and development efforts in the Oshoto area during the 1970s by the Nubeth Joint Venture (Nubeth) as described in SEIS Section 2.1.1 (Strata, 2011a). In 2008 and 2009, the Applicant began confirmation and exploration drilling at the Ross Project (Strata, 2011a). As of October 2010, the Applicant possessed information from the 1,682 holes drilled by Nubeth as well as its own 540 recent exploration drillholes, which are all located within a 0.8-km [0.5-mi] radius of the Ross Project area. The logs for these drillholes were used by the Applicant to characterize the site-specific stratigraphy of the Ross Project area (Strata, 2011a; Strata, 2011b).

The Pierre Shale in this area is a massively bedded, relatively uniform, thick marine shale that is considered a regional confining layer (or “unit” or “interval” or “horizon”) (NRC, 2009b). This unit outcrops approximately 0.4 km [0.3 mi] east of the Ross Project’s eastern boundary (see Figure 3.6). Based upon the width of the outcrop and geophysical logs from oil wells located in the general area, the Applicant has estimated the thickness of the Pierre Shale to be approximately 670-m [2,200-ft] thick under the Ross Project area (Strata, 2011a; Robinson et al., 1964). Because of its thickness and low permeability, the Pierre Shale is considered the lower ground-water-confining unit within the Ross Project vicinity, separating the older, deeper Formations below the Pierre Shale from the Ross Project’s target ore zone which is in the overlying Fox Hills and Lance Formations.

The Madison Formation, a regional water source, is approximately 2,100 m [7,000 ft] below the Pierre Shale or about 2,700 m [9,000 ft] below the uranium-recovery activities of the proposed Ross Project. About 150 m [500 ft] below the Madison-Formation aquifer, the Cambrian-age Deadwood and Flathead Formations are encountered at depths of approximately 2,490 – 2,600 m [8,160 – 8,560 ft] bgs (WDEQ/WQD, 2011b). The Applicant proposes that these Formations are the optimum target units for the Underground Injection Control (UIC) Class I deep-injection wells that would be used for waste-water disposal at the Ross Project. The Deadwood and Flathead Formations are separated from the Madison Formation by at least 140 m [400 ft] of the impermeable Red River Formation and Icebox Shale (Strata, 2011b). The impermeable rocks above the geologic interval targeted for the uranium-recovery injection wells would confine the injected fluids and prevent impacts to the Madison-Formation aquifer. The Applicant has already received its UIC Class I Permit for this type of deep-well disposal (WDEQ/WQD, 2011b).

The Fox Hills Formation, which lies between the Pierre Shale and the Lance Formation, outcrops along the proposed eastern boundary of the Ross Project (see Figure 3.6). The Fox Hills Formation is a sequence of marginal marine to estuarine sand deposits that were deposited during the eastward regression of the Upper Cretaceous interior seaway (Dunlap, 1958; Merewether, 1996). In the vicinity of Oshoto, the Fox Hills Formation is divided into lower and upper units, which are based upon differences in color, bedding, trace fossil concentrations, lithology, and texture (Dodge and Spencer, 1977).

Above the Fox Hills Formation, the Lance Formation has been interpreted as being fluvio-deltaic in origin, consisting of a mixture of non-marine-deposited sandstones and floodplain mudstones with thin beds of coal (Connor, 1992). This depositional environment created a stratigraphic sequence of shale, mudstones, and sandstones that is complicated and vertically heterogeneous (Dodge and Powell, 1975).

The horizontal continuity of the various stratigraphic horizons beneath the Ross Project is clearly depicted on the geologic cross-sections and fence diagrams provided by the Applicant (Strata, 2011a; Strata, 2012b). The Upper Fox Hills and Lower Lance Formations are stratigraphically continuous and hydraulically isolated from the overlying Upper Lance Formation by continuous and impermeable mudstones and claystones as well as from the underlying units by the basal Fox Hills siltstone-claystone unit and the Pierre Shale.

3.4.2 Soils

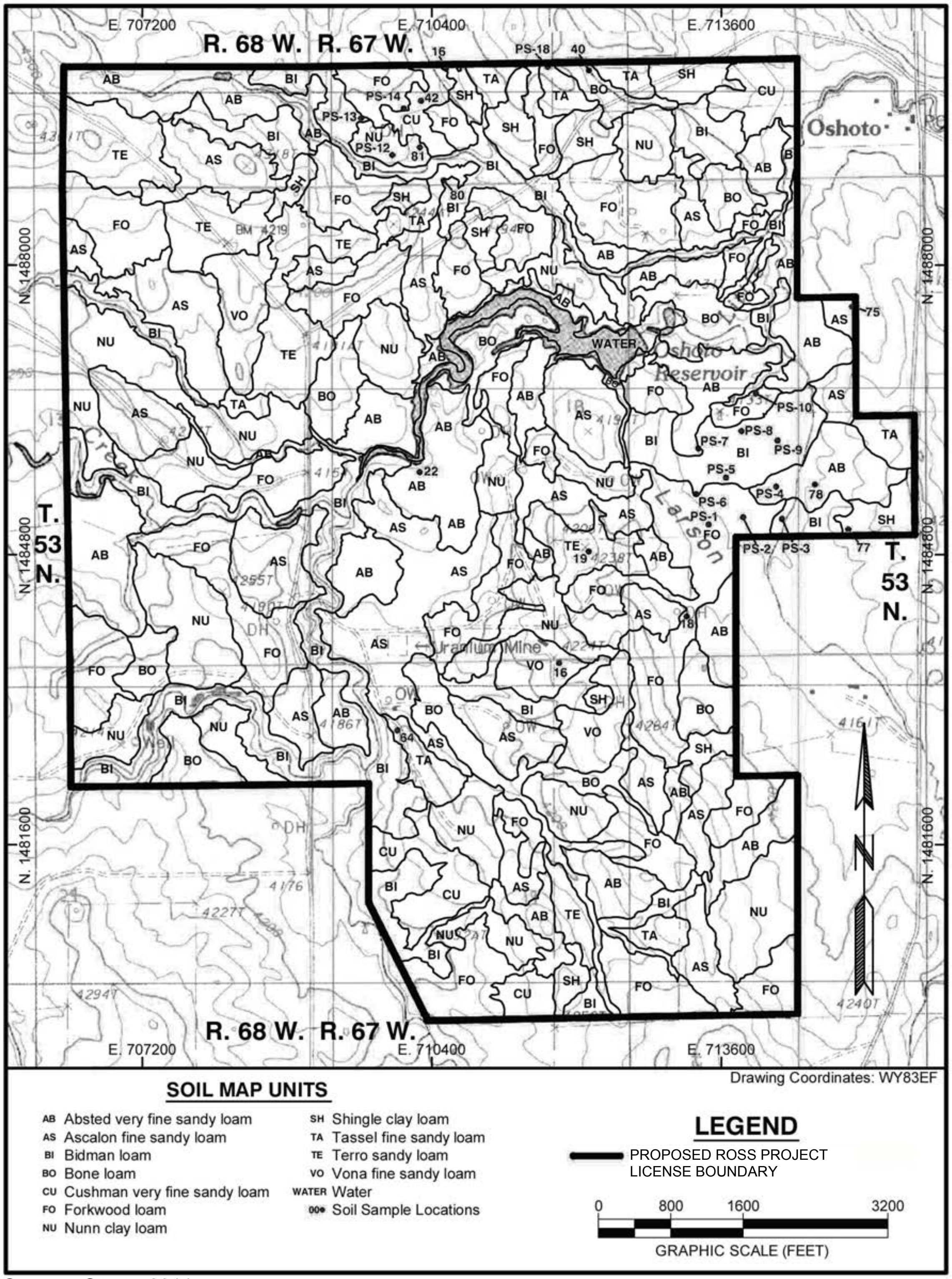
Soils at the Ross Project are typical for semi-arid grass- and shrublands in the western U.S. (Strata, 2011a). Most of these soils are classified as Aridic Argiustolls, Ustic Haplargids, or Ustic Torrifluvents that were derived from the Lance Formation over time.

General topography of the Ross Project area ranges from nearly level uplands to steep hills, ridges, and breaks. The soils occurring on hills, ridges, and breaks at the Ross Project are generally sandy or coarse texture with clayey or fine-textured soils occurring on nearly level uplands and near drainages. The Ross Project area contains moderate and deep soils on level upland areas and drainages with shallow soils located on hills, ridges, and breaks. Figure 3.8 depicts the types of soils charted on the Ross Project area during "pre-licensing, site-characterization" (i.e., before Strata submitted its license application) activities (Strata, 2011a; Strata, 2012b). The area of the Ross Project is about equally divided between sandy loam soils and clay loam soils (Strata, 2011a). The soil characteristics of both the Proposed Action's south site (Alternative 1) and the north site (Alternative 3) are of particular interest since these would be the largest areas of soils disturbance during the Ross Project (see Table 3.3).

Approximate topsoil salvage depths range from 0.13 – 1.5 m [0.42 – 5 ft] with an average of 0.5 m [1.7 ft]. Factors that affect the suitability of a soil as a vegetation-growth medium are: texture, sodium-adsorption ratio (SAR), electrical conductivity (EC), and pH as well as selenium and calcium carbonate concentrations. Based upon a comparison of laboratory-analysis results and field observations by the Applicant, using the respective Wyoming Department of Environmental Quality (WDEQ)/Land Quality Division (LQD) standards, suitable and marginally suitable material was found in 16 of the 26 samples obtained within the Ross Project area (Strata, 2011a; WDEQ/LQD, 1994); unsuitable material was found in 7 of the 26 samples. The parameters that exceeded topsoil suitability criteria in those seven samples were high clay texture, high SAR, alkaline pH, and high concentration of selenium.

The hazard for wind and water erosion at the Ross Project varies from negligible to severe, based upon the soil-mapping descriptions. The potential for wind and water erosion is primarily dependent upon the surface characteristics of the soils, including texture and organic-matter content. Given the slightly coarser texture of the surface horizons at the majority of the Ross Project, the soils are slightly more susceptible to erosion from wind than water.

Laboratory analyses for non-radioactive, chemical constituents in the soils at the Ross Project are not required by WDEQ to establish pre-licensing or pre-operational values prior to permitting. For radioactive constituents, the Applicant collected and analyzed some soil samples to establish the pre-licensing, site-characterization concentrations of some radioactive



Source: Strata, 2011a.

Figure 3.8
Mapped Soil Types at Ross Project Area

Table 3.3 Soil Coverage and Characteristics at Ross Project Area					
Soil Name	**Soil Map Symbol**	**Alternative 1 (South) Site (ha [ac])**	**Alternative 3 (North) Site (ha [ac])**	**Water Erosion Hazard**	**Wind Erosion Hazard**
Absted very fine sandy loam	AB	3.7 [9.1]	N/A	Moderate	Moderate
Bidman loam	BI	9.3 [23.1]	2.2 [5.4]	Moderate	Moderate
Cushman very fine sandy loam	CU	N/A	2.0 [5.0]	Moderate	Slight
Forkwood loam	FO	7.1 [17.5]	3.4 [8.4]	Moderate	Slight
Nunn clay loam	NU	N/A	2.4 [5.9]	Slight	Slight
Shingle clay loam	SH	N/A	2.3 [5.7]	Moderate	Moderate
Tassel fine sandy loam	TA	N/A	2.7 [6.7]	Slight	Moderate

Source: Strata, 2011a.

Notes:

N/A = The type of soil is not present at the south or north site as indicated.
"Water Erosion Hazard" describes the susceptibility of the soil type to erosion by water, and "Wind Erosion Hazard" describes the susceptibility of the soil type to erosion by wind.

species. The concentrations of specific radioactive species are presented in Table 3.21 (see Section 3.12.1).

3.4.3 Uranium Mineralization

The process of uranium mineralization in the Lance District in general and specifically at the Ross Project area is consistent with the characteristics of the uranium deposits that are identified in GEIS Section 2.1.2 as amenable to in situ uranium recovery. This mineralization includes fluvial sandstones (NRC, 2009b). The lithological variability within the Upper Lance and Fox Hills Formations would allow the geometric definition of ore deposits (i.e., areas of uranium mineralization or "ore bodies") with sufficient size and continuity to make economic recovery viable. The saturated sandstone lithology of the ore zone would provide adequate permeability to allow uranium-recovery process solutions (i.e., lixiviant) access and interaction with uranium in the ore zone. In addition, the presence of impermeable units above and below the ore zone would prevent vertical migration of lixiviant or other fluids. Thus, the geology of the deposits would provide the characteristics required for an effective uranium-recovery project.

The mineralogy and petrography determined by the Applicant indicated that the ore zone is suitable for ISR (Strata, 2011a). The sandstone in the ore zone consists of 60 percent quartz, 35 percent feldspar, 5 percent montmorillonite clay, approximately 1 percent organic material, and less than 1 percent of pyrite and carbonate minerals (Strata, 2011a). The presence of pyrite confirms the geochemical conditions necessary for formation of the roll front. Petrographic analyses show that the ore zone has sufficient porosity (or reservoir quality) for movement of lixiviant from injection to recovery wells (Strata, 2011a). The ore zone is composed of fine grained, moderately well sorted, argillaceous sandstone with subangular to subrounded grains that are lightly to moderately compacted.

What are the characteristics of uranium deposits that make them amenable to in situ uranium recovery?

Certain geologic and hydrological features make a uranium deposit in an ore zone suitable for in situ uranium recovery (based upon Holen and Hatchell, 1986 as cited in NRC, 2009b):

- **Deposit geometry:** For ISR operations, the wellfield boundaries are defined based upon the geometry of the specific uranium mineralization (the "ore body"). The deposit should generally be horizontal and have sufficient size and lateral continuity to enable economic uranium extraction and recovery.
- **Permeable host rock:** The host rock of the ore-zone aquifer must be permeable enough to allow process solutions (the lixiviant) to access and interact with the uranium mineralization. Preferred flow pathways, such as fractures in the rock, can short circuit portions of the mineralization and reduce the recovery efficiency. The most common host rocks are sandstones.
- **Confining layers:** Hydrogeologic (formation) geometry must prevent lixiviant from vertically migrating. Typically, low permeability layers such as shales or clays "confine" the uranium-bearing sandstone(s) both above and below. This confinement isolates the uranium-ore zone from overlying and underlying aquifers.
- **Saturated conditions:** For ISR uranium-recovery techniques to work, the uranium mineralization should be located in a hydrologically saturated zone (in an aquifer).

Consistent with GEIS Section 2.1.2 and typical of roll-front deposits (NRC, 2009b), analysis of the samples from the ore zone at the Ross Project shows that the principal uranium minerals are uraninite, a uranium oxide (UO_2), and coffinite, a uranium silicate ($U[SiO_4][OH])_4$) (Strata, 2011a). Vanadium in the form of vanadinite (a lead chlorovanadate [$Pb_5\{VO_4\}_3Cl$]) and carnotite [a hydrated potassium uranyl vanadate ($K_2[UO_2]_2[VO_4]_2$ $3H_2O$)] is also found in association with the uranium at an average ratio of 0.6 (vanadium) to 1.0 (uranium).

3.4.4 Seismology

There are no active faults with surface expression mapped within or near the Ross Project, according to the U.S. Geological Survey (USGS) (USGS, 2011). The closest capable faults to the Project area are located in central Wyoming, 270 km [170 mi] to the west-southwest. Six east-west trending structural faults through the Ross Project area were mapped by Buswell (1982). However, these were based upon limited observations and information from one core sample and one aquifer test. The Applicant's examination of multiple geological cross-sections developed from stratigraphic information obtained from exploration drillholes do not appear to support this interpretation of the Ross Project area's faults (see SEIS Section 3.4.1.2) (Strata, 2011a). Instead, it appears that the variability in stratigraphic elevations is due to heterogeneity in the thickness of the various shale and sandstone units within the Upper Cretaceous Formations.

Two earthquakes with magnitudes greater than 2.5 (on the Richter Magnitude Scale) have been recorded in Crook County and nine in Campbell County (Strata, 2011a). Of those with magnitudes greater than 2.5, 3 had magnitudes 3.0 and greater (Case et al., 2002). The first reported earthquake in Crook County with a magnitude of greater than 3 occurred near Sundance on February 3, 1897, severely shaking the Shober School on Little Houston Creek southwest of Sundance. On February 18, 1972, a magnitude 4.3 earthquake occurred approximately 30 km [18 mi] east of Gillette near the Crook-Campbell County line (Case et al., 2002). No damage was reported. On November 2004, an earthquake of magnitude of 3.7 was recorded near Moorcroft in Crook County, 35 km [22 mi] south of the Ross Project area. The occurrence of these few, low-magnitude events is consistent with the predicted low probability of seismic-induced or earthquake-caused ground motion in northeastern Wyoming (Algermissen et al., 1982).

Earthquakes generally do not result in ground-surface rupture unless the magnitude of the event is greater than 6.5 (Case and Green, 2000). Because of this, areas of Wyoming that do not have active faults exposed at the surface, such as the Ross Project area, are generally thought not to be capable of having earthquakes with magnitudes over 6.5. As shown on Figure 3.9, the probability of an earthquake with magnitude greater than or equal to 6.5 in the vicinity of the Ross Project is less than 0.001. This Figure was prepared using the USGS Probabilistic Seismic Hazard Analysis (PSHA) model (USGS, 2010). Earthquakes with magnitudes less than 6.5 would cause little damage in specially built structures, but they could cause considerable damage to ordinary buildings and even severe damage to poorly built structures. Some walls could collapse, but underground pipes would generally not be broken, and ground cracking would not occur or would be minor (USGS, 2010).

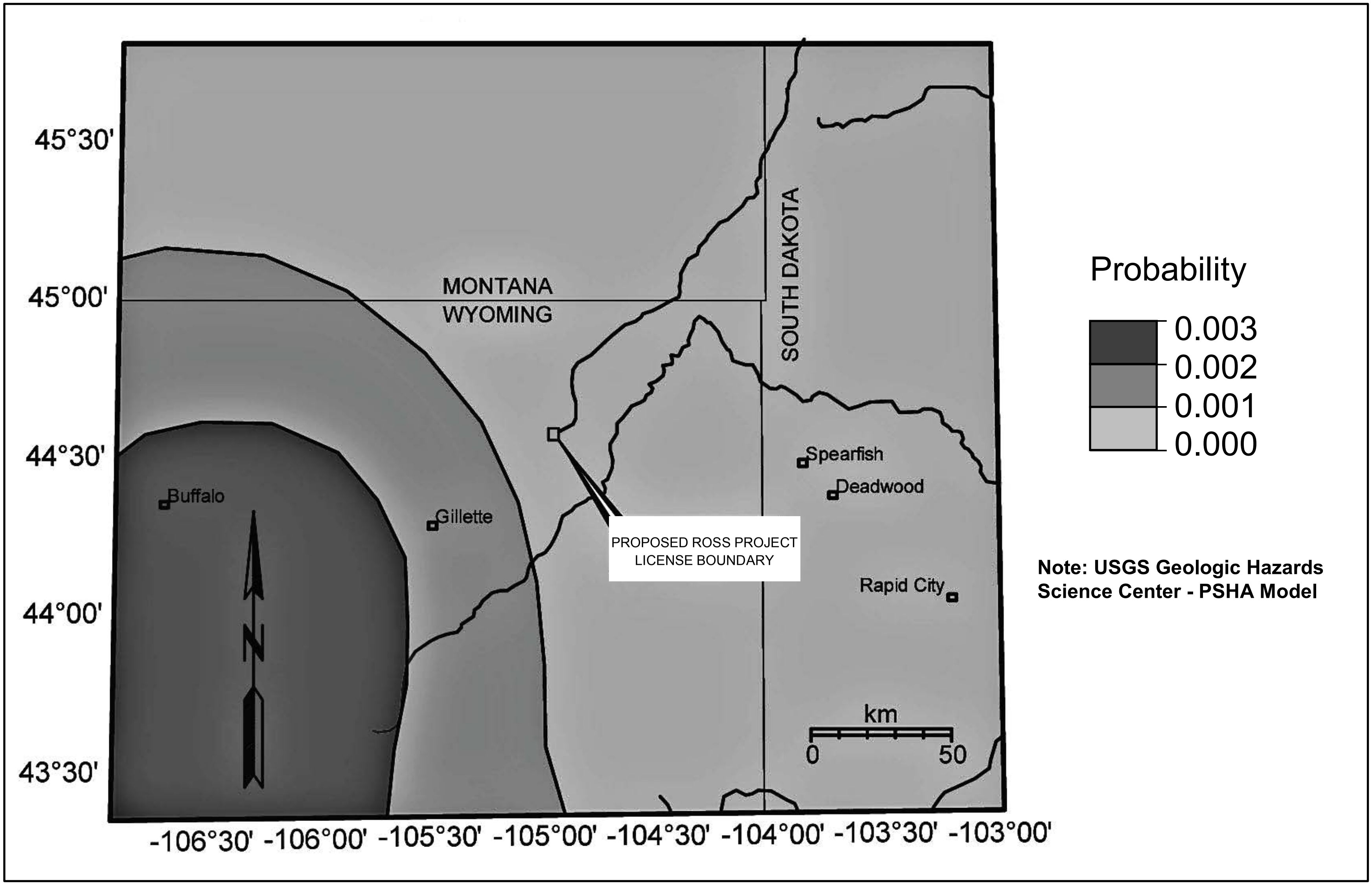
3.5 Water Resources

Water resources in the vicinity of Ross Project include both surface water and ground water. Both the quantity and the quality of surface and ground waters are described in this section. "Pre-licensing, site-characterization" water-quality data have been collected and analyzed by the Applicant in accordance with the following guidelines:

- American Society for Testing and Materials (ASTM) International's Standard D449-85a, *Standard Guide for Sampling Groundwater Monitoring Wells*, as recommended in the NRC's guidance document, *Standard Review Plan for In Situ Leach Uranium Extraction License Applications*, NUREG–1569 (NRC, 2003b). (The ASTM Standard noted here was replaced by ASTM Standard D4448-01 in 2007.)
- WDEQ's "Hydrology, Coal and Noncoal," Guideline No. 8 (WDEQ/LQD, 2005b).
- NRC's Regulatory Guide 4.14, *Radiological Effluent and Environmental Monitoring at Uranium Mills*, Revision 1 (NRC, 1980).

As a general rule, these guidance documents by both NRC and WDEQ recommend water samples be filtered before the analysis of any metals each sample might contain. ASTM D449-85a (now ASTM 4448-01) and the NRC's Regulatory Guide 4.14 also specify analysis of radiological parameters in filtered samples (NRC, 1980). The results of the analysis of constituents in filtered samples are then reported as "dissolved" concentrations (versus "unfiltered" samples, which are reported as "total" concentrations). The filtering of water samples before analysis for metals is consistent with WDEQ/WQD's *Groundwater Sampling for Metals: Summary*, which explains that filtering samples eliminates bias that may arise from variable turbidity in the samples (WDEQ/WQD, 2005a). The NRC's guidance on filtering samples applies to both pre-licensing, site-characterization monitoring efforts as well as post-licensing, pre-operational and operational environmental monitoring efforts during ISR operation and aquifer restoration.

The standardized protocol for filtering samples that would be analyzed for metals also allows a sound comparison among other data sets. For example, pre- and post-ISR operation water-quality data available for Nubeth also reported dissolved metal concentrations (i.e., filtered samples were analyzed).



Source: Strata, 2012a.

Figure 3.9
Probability of Earthquake with Magnitude of Greater Than or Equal to 6.5 in 50 Years

3.5.1 Surface Water

The Ross Project area is located in the upper reaches of the Little Missouri River Basin. The Little Missouri River originates in northeastern Wyoming, flows through southeastern Montana, through northwestern South Dakota, and into North Dakota where it empties into the Missouri River at Lake Sakakawea. The total river length is 652 km (405 mi), and the total drainage area (i.e., the area where all surface waters flow toward the Little Missouri River) is approximately 24,500 km^2 [9,470 mi^2]. Figure 3.10 depicts the Little Missouri River Basin. The drainage area of the Little Missouri River at the downstream boundary of the Ross Project area is approximately 47 km^2 [18 mi^2].

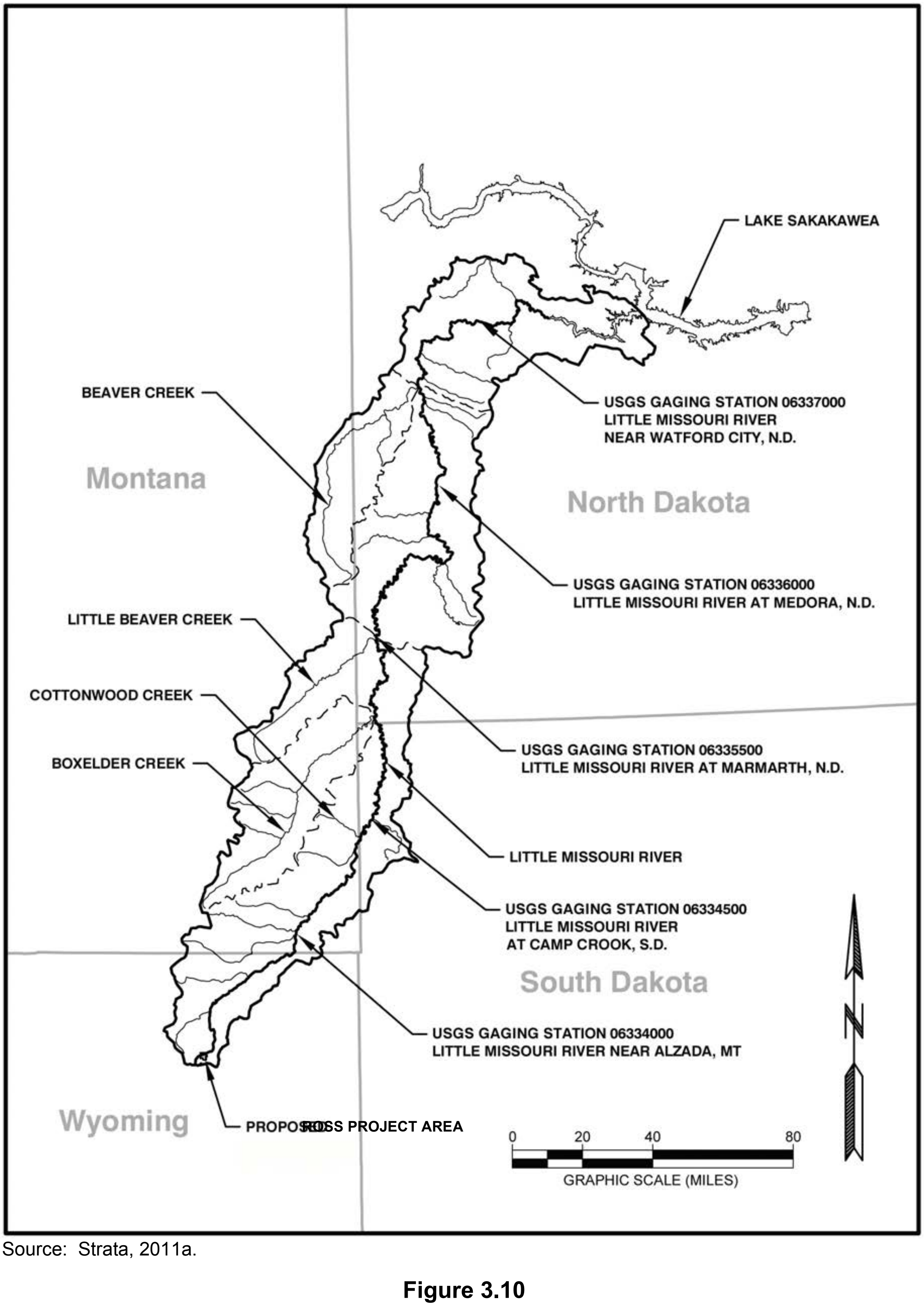
A surface-water monitoring system has been employed by the Applicant to characterize surface-water quantity and quality at the Ross Project area. This system includes three monitoring stations and is designed to monitor the major surface-water drainages to the Little Missouri River and to establish pre-licensing, site-characterization surface-water quantity and quality.

3.5.1.1 Surface-Water Features

The surface-water features located within the Ross Project are depicted in Figure 3.11 and consist of several reservoirs and minor stream channels. Oshoto Reservoir, located in the channel of the Little Missouri River, is the main hydrologic feature of the Project area (Water Right Permit No. P6046R) (WSEO, 2006). The only potential springs identified within the Ross Project area are associated with nearby wetlands (see SEIS Section 3.5.2) or with the Little Missouri River in the vicinity of the Oshoto Reservoir.

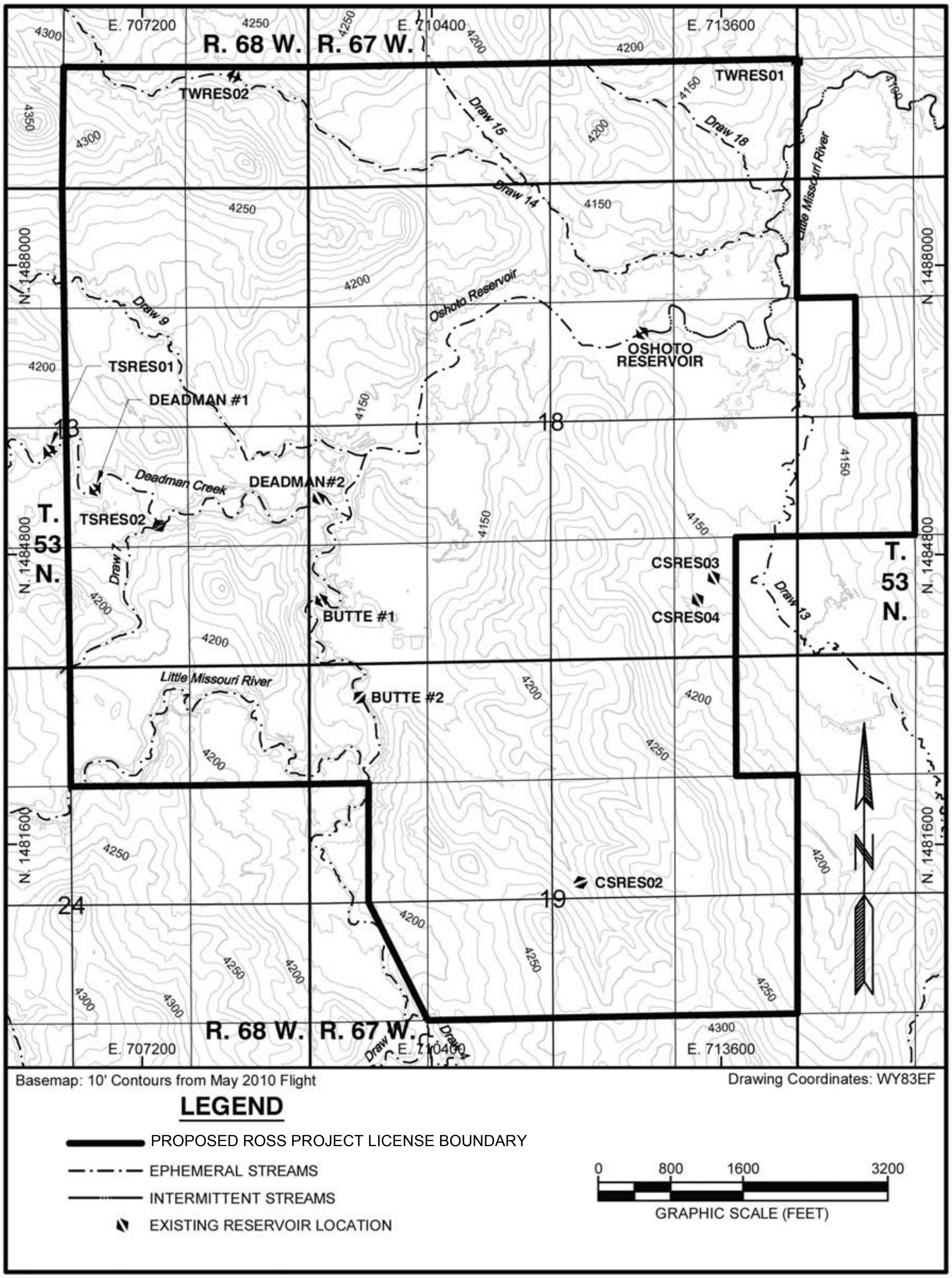
The Applicant has identified 12 existing reservoirs within or just outside the Ross Project area using aerial photography, Wyoming State Engineer's Office (WSEO) permits, and landowner interviews (see Figure 3.11). Other than the Oshoto Reservoir, which has a maximum capacity of 42 ha-m [339 ac-ft] and an area of 11 ha [28 ac], all the identified reservoirs have a capacity of less than approximately 1 ha-m [10 ac-ft] and a surface area of less than approximately 1 ha [3 ac] (Strata, 2011a). The Oshoto Reservoir has the potential to affect stream flow downstream of the Reservoir itself and appears to influence water-table elevations in its proximity (Strata, 2011a).

There are three Wyoming Pollutant Discharge Elimination System (WYPDES)-permitted outfalls associated with the oil-production operations within the watershed that includes the Ross Project area: two upstream from the Ross Project (Permit Nos. WY0044296 and WY0033065) and one downstream (Permit No. WY0034592) (Strata, 2011a). Discharge rates from these outfalls are relatively low, approximately 0 – 150 m^3/d [0 – 5,300 ft^3/d].



Source: Strata, 2011a.

Figure 3.10
Little Missouri River Basin and Surface-Water Gaging Stations



Source: Strata, 2011a.

Figure 3.11
Surface-Water Features of Ross Project Area

3.5.1.2 Surface-Water Flow

As shown in Figure 3.10, five USGS gaging stations are located on the Little Missouri River downstream of the Ross Project (USGS, 2012a). The mean annual discharges range from 2 m^3/s [77 ft^3/s] at the most upstream gaging station (near Alzada, Montana) to 15.1 m^3/s [533 ft^3/s] at the most downstream gaging station (near Watford City, North Dakota). The discharges are typically lowest from November through January and highest during the months of March through June (Strata, 2011a). The peak flow for the Alzada, Montana, gaging station occurred in April 1944 when an estimated discharge of 170 m^3/s [6,000 ft^3/s] occurred. The peak flow at the Camp Crook, South Dakota, gaging station took place in March 1978 with a flow of 267 m^3/s [9,420 ft^3/s]. The timing of these events indicates that snow melt and spring runoff typically result in the highest flows for this portion of the Little Missouri River.

The Applicant has established three surface-water monitoring stations and installed continuous stage recorders and pump samplers at each station within the Ross Project area in 2010 (see Figure 3.12) (Strata, 2011a). The stations were located at two sites on the Little Missouri River (SW-1 and SW-2) and one site on Deadman Creek (SW-3), an ephemeral tributary to Little Missouri River. The stage recorders are designed to continuously measure discharge and are integrated with the pump samplers that collect water-quality samples during runoff events. The Applicant reports flow data from the three surface-water monitoring stations from June 15, 2010, to October 11, 2011, with a break during the respective winter when the monitoring stations were removed to prevent their freezing (Strata, 2012a).

The results of the surface-water monitoring indicate that, where the streams enter the Ross Project area (SW-2 and SW-3), flow is in response to only snow-melt or precipitation events (i.e., ephemeral) (Strata, 2011a). The Little Missouri River, downstream from the proposed Ross Project boundary (SW-1), has flow for an extended period of the year but not all of the year and is, thus, intermittent. The Applicant compared the average daily flow observed at SW-1 to the water-surface elevation in Oshoto Reservoir (Strata, 2011a); the comparison suggests a correlation between the increased flow in the Little Missouri River downstream of Oshoto Reservoir and the amount of head in the Reservoir. This would indicate that some of the flow could be attributed to the stored capacity in Oshoto Reservoir.

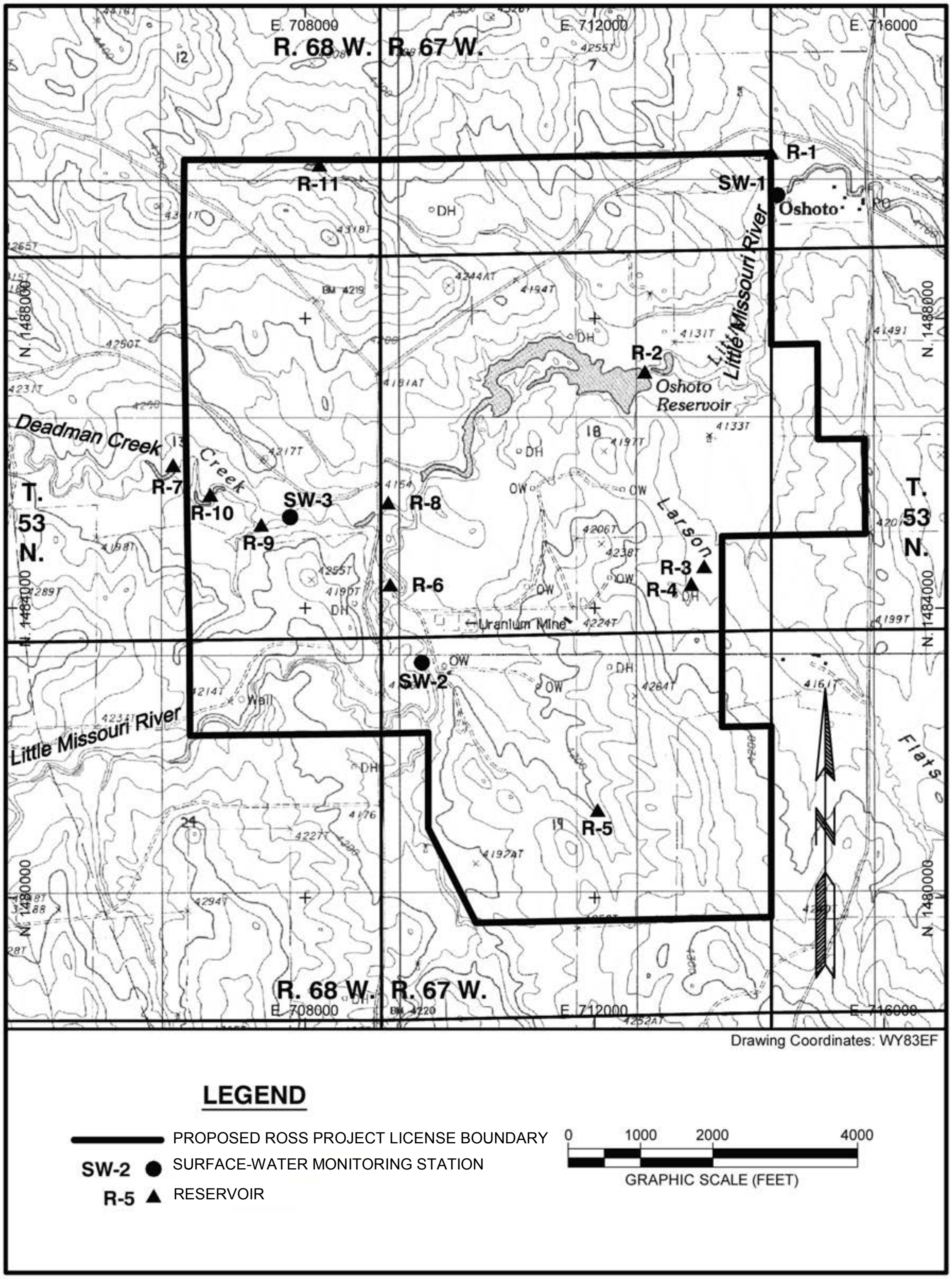
What are the types of streams at the Ross Project area?

Perennial Streams: A perennial stream is a stream or part of a stream that flows continually during all of the calendar year as a result of ground-water discharge or surface runoff.

Intermittent Streams: An intermittent stream is a stream or part of a stream where the channel bottom is above the local water table for some part of the year, but which is not a perennial stream.

Ephemeral Streams: An ephemeral stream is a stream which flows only in direct response to a single precipitation event in the immediate watershed or in response to a single snow-melt event, and which has a channel bottom that is always above the prevailing water table.

All streams within the Ross Project area, including the Little Missouri River and Deadman Creek, are classified by WDEQ/Water Quality Division (WQD) as Class 3B streams (WDEQ/WQD, 2001). A Class 3B stream is defined by the WDEQ/WQD as an intermittent or ephemeral stream with a designated use of “aquatic life other than fish.” Uses such as drinking water and fisheries are excluded in a Class 3B stream. Approximately 64 km [40 mi] downstream of the Ross Project, the Little Missouri River becomes a Class 2ABWW stream at



Source: Strata, 2012a.

Figure 3.12
Surface-Water Monitoring Stations at Ross Project Area

its confluence with Government Canyon Creek; at this point, the River becomes protected as a drinking-water source (2AB) and warm-water (WW) fishery.

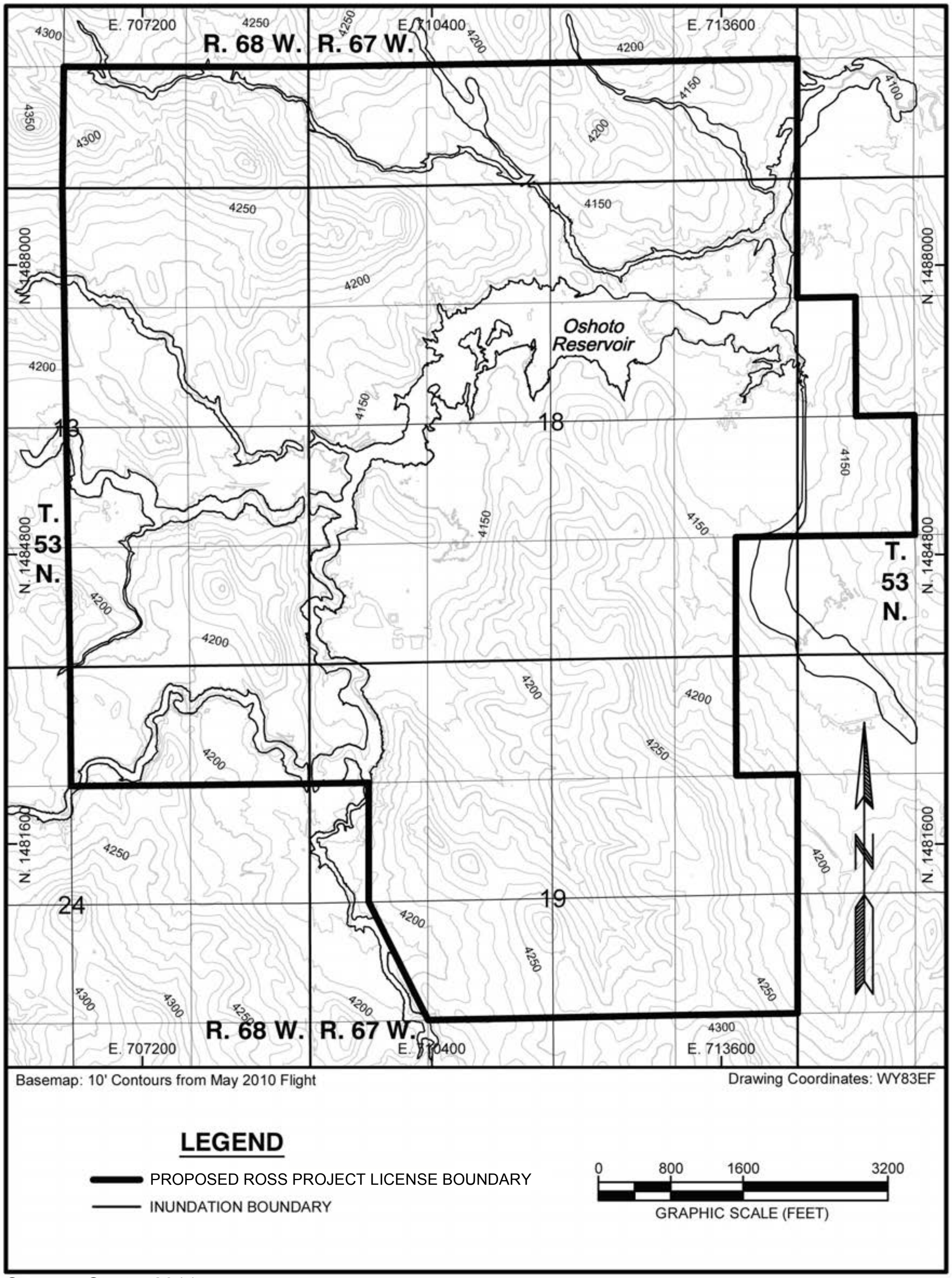
There are no long-term stream-flow records for flows within or adjacent to the Ross Project; therefore, an U.S. Army Corps of Engineers' (USACE) Hydrologic Engineering Center's Hydrologic Modeling System (HMS) was developed by the Applicant to estimate the peaks and volumes of floods for various recurrence intervals (Strata, 2011a). The resulting inundation boundaries are shown on Figure 3.13. Measured peak flows during a 2-year, 24-hour storm event in May 2011 were less than predicted by the model, suggesting that the predicted model flows are conservatively high (Strata, 2012a).

3.5.1.3 Surface-Water Quality

Data from water-quality analyses of samples obtained from the Ross Project surface-water monitoring stations in 2009 and 2010 are provided in the Applicant's *Environmental Report* (ER) and *Technical Report* (TR) (see Figure 3.12 for sampling locations) (Strata, 2011a; Strata, 2011b). Due to reasons ranging from the Applicant's not having a landowner's permission to no-flow conditions (i.e., there was no water flowing or the water was frozen), the number of quarters in which the monitoring stations were sampled ranges from one to six (Strata, 2011a). Water-quality analytical data from samples collected in 2011 were submitted to WDEQ/LQD and were provided in the Applicant's Responses to the RAIs issued by the NRC (Strata, 2012a). The data from 2011 are generally consistent with the 2009 and 2010 data, indicating a representative characterization of surface-water quality.

The surface-water monitoring data characterizing the Little Missouri River and Deadman Creek from the first and second quarters of 2010 are summarized and described below. These data indicate that the overall water quality meets Wyoming's surface-water criteria for a Class 3B stream, which is the designation for the Little Missouri River and Deadman Creek.

- The water quality in all streams is generally consistent across the entire Ross Project area.
- The field pH measurements ranged from 7.6 – 8.9 standard units (s.u.), indicating alkaline water.
- The field measurements of dissolved oxygen ranged from 6.9 – 10.5 mg/L, indicating an intermediate to high level of oxygen in the water.
- Total salinity of the surface-water samples, expressed as total dissolved solids (TDS) concentrations, is low to moderate, ranging from 220 – 940 mg/L, and the water composition is dominated by sodium and bicarbonate.
- Iron and manganese concentrations in unfiltered samples ranged from 0.32 – 0.95 mg/L and 0.05 – 0.21 mg/L, respectively, suggesting the presence of suspended sediment in the samples.
- Dissolved metals were near or below detection limits, with the exception of iron and uranium. Iron concentrations ranged from less than 0.07– 0.34 mg/L. Concentrations of uranium ranged from 0.003 – 0.02 mg/L.



Source: Strata, 2011a.

Figure 3.13
Predicted 100-Year Flood Inundation Boundaries

- Dissolved radium-226 (Ra-226) was less than the detection limit of 0.01 Bq/L [0.2 pCi/L]. Dissolved radium-228 (Ra-228) was undetectable (i.e., less than 0.04 Bq/L [1 pCi/L]), except for one sample obtained at SW-2, which was counted at 0.05 Bq/L [1.3 pCi/L].
- Gross alpha and gross beta ranged from 0.2 – 0.33 Bq/L [4 – 8.8 pCi/L) and 0. 2 – 0.41 Bq/L [6 – 11.2 pCi/L], respectively.

Other water-quality data suggest that the TDS increases downstream in the Little Missouri River and sulfate becomes the dominate anion (Langford, 1964). The total anion/cation balances were calculated from the analyses of major ions as a quality-control check on the laboratory analyses. The balances, less than 3 percent in 31 of the 36 samples analyzed, and between 3 and 5 percent in five samples, validated the accuracy of the analyses (Strata, 2011a).

The Applicant attempted to collect water-quality samples from 11 reservoirs (see Figure 3.12) from the third quarter of 2009 through the third quarter of 2011 (i.e., quarterly) (Strata, 2011a; Strata, 2011b; Strata, 2012a). Samples were not collected when the reservoirs were dry, were frozen, or when the Applicant was not able to obtain the landowner's permission. These water-quality data indicate the following:

- Higher TDS corresponds to low-flow conditions in the fourth quarters of both years. TDS in samples of the reservoirs on the channels of the Little Missouri River and Deadman Creek, upstream from Oshoto Reservoir, ranged from 800 – 2,320 mg/L compared to a range of 460 – 920 mg/L in the Oshoto Reservoir and a range of 80 – 170 mg/L in the reservoir on the Little Missouri River downstream of the Oshoto Reservoir. The TDS in the reservoirs upland from the stream channels range from 60 – 1,190 mg/L. Bicarbonate or carbonate (depending upon the pH) was the dominant anion in all of the reservoirs. Sodium was the dominant cation, except in water on the low end of the TDS range, where calcium was often the dominant cation.
- The water in all reservoirs was alkaline, with field pH measurements generally ranging from 7 – 11 s.u.
- Field-measured dissolved oxygen ranged from 0.46 – 11.3 mg/L, suggesting seasonal low oxygen conditions.
- Similar to the streams, dissolved metals in the reservoirs were generally at or near the laboratory's detection limits, except for uranium and iron. Uranium ranged from less than 0.001 – 0.02 mg/L in all of the reservoirs except for those on Deadman Creek, where uranium concentration ranged from 0.015 – 0.087 mg/L. Detectable concentrations of dissolved iron generally corresponded to depleted dissolved oxygen levels. Measureable concentrations of total iron and manganese indicate the presence of sediment in the samples.
- The available data for radionuclides show that most of the analyses were less than the laboratory's lower limit of detection. However, detectable concentrations of lead-210 (Pb-210), dissolved and suspended Ra-226, dissolved Ra-228, and suspended thorium-230 (Th-230) were detected. Gross alpha and gross beta ranged from less than 0.07 – 1.8 Bq/L [2 – 48.7 pCi/L] and 0.14 – 1.83 Bq/L [3.9 – 49.4 pCi/L], respectively. The highest values of gross alpha and gross beta were measured in samples from reservoirs on Deadman Creek.

3.5.1.4 Surface-Water Uses

A search of the WSEO database of permitted surface-water rights within the Ross Project area boundaries and the adjacent 3-km [2-mi] radius revealed that 43 surface-water rights existed within and adjacent to the Ross Project in 2010 (WSEO, 2006; Strata, 2011a). The search of the WSEO database indicated that nearly half of the water-right permits have been cancelled, while the remaining permits are complete, fully adjudicated, or un-adjudicated (Strata, 2011a). In addition to the permitted surface-water rights, there are at least 17 additional reservoirs within or adjacent to the Ross Project area not listed in the WSEO water-rights database (Strata, 2011a).

Surface water within the Ross Project area and surrounding 3-km [2-mi] vicinity is primarily used for livestock watering, with lesser amounts used for irrigation and industrial uses (primarily as a temporary water supply for oil- and gas-extraction activities) (Strata, 2011a). Including the reservoirs not listed in the WSEO database, stock reservoirs account for approximately 90 percent of the total active water rights (Strata, 2011a). Most of the stock reservoirs were constructed before 1970, and the majority are still in use today. Irrigation-water rights only account for a relatively small portion (less than 10 percent) of the surface-water rights. All of the irrigation rights were permitted 50 – 100 years ago for relatively small areas (28 ha [70 ac] or less). The one water right for Nubeth signifies the rise of uranium exploration in the late 1970s. Following this, there were some 15 temporary water-haul permits for oil- and gas-related activities from 1980 – 1991. Finally, the two most recent water rights were appropriated by the Applicant for exploration activities at the Ross Project area (Strata, 2011a).

3.5.2 Wetlands

The Federal definition of wetlands includes “those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas” (33 CFR Part 328.3). Wetlands are important resources that provide habitat for aquatic fauna and flora, filter sediments and toxicants, and attenuate floodwaters.

Projects that discharge, dredge, or fill material into “Waters of the United States,” a concept related to surface- and ground-water regulation which includes special aquatic sites and wetlands under the jurisdiction of the USACE, require accurate identification of wetland boundaries for Section 404 of the *Clean Water Act of 1972*-permitting process. Through the Section 404-permitting process, the USACE can authorize dredge or fill (i.e., construction) activities by its issuance of standard individual permits, regional permits, or Nationwide Permits (NWP). Due to the potential for the Ross Project to adversely impact local historical and cultural resources, the USACE cannot verify a Section-404 NWP for construction activities in Waters of the U.S. until such time as the lead agency (i.e., the NRC) has completed the consultation efforts required under the *National Historic Preservation Act of 1966* (NHPA) with respect to the potential impacts in the proposed NWP’s areas of effect.

Site-specific field surveys on behalf of the Applicant were conducted at the Ross Project by WWC Engineering, Inc. (WWC) staff on June 22 and 28 as well as July 8 and 21, 2010. These surveys were in accordance with the “Interim Regional Supplement to the USACE Wetlands Delineation Manual: Great Plains Region” (USACE, 2008; Strata, 2011a). These wetlands surveys were conducted to identify and to characterize the wetlands located within the Ross Project area. Existing data used in the survey included the Natural Resource Conservation Service's (NRCS's) soil mapping, U.S. Fish and Wildlife Service's (USFWS's) National Wetlands Inventory (NWI) mapping, and aerial photography taken in May 2010 (NRCS, 2010; USFWS, 2012a; Strata, 2011a).

Thirteen wetland sites were identified on the NWI maps within the Ross Project area and were investigated during the 2010 field surveys. Potential wetlands identified during the initial June survey were later visited during another survey in July to verify that wetland characteristics were present. The wetlands-survey results, photographs, and correspondence with the USACE are provided in the Applicant's ER (Strata, 2011a). All but two of the NWI areas were included in the field-delineated wetlands (Strata, 2011a). The two sites not included did not have the three required characteristics for a wetland. The three criteria are: 1) hydric soil (i.e., soils that are commonly flooded or saturated), 2) hydrophytic vegetation (i.e., plants that grow in hydric soils), and 3) wetland hydrology (USACE, 2008).

Many of the potential wetland areas delineated during the 2010 field surveys were small depressions (<0.04 ha [0.1 ac]) that were in close proximity to each other but were distinct depressions separated by upland vegetation. A significant number of these small-depression areas appeared to be influenced by ground water, receiving seepage from the Lance Formation, which outcrops in the vicinity. These potential wetlands were classified according to Cowardin et al. (1979) to more accurately describe the types of potential wetlands present within the Ross Project area (Strata, 2011a). Approximately 93 percent of the potential wetlands were human-made (i.e., diked or excavated). A significant majority of these are preliminarily classified as Palustrine, Aquatic Bed, Seasonally Flooded (PABFh) or Diked. Of the areas designated as PABFh, approximately half were areas of open water. In addition, there were approximately 2.1 ha [5.1 ac] (6,750 linear m [22,130 linear ft] x an average 3-m- [10-ft-] wide channel) of "Other Waters of the U.S." identified within the Ross Project area (Strata, 2011a).

A *Wetlands Delineation Report* for the Ross Project was submitted to the USACE Omaha District in Cheyenne, Wyoming, during September 2010 (Strata, 2011a). The USACE provided the Applicant a letter on December 9, 2010, that verified the following (USACE, 2010):

- The methods used to identify wetlands and other surface waters were consistent with the USACE's *Wetland Delineation Manual* and its current supplements (USACE, 1987).
- Exhibit 1 in the *Wetlands Delineation Report*, entitled "Wetlands and Other Waters of the U.S. Delineation for the Proposed Ross ISR Project, Oshoto, Wyoming (Wetland Map)" (dated August 23, 2010), provided an accurate depiction of the boundaries of all wetlands and other waters within the Ross Project area.
- All of the wetlands and channeled waterways identified in the *Wetlands Delineation Report* are connected or adjacent to the Little Missouri River, a navigable water, and are thus likely to be Waters of the U.S. as defined in 33 CFR Part 328.

USACE's final determination of specific wetland areas would not occur until the Applicant applies for coverage for specific construction activities, such as pipeline installation and access-road stream-channel crossings. At that time, the Applicant would be required to provide a site-specific mitigation plan for its disturbance of jurisdictional wetlands (i.e., those wetlands that are under the jurisdiction of the USACE).

3.5.3 Ground Water

3.5.3.1 Regional Ground-Water Resources

The Applicant presented a description of the regional hydrogeology within which the Ross Project area resides, based upon published literature, in its license application (Strata, 2011a; Strata, 2011b). The site-specific hydrogeology of the Lance Formation and the associated stratigraphy underlying the Ross Project area is not specifically described in the GEIS; thus, detailed information is included here. Water-bearing bedrock intervals in the eastern Powder River Basin range in age from Precambrian to Paleocene (see Figure 3.7). Regionally, recharge occurs in the outcrop areas, with ground water moving away from the outcrop into the Basin. Due to the geologic dip of the units, stratigraphic horizons that are accessible near the Black Hills uplift are deeply buried in the Basin's center about 125 km [75 mi] west from the Ross Project area (Hinaman, 2005).

Within the northeast corner of Wyoming there are a number of water-bearing intervals tapped by municipalities and industrial users (Strata, 2011a; Langford, 1964). Below the Fox Hills aquifer, the Minnelusa Formation (210 – 270-m [700 – 900-ft] thick), and the underlying Madison Formation (90 – 270-m [300 – 900-ft] thick) are the most significant aquifers (Whitcomb and Morris, 1964). The Minnelusa and Madison aquifers are recharged at the outcrop in the area of the Black Hills uplift. Ground-water flow in all aquifers is from the recharge areas along the outcrop, westward towards the center of the Powder River Basin. Flow directions are locally modified by pumping wells. The Minnelusa Formation has received aquifer exemptions in portions of Campbell County which allow it to be used for waste-water disposal (EPA, 1997).

The Minnelusa Formation is also an important hydrocarbon reservoir interval in the areas of the Powder River Basin that are west of the Ross Project (De Bruin, 2007). At the Ross Project area, the Minnelusa Formation is approximately 1,860 m [6,100 ft] bgs (Strata, 2011a). It is separated from the Ross Project's proposed ore zone by 1,680 m [5,500 ft] of sandstone, claystone, and shale, most notably the Pierre Shale which is over 600-m [2,000-ft] thick under the Ross Project area (see SEIS Section 3.4) (Whitcomb and Morris, 1964).

Water-supply wells in the Madison Formation have reported yields of up to 60 L/s [1,000 gal/min]; the Formation is an important source of drinking water for the communities of Gillette and Moorcroft. The city of Gillette operates a wellfield consisting of ten wells north of the town of Moorcroft, yielding 590 L/s [9,300 gal/min] from a depth of approximately 760 m [2,500 ft]. The water is piped approximately 53 km [33 mi] to Gillette and blended with locally-produced ground water from the Fort Union Formation and to a lesser degree from wells completed in the Lance and Fox Hills Formations. Other towns in the vicinity (e.g., Moorcroft, Sundance, Upton, Newcastle, and Hulett) also use the Madison Formation for municipal water supply (Strata, 2011a). In the vicinity of Gillette, the Fox Hills and Lance Formations are typically targeted by industrial users, while smaller municipalities, subdivisions, and improvement districts west of Ross Project area use wells completed within the shallower Fort Union Formation.

3.5.3.2 Local Ground-Water Resources

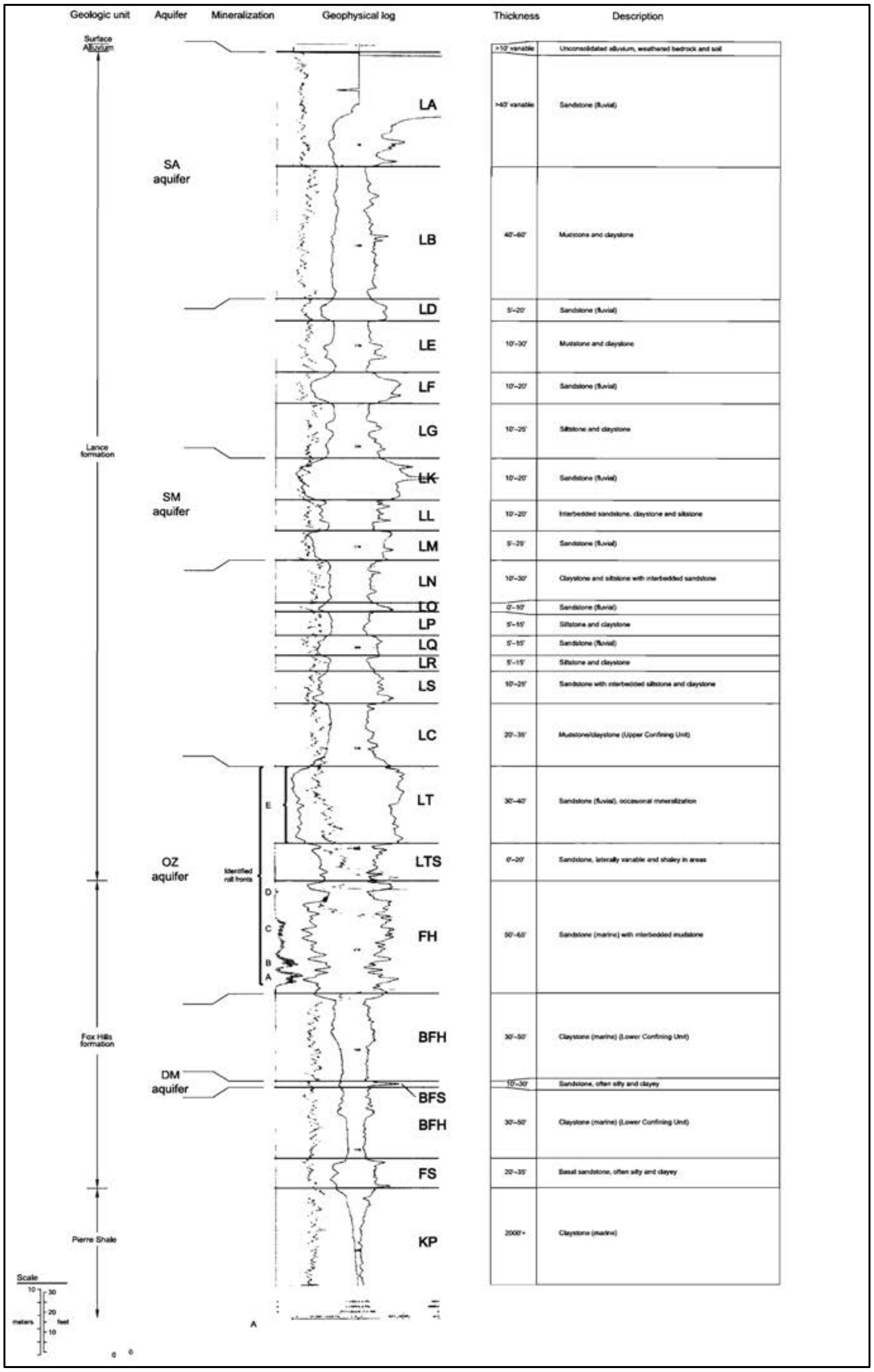
The detailed geologic stratigraphy and its relationship to the corresponding hydrology are illustrated in Figure 3.7. The detailed stratigraphic sequence from the land surface to the confining unit below the ore zone is, in descending order: recent, unconsolidated, surficial deposits including residual soils, colluvium, and alluvium; Lance Formation; Fox Hills Formation; and Pierre Shale (see SEIS Section 3.4). Figure 3.14 illustrates the geophysical log and corresponding lithology obtained from Exploration Drillhole No. RMR008, the location of which is shown in Figure 3.6 in SEIS Section 3.4.1. This particular drillhole was chosen as the “type log” by the Applicant for the Ross Project because of the clarity of the geophysical logs and the associated stratigraphic descriptions from land surface to the top of the Pierre Shale (Strata, 2011a).

Within the Ross Project area, there are four named aquifers existing between the land surface and the Pierre Shale. The correspondence between stratigraphic horizons and hydrologic units, and the related nomenclature, are summarized in Table 3.4.

Table 3.4
Geologic Units, Stratigraphic Horizons, and Hydrologic Intervals of Ross Project Area

<table>
<tr><th>Geologic
Unit</th><th>Stratigraphic
Horizon</th><th>Hydrologic
Interval</th></tr>
<tr><td>Lance Formation and/or
Recent Alluvium/Colluvium</td><td>Qal/LA/LB</td><td>SA
(Surficial Aquifer)</td></tr>
<tr><td rowspan="6">Lance Formation</td><td>LD-LG</td><td>Lance Units
(Aquitard)</td></tr>
<tr><td>LK-LM</td><td>SM
(Shallow-Monitoring Aquifer)</td></tr>
<tr><td>LN-LS</td><td>Sandstone
within Confining Unit</td></tr>
<tr><td>LC</td><td>Upper Confining Unit</td></tr>
<tr><td>LT-LTS</td><td rowspan="2">OZ
(Ore-Zone Aquifer)</td></tr>
<tr><td>FH</td></tr>
<tr><td rowspan="3">Fox Hills Formation</td><td>BFH</td><td>Lower Confining Unit
(Aquitard)</td></tr>
<tr><td>BFS</td><td>DM
(Deep-Monitoring Aquifer)</td></tr>
<tr><td>BFH/FS</td><td>Sandstone
within Confining Unit</td></tr>
<tr><td>Pierre Shale</td><td>KP</td><td>Regional Confining Unit
(Aquitard)</td></tr>
</table>

Source: Strata, 2012b.



Source: Strata, 2011a.

Note:

Nomenclature used to describe stratigraphic horizons and hydrogeologic units or intervals at the Ross Project Area (developed by Strata from the geophysical log and corresponding lithology obtained from Exploration Drillhole No. RMR0008. The respective location is shown in Figure 3.8.)

Figure 3.14
Stratigraphic Horizons and Hydrogeologic Units at Ross Project Area

The surficial aquifer, or the SA interval, is the “water-table” aquifer within the Ross Project area. It consists of the uppermost water-bearing unit within the Upper Lance Formation and the alluvium of the Little Missouri River and Deadman Creek. Ground-water levels range from near-surface in the river valleys to over 15 m [50 ft] bgs in topographically higher areas.

The sandstones of the Lower Lance Formation (LT intervals) make up the upper portion of the ore zone (i.e., ore-zone [OZ] aquifer) (see Figure 3.14). The LT sands range in thickness from 9 – 12 m [30 – 40 ft] and show hydraulic continuity beneath the Ross Project area. Above the LT sands is a shale layer varying in thickness from 6 – 24 m [20 ft – 80 ft], locally called the LC interval aquitard. The Applicant designates the LC aquitard as the “upper confining unit.” The LC aquitard serves as a confining unit that separates the uranium-mineralized sandstones of the FH and LT horizons and the OZ aquifer, from the water-bearing unit above (see Figure 3.14).

The water-bearing sands above the upper confining unit are referred to as the “shallow-monitoring (SM) unit,” or the SM aquifer, and is composed of the LM- through LK-horizon sandstones. Above the SM aquifer is a sequence of thin sands, shales, and silts. Many of the thin sandstones contain water; however, these sandstones are generally discontinuous and, while they may be used locally for stock and domestic wells, they are not regionally extensive.

The Lance Formation is recharged at the outcrop and at the subcrop beneath the alluvium in the valley of the Little Missouri River and its tributaries. Natural ground-water flow would be expected to be westward from the outcrop toward the Basin.

At the Ross Project area, the thickness of the Fox Hills Formation is approximately 46 m [150 ft], with local variations of up to 15 m [50 ft] or more. The Fox Hills Formation consists of an upper sandstone unit (i.e., FH horizon) and a lower sandstone unit (i.e., FS horizon) which are separated by an intervening shale, claystone, and mudstone interval (i.e., BFH horizon) containing the BFS sandstone unit (see Figure 3.14). Uranium mineralization primarily occurs within the Fox Hills Formation’s sands, although in localized areas mineralization occurs within the overlying Lance Formation’s (i.e., LT horizon) sandstone.

The FS and BFS sandstones represent the only water-bearing units within the Lower Fox Hills Formation (see Table 3.4). Both sand units are believed to be continuous throughout the Ross Project area, although in places they are relatively thin. The BFS horizon is the nearest aquifer below the uranium-bearing sandstone (the FH horizon and also known as the ore zone) in the Upper Fox Hills Formation, and in terms of uranium-recovery activities, it is referred to as the “deep-monitoring (DM) unit,” or the DM aquifer. It is separated from the FH sand (i.e., the ore zone) above and the FS (basal sandstone) below by a shale, claystone, and mudstone (BFH horizon). The Applicant provides potentiometric contours for the DM interval in its ER (Strata, 2011a).

The Pierre Shale yields very little water; it is considered regionally as a confining unit (NRC, 2009b; Whitehead, 1996). No wells are known to be completed within the Pierre Shale at the Ross Project area. Exploratory drilling in the upper 30 m [100 ft] of the Pierre Shale by Nuclear Dynamics showed that the shale was composed of silts and clay, with some calcareous cement.

The FH horizon sandstones within the Upper Fox Hills Formation contain uranium and are the primary uranium-recovery target units for the Proposed Action. The Applicant has designated

> **What terms are used to describe hydrologic characteristics?**
>
> **Transmissivity:** This term is used to define the flow rate of water through a vertical section of an aquifer, considering a unit width and extending the full saturated height of the aquifer under unit hydraulic gradient. Transmissivity is a function of an aquifer's saturated thickness and hydraulic conductivity.
>
> **Hydraulic Conductivity:** This term represents a measure of the capacity of a porous medium to transmit water. It is used to define the flow rate per unit cross-sectional area of an aquifer under unit hydraulic gradient.
>
> **Storativity:** This term is used to characterize the capacity of an aquifer to release ground water from storage in response to a decline in water levels.

the OZ aquifer as consisting of the FH sandstones with the overlying Lower Lance Formation sandstones (LT horizon). The lithologies of the ore zone range from thick-bedded, blocky sandstones to thin, interbedded sandstones, siltstones, and shales. The OZ aquifer is underlain by claystone of the Fox Hills Formation (i.e., BFH interval). Within the Ross Project area, this ore-zone interval ranges from 27 – 55-m [90 – 180-ft] thick (see Figure 3.14). Thin, silty, and clayey sandstone comprises the DM aquifer. The Applicant designates the BFH aquitard above the DM aquifer and below the ore zone as the "lower confining unit." Isopachs of the lower confining unit (BFH) show that it ranges in thickness from less than 3 m [10 ft] to more than 15 m [50 ft] (Strata, 2011a). Above the ore zone, the mudstone and claystone of the Lance Formation form the upper confining unit, as noted above, ranging in thickness from less than 6 m [20 ft] to more than 15 m [50 ft] (see Figure 3.14).

The FH sandstones, shales, and silts have been studied extensively through both core analysis and aquifer tests. Seven pumping tests targeting the ore zone were performed by the Applicant at six separate well clusters. Applicable methodology and testing were used and those results are shown in Table 3.5 (additional details can be found in Strata, 2011b).

Table 3.5
Ore-Zone Aquifer Hydrogeologic Characteristics

	Transmissivity m^2/day [ft^2/day]	Hydraulic Conductivity cm/s [ft/day]	Storativity (Unitless)
Minimum	0.353 [3.80]	4.59E-05 [0.13]	4.00E-06
Maximum	34.2 [368]	2.69E-03 [7.62]	1.50E-04
Median	8.20 [88.3]	1.25E-03 [3.55]	6.10E-05
Geometric Mean	6.10 [65.6]	6.74E-04 [1.91]	4.50E-05
Average	8.15 [87.8]	1.15E-03 [3.26]	6.70E-05

Source: Addendum 2.7-F, Table 3, in Strata, 2011b.

The aquifer properties determined by the 2010 tests are comparable to results reported for previous pumping tests within the Ross Project area (Strata, 2011b).

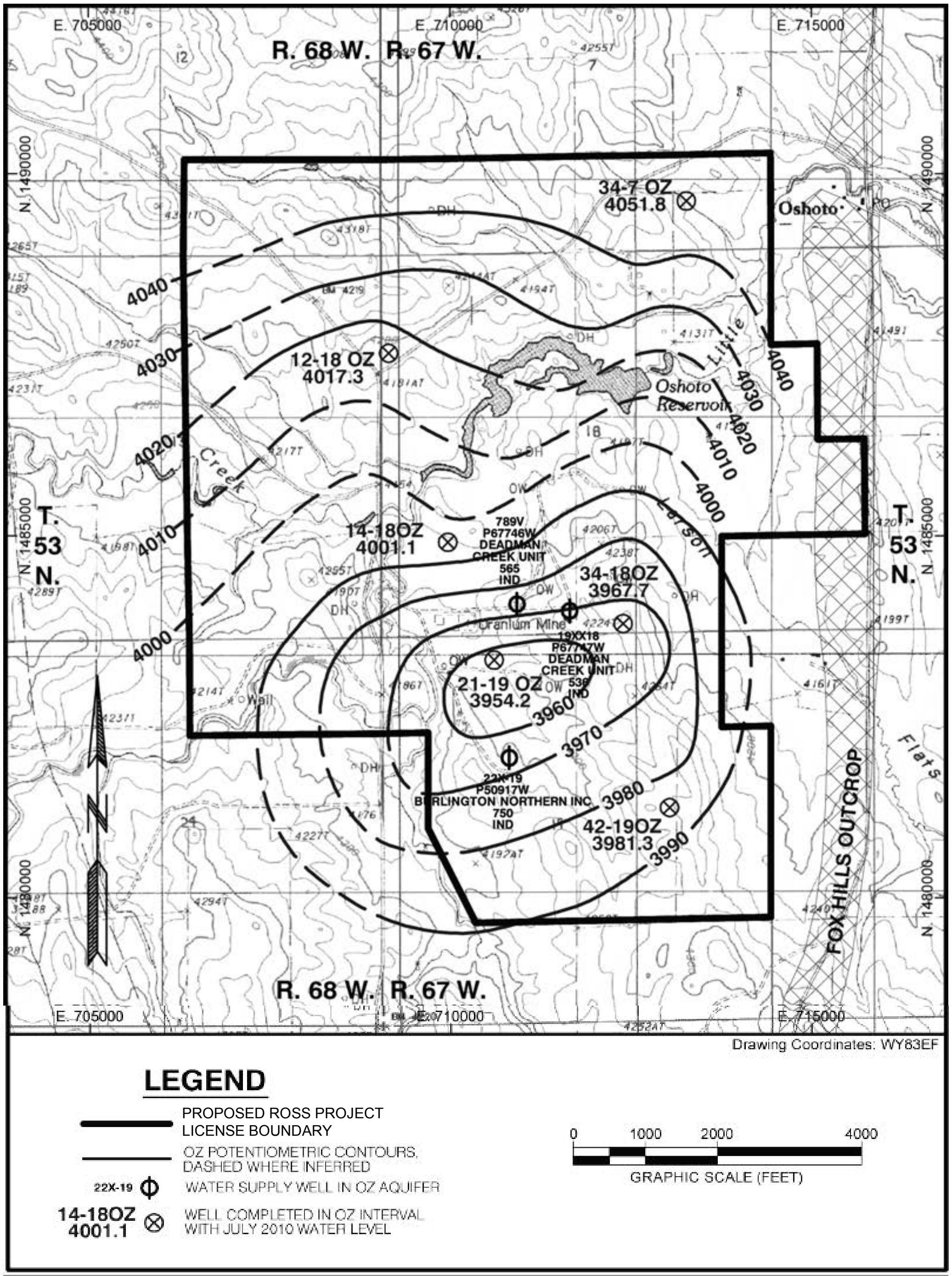
The Applicant developed a static piezometric surface (i.e., a map showing the static water levels expressed as feet above sea level) for the ore-zone aquifer (see Figure 3.15). The ore zone's potentiometric surface shows a distinct cone of depression near the No. 21-19 well cluster that has resulted from 30 years of ground-water withdrawals by oil-field water-supply wells completed in the OZ aquifer. This pumping has changed the hydraulic gradient and the direction of ground-water flow throughout most of the Ross Project area. The potentiometric surface near the No. 34-7 well cluster, which is farthest from the oil-field water-supply wells that have been pumping for 30 years, has been least affected by such pumping. Based upon the Applicant's estimates, approximately 46 m [150 ft] of drawdown (i.e., the decline in water level) in the ore-zone aquifer has occurred in the vicinity of the No. 21-19 well cluster since pumping began in 1980 for local oil-field water-flood operations (Strata, 2011b). An updated map of the ore zone's piezometric surface prepared by the Applicant using a ground-water model provides additional detail of the drawdown associated with the withdrawals from the Merit Oil Company's (Merit's) three water-supply wells (Strata, 2012b).

The Applicant also calculated horizontal gradients and vertical-head differences between the OZ, SM, and DM aquifers (Strata, 2011a). Horizontal gradients in the OZ aquifer are toward the oil-field water-supply wells, and they range from 0.009 – 0.025, with the steeper gradients being in the vicinity of the oil-field water-supply wells. Vertical-head differences between the OZ and the DM aquifers range from 6 m [20 ft] downwards in the northwestern portion of the Ross Project area to 3 m [10 ft] upwards in the area of the oil-field water-supply wells. Vertical gradients are downwards from the SM to the OZ aquifers, with head differences ranging from 15 – 46 m [50 – 150 ft].

The OZ aquifer remains a confined aquifer across the Ross Project area, with potentiometric heads ranging from approximately 46 m [150 ft] to more than 122 m [400 ft] above the top of the ore zone (Strata, 2011a). Recharge to the Fox Hills Formation and, hence, the OZ aquifer, is from precipitation along the outcrop, ground water from the subcrop beneath alluvium in the valley of the Little Missouri River and its tributaries, and from leakage from the overlying Lance Formation. Under current conditions, discharge is to the oil-field water-supply wells.

Continuous measurement of water levels for the period April to October 2010 were recorded by the Applicant in six monitoring wells completed in the OZ aquifer and are presented graphically by the Applicant in its TR (Strata, 2011b). The hydrograph for Well 34-7OZ, which is located farthest from the oil-field water-supply wells, displays the least variation. The variability in the ore-zone-well hydrographs is a function of the well locations relative to the oil-field water-supply wells in Sections 18 and 19. The wells located closest to this area (Wells 21-19OZ, 34-18OZ, 14-18OZ, and 42-19OZ) display water-level fluctuations that are related to pumping of the water-supply wells. Pumping starts and stops that occurred in late June though early July 2010 are apparent on hydrographs from these wells. A rapid water-level rise (over 4.6 m [15 ft] in Well 21-19OZ) in late September 2010 was attributed to a temporary cessation of pumping. This was followed by a rapid decline in the water level, which was interpreted as an indication of resumption of pumping.

Other than the aquifer testing that took place over the period above, other recorded perturbations are related to sampling events and barometric fluctuations. The barometric fluctuations are less than 0.2 m [0.5 ft]. During January through October 2010, the hydrograph



Source: Strata, 2011a.

Figure 3.15
Potentiometric Contours of Ground Water in Ore-Zone Aquifer

for Well 34-7OZ showed a steady increase of approximately 0.6 m [2 ft]. The cause of this increase has not been identified; similar patterns have not been seen in other ore-zone well hydrographs. The hydrograph for Well 12-18OZ varies within a range of approximately 0.76 m [2.5 ft]. Most of the water-level changes are interpreted as responses to barometric pressure changes. However, fluctuations in the late June though early July time period coincide with pumping-related water-level changes observed in the group of four wells discussed above.

The shale, claystone, and mudstone unit, the BFH horizon and lower confining unit, separates the DM aquifer from the FH horizon. This low-permeability unit ranges in thickness from less than 3 m [10 ft] to 24 m [80 ft]. Vertical hydraulic conductivities for this interval are expected to be comparable to that of the Pierre Shale (i.e., 2×10^{-7} cm/s [5×10^{-4} ft/d] or less), based upon their similar lithologies.

Aquifer pumping tests were performed on six well clusters, where the Applicant pumped from the OZ aquifer and monitored the SA, SM, and DM aquifers (Strata, 2011a). No effects from the Applicant's pumping were measured in any of wells completed in the overlying SA or SM horizon, which indicates that the shale layer between the SM and OZ aquifers prevents hydrologic communication between the aquifers. The intact confining layer between the overlying (i.e., SM) aquifer and the OZ aquifer was also demonstrated during Nubeth's research and development.

Water levels in two of the six underlying DM wells (Nos. 14-18DM and 34-18DM) declined slightly during Applicant's pumping (Strata, 2011a). The lower confining unit is 9 – 15-m [30 – 50-ft] thick in the portions of the Ross Project area where these wells are located. The NRC staff has determined that these responses were correctly interpreted by the Applicant as communication between the OZ and DM aquifers due to improperly abandoned drillholes, which were installed during previous resource-exploration efforts, that had not yet been located and properly abandoned by the Applicant (NRC, 2014a). The water levels in the other four wells in the DM aquifer were not affected by the pumping in the OZ aquifer, which confirmed the integrity of the confining layer between those two aquifers. Prior to the Applicant's conducting the aquifer pumping test at Well 12-18, all exploration drillholes in the vicinity of that well cluster had been located and properly abandoned, and no response of the DM-aquifer well was observed during that pumping test.

The communication between the OZ and DM aquifers in locations where the lower-confining unit has been breached has been demonstrated by: 1) the responses observed in the DM zone during the two aquifer pumping tests, where old exploration drillholes had not been properly abandoned, and 2) the similarities in the potentiometric heads in the DM, OZ, and SM aquifers in the vicinity of the oil-field water-supply wells, which are completed in both the OZ and DM intervals. To prevent communication between aquifers during uranium-recovery operations, as indicated in Condition No. 10.12 of the Draft Source and Byproduct Materials License, the Applicant will attempt to locate and properly abandon all historical drillholes located within the ring of perimeter-monitoring wells in each wellfield prior to conducting tests for the respective "hydrologic-test data package" required by the NRC for the Applicant to begin wellfield operations (see SEIS Section 2.1.1.1 and the Draft License currently available as NRC, 2014b).

3.5.3.3 Ground-Water Quality

The Applicant has compiled regional water-quality data listed in the USGS's National Water Information System (NWIS) from 16 wells located in Crook and Campbell Counties that were completed in the Lance and Fox Hills aquifers (Strata, 2011a; USGS, 2012b). Data from these wells indicated that the water quality of the Lance and Fox Hills Formations' aquifers is slightly alkaline (i.e., median pH of 8.4) with a median TDS of 1,130 mg/L, with sodium and bicarbonate as the dominant dissolved species.

The water quality of the shallow ground water from alluvial deposits in the Lance Formation is dominated by sodium, sulfate, and bicarbonate with moderate levels of TDS of approximately 1,200 – 1,400 mg/L (Langford, 1964). Rankl and Lowry (1990) noted that the water quality in the aquifer sequence through the Lance and Fox Hills Formations depends upon the stratigraphy and varies according to well depth. As well depths increase from 30.5 – 152 m [100 – 500 ft], TDS in the waters decrease sharply due to declining concentrations of calcium, magnesium, and sulfate. Water from wells at depths of 152 m [500 ft] or greater are dominated by bicarbonate and sodium.

The deep-injection-well UIC Class I permit application for the Ross Project contains estimates of water quality in deeper formations, from the Minnelusa through the Cambrian Formations (WDEQ/WQD, 2011b). The Minnelusa, Deadwood, and Flathead Formations are expected to have TDS concentrations greater than 10,000 mg/L, while the Madison Formation likely has a TDS concentration of approximately 1,000 mg/L in the vicinity of the Ross Project area.

To comply with the requirements of 10 CFR Part 40, Appendix A, Criterion 7, the Applicant has collected pre-licensing, site-characterization ground-water-quality data from the Ross Project area. These data originate from three sources: 1) data from the Applicant's own pre-licensing, site-characterization monitoring-well network at the Ross Project and the respective analytical data; 2) data from the sampling and analysis of existing water-supply wells; and 3) historical data from the former Nubeth operation (Nuclear Dynamics, 1978). The first source of ground-water-quality data is the Applicant's own ground-water monitoring network which it constructed in 2009 and 2012 and which consists of six monitoring-well clusters and four piezometers (Strata, 2011a). The locations of the monitoring-well clusters are shown in Figure 3.14. Each well cluster would include four monitoring wells targeting the OZ aquifer and the aquifer units above the ore zone (SA and SM) and below the ore zone (DM) (see Figure 3.14). The Applicant provided construction details of the wells and methods used for ground-water sampling in its ER (Strata, 2011a). The four piezometers in the SA were installed in the portion of the Ross Project area proposed for the Central Processing Plant (CPP) and surface impoundments (Strata, 2011a).

Analytical data and field measurements of selected parameters obtained during the 2009 and 2010 quarterly sampling efforts are provided in the Applicant's ER and TR (Strata, 2011a; Strata, 2011b). Water-quality data from samples collected in 2011 and submitted to WDEQ/LQD are provided in information the NRC subsequently received from the Applicant (Strata, 2012a). All of the ground-water-quality data are presented in Appendix C of this SEIS. The Applicant adhered to both the WDEQ/LQD's *Hydrology*, "Coal and Noncoal," Guideline No. 8, and the NRC's Regulatory Guide 4.14, Revision 1, during its sampling and analysis efforts, generating the data in Appendix C (WDEQ/LQD, 2005b; NRC, 1980). The data from 2011 are generally consistent with the 2009 and 2010 data; this consistency indicates a representative characterization of ground-water quality. Appendix C data are summarized in the following paragraphs.

The maximum, average, and minimum values of the chemical constituents measured in ground water from wells installed in each aquifer (SA, SM, OZ, and DM) are presented in Table 3.6. TDS in the ground water at the Ross Project area are predominately bicarbonate-sulfate-sodium; this differs from the typical ground water described in GEIS Section 3.2.4.3.3, which is the bicarbonate-sulfate-calcium type. The pH conditions of greater than 8.0 in the Ross Project area's aquifers are consistent with bicarbonate water, and the dissolved oxygen levels of less than 5 mg/L as measured in the field by the Applicant suggest low-oxygen conditions (Strata, 2011a). The measured values of these two parameters are typical of uranium-bearing aquifers (NRC, 2009b).

The water-quality data included in Table 3.6 indicate distinctive water quality in each aquifer unit (i.e., the SA, SM, OZ, and DM). The distinctive water qualities suggest that vertical movement of water between the aquifers is prevented by the stratigraphic layers between the aquifer units. Average values of TDS in Strata's pre-licensing, site-characterization ground-water monitoring network range from 730 mg/L in the SA unit to 1,574 mg/L in the OZ unit. Ground-water from piezometers in the SA also show that TDS increases sharply with increasing distance from the Little Missouri River (Strata, 2011a).

Table 3.7 summarizes the water-quality data collected by Nubeth in 1976 and 1978, before the operation's research and development activities began. The operation's single-well, push-pull, in situ test conducted in 1976 was located approximately 300 m [1,000 ft] north of Oshoto Reservoir, whereas the 1978 samples were collected approximately 900 m [3,000 ft] south of Oshoto Reservoir (Nubeth, 1977). The distance between the two sampling locations, and the westerly flow of the underlying ground water, would prevent mixing of the ground water in the two locations. TDS and sulfate measured in 1976 and 1978 are within the range of total concentrations of TDS and sulfate in the OZ aquifer, as reported by the Applicant and shown in Table 3.6. Maximum concentrations of dissolved iron and dissolved manganese measured in the OZ aquifer by the Applicant are greater, however, than the concentrations measured in 1978; this suggests that current oxygen levels in the OZ aquifer are lower than they were in the 1970s. In addition, the maximum concentrations of ammonia, most trace metals, radium, gross alpha, and gross beta measured in 1978 are greater than the maximum values in the OZ aquifer than those reported by the Applicant and shown in Table 3.6.

The Table 3.8 presents the WDEQ's and the U.S. Environmental Protection Agency's (EPA's) water-quality standards for constituents that were found to exceed the standards in the Applicant's pre-licensing, site-characterization data (WDEQ/WQD, 2005b; 40 CFR Part 41). Constituent concentrations that exceed the standards are indicated by shading in Tables 3.6 and Table 3.7.

Typical of uranium-bearing aquifers described in GEIS Section 3.3.4.3.3 (NRC, 2009b), the average TDS of each aquifer unit associated with the Ross Project area exceed the EPA's Secondary Maximum Contaminant Levels (MCLs) for drinking water of 500 mg/L, but they were within all the upper limits set by the WDEQ for Class II Agriculture Use (see Tables 3.6, 3.7, and 3.8) (WDEQ/WQD, 2005b). The two upper aquifers, the SA and the SM, contained lower TDS than the lower units, and the OZ aquifer contained the highest average TDS.

Comparison of the metals, radionuclides, ammonia, and fluoride to the EPA's MCLs for drinking water and WDEQ standards are provided in Tables 3.6, 3.7, and 3.8. Ammonia was measured in all four aquifer units at concentrations greater than the WDEQ's Domestic Use standard,

Table 3.6
Ground-Water Quality from the Ore-Zone (OZ) Aquifer and Aquifers Above (SM and SA) and Below (DM) the Ore Zone

Constituent	††	Units	Ross Project Monitoring-Well Data Collected (2009 – 2011†)											
			SA			SM			OZ			DM		
			Min	Ave	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave	Max
Bicarbonate	T	mg/L	<5	*	572	<5	*	752	478	583	662	<5	*	448
Calcium	T	mg/L	2	21	54	<1	*	3	3	6	11	1	3	8
Carbonate	T	mg/L	<5	*	218	25	98	250	8	26	52	22	103	324
Chloride	T	mg/L	2	29	86	2	4	8	3	7	11	139	491	818
Magnesium	T	mg/L	<1	*	35	<1	*	2	1	2	3	<1	*	2
Potassium	T	mg/L	7	12	22	4	15	47	3	6	17	8	19	48
Sodium	T	mg/L	78	224	416	275	417	542	368	545	718	302	520	807
Sulfate	T	mg/L	84	172	347	179	318	574	294	602	937	<1	*	234
TDS	T	mg/L	370	730	1230	830	1145	1350	1050	1574	2070	870	1321	2130
pH (Lab)	T	s.u.	8.1	9.0	11	8.7	9.5	11.6	8.4	8.7	9	8.7	10	11.7
Ammonia	T	mg/L	<0.1**	*	0.6	<0.1	*	2.8	<0.1	*	0.8	<0.1	*	3.9
Arsenic	D	mg/L	<0.005	*	<0.005	<0.005	*	0.023	<0.005	*	<0.005	<0.005	*	0.014
Barium	D	mg/L	<0.5	*	<0.5	<0.5	*	<0.5	<0.5	*	<0.5	<0.5	*	<0.5
Boron	D	mg/L	<0.1	*	0.3	0.2	0.5	0.8	0.3	0.4	0.6	0.3	0.8	1
Cadmium	D	mg/L	<0.002	*	<0.002	<0.002	*	<0.002	<0.002	*	<0.002	<0.002	*	<0.002
Chromium	D	mg/L	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01
Copper	D	mg/L	<0.01	*	<0.01	<0.01	*	0.02	<0.01	*	<0.01	<0.01	*	<0.01
Fluoride	T	mg/L	0.1	0.3	0.8	0.8	1.3	2.1	0.2	0.5	1.3	0.8	1.1	1.6
Iron	D	mg/L	<0.05	*	0.66	<0.05	*	0.21	<0.05	*	0.69	<0.05	*	0.4
Lead	D	mg/L	<0.02	*	<0.02	<0.02	*	<0.02	<0.02	*	<0.02	<0.02	*	<0.02
Mercury	D	mg/L	<0.001	*	<0.001	<0.001	*	<0.001	<0.001	*	<0.001	<0.001	*	<0.001
Manganese	D	mg/L	<0.02	*	0.36	<0.02	*	0.88	<0.02	*	0.06	<0.02	*	0.37
Molybdenum	D	mg/L	<0.02	*	0.07	<0.02	*	0.05	<0.02	*	<0.02	<0.02	*	0.06
Nickel	D	mg/L	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01	<0.01	*	<0.01
Selenium	D	mg/L	<0.005	*	0.008	<0.005	*	0.017	<0.005	*	0.009	<0.005	*	0.03
Silver	D	mg/L	<0.003	*	0.006	<0.003	*	0.011	<0.003	*	<0.003	<0.003	*	0.005
Uranium	D	mg/L	<0.001	*	0.007	<0.001	*	0.004	0.005	*	0.109	<0.001	*	0.003
Vanadium	D	mg/L	<0.02	*	<0.02	<0.02	*	0.02	<0.02	*	<0.02	<0.02	*	<0.02
Zinc	D	mg/L	<0.01	*	1.32	<0.01	*	0.03	<0.01	*	0.02	<0.01	*	0.09
Radium-226	D	pCi/L	<0.2	*	0.5	<0.2	*	3.7	0.6	3.8	12.1	<0.2	*	0.7
Radium-228	D	pCi/L	<1	*	1.8	<1	*	12.27	<1	*	1.6	<1	*	2.2
Gross Alpha	T	pCi/L	<6	*	13.8	<3	*	12.2	<5	*	222	<2	*	28.3
Gross Beta	T	pCi/L	<7	*	17.6	<3	*	319**	<7	*	46.8	<7	*	41

Sources: Strata, 2011a; Strata, 2012a. The complete data set is presented in Appendix C.

† = Shading indicates a value greater than WDEQ and EPA Water-Quality Standards (see Table 3.8).

†† = "D" indicates dissolved concentrations (i.e., the sample was filtered before analysis) and "T" means total concentrations (i.e., the sample was not filtered before analysis).

* = Indicates that one or more values are less than the detection limit; thus an average was not calculated.

** = Indicates that "319" appears to be an anomalous value; the next lowest value is 42.5 (see text).

< = Less than, where the value following the "<" value is the detection limit.

N/A = Datum not available.

Table 3.7
Ground-Water Quality of the Ore-Zone Aquifer and the Aquifer Above the Ore Zone at Nubeth in 1978

		Nubeth Well Data (1976†) Ore Zone Pre-Test Sample	Nubeth Well Data Collected (1978†)				
			Ore Zone			Above Ore Zone	
Constituent††	Units		Min	Ave	Max	Ave	Max
Bicarbonate	mg/L	400	535	594	742	653	682
Calcium	mg/L	11	1.2	6.3	15	6	11
Carbonate	mg/L	94	5	22	57	17	23
Chloride	mg/L	20	2	9.5	14	6	11
Magnesium	mg/L	4	1.4	2.7	3.4	2.7	3.0
Potassium	mg/L	6	2.6	5.1	12	3.9	5.0
Sodium	mg/L	489	481	620	734	592	643
Sulfate	mg/L	525	347	718	970	567	620
TDS	mg/L	1379	1230	1626	1800	1498	1530
pH	s.u.	8.4	8.4	8.7	9.2	8.6	8.8
Ammonia	mg/L	0.55	0.29	0.73	1.7	0.53	0.70
Arsenic	mg/L	Not Detected	<0.002	*	0.036	<0.005	0.032
Barium	mg/L	Not Detected	<0.01	*	<0.01	<0.10	<0.10
Boron	mg/L	0.45	0.2	0.5	0.6	0.6	0.7
Cadmium	mg/L	Not Detected	0.004	0.005	0.007	0.004	0.007
Chromium	mg/L	Not Detected	<0.01	*	0.026	<0.01	<0.01
Copper	mg/L	0.01	<0.01	*	0.022	0.01	0.025
Fluoride	mg/L	N/A	N/A	N/A	N/A	N/A	N/A
Iron	mg/L	N/A	0.01	0.09	0.28	0.074	0.17
Lead	mg/L	Not Detected	0.01	0.04	0.07	0.037	0.070
Mercury	mg/L	Not Detected	<0.00001	*	0.0001	0.00003	0.00004
Manganese	mg/L	Not Detected	0.002	0.012	0.021	0.014	0.019
Molybdenum	mg/L	Not Detected	<0.002	*	0.006	<0.005	<0.005
Nickel	mg/L	N/A	0.01	0.019	0.041	0.016	0.027
Selenium	mg/L	Not Detected	<0.005	*	0.022	<0.005	<0.005
Silver	mg/L	Not Detected	<0.005	*	0.011	<0.005	<0.005
Uranium	mg/L	0.19**	0.002	0.07	0.3	0.004	0.008
Vanadium	mg/L	Not Detected	<0.005	*	<0.01	<0.005	<0.005
Zinc	mg/L	0.33	0.004	0.011	0.046	0.016	0.025
Radium-226	pCi/L	30	0	23	107	0.26	0.50
Radium-228	pCi/L	N/A	N/A	N/A	N/A	N/A	N/A
Gross Alpha	pCi/L	340	1	106	340	1.4	3.9
Gross Beta	pCi/L	33	0	96	390	3.2	15

Sources: Nubeth, 1977; Nuclear Dynamics, 1978.

Notes:

† = Shading indicates a value greater than WDEQ and EPA Water Quality Standards (see Table 3.8)

†† = All constituents reported as dissolved concentrations (i.e., the samples were filtered).

***** = Indicates that one or more values are less than the detection limit; thus, an average was not calculated.

****** = Indicates that the uranium concentration is expressed as U_3O_8.

< = Less than, where the value following the "<" value is the detection limit.

N/A = Datum not available.

Table 3.8
Water-Quality Standards Exceeded in Ground Water at Ross Project Area (Pre-Licensing, Site-Characterization Samples)

Water-Quality Constituent	Units	WDEQ Class I Domestic Use	WDEQ Class II Agriculture Use	EPA Primary MCL	EPA Secondary MCL
Ammonia	mg/L	0.5	N/A	N/A	N/A
Arsenic	mg/L	0.05	0.1	0.01	N/A
Boron	mg/L	0.75	0.75	N/A	N/A
Chloride	mg/L	250	100	N/A	250
Iron	mg/L	0.3	5	N/A	0.3
Manganese	mg/L	0.05	0.2	N/A	0.05
Selenium	mg/L	0.05	0.02	0.05	N/A
Sulfate	mg/L	250	200	N/A	250
Total Dissolved Solids (TDS)	mg/L	500	2000	N/A	500
Uranium	mg/L	N/A	N/A	0.03	N/A
Radium-226 + 228	pCi/L	5	5	5	N/A
Gross Alpha	pCi/L	15	15	15	N/A

Source: WDEQ/WQD, 2005b; 40 CFR Part 41.

Notes:

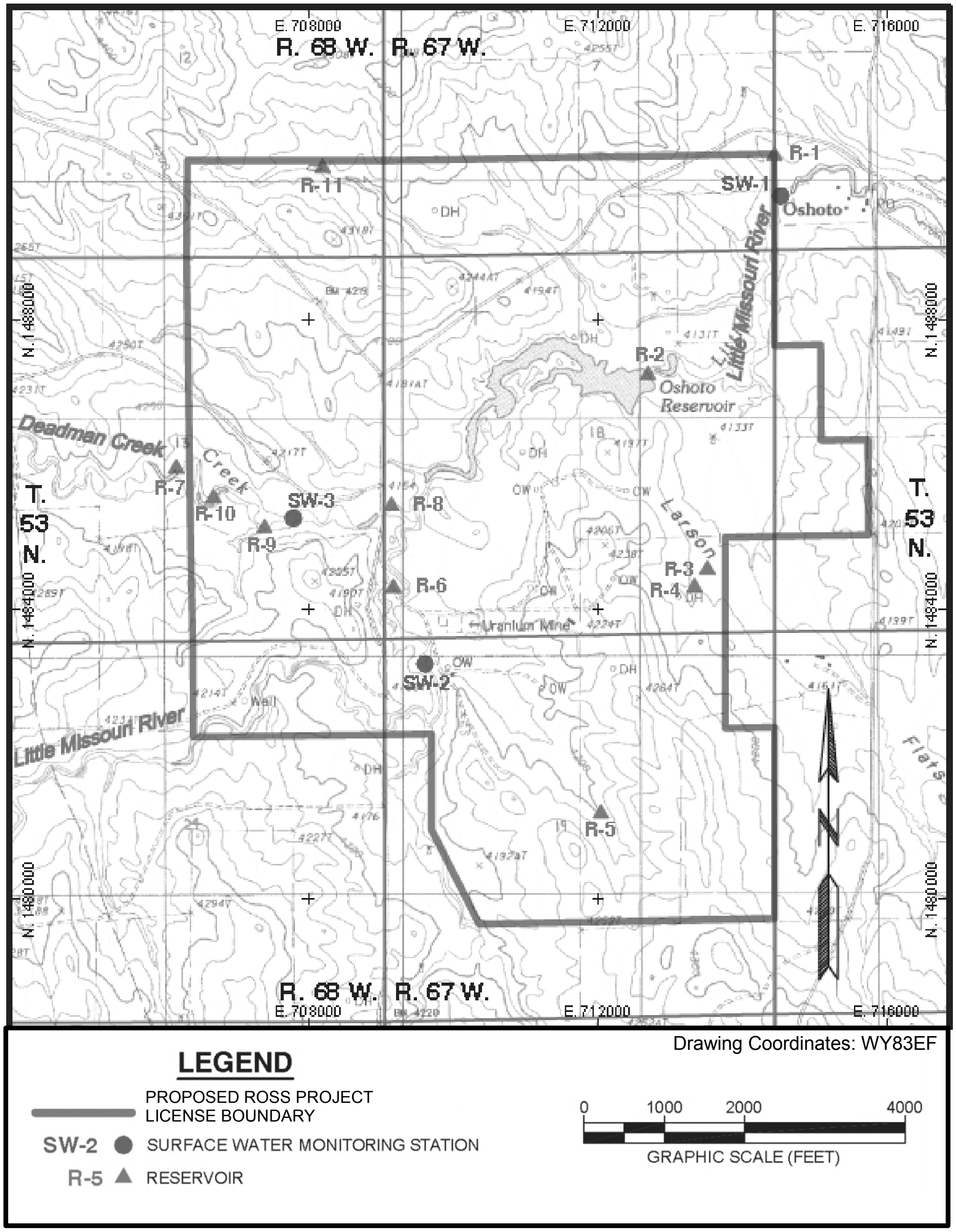
N/A = Not applicable.

Per the WDEQ/LQD's *Hydrology*, Guideline No. 8 and NRC's *Regulatory Guide 4.14*, the water-quality data produced by the Applicant and used for a comparison with the water-quality standards above are dissolved concentrations, except for ammonium, chloride, fluoride, sulfate, and TDS (WDEQ/LQD, 2005b; NRC, 1980).

0.5 mg/L. Iron and manganese were present in all aquifer units in concentrations greater than WDEQ's Domestic Use standard and EPA's Secondary MCL for drinking water, except for iron in the SM aquifer, which was less than the respective standards. Arsenic was measured in concentrations greater than the EPA's Primary MCL for drinking water in the SM aquifer, but less than the WDEQ's Domestic Use standard. Boron was present at concentrations greater than the WDEQ Domestic Use standard in the SM and DM. Uranium and Ra-226 were present in the OZ at concentrations greater than the standards (see Table 3.8). Gross alpha exceeded the standards in both the OZ and DM aquifers.

As part of its pre-licensing, site-characterization ground-water sampling and analysis efforts, the Applicant identified 29 currently operable water-supply wells within the Ross Project area and the surrounding 2-km (1.2-mi) area (Strata, 2011a). These wells included 2 industrial wells, 12 domestic wells, and 15 stock wells (1 industrial well could not be accessed nor sampled). The locations of these wells are shown in FSEIS Figure 3.16.

The two industrial wells, completed at depths of 163 m and 229 m [536 ft and 750 ft], were permitted in the early 1980s and provide water for enhanced oil recovery (EOR). Water used in



Source: Strata, 2011a.

Figure 3.16
Locations of 29 Water-Supply Wells
within a 3-Kilometer [2-Mile] Radius of Ross Project Area

EOR is injected into the oil-bearing rock to displace oil from the rock, thus allowing the oil to be pumped to the surface. Well 19XX18 was originally used by Nubeth as a recovery well for its research and development activities, before being converted to a water-supply well for the nearby EOR. The Applicant's review of the well-permit reports listed in the WSEO database during 2010 determined general information about each well (WSEO, 2006; Strata, 2011a). Completion depths of permitted stock wells range from 10 – 93 m [40 – 304 ft]. Domestic wells are generally deeper than the stock wells, ranging from 46 – 180 m [150 – 600 ft]. The limited information available on these wells precluded a determination of which aquifer was supplying water to the domestic wells.

The water-supply wells were sampled in consecutive quarters in 2009, 2010, and 2011 with the same methods established for monitoring wells (Strata, 2011a). The results of the water-quality analyses are provided in the Applicant's license application and subsequent information received by the NRC (Strata, 2011a; Strata, 2012a); all of the data provided by the Applicant are included as Appendix C in this SEIS. Comparisons between the measured water quality and the WDEQ's Use standards and the EPA's Primary and Secondary MCL standards are also discussed in the Applicant's ER (WDEQ/WQD, 2005b; 40 CFR 141; Strata, 2011a). As described below for each type of well, these analyses indicated that the TDS of 26 of the 29 local wells supplying water to homes, industry, and/or livestock exceeded 500 mg/L, which is the WDEQ's Class I Domestic Use standard and the EPA's Secondary MCL for drinking water, and some of the wells exceeded both the WDEQ's Domestic and Agricultural Uses and the EPA's standards for other parameters.

Domestic Wells

TDS in samples from all domestic wells sampled exceeded both Wyoming's Class I Domestic Use and the EPA's Secondary MCL for drinking water standards. Sulfate exceeded Wyoming's Class I Domestic Use, Wyoming's Class II Agricultural Use, and the EPA's Secondary MCL in 7 of the 12 wells sampled. Gross alpha in excess of Wyoming's Class I Domestic Use and Class II Agriculture Use standard as well as the EPA's Primary MCL of 0.55 Bq/L [15 pCi/L] was measured in samples from 4 of the 12 domestic wells. Wyoming's Class I Domestic Use standard and the respective EPA Secondary MCL for iron were exceeded in three of the wells.

Industrial Wells

Samples from the industrial wells in Ross Project area exceeded Wyoming's Class II Agriculture Use standards and the EPA's Secondary MCLs for TDS and sulfate. Wyoming's Class II Agriculture Use standard and the EPA's MCLs were exceeded in Well 19XX18 for radiological parameters: uranium, Ra-226 + 228, and gross alpha. The gross-alpha standards were also exceeded in samples from Well 22X-19.

Stock Wells

The quality of the water in livestock wells is variable. TDS ranged from 370 – 1,610 mg/L; TDS measured in 12 of the 15 wells exceeded the EPA's Secondary MCL for drinking water, but the concentrations were consistently less than the WDEQ's Class II Agriculture Use standard of 2,000 mg/L. Sulfate, ranging from 28 – 679 mg/L, often exceeded Wyoming's Class II Agriculture Use standard and the EPA's Secondary MCL. Gross alpha exceeded Wyoming's Class I Domestic Use and Class II Agriculture Use standards and the EPA's Primary MCL for drinking water in 7 of the 15 stock wells. Selenium exceeded the respective Wyoming Class II Agriculture Use standard in three wells and the EPA's Primary MCL in one well.

3.5.3.4 Ground-Water Uses

In order to assess historical and current ground-water use, ground-water rights and unregistered water wells were investigated by the Applicant within the Ross Project area and the surrounding 3-km [2-mi] vicinity. Sources of data included WSEO-registered wells, landowner interviews, and field surveys (WSEO, 2006). The search revealed 119 ground-water rights and unregistered wells. The locations and uses of these wells are summarized in the Applicant's ER (Strata, 2011a). Historical ground-water use began with the first domestic and livestock well in 1918. From approximately 1918 – 1977, ground water was used primarily for domestic and livestock consumption, with lesser amounts of water used for irrigation.

In 1977, Nubeth permitted 14 monitoring and industrial-use wells associated with its research and development activities. In addition, between 1980 and 1991, many industrial and miscellaneous wells associated with oil and gas production were permitted in and around the Ross Project area. These include three wells within the Ross Project area itself (P50917W, P67746W and P67747W) that are currently used as water-supply wells for EOR (i.e., water flooding) (Strata, 2011a). In 1981, International Minerals & Chemical Corporation (IM&CC) permitted five pits (P58895W, P58896W, P58899W, P58902W, and P58905W) for dewatering and dust suppression associated with bentonite mining. According to WSEO records, the water rights were cancelled prior to 2001 at the request of IM&CC.

Between 1991 and 2009, the only ground-water rights that were filed within the Ross Project area and surrounding vicinity are for domestic and livestock use. In 2009, the Applicant obtained ground-water rights for its pre-licensing, site-characterization monitoring wells. Historical ground-water use within the Ross Project area is summarized in Table 3.9.

Within the Ross Project area itself, ground-water use follows a similar pattern to that observed within the 3-km [2-mile] surrounding vicinity, except that historical use has been livestock only (i.e., no domestic or irrigation use). More recent uses include monitoring-well use as well as industrial uses associated with Nubeth and with water supply for oil- and gas-extraction activities. Most of the ground-water rights represented in Table 3.9 have been cancelled or are no longer active.

Current ground-water use in the Ross Project area is limited to four livestock wells, the Applicant's regional pre-licensing, site-characterization monitoring wells, and three industrial wells (i.e., water supply for oil and gas extraction). The stock wells are completed at total depths ranging from 39 – 81 m [128 – 265 ft], which are considerably above the ore-zone aquifer. The currently operating, industrial water wells are completed at total depths of 163 – 230 m [536 – 750 ft]. Together, these wells withdraw an average of approximately 2 L/s [30 gal/min] from the ore-zone aquifer.

Table 3.9 Historical Ground-Water Use within Three Kilometers [Two Miles] of Ross Project Area			
Use	**Number of Wells**	**Percent of Total Use**	**Appropriation Dates**
Domestic Only	5	4	1943 – 1995
Domestic and Stock	15	13	1918 – 2003
Domestic, Stock, and Irrigation	1	<1	1972 – 1972
Stock Only	34	29	1933 – 2010
Stock and Irrigation	1	<1	1961 – 1961
Monitoring	39	33	1977 – 2010
Industrial or Miscellaneous	24	20	1977 – 1991
TOTAL	119	100	1918 – 2010

Source: Strata, 2011a.

3.6 Ecology

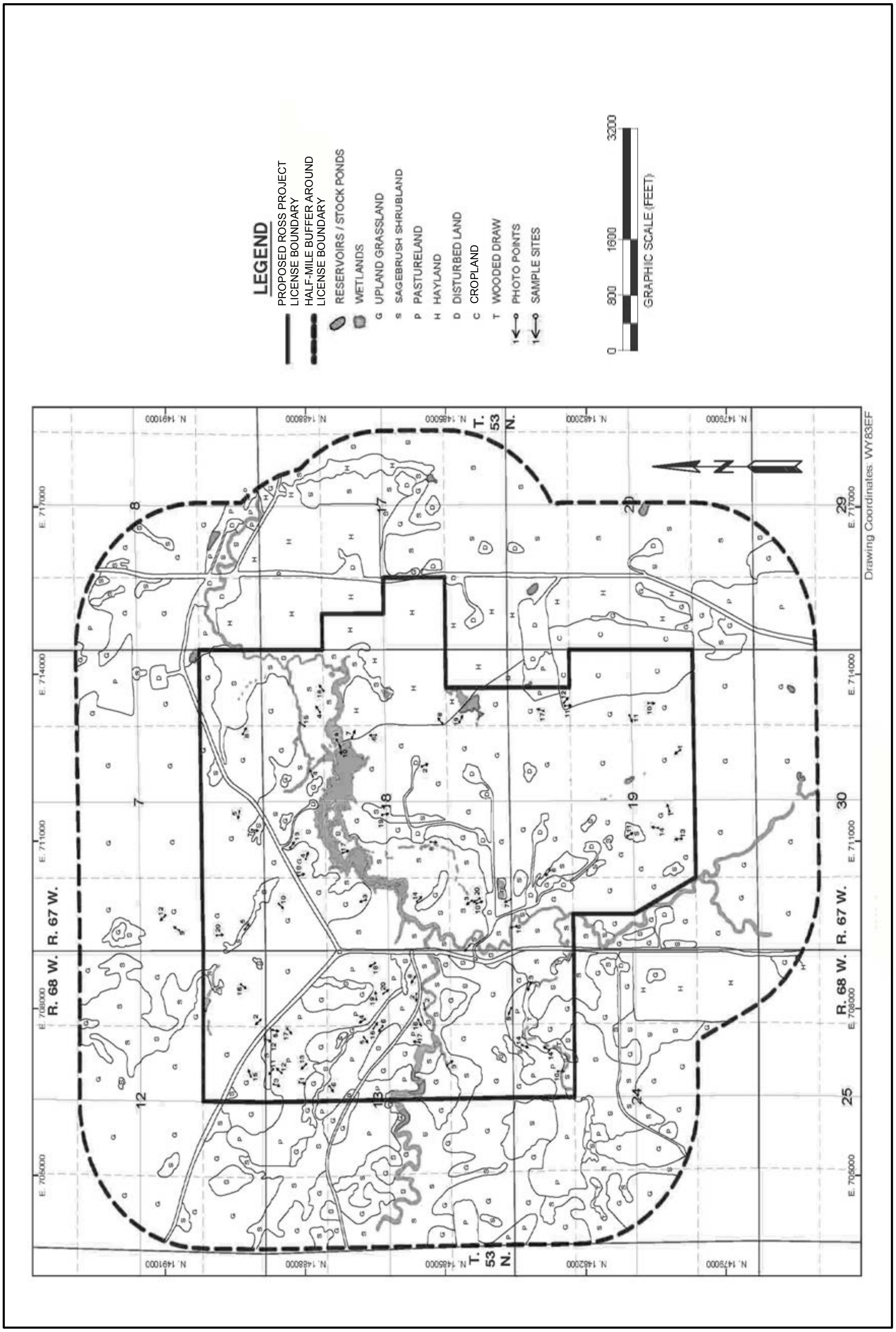
The Proposed Action is located within the Powder River Basin of the Northwest Great Plains ecoregion. As described in GEIS Section 3.3.5.1, this area is characterized by rolling prairie and dissected river breaks surrounding the Powder, Cheyenne, and Upper North Platte Rivers (NRC, 2009b). Vegetation within this region is composed of sagebrush and mixed-grass prairie dominated by blue grama (*Bouteloua gracilis*), western wheatgrass (*Pascopyrum smithii*), needle-and-thread grass (*Stipa comata*), rabbitbrush (*Chrysothamnus sp.*), fringed sage (*Artemisia frigida*), and other forbs, shrubs, and grasses (NRC, 2009b).

The Applicant has conducted a number of ecological studies of the proposed Ross Project area to address the guidelines indicated in NUREG–1569, including the identification of important species and their relative abundance, as well as to meet applicable Wyoming requirements (NRC, 2003b). These studies included vegetation and wildlife field surveys conducted on the Ross Project area in late 2009 and 2010 (Strata, 2011a).

3.6.1 Terrestrial Species

3.6.1.1 Vegetation

The Applicant conducted pre-licensing, site-characterization vegetation surveys during 2009 and 2010, in accordance with State and Federal guidelines (Strata, 2011a). The spatial distribution of the vegetation types within the Ross Project area are shown in Figure 3.17. The vegetation mapped at the Ross Project area included upland grassland, sagebrush shrubland, pastureland, hayland, reservoir/stock pond, wetland, disturbed land, cropland, and wooded draw. No threatened or endangered plant species have been documented on the Ross Project area.



Source: Strata, 2011a.

Figure 3.17
Vegetation Types at Ross Project Area

Each vegetation community was investigated by the Applicant to establish a pre-licensing site characterization in support of the Ross Project. In terms of diversity, the sagebrush-shrubland vegetation type exhibited the highest total number of individual plant species recorded in 2010, followed by the upland-grassland and pastureland vegetation types (see Table 3.10).

Table 3.10
Species Diversity by Vegetation Type at Ross Project Area

Species Type	Number of Individual Plant Species Recorded		
	Sagebrush Shrubland	**Upland Grassland**	**Pastureland**
Perennials			
Grass	16	16	9
Grass-like	2	2	0
Forb	28	27	6
Subshrub	4	4	1
Full Shrub	5	1	1
Succulent	1	1	0
Subtotal	**56**	**51**	**17**
Annuals			
Grass	2	2	0
Forb	7	3	1
Subtotal	**9**	**5**	**1**
TOTAL	**65**	**56**	**18**

Source: Strata, 2011a.

Several species of designated and prohibited noxious weeds listed by the *Wyoming Weed and Pest Control Act* were identified on the Ross Project area. These species included field bindweed (*Convolvulus arvensis*), perennial sow thistle (*Sonchus arvensis*), quackgrass (*Agropyron repens*), Canada thistle (*Cirsium arvense*), hounds tongue (*Cynoglossum officinale*), leafy spurge (*Euphorbia esula*), common burdock (*Arctium minus*), Scotch thistle (*Onopordum acanthium*), Russian olive (*Eleagnus angustifolia*), and skeletonleaf bursage (*Ambrosia tomentosa*). These weed species may be locally abundant in small areas, especially around the Oshoto Reservoir and along the Little Missouri River and Deadman Creek, but they were not common throughout the entire area of the Ross Project.

Selenium-indicator species identified on the Ross Project area in 2010 included two-grooved milkvetch (*Astragalus bisulcatus*), woody aster (*Xylorhiza glabriuscula*), and stemmy goldenweed (*Haplopappus multicaulis*); however, these indicator species were not abundant. Little larkspur (*Delphinium bicolor*), locoweed (*Oxytropis sericea* and *Oxytropis lambertii*), and meadow deathcamas (*Zigadenus venenosus*) are poisonous plants that were observed on the Ross Project area in limited numbers (locoweed is only poisonous for cattle). Cheatgrass (*Bromus tectorum*), although not a State-listed noxious weed, was abundant in some areas within the Ross Project area (Strata, 2011a).

3.6.1.2 Wildlife

Habitat Description

Information on terrestrial vertebrate wildlife species in the vicinity of the Ross Project area was obtained from several sources, including records from the WGFD, BLM, and USFWS as well as from GEIS Section 4.4.5 (NRC, 2009b). Previous site-specific data for the Ross Project area and its surrounding environs were obtained from those same sources and Nubeth's *Environmental Report Supportive Information* (ND Resources, 1977). In addition, the Applicant completed site-specific wildlife field surveys from November 2009 through October 2010 to establish one year of pre-licensing, site-characterization data (Strata, 2011a). Over 140 different species were noted during these surveys or documented by other sources (e.g., the WGFD) (see Table 3.11). The surveys also focused on the Applicant obtaining information regarding bald eagles' winter roosts; however, all nesting raptors, threatened and endangered species, the BLM's "Sensitive Species" (BLMSS), and the USFWS's "Birds of Conservation Concern" (BCC) (also known as "Migratory Birds of High Federal Interest"), and Wyoming's "Species of Greatest Conservation Need" (SGCN) were included in the field-survey protocols. Surveys were also conducted on the Ross Project area for swift fox, breeding birds, and northern leopard frogs. In addition to those species that were targeted, others were noted when observed.

Table 3.11
Wildlife Species Observed on or near Ross Project Area

Scientific Name	Common Name
Mammals	
Sylvilagus audubonii	Desert Cottontail
Lepus californicus	Black-tailed Jackrabbit
Lepus townsendii	White-tailed Jackrabbit
Tamias minimus	Least Chipmunk
Spermophilus tridecemlineatus	Thirteen-lined Ground Squirrel
Cynomys ludovicianus	Black-tailed Prairie Dog
Sciurus niger	Eastern Fox Squirrel
Thomomys talpoides	Northern Pocket Gopher
Dipodomys ordii	Ord's Kangaroo Rat
Castor Canadensis	Beaver
Peromyscus maniculatus	Deer Mouse
Neotoma cinerea	Bushy-tailed Woodrat

Table 3.11
Wildlife Species Observed on or near Ross Project Area
(*Continued*)

Scientific Name	Common Name
Mammals (*Continued*)	
Microtus 0ochrogaster	Prairie Vole
Ondatra zibethicus	Muskrat
Erethizon dorsatum	Porcupine
Canis latrans	Coyote
Vulpes vulpes	Red Fox
Procyon lotor	Raccoon
Mustela frenata	Long-tailed Weasel
Taxidea taxus	Badger
Mephitis mephitis	Striped Skunk
Felis concolor	Mountain Lion
Felis rufus	Bobcat
Cervus elaphus	American Elk
Odocoileus hemionus	Mule Deer
Odocoileus virginianus	White-tailed Deer
Antilocapra americana	Pronghorn
Birds	
Branta canadensis	Canada Goose
Cygnus buccinator	Trumpeter Swan
Cygnus columbianus	Tundra Swan
Anas strepera	Gadwall
Anas americana	American Wigeon
Anas platyrhynchos	Mallard
Anas discors	Blue-winged Teal
Anas crecca	Green-winged Teal
Anas cyanoptera	Cinnamon Teal
Anas clypeata	Northern Shoveler
Anas acuta	Northern Pintail
Aythya valisineria	Canvasback

Table 3.11
Wildlife Species Observed on or near Ross Project Area
(*Continued*)

Scientific Name	Common Name
Birds (*Continued*)	
Aythya americana	Redhead
Aythya collaris	Ring-necked Duck
Aythya affinis	Lesser Scaup
Bucephala albeola	Bufflehead
Oxyura jamaicensis	Ruddy Duck
Podilymbus podiceps	Pied-billed Grebe
Podiceps auritus	Horned Grebe
Podiceps nigricollis	Eared Grebe
Pelecanus erythrorhynchos	White Pelican
Phalacrocorax auritus	Double-crested Cormorant
Ardea herodias	Great Blue Heron
Cathartes aura	Turkey Vulture
Pandion haliaetus	Osprey
Haliaeetus leucocephalus	Bald Eagle
Circus cyaneus	Northern Harrier
Accipiter striatus	Sharp-shinned Hawk
Accipiter cooperii	Cooper's Hawk
Buteo swainson	Swainson's Hawk
Buteo jamaicensis	Red-tailed Hawk
Buteo regalis	Ferruginous Hawk
Buteo lagopus	Rough-legged Hawk
Aquila chrysaetos	Golden Eagle
Falco sparverius	American Kestrel
Falco mexicanus	Prairie Falcon
Centrocercus urophasianus	Greater Sage-grouse
Tympanuchus phasianellus	Sharp-tailed grouse
Meleagris gallopavo	Wild Turkey
Porzana carolina	Sora Rail
Fulica americana	American Coot

Table 3.11
Wildlife Species Observed on or near Ross Project Area
(*Continued*)

Scientific Name	Common Name
Birds (*Continued*)	
Charadrius vociferous	Killdeer
Recurvirostra americana	American Avocet
Bartramia longicauda	Upland Sandpiper
Actitis macularia	Spotted Sandpiper
Gallinago delicata	Wilson’s Snipe
Phalaropus tricolor	Wilson's Phalarope
Larus californicus	California Gull
Larus argentatus	Herring Gull
Chlidonias niger	Black Tern
Columba livia	Rock Pigeon
Zenaida macroura	Mourning Dove
Bubo virginianus	Great Horned Owl
Asio flammeus	Short-eared Owl
Chordeiles minor	Common Nighthawk
Ceryle alcyon	Belted Kingfisher
Picoides villosus	Hairy Woodpecker
Colaptes auratus	Northern Flicker
Contopus sordidulus	Western Wood-Pewee
Sayornis saya	Say's Phoebe
Tyrannus verticalis	Western Kingbird
Tyrannus tyrannus	Eastern Kingbird
Eremophila alpestris	Horned Lark
Tachyceneta bicolor	Tree Swallow
Tachycineta thalassina	Violet-green Swallow
Stelgidopteryx serripennis	Northern Rough-winged Swallow
Riparia riparia	Bank Swallow
Hirundo pyrrhonota	Cliff Swallow
Hirundo rustica	Barn Swallow
Cyanocitta cristata	Blue jay

Table 3.11
Wildlife Species Observed on or near Ross Project Area
(*Continued*)

Scientific Name	Common Name
Birds (*Continued*)	
Pica pica	Black-billed Magpie
Corvus brachyrhynchos	American Crow
Corvus corax	Common Raven
Parus atricapillus	Black-capped Chickadee
Sitta canadensis	Red-breasted Nuthatch
Salpinctes obsoletus	Rock Wren
Troglodytes aedon	House Wren
Sialia currucoides	Mountain Bluebird
Turdus migratorius	American Robin
Oreoscoptes montanus	Sage Thrasher
Toxostoma rufum	Brown Thrasher
Sturnus vulgaris	European Starling
Lanius ludovicianus	Loggerhead Shrike
Vermivora celata	Orange-crowned Warbler
Dendroica petechia	Yellow Warbler
Dendroica coronate	Yellow-rumped Warbler
Geothlypis trichas	Common Yellowthroat
Wilsonia pusilla	Wilson's Warbler
Spizella passerine	Chipping Sparrow
Spizella breweri	Brewer's Sparrow
Pooecetes gramineus	Vesper Sparrow
Chondestes grammacus	Lark Sparrow
Calamospiza melanocorys	Lark Bunting
Ammodramus savannarum	Grasshopper Sparrow
Junco hyemalis	Dark-eyed Junco
Calcarius mccownii	McCown's Longspur
Agelaius phoeniceus	Red-winged Blackbird
Sturnella neglecta	Western Meadowlark

Table 3.11
Wildlife Species Observed on or near Ross Project Area
(*Continued*)

Scientific Name	Common Name
Birds (*Continued*)	
Xanthocephalus xanthocephalus	Yellow-headed Blackbird
Euphagus cyanocephalus	Brewer's Blackbird
Quiscalus quiscula	Common Grackle
Molothrus ater	Brown-headed Cowbird
Icterus bullockii	Bullock's Oriole
Carpodacus mexicanus	House Finch
Carduelis pinus	Pine Siskin
Passer domesticus	House Sparrow
Amphibians	
Ambystoma tigrinum	Tiger Salamander
Pseudaris triseriata maculate	Boreal Chorus Frog
Rana pipiens	Northern Leopard Frog
Reptiles	
Phrynosoma douglassi brevirostre	Eastern Short-horned Lizard
Sceloporus graciosus graciosus	Northern Sagebrush Lizard
Chelydra serpentina serpentina	Common Snapping Turtle
Chrysemys picta belli	Western Painted Turtle
Crotalus viridis viridis	Prairie Rattlesnake
Pituophis melanoleucas sayi	Bullsnake
Thamnophis elegans vagrans	Wandering Garter Snake
Fish	
Ameiurus melas	Black Bullhead
Lepomis cyanellus	Green Sunfish
Lepomis macrochirus	Bluegill
Catastomus commersoni	White Sucker

Source: Strata, 2011a.

Mammals

Pronghorn antelope (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), and white-tailed deer (*O. virginianus*) were the only big-game species that were observed on the Ross Project area during the 2009 and 2010 surveys (Strata, 2011a). American elk (*Cervus elaphus*) have been recorded in the area by the WGFD; however, none were observed during the Applicant's field surveys. No crucial big-game habitats or migration corridors are recognized by the WGFD at the Ross Project or the surrounding 1.6-km [1-mi] vicinity.

Pronghorn antelope and mule deer are common but not abundant on the Ross Project area. Pronghorn herds were most often observed in sagebrush-shrubland and upland-grassland habitats, and the mule deer frequented the sagebrush-shrubland habitat (Strata, 2011a). Both species used haylands and cultivated fields in the area. White-tailed deer were not abundant, but they were observed in the riparian habitats and on the cultivated fields within and near the Ross Project area. Pronghorn antelopes' use of the Ross Project and surrounding areas has been classified by the WGFD as yearlong, and mule deer use within the areas as winter and yearlong. White-tailed deer and elk use has been classified by the WGFD as out of their normal range. The Ross Project is located within the WGFD's North Black Hills pronghorn-herd unit, the Powder River and Black Hills mule deer-herd units, and the Powder River and Black Hills white-tailed deer-herd units. The Ross Project area is not within a specific elk-herd unit, but it is included in the WGFD-designated area referred to as "Hunt Area 129" (Strata, 2011a).

A variety of small- and medium-sized mammals could potentially be present on the Ross Project area. These mammals include a variety of predators and furbearers, such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), badger (*Taxidea taxus*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*). Prey species that were observed included rodents (e.g., mice, rats, voles, gophers, ground squirrels, chipmunks, prairie dogs), jackrabbits (*Lepus spp.*), and cottontails (*Sylvilagus spp.*). These species are cyclically common and widespread throughout the vicinity, and they are important food sources for raptors and other predators. Each of these prey species was either directly observed during Strata's field surveys or was known to exist through the presence of burrow formation or of droppings. Jackrabbit and cottontail sightings were common.

While black-tailed prairie dogs (*Cynomys ludovicianus*) are listed as occurring in the general area of the Ross Project, no black-tailed prairie-dog colonies (important as habitat for black-footed ferrets) were located within the 1.6-km [1-mi] survey area. Other mammal species, such as the striped skunk (*Mephitis mephitis*), porcupine (*Erethizon dorsatum*), and various weasels (*Mustela spp.*) inhabit sagebrush grassland and riparian communities, and these species were recorded within the Ross Project area during the Applicant's wildlife field surveys. No bat species were observed during the surveys. There are no records of prior use of the Ross Project by swift fox (*Vulpes velox*), and none were observed during the 2009 or 2010 field surveys.

Birds

Suitable habitat for several raptor species occurs at the Ross Project area and within the 1.6-km [1-mi] vicinity surrounding it. Several raptor species were observed during the wildlife surveys; these included the bald eagle, red-tailed hawk (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), ferruginous hawk (*Buteo regalis*), Swainson's hawk (*Buteo swainsoni*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), Cooper's hawk (*Accipiter cooperii*), Sharp-shinned hawk (*Accipiter striatus*), rough-legged hawk (*Buteo lagopus*), great horned owl (*Bubo virginianus*), and short-eared owl (*Asio flammeus*). Turkey vultures (*Cathartes aura*) and prairie falcons (*Falco mexicanus*) have also been recorded on the Ross Project area, but they were not seen during the Applicant's field surveys.

In the vicinity of the Ross Project area, nests were observed for the ferruginous, red-tailed, and Swainson's hawks (Strata, 2011a). The only nest observed within the Project area itself was a Swainson's hawk's nest, which was observed to be inactive during the 2010 field survey. A total of seven intact nesting sites were observed within 1.6 km [1 mi] of the Ross Project area.

The wild turkey (*Meleagris gallopavo*), Greater sage-grouse (*Centrocercus urophasianus*), sharp-tailed grouse (*Tympanuchus phasianellus*), and mourning dove (*Zenaida macroura*) were observed at the Ross Project area by the Applicant. Mourning doves were recorded during the spring and summer months.

The Greater sage-grouse (*Centrocercus urophasianus*) is listed as a Federal candidate species and a Species of Greatest Conservation Need (SGCN) in Wyoming (75 *Federal Register* (FR) 13090; WGFD, 2005). Potential sage-grouse habitat is present at the Ross Project area (upland grassland, sagebrush shrubland, pastureland, hayland, and reservoir/stock ponds). Two leks, where male sage-grouse congregate for competitive mating displays, have been recorded within a few miles of the Ross Project area. Male sage-grouse assemble before and during the breeding season on a daily basis; the same group of males meet at the same traditional locations each season. Nonetheless, the Ross Project area is not located within a region currently designated as a sage-grouse core area by the WGFD. See SEIS Section 3.6.1.4, Protected Species, for further information regarding the Greater sage-grouse.

Breeding-bird surveys were conducted within the Ross Project area in four habitat types: upland grassland, sagebrush shrubland, pastureland/hayland, and wetland/reservoir. Twenty-seven species were recorded during the 2010 breeding-bird surveys. The wetland/reservoir habitat produced the greatest species diversity, with 19 species observed. The upland grassland habitat had the fewest species, with six species observed.

Natural aquatic habitats on the Ross Project occur at the Oshoto Reservoir and along the Little Missouri River. During the Applicant's wildlife field surveys, 17 waterfowl and 8 shorebird species were observed. In these categories, the horned grebe (*Podilymbus podiceps*) and upland sandpiper (*Bartramia longicauda*) are the only USFWS's BCC observed within or near the Ross Project area.

3.6.1.3 Reptiles, Amphibians, and Aquatic Species

During the Applicant's pre-licensing, site-characterization wildlife field surveys in 2009 and 2010, the eastern short-horned lizard (*Phrynosoma douglassi brevirostre*) and northern sagebrush lizard (*Sceloporus graciosus graciosus*) were often observed. Other reptiles observed in the area included the bullsnake (*Pituophis cantenifer*), wandering garter snake (*Thamnophis elegans vagrans*), and the prairie rattlesnake (*Crotalus viridis viridis*).

Water is a limiting factor for wildlife on the Ross Project area, where only one stream flows occasionally, and the Oshoto Reservoir is the major water feature within the Ross Project area.

All other natural drainages are categorized as intermittent or ephemeral (see SEIS Section 3.5.1). The lack of deep-water habitat and perennial water sources decreases the potential for many aquatic species to exist. Three aquatic or semi-aquatic amphibian species and two aquatic reptiles were recorded during the Applicant's pre-licensing, site-characterization surveys: the tiger salamander (*Ambystoma tigrinum*), boreal chorus frog (*Pseudacris triseriata*), northern leopard frog (*Rana pipiens)*, common snapping turtle (*Chelydra serpentine*), and western painted turtle (*Chrysemys picta*). All five species were heard and/or seen in the Oshoto Reservoir, Little Missouri River, or near stock reservoirs. All five species are common to the Ross Project area and the local vicinity as a whole. No egg masses were identified during the egg-mass surveys completed in early June 2010. The reason for their absence could have been that recent high winds might have broken up the egg masses and dispersed the individual eggs. During walking surveys along shorelines and riparian areas in August 2010, the leopard frog appeared to be quite common—over 500 individual adults were counted—while the chorus frog was uncommon.

The Applicant also conducted fish sampling from the Oshoto Reservoir in September 2010, under a WGFD Chapter 33 Collection Permit, as part of its establishing pre-licensing, site-characterization radiological conditions for the Ross Project. The dominant fish population in the Oshoto Reservoir included black bullheads (*Ameiurus melas*) and green sunfish (*Lepomis cyanellus*); white suckers (*Catastomus* commeroni) and bluegill (*Lepomis macrochirus*) were also present. The sample fish from this population were stunted in size for their ages; high reproductive rates and limited predation leads to over-population and stunted growth. The Oshoto Reservoir and the other water bodies within the Ross Project area are not considered viable sport fisheries (see SEIS Section 3.2.2).

3.6.1.4 Protected Species

The Ute ladies'-tresses orchid (*Spiranthes diluvialis*) is Federally listed as threatened. The species is a perennial, terrestrial orchid that occurs in Colorado, Idaho, Montana, Nebraska, Utah, Washington, and Wyoming. Within Wyoming, this orchid inhabits moist meadows with moderately dense but short vegetation cover. As noted in Fertig (2000), this species is found at elevations of 1,280 – 2,130 m [4,200 – 7,000 ft], though no known populations occur in Wyoming above 1,680 m [5,500 ft]. This species was not located during the Applicant's vegetation surveys, and it is not known to occur on or in the vicinity of the Ross Project area.

The blowout penstemon (*Penstemon haydenii*) is Federally listed as endangered, although it is not included on the list for Crook County. However, it is on the list for neighboring Campbell County, and the Applicant therefore evaluated the potential for the blowout penstemon to occur in the Ross Project area. This species is found exclusively in sparsely vegetated, early successional sand dunes or blowout areas at elevations of 1,786 – 2,268 m [5,860 – 7,440 ft] (Fertig, 2008). The Ross Project does not have sand-dune habitat, and it is outside of the elevation range in which this species is typically found. This species was not identified during Strata's vegetation field surveys; appropriate habitat was not identified; and it is not known to occur on or in the vicinity of the Ross Project area.

The black-footed ferret (*Mustela nigripes*) is a Federally listed endangered species, which inhabits prairie-dog colonies. A black-footed ferret survey was not required by USFWS requirements, because black-footed ferrets live exclusively in prairie-dog colonies, which are not present on or within 1.6 km [1 mi] of the Ross Project area (Strata, 2011a).

The bald eagle (*Haliaeetus leucocephalus*) was delisted from Federal threatened status in 2007, but it is still protected under the *Bald and Golden Eagle Protection Act* and the *Migratory Bird Treaty Act*. Potential habitat for bald-eagle nesting and roosting activities is quite limited within the Ross Project because of the lack of trees. Bald eagles were observed from the Ross Project area during wildlife surveys that took place November and December of 2009 and January through September of 2010 (Strata, 2011a). No nests were observed, however, and the bald eagle is considered to be a winter migrant to the area.

The Greater sage-grouse (*Centrocercus urophasianus*) is Federally listed as a Candidate species, as a Wyoming SGCN, and as a BLMSS. On March 5, 2010, the USFWS published a finding in the FR stating that listing of the species was warranted but was precluded by higher priority listing actions (75 FR 13909). The Governor of Wyoming issued Executive Order (EO) 2010-4 in August 2010, which was subsequently replaced in June 2011 by EO 2011-5. This is the State's current guidance, and it sets forth a permitting process and stipulations for developments that include ground-disturbing activities in designated sage-grouse core areas (WGFD, 2013).

The Greater sage-grouse inhabits open sagebrush plains in the western U.S. and is found at elevations of 1,200 – 2,700 m [3,900 – 8,860 ft], corresponding with the occurrence of sagebrush habitat (69 FR 933). The Greater sage-grouse is a mottled brown, black, and white ground-dwelling bird that can be up to 0.6 m [2 ft] tall and 76 cm [30 in] in length (69 FR 933). The birds' breeding habitat, referred to as leks (see SEIS Section 3.6.1.2), and the stands of sagebrush surrounding leks are used by sage-grouse in early spring. These areas are particularly important habitat because the birds often return to the same leks and nesting areas each year. Leks are generally more sparsely vegetated areas, such as ridgelines or disturbed areas adjacent to stands of sagebrush habitat.

One sage-grouse lek is known to occur within 3 km [2 mi] of the Ross Project area, the Oshoto Lek (Sections 28 and 29, T53N, 67W). The Cap'n Bob Lek (Section 32, T53 N, R67W) is located approximately 3.5 km [2.2 mi] from the Ross Project area; no other sage-grouse leks have been identified. Details of sage-grouse mating activities at these Leks are summarized in Table 3.12. A ground survey of the Oshoto and Cap'n Bob Leks were conducted by the Applicant on two days in April 2010. On the Cap'n Bob Lek, a total of two males and one female were observed on one day, and two males were observed on the second day; no sage-grouse were observed at the Oshoto Lek during the survey. No broods or brood-rearing areas were identified during the Applicant's 2010 survey. In addition, no sage-grouse wintering areas were identified on the Ross Project area (Strata, 2011a). Surveys completed by the WGFD in 2012 recorded one male at the Oshoto Lek, and four males at the Cap'n Bob Lek, as indicated in Table 3.12.

The primary threat to this species' survival is habitat loss and fragmentation (WGFD, 2013). Although the two Leks described earlier were recorded near the Ross Project, the Project area itself is not located within a designated sage-grouse core area; the area's location is, however, within the western range of the Greater sage-grouse. Sharp-tailed sage-grouse were observed on the Ross Project area during the 2009 winter field survey, and they are consequently considered yearlong residents of the Project area.

Table 3.12 Summary of Sage-Grouse Activity in Oshoto and Cap'n Bob Leks		
Year of Survey	**Oshoto**	**Cap'n Bob**
1985	6 males	No information
1988	0	″
1988	0	″
1991	0	″
1994	0	″
1997	0	″
2000	0	″
2001	5 males	″
2004	2 males	″
2007	0	10 males
2007	0	10 males
2010	0	2 males 1 female
2010	0	2 males
2012	1 male	4 males

Sources: Strata, 2011a; WGFD, 2013.

Table 3.13 lists species that occur in Crook County and that are listed by the USFWS as a BCC, are listed as a BLMSS, and/or are State-listed under the *Final Comprehensive Wildlife Conservation Strategy for Wyoming*.

Table 3.13 Species of Concern in Crook County and at Ross Project Area				
Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Mammals				
Hayden's Shrew *Sorex haydeni*			Tier III	

Table 3.13 Species of Concern in Crook County and at Ross Project Area (*Continued*)				
Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Mammals (Continued)				
Western Harvest Mouse *Reithrodontomys megalotis*				
Prairie Vole *Microtus ochrogaster*				Yes
Vagrant Shrew *Sorex vagrans*			Tier III	
Long-eared Myotis *Myotis evotis*		Yes	Tier II	
Northern Myotis *Myotis septentrionalis*			Tier II	
Little Brown Myotis *Myotis lucifugus*			Tier II	
Long-legged Myotis *Myotis volans*			Tier II	
Fringed myotis *Myotis thysanodes*		Yes	Tier II	
Hoary Bat *Lasiurus cinereus*				
Silver-haired Bat *Lasionycteris noctivagans*				
Big Brown Bat *Eptesicus fuscus*			Tier II	
Black-tailed Prairie Dog *Cynomys ludovicianus*				Yes
Plains Pocket Gopher *Geomys bursarius*			Tier II	
Olive-backed Pocket Mouse *Perognathus fasciatus*			Tier II	
Silky Pocket Mouse *Perognathus flavus*			Tier II	

Table 3.13
Species of Concern in Crook County and at Ross Project Area
(*Continued*)

Common Name *Scientific Name*	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Mammals ***(Continued)***				
Sagebrush Vole *Lemmiscus curtatus*				
Swift Fox *Vulpes velox*		Yes	Tier II	
Black-footed Ferret *Mustela nigripes*			Tier I	
Birds				
Waterfowl and Shorebirds				
Trumpeter swan *Cygnus buccinator*		Yes	Tier II	Yes
Northern Pintail *Anas acuta*			Tier II	Yes
Canvasback *Aythya valisineria*			Tier II	Yes
Redhead *Aythya americana*			Tier II	Yes
Lesser Scaup *Aythya affinis*			Tier II	Yes
Horned Grebe *Podiceps auritus*				Yes
Western Grebe *Aechmophorus occidentalis*				
American Bittern *Botauosus lentiginosus*	Yes		Tier II	
Great Blue Heron *Ardea herodias*				Yes
Black-crowned Night-Heron *Nycticorax nycticorax*			Tier II	
White-faced Ibis *Plegadis chihi*		Yes	Tier II	

Table 3.13 Species of Concern in Crook County and at Ross Project Area (*Continued*)				
Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Birds ***(Continued)***				
Waterfowl and Shorebirds ***(Continued)***				
Sandhill Crane *Grus canadensis*			Tier III	
Mountain Plover *Charadrius montanus*	Yes	Yes	Tier I	
Upland Sandpiper *Bartramia longicauda*	Yes		Tier II	Yes
Marbled Godwit *Limosa fedoa*				
Long-billed Curlew *Numenius americanus*	Yes	Yes	Tier II	
Raptors				
Bald Eagle *Haliaeetus leucocephalus*	Yes		Tier I	Yes
Northern Goshawk *Accipiter gentilis*	Yes	Yes	Tier I	
Swainson's Hawk *Buteo swainsoni*	Yes		Tier II	Yes
Ferruginous Hawk *Buteo regalis*	Yes	Yes	Tier I	Yes
Golden Eagle *Aquila chrysaetos*	Yes			Yes
Merlin *Falco columbarius*			Tier III	
Peregrine Falcon *Falco peregrinus*	Yes		Tier II	
Prairie Falcon *Falco mexicanus*	Yes			Yes
Burrowing Owl *Athene cunicularia*	Yes	Yes	Tier I	

Table 3.13
Species of Concern in Crook County and at Ross Project Area
(*Continued*)

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Birds (Continued)				
Raptors (*Continued*)				
Short-eared Owl *Asio flammeus*	Yes		Tier II	Yes
Upland Game				
Greater Sage-grouse *Centrocercus urophasianus*		Yes	Tier I	Yes
Other				
White Pelican *Pelecanus erythrorhynchos*				Yes
Franklin's Gull *Larus pipixcan*			Tier II	
Forster's Tern *Sterna forsteri*			Tier II	
Black Tern *Chlidonias niger*			Tier II	Yes
Black-billed Cuckoo *Coccyzus erythropthalmus*				
Yellow-billed Cuckoo *Coccyzus americanus*		Yes	Tier III	
Lewis's Woodpecker *Melanerpes lewis*			Tier II	
Pinyon Jay *Gymnorhinus cyanocephalus*				
Willow Flycatcher *Empidonax traillii*			Tier III	
Pygmy Nuthatch *Sitta pygmaea*			Tier II	
Sage Thrasher *Oreoscoptes montanus*		Yes	Tier II	Yes
Loggerhead Shrike *Lanius ludovicianus*		Yes		Yes

Table 3.13
Species of Concern in Crook County and on the Ross Project Area
(*Continued*)

Common Name ***Scientific Name***	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
***Birds* (*Continued*)**				
***Other* (*Continued*)**				
Dickcissel *Spiza americana*			Tier II	
Brewer's Sparrow *Spizella breweri*	Yes	Yes	Tier II	Yes
Sage Sparrow *Amphispoza belli*	Yes	Yes	Tier II	
Lark Bunting *Calamospiza melanocorys*			Tier II	Yes
Baird's Sparrow *Ammodramus bairdii*	Yes	Yes		
Grasshopper Sparrow *Ammodramus savannarum*			Tier II	Yes
McCown's Longspur *Calcarius mccownii*	Yes		Tier II	Yes
Chestnut-collared Longspur *Calcarius ornatus*			Tier II	
Bobolink *Dolichonyx oryzivorus*			Tier II	
Cassin's Finch *Carpodacus cassinii*				
Amphibians				
Tiger Salamander *Ambystoma tigrinum*				Yes
Plains Spadefoot *Scaphiopus bombifrons*			Tier III	
Great Plains Toad *Bufo cognatus*			Tier III	
Boreal Chorus Frog *Pseudaris triseriata maculate*				Yes

Table 3.13
Species of Concern in Crook County and at Ross Project Area
(*Continued*)

Common Name *Scientific Name*	**USFWS Birds of Conservation Concern**	**BLM Sensitive Species**	**Wyoming Species of Greatest Conservation Need (by Tier Status)**	**Observed on the Ross Project Area**
Amphibians (Continued)				
Bullfrog *Rana catesbeiana*				
Northern Leopard Frog *Rana pipiens*		Yes	Tier III	Yes
Reptiles				
Northern Sagebrush Lizard *Sceloporus graciosus graciosus*				Yes
Western Painted Turtle *Chrysemys picta belli*			Tier III	Yes
Prairie Rattlesnake *Crotalus viridis viridis*				Yes
Plains Hognose Snake *Heterondon nasicus nasicus*			Tier II	
Bullsnake *Pituophis melanoleucas sayi*				
Wandering Garter Snake *Thamnophis elegans vagrans*				
Eastern Yellowbelly Racer *Coluber constrictor flaviventris*				

Sources: Strata, 2011a; USFWS 2012b; WGFD, 2010.

In addition to the species previously discussed above, 17 bird species on the USFWS's list of Birds of Conservation Concern (BCC) could potentially be present within the Ross Project area. Of these 17 bird species, 8 have been observed within or near the Ross Project (see Table 3.13). Ten non-raptor or non-game bird species on the BLMSS list could potentially occur within the Ross Project. Of the ten bird species, four have been observed on or near the Ross Project area (see Table 3.14). Thirty-two non-raptor or non-game bird species on the SGCN list could potentially be present within the Ross Project area. Of the 32 bird species, 15 have been actually observed on or near the Project area (see Tables 3.13 and 3.14).

In addition to the species previously discussed above, 20 bird species on the USFWS's BCC list could potentially be present within the Ross Project area. Of these 20 bird species, 7 have been observed within or near the Ross Project (see Table 3.13). Ten non-raptor or non-game bird species on the BLMSS list could potentially occur within the Ross Project. Of the ten bird species, four have been observed on or near the Ross Project area (see Table 3.14). Thirty-two non-raptor or non-game bird species on Wyoming's SGCN list could potentially be present within the Ross Project area. Of the 32 bird species, 15 have been actually observed on or near the Project area (see Tables 3.13 and 3.14).

Table 3.14
Avian Species of Concern Observed at Ross Project Area

Common Name ***Scientific Name***	**Primary Nesting Habitat(s)**[1]	**Status**[2]
Level 1 Species of Concern/Conservation Needed		
Bald Eagle *Haliaeetus leucocephalus*	Montane Riparian, Plains/Basin Riparian	Uncommon yearlong resident
Ferruginous Hawk *Buteo regalis*	Shrub Steppe and Short-Grass Prairie	Summer uncommon resident
Upland Sandpiper *Bartramia longicauda*	Short-Grass Prairie	Summer uncommon resident
Short-eared Owl *Asio flammeus*	Short-Grass Prairie and Meadows	Common yearlong resident
Brewer's Sparrow *Spizella breweri*	Shrub Steppe and Mountain-Foothills Shrub	Common summer resident
Level 2 Species of Concern/Continued Monitoring Recommended		
Sage Thrasher *Oreoscoptes montanus*	Shrub Steppe	Common summer resident
Loggerhead Shrike *Lanius ludovicianus*	Shrub Steppe	Common summer resident
McCown's Longspur *Calcarius mccownii*	Shrub Steppe and Short-Grass Prairie	Common summer resident
Grasshopper Sparrow *Ammodramus savannarum*	Shrub Steppe and Short-Grass Prairie	Common summer resident

Table 3.14 Avian Species of Concern Observed at Ross Project Area (*Continued*)		
Common Name ***Scientific Name***	**Primary Nesting Habitat(s)[1]**	**Status[2]**
Level 2 Species of Concern/Continued Monitoring Recommended (Contined)		
Lark Bunting *Calamospiza melanocorys*	Shrub Steppe and Short-Grass Prairie	Abundant summer resident
Level 3 Species of Concern/Species of Local Interest		
Golden Eagle *Aquila chrysaetos*	Specialized (Cliffs)	Common yearlong resident
Prairie Falcon *Falco mexicanus*	Specialized (Cliffs)	Common yearlong resident

Sources: USFWS, 2011; USGS, 2006.

3.7 Meteorology, Climatology, and Air Quality

3.7.1 Meteorology

The region within which the Ross Project area is located is characterized by hot summers and cold winters, and rapid temperature fluctuations are common. The Rocky Mountains (the “Rockies”) have a great influence on the climate. As air crosses the Rockies from the west, much moisture is lost on the windward sides of the Mountains, and the air becomes warmer as it descends on the eastern slopes of the Rockies (NRC, 2009b). The Ross Project area is located in this semi-arid area (Strata, 2011a).

The closest National Weather Service (NWS) station with a long recording period is Gillette Airport, which is located 56 km [35 mi] southwest of the Ross Project (Strata, 2011a). As GEIS Section 3.4.6.1 noted, there is a NWS station in Crook County, at Colony, Wyoming (72 km [45 mi] northeast of the Ross Project) (NRC, 2009b). This station, however, ceased operation in 2008. In addition, the Applicant has installed a site-specific meteorology station in 2010, where meteorology data have been collected every month since the station went online (Strata, 2011a).

3.7.1.1 Temperature

As described in GEIS Section 3.4.6.1, the northwest Great Plains region has summer nights that are normally cool, even though daytime temperatures can be very warm. Winters can be quite cold; however, warm spells during winter months are common. The average temperatures for the two NWS stations in the vicinity of the Ross Project area, Colony and Gillette Airport, are shown in Table 3.15, in addition to the information collected by the Applicant in 2010 (NRC, 2009b; NWS, 2011; Strata, 2011a).

Table 3.15
Average, Minimum, and Maximum Temperatures in Ross Project Vicinity

Station	Average Temperature °C [°F]	Average Minimum Temperature °C [°F]	Average Maximum Temperature °C [°F]
Ross Project[1]	8.9 [48]	- 4.3 [24.3]	23.9 [75]
Gillette Airport[2]	8.1 [46.5]	N/A	N/A
Colony[3]	8.3 [47]	- 5.3 [22.5]	22.4 [72.3]

Source: Strata, 2011a; NRC, 2009b; NWS, 2011.

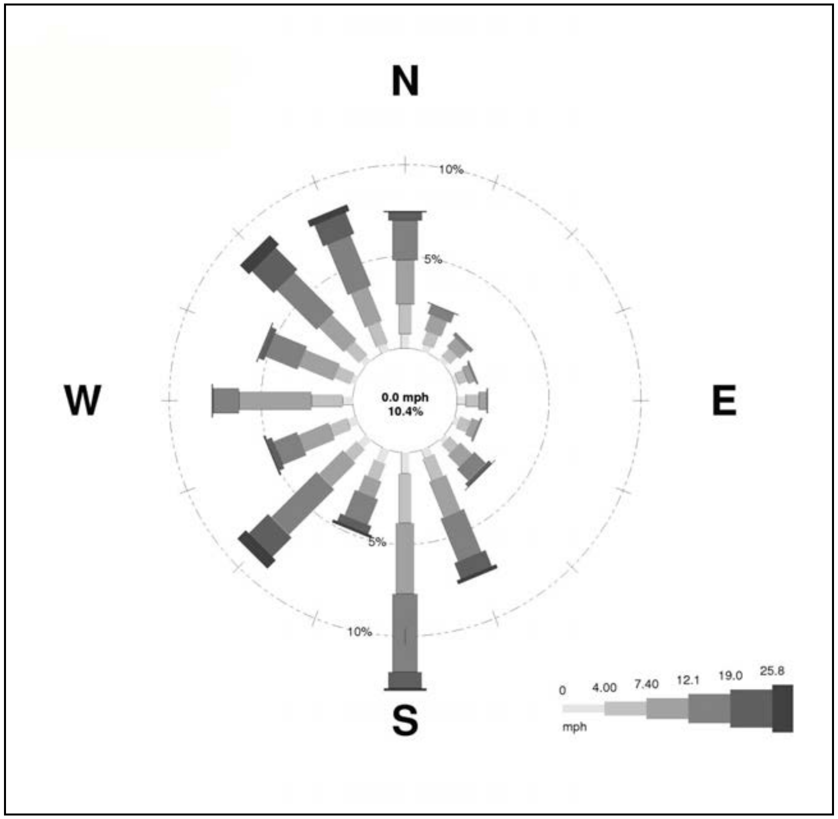
Notes: N/A = Data not available.
[1]Monitoring period = 2010.
[2]Monitoring period = 1902 – 2009.
[3]Monitoring period = 1971 – 2000.

At the Gillette Airport station, the warmest month of the year is July, with an average temperature of 23.6 °C [74.5 °F] (Strata, 2011a). The coldest month is December, with an average temperature of -4.7 °C [23.6 °F]. This trend was also observed at the Ross Project's meteorology station, with an average July temperature of 23.1 °C [73.6 °F] and an average December temperature of -4.7 °C [23 °F] for 2010.

3.7.1.2 Wind

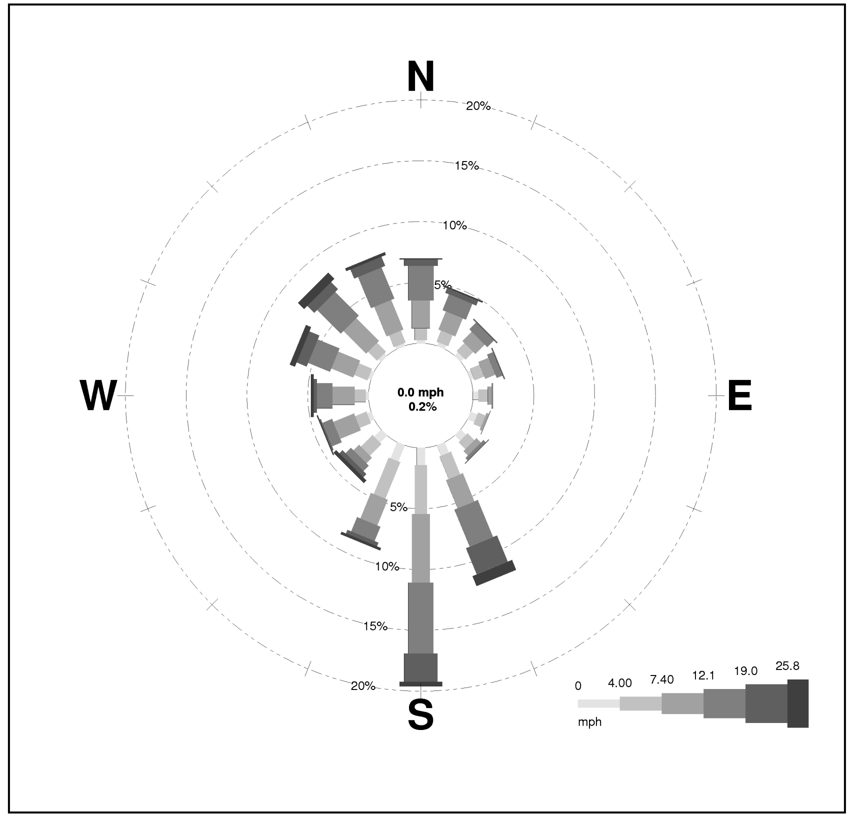
The wind speed at the Gillette Airport from 2000 – 2009 averaged 16.9 km/hr [10.5 mi/hr], with a maximum monthly wind speed of 77 km/hr [48 mi/hr] (see Figure 3.18) (Strata, 2011a). The highest winds were recorded in January through March, with the lowest speeds from July through September. As shown on the wind rose for the Ross Project area, the prevailing wind direction (as shown on Figure 3.19) is generally southerly. This is true throughout the year except for May, when the prevailing wind direction is from the southeast. Despite this southerly trend, the highest wind speeds tend to occur from the north-northwest.

During the 12 months of monitoring at the Applicant's meteorology station in 2010, the average annual wind speed was 18.7 km/hr [11.6 mi/hr], ranging from a minimum wind speed of 0.8 km/hr [0.5 mi/hr] to a maximum wind speed of 73.4 km/hr [45.6 mi/hr]. More southerly winds were recorded at the Ross Project than at the Gillette Airport station (as shown in Figure 3.18); however, as at Gillette Airport, the highest wind speeds are from the northwest.



Source: Strata, 2012a.

Figure 3.18
Gillette Airport Wind Rose



Source: IML, 2010, as shown in Strata, 2012a.

Figure 3.19
Ross Project Area Wind Rose

3.7.1.3 Precipitation

The Ross Project area and the surrounding area receive relatively little rainfall, with average annual precipitation ranging from 25 – 38 cm [10 – 15 in]. The region receives an average annual snowfall of 127 – 152 cm [50 – 60 in]. At the Gillette Airport station, between 2005 – 2009, the average annual precipitation was measured at 30.5 cm [12 in] (Strata, 2011a). Approximately one-half of the precipitation is associated with spring snows and thunderstorms. May is the wettest month, with more than 5 cm [2 in] of precipitation, while January is the driest month, with average precipitation of approximately 1.3 cm [0.5 in] or less (Strata, 2011a).

At the Applicant's onsite meteorology station, the total precipitation measured in 2010 was 24.8 cm [9.8 in], compared to 32.5 cm [12.8 in] for the same period at the Gillette Airport station (Strata, 2011a). The difference in precipitation during 2010 was primarily due to the fact that Gillette Airport received 6.4 cm [2.5 in] more in the month of May than the Ross Project. Otherwise, the monthly precipitation data are very similar.

3.7.1.4 Evaporation

As with the majority of the western U.S., the evaporation rate in northeastern Wyoming exceeds the rate of precipitation. As discussed in GEIS Section 3.4.6.1, evaporation rates in the region range from 102 – 127 cm/yr [40 – 50 in/yr] (NRC, 2009b). An evaporation pan was installed at the Ross Project's meteorology station in June 2010; however, data are available from only June through late October 2010, because the gauge was removed to prevent its freezing. At the Gillette Airport station, evaporation in 2010 varied from slightly more than 10 cm [4 in] in April to almost 25 cm [10 in] in July and August. For the period of time the evaporation pan operated at the Ross Project, similar rates were observed (Strata, 2011a).

3.7.1.5 Atmospheric Stability Classification and Mixing Height

Atmospheric stability classification and mixing height are environmental variables that influence the ability of the atmosphere to disperse air pollutants. The stability class is a measure of atmospheric turbulence, and mixing height characterizes the vertical extent of contaminants mixing in the atmosphere. The nearest upper-air data available from the NWS are from Rapid City, South Dakota, approximately 170 km [106 mi] southeast of the Ross Project (Strata, 2011a). However, Rapid City is approximately 300 m [1,000 ft] lower in elevation than the Ross Project, and it is on the other side of the Black Hills. Therefore, the data are likely not representative of conditions at the Ross Project area.

Stability-class information was collected using the Applicant's meteorological station, which demonstrated that the class distributions were predominantly neutral approximately 62 percent of the time. Other calculated conditions were Stability Class D (17 percent) and Class E (12.6 percent) (Strata, 2011a). The classification that results in the least vertical mixing, Class F, was approximately 4.7 percent of the time at the Ross Project area, while Classes A through C ranged from 3 – 6.7 percent (Strata, 2011a).

Average annual mixing heights were not reported, although Wyoming has provided statewide mixing heights to be used in dispersion modeling (see Table 3.16) (Strata, 2011a).

Table 3.16 Statewide Mixing Heights for Dispersion Modeling	
Stability Class	**Mixing Height (m [ft])**
Class A	3,450 [11,319]
Class B	2,300 [7,546]
Class C	2,300 [7,546]
Class D	2,300 [7,546]
Class E	10,000 [32,808]
Class F	10,000 [32,808]

Source: Strata, 2011a.

Stability classes E and F are given an arbitrarily high number by the WDEQ/Air Quality Division (AQD) to indicate an absence of a distinct boundary in the upper atmosphere.

3.7.2 Climatology

On a larger scale, climate change is a subject of national and international interest. The recent compilation of the current scientific understanding in this area by the U.S. Global Change Research Program (GCRP), a Federal advisory committee, was considered in preparation of this SEIS (GCRP, 2009). Average temperatures in the U.S. have risen more than 1.1 °C [2 °F] over the past 50 years and are projected to rise more in the future. During the period from 1993 – 2008, the average temperature in the Great Plains increased by approximately 0.83 °C [1.5 °F] from 1961 – 1979 temperatures (GCRP, 2009). The projected change in temperature over the period from 2000 – 2020, which encompasses the period that the Ross Project would be licensed, ranges from a decrease of approximately 0.28 °C [0.5 °F] to an increase of approximately 1.1 °C [3.4 °F]. Although the GCRP did not incrementally forecast a change in precipitation by decade, it did project a change in spring precipitation from the base period (1961 – 1979) to the next century (2080 – 2099). For the region in Wyoming where the Ross Project is located, the GCRP forecast a 10 – 15 percent increase in spring precipitation (GCRP, 2009).

The EPA has determined that potential changes in climate caused by greenhouse-gas (GHG) emissions endanger public health and welfare based upon a body of scientific evidence assessed by the GCRP as well as the National Research Council (74 FR 66496). The Administrator of the EPA has issued an endangerment finding based upon a technical-support document compiled by these scientific organizations. This endangerment finding specifies that, while ambient concentrations of GHG emissions do not cause direct adverse health effects (such as respiratory issues or toxic effects), public-health risks and impacts can result indirectly from changes in climate. Based upon the EPA's determination, the NRC recognizes that GHGs could have an effect on climate change. In Memorandum and Order CLI-09-21, the Commission provided guidance to the NRC staff to consider carbon dioxide and other GHG emissions in its *National Environmental Policy Act of 1969* (NEPA) reviews (NRC, 2009a). GHG emissions, as projected for the Ross Project, are considered as an element of the air-quality impacts evaluation in this SEIS; GHG emissions are discussed in SEIS Section 5 "Cumulative Impacts."

3.7.3 Air Quality

> **What is an air-quality attainment area?**
>
> The attainment status of an area refers to whether or not its air quality "attains" the National Ambient Air Quality Standards (NAAQS) for specific air pollutants ("criteria pollutants"). That is, an attainment area is a particular geographic area where the respective concentrations of primary (or "criteria") air pollutants meet the health-based NAAQS for the corresponding primary air pollutants. If the area persistently exceeds the NAAQS for one or more primary air pollutants, it is classified as being in "non-attainment" for the particular air pollutant(s) that exceed(s) the respective NAAQS standard. The Powder River Basin is an attainment area for PM_{10}.

As described in GEIS Section 3.4 (NRC, 2009b), all of the NSDWUMR is classified as an attainment area for all the primary criteria pollutants under the National Ambient Air Quality Standards (NAAQS) (NRC, 2009b). (The EPA sets NAAQS for air pollutants considered harmful to the public's health and the environment [40 CFR Part 50]. Some states, including Wyoming, also set their own Ambient Air Quality Standards, such as the Wyoming Ambient Air Quality Standards [WAAQS].) Primary NAAQS are established to directly protect public health, and secondary NAAQS are established to protect public welfare by safeguarding against environmental and property damage. As discussed in GEIS Section 3.4.6, the NAAQS defines acceptable ambient-air concentrations for six common nonradiological particulate and gaseous air pollutants (i.e., primary or criteria pollutants): nitrogen oxides (as NO_2), ozone (O_3), sulfur oxides (as SO_2), carbon monoxide (CO), lead (Pb), and particulate matter (less than 10 and 2.5 μm in diameter [PM_{10} and $PM_{2.5}$]). In particular, most of the Powder River Basin, where significant coal mining is ongoing, and which includes the Ross Project area, is currently designated an attainment area for all air pollutants (Strata, 2011a).

As noted above, states may develop standards that are more strict than or that supplement the NAAQS. The WDEQ/AQD has submitted a draft revision of its own WAAQS to the appropriate State boards. These revisions would result in Wyoming's adding one-hour NO_2 and SO_2 standards and revoking the current 24-hour and 1-hour standards for SO_2 of the existing WAAQS to be identical with NAAQS (see Table 3.17). The Wyoming-specific annual (arithmetic mean) PM_{10} standard of 50 μg/m^3 (0.025 ppm), which is required for short-term modeling of surface coal-mine emissions, will be retained. Some primary and secondary NAAQS are presented in Table 3.17 (WDEQ/AQD, 2010).

The air quality in the vicinity of the Ross Project area is currently in compliance with the NAAQS for all primary air pollutants, including particulates (i.e., fugitive dusts) and combustion-engine gaseous emissions.

3.7.3.1 Particulates

"Particulates" refers to particles that are suspended in the air. Some particulates are large enough to be seen (e.g., smoke and wind-blown dust), while others are too small to be visible. Agriculture, forestry, transportation, wind, and fire all contribute airborne particulates to the atmosphere. The NAAQS and WAAQS specify the allowable concentration of airborne particulates of 10 microns in diameter or smaller, or "PM_{10}," to 150 μg/m^3 [9.4 x 10^{-9} lb/ft^3] over

Table 3.17
National and Wyoming Ambient Air Quality Standards

Criteria Pollutant	National Primary Standards	Wyoming Primary Standards	Averaging Time	Secondary Standards
Carbon Monoxide	9 ppm (10,000 µg/m^3)	9 ppm (10,000 µg/m^3)	8 Hours†	N/A*
	35 ppm (40,000 µg/m^3)	35 ppm (40,000 µg/m^3)	1 Hour†	N/A
Nitrogen Dioxide	0.053 ppm (100 µg/m^3)	0.05 ppm (100 µg/m^3)	Annual Arithmetic Mean	Same as Primary
	0.100 ppm (187 µg/m^3)	0.100 ppm (187 µg/m^3)	1 Hour	N/A
Particulate Matter (10-µm Diameter) (PM_{10})	150 µg/m^3	150 µg/m^3	24 Hours	Same as Primary
	N/A	50 µg/m^3	Annual Arithmetic Mean	N/A
Particulate Matter (2.5-µm Diameter) ($PM_{2.5}$)	12.0 µg/m^3	12.0 µg/m^3	Annual Arithmetic Mean	Same as Primary
	35 µg/m^3	35 µg/m^3	24 Hours[a]	Same as Primary
Ozone	0.08 ppm (157 µg/m^3)	0.08 ppm (157 µg/m^3)	8 Hours[b]	Same as Primary
Sulfur Oxides	N/A	*23 ppm* (*Will Revoke*) *60 µg/m^3*	Annual Arithmetic Mean	N/A
	N/A	*100 ppm* (*Will Revoke*) *260 µg/m^3*	24 Hours†	N/A
	75 ppm 200 µg/m^3	*75 ppm* (*Will Add*) *200 µg/m^3*	1 Hour	N/A
	N/A	0.5 ppm (1,300 µg/m^3)	3 hours†	0.5 ppm (1,300 µg/m^3)

Sources: Modified from EPA's "National Ambient Air Quality Standards (NAAQS)," as of October 2011; WDEQ/AQD, 2012.

Notes:

† Not to be exceeded more than once per year.

* N/A = Not applicable.

[a] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35.0 µg/m^3 (effective December 18, 2006).

[b] To attain this standard, the 3-year average of the fourth highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.

Italics: Standard is in the rulemaking process in Wyoming. The intention is for WAAQS to reflect NAAQS, while retaining the State annual-average PM_{10} standard of 50 µg/m^3.

24 hours (see Table 3.17). Wyoming has a supplemental annual (arithmetic mean) PM_{10} standard of 50 μg/m^3 [3.1 x 10^{-9} lb/ft^3] that is averaged over the year (WDEQ/AQD, 2010). The NAAQS also limits allowable concentrations of airborne particulates that are 2.5 microns in diameter or smaller, or "$PM_{2.5}$". Based upon the pre-licensing, site-characterization data collected by the Applicant, three radionuclide particulates of interest (natural uranium, Ra-226, and Th-230) are found at concentrations at or below the lowest analytical detection limit and one radionuclide particulate (Pb-210) is found at concentrations just above the lowest analytical detection limits. The Pb-210 particulate concentrations are consistent with the radon flux, as Pb-210 is a progeny of the radon-222 (Rn-222) radioactive decay.

The eastern portion of the Powder River Basin has an extensive network of PM_{10} monitoring stations that are operated by the mining industry because of the number of the coal mines in the region. There are five surface coal mines within approximately 50 km [30 mi] of the Ross Project area. PM_{10} compliance with the NAAQS and WAAQS 24-hour standards at these five mines (and, by inference, at the Ross Project area) has been consistently demonstrated by these stations (Strata, 2011a). However, there have been three small excursions over the 24-hour PM_{10} at the mines; these were determined to be due to high-wind conditions. There are also monitoring stations operated by the WDEQ/AQD in the cities of Sheridan, Gillette, Arvada, and Wright, where particulates are generally measured as PM_{10}.

The WDEQ/AQD operates a $PM_{2.5}$ particulate sampler at the Buckskin Mine, about 50 km [30 mi] west of the Ross Project area. Ambient air-quality monitoring data from 2005 – 2009 from the Buckskin Mine show that the average $PM_{2.5}$ ranged from 5.1 – 6.2 μg/m^3 [3.2 – 3.9 x 10^{-10} lb/ft^3], about one-third the annual mean $PM_{2.5}$ standard of 12 μg/m^3 [9.4 x 10^{-10} lb/ft^3]. No excursions above the 24-hour standard of 5 μg/m^3 were recorded at the Mine. The data indicate that particulates from highway and non-road-construction vehicles comprise approximately 28 percent of the total PM_{10} and $PM_{2.5}$ particulate emissions.

As discussed in GEIS Section 3.4.6, prevention of significant deterioration (PSD) requirements identify maximum allowable increases in concentrations for particulate matter for areas designated as in attainment. Different increment levels are identified for different classification areas, with Class I areas having the most stringent requirements. The nearest Class I areas to the Ross Project area is the Northern Cheyenne Indian Reservation (in Montana) and Wind Cave National Park (South Dakota); these areas are 130 km [80 mi] and 160 km [100 mi] from the Ross Project area, respectively. The other sensitive areas are the Class II Devils Tower and the Class II Cloud Peak Wilderness Area. These areas are approximately 16 km [10 mi] and 180 km [110 mi], respectively, from the Ross Project area (Strata, 2011a).

3.7.3.2 Gaseous Emissions

Existing regional air pollutants are known to include gaseous emissions, such as CO, CO_2, NO_2, NO_x, O_3, and SO_2, as well as volatile organic compounds and hazardous air pollutants in addition to $PM_{2.5}$ and PM_{10}, all of which have been extensively monitored near the Ross Project area and in the Powder River Basin since 1975 (Strata, 2011a). Please refer to SEIS Table 3.17, which presents both the respective NAAQS and WAAQS gaseous-emission standards.

Radon is a radioactive, gaseous air emission which is discussed further in SEIS Section 3.12.1, ***Air***. Based upon the Applicant's pre-licensing, site-characterization air sampling, the naturally occurring radon concentrations in the air at the Ross Project range from 0.007 – 0.07 Bq/L (0.2

– 2.0 pCi/L) with a resultant exposure between 9.0 x 10^{-5} – 3.82 x 10^{-4} Sv [9.2 – 38.2 mrem]. These values are consistent with levels for radon in air overlying mineralized environments (as cited in NRC, 2009b). Air-quality monitoring for gaseous emissions within the Powder River Basin includes measuring ozone (as O_3) and nitrogen oxides (as NO_2) at two WDEQ/AQD stations, the closest of which is 29 km [18 mi] from the Ross Project area. A Wyoming Air Resources Monitoring System (WARMS), which is operated by the BLM, monitors sulfur- and nitrogen-oxide concentrations near Buffalo, Sheridan, and Newcastle. Nitrogen oxides (as NO_2) are also monitored by the WDEQ/AQD at the Thunder Mountain Basin National Grassland monitoring station, 29 km [18 mi] west of the Ross Project area as well as at private monitoring stations at the Belle Ayr and Antelope coal mines (see SEIS Section 5.2). All of these monitoring stations routinely indicate that the annual mean NO_2 emissions are well below the NAAQS and WAAQS.

Ozone is also monitored in the Powder River Basin which is considered an ozone attainment area. Although no violations of the ozone standard have occurred in the area, the levels reported by these nearby air-quality monitoring stations are occasionally close to the respective ozone standard.

PSD requirements also incorporate gaseous-emission standards (e.g., for NO_2, SO_2, and O_3) for maximum allowable increases in concentrations for areas designated as “in attainment,” as discussed above. Class I areas have the most stringent PSD requirements; Class I areas nearest to the Ross Project area are presented in SEIS Section 3.7.3.2.

3.8 Noise

As described in GEIS Section 3.4.6, eastern Wyoming is predominantly rural and undeveloped, except for the heavily mined Powder River Basin. Rural areas tend to be quiet, and natural phenomena, such as wind, rain, insects, and livestock, tend to contribute the most to ambient noise. As noted in the adjacent text box, the unit of measure used to represent sound-pressure levels is the decibel (dB) or the A-weighted decibel (dBA). dBA is a measure designed to simulate human hearing by placing less emphasis on lower frequency noises, because the human ear does not perceive sounds at low frequencies in the same manner as sounds at higher frequencies. In the undeveloped rural areas of Wyoming, the existing ambient noise levels range from 22 decibels (dB) on calm days up to 38 dB, depending upon factors such as wind and traffic (NRC, 2009b). It should be noted that noise levels lessen with increasing distance from the respective source. Noise from a

How Is sound measured?

The human ear responds to a wide range of sound pressures. The range of sounds people normally experience extends from low to high pressures by a factor of 1 million. Sound is commonly measured using decibels (dB). Another common sound measurement is the A-weighted sound level (dBA). The equivalent sound level is expressed as an A-weighted sound level over a specified period of time—usually 1 or 24 hours. The A-weighting measures different sound frequencies and the variation of the human ear’s response over the frequency range. Higher frequencies receive less A-weighting than lower ones.

What is noise?

Sound waves are characterized by frequency and measured in hertz (Hz). Noises that are perceptible to human hearing range from 31 to 20,000 Hz. Audible sounds (those that can be heard) range from about 60 dB at a frequency of 31 Hz to less than about 1 dB between 900 and 8,000 Hz. dBAs assume a human receptor to a particular noise-producing activity.

line source, such as a highway, is reduced by approximately 3 dB per doubling of distance. For example, road noise at 15 m [49 ft] from a highway is reduced by 3 dB at 30 m [98 ft] and further reduced by an additional 3 dB at 60 m [196 ft]. For point sources, such as equipment, compressors, and pumps, the reduction factor with distance is greater, at approximately 6 dB per doubling of distance.

The land uses in the Ross Project area include livestock grazing, oil production, crop production, ordinary transportation, recreation, and wildlife habitat (see SEIS Section 3.2). Existing ambient noise levels at the Ross Project area were measured by the Applicant to establish pre-licensing, site-characterization noise levels at the 11 residences in a 3-km [2-mi] vicinity of the Ross Project (including the nearest 2 along New Haven Road, adjacent to the Project area) (see Figure 3.1). Future site-specific noise levels associated with uranium-recovery activities would be measured against these levels to identify relative increases in noise levels.

The Applicant's noise study specifically considered the two nearest residences to the Ross Project. The first nearest residence is 210 m [690 ft] from the Ross Project's respective boundary and approximately 760 m [2,500 ft] from the location of the CPP in the Proposed Action. The second residence is 255 m [835 ft] from the respective boundary and 1,700 m [5,600 ft] from the proposed location of the CPP. Because these residences are so close to the Ross Project area, they bound the upper range of noise for all four of the residences next to the Ross Project area, where all of the residences are located within 0.5 km [0.3 mi] of the Ross Project's boundary (Strata, 2011a). The noise levels at these two residences averaged 35.4 dBA and 37.4 dBA, depending upon simultaneous factors such as wind speed, traffic volume, vehicular speed, and the type of load being transported (Strata, 2011a).

Truck traffic, in particular bentonite-hauling trucks from the Oshoto bentonite mine 8 km [5 mi] northeast of the Ross Project area and, less frequently, livestock hauling, are the main contributors to existing traffic noise on D and New Haven Roads. According to the U.S. Department of Transportation (USDOT), typical noise levels at road speeds ranging from 80 – 113 km/hr [50 – 70 mi/hr] are 62 – 68 dBA for passenger automobiles, 74 – 79 dBA for medium trucks, and 80 – 82 dBA for heavy trucks (USDOT, 1995). Posted speed limits for D Road, which passes adjacent to the Ross Project area, are 88 km/hr [55 mi/hr] for automobiles and 72 km/hr [45 mi/hr] for trucks. Peak noise levels attributed to truck traffic have been measured at 80 – 90 dBA (Strata, 2011a). However, a passing truck hauling bentonite registered 73.4 dBA at the residence on New Haven Road nearest to the Project area, lower than the USDOT values for either medium or heavy trucks.

In a separate noise study, the Applicant collected noise measurements at the Applicant's Field Office for an entire week; the data yielded an average day-night noise level (l_{dn}) of 41.6 dBA overall, with no variance between weekday and weekend measurements (Strata, 2011a). The l_{dn} is the A-weighted equivalent noise level for a 24-hour period that includes a noise level at nighttime that is 10 dBA lower than the daytime noise level. Nighttime hours are considered to be from 10 p.m. to 7 a.m. (EPA, 1978).

The Wyoming Department of Transportation (WYDOT) has defined Noise Abatement Criteria (NAC) that take into account land use, because different land-use areas are sensitive to noise in different ways (NACs are used for impact determinations only). The WYDOT procedures consider a person to be affected by traffic noise from highways when existing or future sound levels approach or exceed the NAC, or when expected future sound levels exceed existing sound levels by 15 dBA. In addition, the sound characteristics of noise can affect the acceptability of noise levels to receptors and the acceptability of noise levels is increased when the noise is familiar and routine (WYDOT, 2011). There are no NACs for undeveloped land. The exterior of residential structures would be considered affected by highway traffic above 67 dBA $L_{eq(h)}$ (i.e., equivalent continuous noise level).

Ambient noise levels in larger communities would be expected to be similar to other urban areas (i.e., approximately 50 – 78 dBA). However, the nearest cities to the Ross Project are all quite distant from the Ross Project area and are, thus, not expected to be affected by the noise levels at the Ross Project (nor, conversely, affect the noise levels at the Ross Project). For example, Casper, Wyoming, which has a population of 55,000 and is 230 km [140 mi] away from the Ross Project area (USCB, 2010), and smaller communities, such as Hulett and Moorcroft, which are located 22 km [14 miles] and 35 km [22 miles] away from the Ross Project area, respectively, are too distant to contribute to the noise environment at the Ross Project area.

3.9 Historical, Cultural, and Paleontological Resources

Both NEPA and the *National Historic Preservation Act of 1966* (NHPA), as amended, require Federal agencies to consider the effects of their undertakings on historical and cultural properties. The historical-preservation review process is outlined at regulations promulgated by the Advisory Council on Historic Preservation (ACHP) in 36 CFR Part 800. Historic properties are resources that are eligible for or listed on the National Register of Historic Places (NRHP). Historic properties may include sites, buildings, structures, districts, or objects generally more than 50 years old. In 1992, amendments to Section 101 of the NHPA added traditional cultural properties (TCPs) as another property type whose eligibility can be considered for listing on the NRHP. To be eligible for listing, historical and cultural resources must exhibit integrity of setting, location, design, materials, feeling, and association.

The site condition is an important factor in an assessment of site integrity. The property must be able to convey its significance (NPS, 1997a). Once integrity is established, a resource is evaluated against criteria which define eligibility, as required by 36 CFR Part 60.4; at least one criterion must be met for a resource to be eligible. The criteria include: 1) association with significant events in the past; 2) association with the lives of persons significant in the past; 3) embodiments of distinctive characteristics of type, period, or construction; or 4) yielding or is likely to yield important information about prehistory or history. Both the Secretary of Interior's "Guidelines for Evaluation" and the U.S. National Park Service's (NPS's) Bulletin 15, *How to Apply the National Register Criteria for Evaluation* describe a process in which a historical context is established with associated property types. Historic contexts for evaluation are defined by states (in the case of the Ross Project, Wyoming). Under this process, property-type definitions include characteristics, integrity requirements, and applicable historical contexts. The NRHP-evaluation process is an assessment of whether any given property possesses the characteristics and integrity requirements needed to meet the significance requirements specified by the applicable historical context. Resources that meet these requirements can be evaluated as historic properties.

NEPA established the responsibility of the Federal government to employ all practicable means to preserve important historical, cultural, and natural aspects of national heritage. Implementing regulations for Section 106 provide guidance on how NEPA and Section 106 processes can be coordinated (at Section 800.8[a]) and set forth the manner in which the NEPA process and its documentation can be used to comply with Section 106 (Section 800.9[c]). The NHPA regulations also address the Federal government's responsibility to identify historical and cultural properties and to assess the effects of a given Federal undertaking on those properties (Sections 800.4 through 800.5).

As a Federal undertaking, the issuance of source and byproduct material license by the NRC for the Ross Project could have the potential to affect historic properties located on, in, beneath, or near the Project area. The NRC is therefore required, in accordance with NHPA, to make a reasonable effort to identify historic properties in the area of potential effect (APE) for the Project. The APE is defined for the Project by the Ross Project area boundaries and the area's immediate environs. The APE denotes the area that could be impacted during the Ross Project's phases (i.e., during its construction, operation, aquifer restoration, and decommissioning). If historic properties are known to be present within the APE, the NRC is required to assess the effects of its issuing a license for uranium-recovery operations on any identified properties and to resolve any adverse impacts to those properties.

Several additional statutes and EOs also apply to the Federal lands managed by the BLM, most notably the *Native American Graves Protection and Repatriation Act* (NAGPRA) and the *Archaeological Resources Protection Act of 1979* (ARPA). NAGPRA is applicable to burials found on BLM-managed lands and, in that context, provides for the protection of Native American remains, funerary objects, sacred objects, and/or objects of cultural patrimony as well as their repatriation to affiliated Native American Tribes following a consultation process between Tribes and the land-managing Federal agency (e.g., the BLM). ARPA regulates the permitting of archaeological investigations on public lands, including those managed by BLM. Wyoming also has a statute pertaining to archaeological sites and human remains, entitled *Archaeological Sites* (Wyoming Statute Annotated §36-1-114, et seq.). The Wyoming State Historic Preservation Office (WYSHPO) administers and is responsible for oversight and compliance review for Section 106 of NHPA and NAGPRA as well as compliance with other Federal and State historic-preservation statutes and regulations. The WYSHPO and the Wyoming State Office of the BLM have entered into a programmatic agreement that describes the manner in which the two entities would interact and cooperate under the BLM's National Programmatic Agreement.

3.9.1 Cultural Context of Ross Project Area

The following information is included as an aid to the reader, for an understanding of the Ross Project area in terms of potential prehistoric and historic events that would reasonably be expected to have occurred and that would have left behind artifacts (archaeological resources) of interest to present-day archeologists, paleontologists, and present-day Native American Tribes of the area.

The Ross Project area is within a portion of Wyoming inhabited by aboriginal hunting and gathering people for more than 13,000 years. Throughout the prehistoric past, this area was used by highly mobile hunters and gatherers who exploited a wide variety of resources. The immense expanse of grassland in the Plains region was home to vast herds of bison, also known as buffalo. Exploitation of this resource by indigenous groups organized the Northwest Plains culture. Fur traders, explorers, and the military were the first Euro-Americans to enter the region and encounter the mounted Indians of the region. These bison-dependent people and their way of life were eventually displaced by permanent farming and ranching settlement.

3.9.1.1 Prehistoric Era

Past research activities within the Northwestern Plains culture area have defined a sequence of cultural periods that provide a general context for identification and interpretation of archaeological resources within the proposed Ross Project area. This chronology for the Northwestern Plains was developed from the work of Frison (1991; 2001) with age ranges provided in years Before Present (B.P.):

- Paleoindian period (13,000 – 7,000 years B.P.).
- Early Archaic period (7,000 – 5,000 years B.P.).
- Middle Archaic period (5,000/4,500 – 3,000 years B.P.).
- Late Archaic period (3,000 – 1,850 years B.P.).
- Late Prehistoric period (1,850 – 400 years B.P.).
- Protohistoric period (400 – 250 years B.P.).
- Historic period (250 – 120 years B.P.).

The two most recent cultural periods, about which more is known, are more thoroughly discussed in a separate section below.

The Paleoindian period includes various complexes (Frison, 1991; Frison, 2001). Each of these complexes is correlated with a distinctive projectile-point style derived from generally large, lanceolate, and/or stemmed-point morphology. The Paleoindian period is traditionally thought to be synonymous with the "big-game hunters" who exploited megafauna such as bison and mammoth (Plains Paleoindian groups), although evidence of the use of vegetation resources has been noted at a few Paleoindian sites (foothill-mountain groups).

The Early Archaic period projectile point styles reflect the change from large, lanceolate types that characterized the earlier Paleoindian complexes to large side- or corner-notched types. Subsistence patterns reflect exploitation of a broad spectrum of resources, with a much-diminished use of large mammals.

The onset of the Middle Archaic period has been defined on the basis of the appearance of the McKean Complex as the predominant complex on the Northwestern Plains approximately 4,900 years B.P. (Frison, 1991; Frison, 2001). McKean Complex-projectile points are stemmed variants of the lanceolate point. These projectile-point types continued until 3,100 years B.P., when they were replaced by a variety of large corner-notched points (e.g., Pelican Lake points) (Martin, 1999, as cited in Strata, 2011a). Sites dating to this period exhibit a new emphasis on vegetation procurement and processing.

The Late Archaic period is generally defined by the appearance of corner-notched dart points. These projectile points dominate most assemblages until the introduction of the bow and arrow around 1,500 years B.P. (Frison, 1991). This period witnessed a continued expansion of occupations into the interior grasslands and basins as well as the foothills and mountains.

The Late Prehistoric period is marked by a transition in projectile-point technology around 1,500 years B.P. The large corner-notched dart points characteristic of the Late Archaic period are replaced by smaller corner- and side-notched points for use with the bow and arrow. Approximately 1,000 years B.P., the entire Northwestern Plains appears to have suffered an abrupt collapse or shift in population (Frison, 1991). This population shift appears to reflect a narrower subsistence base, focused mainly on communal procurement of pronghorn antelope and bison.

3.9.1.2 Protohistoric/Historic Periods

The Protohistoric period witnessed the beginning of European influence on prehistoric cultures of the Northwestern Plains. Additions to the material culture include, most notably, the horse and European trade goods such as glass beads, metals, and firearms. Projectile points of this period include side-notched, tri-notched, and un-notched points with the addition of metal points. Introduction of the horse on the southern Plains in the 1600s spread northward to other Tribes, and mounted buffalo hunters became the classic Plains culture known in the period of Euro-American contact. New diseases also spread across the North American continent with the first arrival of Europeans, affecting Native peoples even before the physical appearance of the newcomers.

The Plains Tribes shared a basic commonality of style in their material culture, with regional and Tribal variation. This material culture was strongly characterized by its dependence on bison. Bison played a part in all aspects of physical life by providing food, clothing, shelter, tools, and fuel (e.g., dung) as well as embodying a spiritual force (DeMallie, 2001). The need to follow the seasonal movements of bison herds resulted in seasonal variation in residential patterns. Summer encampments of large groups gathered to hunt, using cooperative hunting techniques such as driving a herd over a cliff (e.g., “buffalo-jump sites”) or into a corral at the bottom of a slope or a cut bank.

Extended family and village groups moved along with the herds, hauling their belongings and portable dwellings to new encampments. Originally, long, low, multiple-family tents, the classic Plains teepee built on a foundation of supporting poles, developed following the adoption of the horse (DeMallie, 2001). Extended families were organized in nomadic bands or semi-sedentary villages; each band or village was independent, but each shared the same language and culture, with the size of their aggregations determined by ecological factors. Communal hunting needed for the bison hunts gave way to smaller, scattered social groups that were optimal at other times. The need for horse pasturage also limited the size and duration of residential groups. Smaller Tribes stayed together more of the year, but larger Tribes might only congregate for summer hunts. The largest Tribes, such as the Blackfoot and Crow, might only rarely gather in a single place and tended toward more lasting divisions that can be viewed as separate Tribes with their own territories and linguistic distinctions (DeMallie, 2001).

Plains groups shared a fundamental belief in the power inherent in all living beings. This power was accessible to individuals in dreams and visions, but it was particularly useful to medicine men and priests whose more heightened understanding and experience of power gave them a special role in the ritual life of Plains communities. Sacred power was acquired by individuals through vision seeking during a retreat which was accompanied by fasting and prayer while awaiting the appearance of spiritual beings in a special form, sometimes an animal that embodied a teaching and protective spirit (DeMallie, 2001).

During the historic period, the Plains Tribes came under duress from the effects of a rapidly changing world. As soldiers, settlers, bison hunters, and other Tribes relocated westward, epidemic diseases ravaged the native populations, and the dislocation of conflict increased, leading to changing demographic patterns and a breakdown of traditional systems of food gathering and inter-group exchange patterns. As Christian missionaries came onto the Plains, they professed belief systems that conflicted with, and sometimes even forbade, native traditional rites related to a life view that often mingled the spirit and physical worlds. The influx of trading-post goods, the shift in hunting patterns, and the loss of access to the seasonal migrations of prey, produced a distorting effect that challenged native life. Cultural transformation was rapid and was characterized by a long period of hostilities with the white settlers and disagreements among various Tribal entities regarding the course of action in the face of encroachment. Eventual resolution of conflict came through military means and treaties that established the present-day reservation system.

The only Tribal reservation in Wyoming is the Wind River Indian Reservation, located approximately 270 km [170 mi] southwest of the Ross Project. The Crow and Northern Cheyenne Indian Reservations in Montana (approximately 160 and 146 km [100 and 91 mi] northwest, respectively) and the Pine Ridge Indian Reservation in South Dakota (approximately 185 km [115 mi] southeast) are the other Tribal-reservation communities nearest the proposed Ross Project area. A review of the literature indicates that Devils Tower has been called *Mato Tipila* by some Native Americans (which means “Bear Lodge”) as well as Bear’s Tipi, Home of the Bear, Tree Rock and Great Gray Horn) (NPS, 2012). This geologic formation is located approximately 16 km [10 mi] from the Ross Project area and is a sacred area for several Plains Tribes (Hanson and Chirinos, 1991, as cited in Strata, 2011a). According to the NPS, over 20 Tribes have potential cultural affiliation with Devils Tower. Six Tribes (i.e., Arapaho, Crow, Lakota, Cheyenne, Kiowa, and Shoshone) have historical and geographical ties to the Devils Tower area (NPS, 1997b). Many Native American Tribes of the northern Plains refer to Devils Tower in their legends as a sacred area.

3.9.1.3 Historic Era

The historical context of the Ross Project area includes several themes common to all of northeastern Wyoming. The earliest cumulative impact on historical resources was associated with intermittent exploration, fur trapping, gold prospecting, and military expedition circa 1810s – 1870s. This era was followed by large-scale stock raising (1870s – 1900s). The dryland farming/homesteading movement was the most substantial historical expansion, occurring from the 1910s – 1930s. The Great Depression resulted in the Federal assistance programs of the mid- to late-1930s, which affected the settlement patterns of this region. Post-war ranching (1945 – present) is the latest historical theme. Crook County, where the Ross Project is situated, was formed in 1875 and named for Brigadier General George Crook, a commander during the Indian Wars.

Although Euro-Americans began to pass through Wyoming in the early 1800s, these visits were limited to government expeditions of discovery and various British and American fur trapping brigades. Beginning in the 1840s, emigrants of the “great western migration” passed on the Oregon-California Trail, which ran along the Platte River and through South Pass heading for lands in Oregon, California, and the Salt Lake Valley, but few Euro-Americans, if any, stayed on in the region. As the lands in the West became more populated and the cattle industry made its way into Wyoming in the 1860s, the region began to attract its own settlers.

The Texas Trail, which operated from 1876 – 1897, was used to move cattle as far north as Canada. Most of the early cattle herds passed through Wyoming and were used to establish Montana's ranching industry. As cattlemen recognized the value of Wyoming's grassland, several large cattle ranches were established and flourished until the devastating blizzards in the winter of 1886 – 1887. The close of the cattle-baron era provided an opening for Wyoming's sheep industry. Several large ranches, including the 4J and the G-M, were established in the Gillette area south of the proposed Ross Project area; however, the industry experienced steady declines in the 1900s (Massey, 1992; Rosenberg, 1991, as cited in Ferguson, 2010). The dryland farming movement of the late 19th and early 20th centuries had a profound effect on the settlement of northeastern Wyoming during the years around World War I. The most intensive period of homesteading activity in northeastern Wyoming occurred in the late 1910s and early 1920s. Promotional efforts by the State and the railroads, the prosperous agricultural years of during World War I, and the *Stock Raising Act of 1916* with its increased acreage (but lack of mineral rights) all contributed to this boom period. It soon became evident, however, that dryland farming alone would not provide an affluent living, and farmers began to increase their livestock holdings (Ferguson, 2010).

A severe drought in 1919 followed by a severe winter, along with a fall in market prices in 1920, forced out many small holders. During the 1920s the size of homesteads in Wyoming nearly doubled while the number of homesteads decreased, indicating the shift to livestock raising (LeCompte and Anderson, 1982, as cited in Strata, 2011a). A period of drought began in 1932, leading to Federal drought-relief programs. In April 1932, the Northeast Wyoming Land Utilization Project ("Utilization Project") began repurchasing the lands of sub-marginal homesteads and making the additional acres of government land available for lease. Two million acres within five counties, including about 226,600 ha [560,000 ac] of Federally owned lands, were included in the Thunder Basin Project, which was designed to alter land use and to relocate settlers onto viable farmland (Resettlement Administration, 1936, as cited in Ferguson, 2010).

During the Utilization Project to rehabilitate the range, impounding dams were erected, wells were repaired, springs developed, and homestead fences removed while division fences were constructed for the new community pastures. The government paid former farmers to remove homesteads and their efforts were so successful that almost no trace remains. The remaining subsidized ranches were significantly larger and provided a stabilizing effect on the local economies. The Thunder Basin Grazing Association, the Spring Creek Association, and the Inyan Kara Grazing Association were formed to provide responsible management of the common rangeland.

Uranium was first discovered in Wyoming during the early 20th century, near Lusk. Section 5.2.1.1 provides a more detailed description of local uranium discoveries, reserves, and historical attempts to recover uranium resources, up until the period of the proposed Ross Project.

3.9.2 Historical Resources

Buildings and Structures

No buildings or structures eligible for the NRHP or Wyoming State Register have been identified within the Ross Project area (Ferguson, 2010). An earthen structure in the area, the Oshoto Dam, does not meet the criteria for eligibility for listing in the NRHP (48 CFR Part 2157). The original dam has been rebuilt numerous times because of flood damage, most recently in 2005, and the dam is considered to be essentially a reconstruction rather than an original structure.

Archaeological Sites

A Class III Cultural Resource Inventory (Class III Inventory) was conducted in support of the Ross Project in April 2010 and July 2010 (Ferguson, 2010). The Inventory included a pedestrian survey in transects of 31.1-m [102-ft] intervals throughout the Ross Project area. Subsurface exposures such as cut banks, anthills, rodent burrows, roads ruts, and cow tracks were examined. Shovel probes were placed at the discretion of the surveyors, primarily in locations where artifacts or features were located or where soil had accumulated. The Inventory focused on landforms where intact sites might be expected, such as intact and stable terraces and their margins as well as areas of exposure (Ferguson, 2010).

In November 2011, additional evaluative work was accomplished by the Applicant's contractor: A geophysical mangetometer survey was conducted at several sites, but the equipment was found to be ineffective because of the nature of the soils. Then, 6 back-hoe trenches, approximately 27 test pits measuring 0.5 m x 0.5 m [1.6 ft x 1.6 ft], and approximately 44 test pits measuring 1.0 m x 1.0 m [3.3 ft x 3.3 ft] were excavated to further evaluate areas where historical sites seemed to be located. The placement of the excavations was focused on the sites near areas where road construction would be expected during the Project. This additional work was described in Strata, 2012a.

In preparation for the Class III Inventory, a Class 1 Inventory (i.e., a records search) was conducted for the Ross Project area in 2010; this search included the records of the Wyoming Cultural Records Office (WYCRO), the WYCRO's online database, and the BLM's Newcastle Field Office (Ferguson, 2010). The records search showed that, prior to the 2010 Class III Inventory, no substantial block inventory (i.e., survey) had been conducted in the Project area. Small-scale investigations, including two associated with power lines and buried telephone cables as well as drilling-pad and access-road installations, have been conducted in the Ross Project area. Only one survey, an inventory for a linear, buried telephone cable in Section 13, identified one prehistoric campsite, Site No. 48CK1603. Avoidance of this campsite was recommended as a result. The campsite lies on both State and private land, and it was described as “bisected” by D Road (Ferguson, 2010).

During the Applicant's initial Class III Inventory for the Ross Project, 24 new sites and 21 isolated finds were recorded. Twenty-three of the recorded sites are prehistoric camps, and one is a historic-period homestead. The 24 sites along with the previously identified Site No. 48CK1603 are listed in Table 3.18. A number of sites yielded projectile points that represent Middle Archaic, Late Archaic, and Late Prehistoric occupations. All but two of the isolated finds are prehistoric artifacts; the two historic isolated finds were described as trash scatters. In addition to the sites identified during the Class III Inventory, the potential exists for deeply buried sites to be exposed within the Ross Project area because of its propitious location near the headwaters of the Little Missouri River and the percentage of the Ross Project area that consists of deep alluvium.

Of the 24 new sites identified during the Applicant's 2010 Class III Inventory for the Ross Project and the previously identified site, two sites (Sites Nos. 48CK1603 and 48CK2083) have been determined by the NRC staff to be eligible for listing on the NRHP (Ferguson, 2010), and the WYSHPO has concurred with this determination (i.e., these are consensus determinations).

The NRC staff and the WYSHPO have also made consensus determinations that Site Nos. 48CK2071, 48CK2072, 48CK2074, 48CK2077, 48CK2084, 48CK2086, 48CK2088, and 48CK2093 are not eligible for listing on the NRHP. The NRC staff and the WYSHPO have determined that the remaining 15 sites (Site Nos. 48CK2070, 48CK2073, 48CK2075, 48CK2076, 48CK2078, 48CK2079, 48CK2080, 48CK2081, 48CK2082, 48CK2085, 48CK2087, 48CK2089, 48CK2090, 48CK2091, and 48CK2092) are currently unevaluated. Site Nos. 48CK2070, 48CK2076, and 48CK2087 were determined by the NRC staff and SHPO to require additional consultation with the Tribes before an NRHP-eligibility determination could be made.

Two field surveys, performed in accordance with Class III cultural-resource inventory methods, have been recently conducted at the Ross Project area. The surveys were designed to identify and to evaluate the NRHP significance of the TCPs in the Ross Project area. The first was performed by representatives of six Tribes on May 13 – 16, 2013, and the second survey was performed by representatives of four Tribes on June 3 – 6, 2013. During the June field survey, additional archaeological content, including bone and lithic artifacts, was found at Site No. 48CK2087, a site formerly limited to a hill-top cairn. The new cultural finds at Site No. 48CK2087 extended the boundaries of that site and required re-interpretation and re-evaluation of the NRHP significance. Additionally, three new archaeological sites were found within the Ross Project Area: Site Nos. 48CK2229, 48CK2230, and 48CK2231. The NRC staff and the WYSHPO have determined that the three new archaeological sites are unevaluated.

Traditional Cultural Properties

In order to complete government-to-government consultation as required by Section 106 of NHPA, the NRC requested from various interested Tribes information about places of cultural, religious, and traditional significance that could be affected by the Ross Project. Places of cultural, religious, and traditional significance that meet the NRHP criteria are included in the definition of "historic property" under 36 CFR Part 800.16(l)(1). According to the NPS's American Indian Liaison Office (at http://www.nps.gov/tribes/Documents/TCP.pdf), "[a] Traditional Cultural Property (TCP) is a property that is eligible for inclusion in the NRHP based upon its associations with the cultural practices, traditions, beliefs, lifeways, arts, crafts, or social institutions of a living community."

TCPs that are considered eligible for listing on the NRHP could include any prehistoric or historic entity (i.e., a district, site, building, structure, or object), as defined in 36 CFR Part 64.4 (Parker and King, 1998). TCPs also include all artifacts, records, and remains that are related to and located within such TCPs. Not all TCPs qualify as eligible properties; consequently, not all TCPs are subject to preservation measures or mitigation treatments. The process for the evaluation of NRHP eligibility involves three steps:

Table 3.18 Historic and Cultural Properties Identified To Date within Ross Project Area		
Smithsonian Number	**NRHP Eligibility Determination* or Recommendation****	**Cultural Affiliation/ Site Type**
48CK1603	Eligible*	Prehistoric Campsite
48CK2070†	Eligible	Stone Circles and Stone Arcs
48CK2071	Not Eligible*	Prehistoric Campsite
48CK2072	Not Eligible*	Late Prehistoric Campsite
48CK2073	Unevaluated*	Prehistoric Campsite
48CK2074	Not Eligible*	Prehistoric Campsite
48CK2075	Unevaluated*	Unknown Prehistoric Campsite
48CK2076	Unevaluated*	Prehistoric Stone Feature Historic Cans
48CK2077	Not Eligible*	Prehistoric Campsite
48CK2078	Unevaluated*	Unknown Prehistoric Campsite and Historic Debris
48CK2079	Unevaluated*	Unknown Prehistoric Campsite
48CK2080†	Eligible	Fasting Bed
48CK2081	Unevaluated*	Unknown Prehistoric Campsite
48CK2082	Unevaluated*	Unknown Prehistoric Campsite
48CK2083	Eligible*	Late Archaic Prehistoric Campsite
48CK2084	Not Eligible*	Prehistoric Campsite
48CK2085	Unevaluated*	Unknown Prehistoric Campsite
48CK2086	Not Eligible*	Prehistoric Campsite
48CK2087†	Eligible	Fasting Beds, Cairn, Lithic Artifacts, and Bone
48CK2088	Not Eligible*	Historic Homestead (Maros Homestead)
48CK2089†	Eligible	Fasting Beds
48CK2090	Unevaluated*	Unknown Prehistoric Campsite
48CK2091	Unevaluated*	Middle Archaic Campsite
48CK2092	Unevaluated*	Unknown Prehistoric Campsite
48CK2093	Not Eligible*	Prehistoric Lithic Scatter
48CK2214†	Eligible	Fasting/Warming Circle and Cairn

Table 3.18
Historic and Cultural Properties Identified To Date within Ross Project Area
(*Continued*)

Smithsonian Number	NRHP Eligibility Determination* or Recommendation**	Cultural Affiliation/ Site Type
48CK2215†	Eligible	Cairns, Fasting Ring, Stone Circle, Historic Artifacts
48CK2216†	Eligible	Fasting Beds
48CK2217†	Eligible	Fasting Bed and Cairn
48CK2218†	Eligible	Stone Circles or Arcs, Cairn, Fasting Bed
48CK2219†	Eligible	Stone Alignment (Ceremonial Site), Stone Circles or Stone Arcs, Cairn, Fasting Circle
48CK2220†	Eligible	Stone Alignment (Ceremonial Site)
48CK2221†	Not Eligible	Possible Stone Circle or Partial Stone Arc
48CK2222†	Eligible	Fasting Circle and Partial Stone Circle
48CK2223†	Unevaluated	Cairn
48CK2224†	Unevaluated	Cairn
48CK2225†	Not Eligible	Possible Fasting Bed
48CK2226†	Not Eligible	Possible Hunting Pit
48CK2227†	Eligible	Plant Gathering Area
48CK2229††	Unevaluated	Cultural Material Scatter Exposed in a Reclaimed Road Bed
48CK2230††	Unevaluated	Cultural Material Scatter Exposed in a Terrace
48CK2231††	Unevaluated	Exposures of Bone, Tools, Flakes And Middle Archaic Projectile Point

* = The WYSHPO has concurred with these eligibility recommendations.
** = The remainder of the eligibility determinations in this table are NRC determinations that will be provided to the WYSHPO for concurrence.
† = Properties of religious and cultural significance located, recorded, and evaluated for NRHP eligibility in the May and June 2013 TCP surveys
†† = New archaeological sites identified during the June 2013 TCP survey

- The first step in the evaluation process is to determine if the entity being evaluated for eligibility for inclusion on the NRHP is tangible (Parker and King, 1998). In this respect, the entity must be a “site” as defined for the NRHP, that is, the location of a significant event, a prehistoric or historic occupation or activity, or a building or structure, whether standing, ruined, or vanished, where the location itself possesses historic, cultural, or archeological value regardless of the value of any existing structure. All TCP resources identified in the Ross Project area meet this threshold.

- The second step in the evaluation process is to assess site integrity. In order to be eligible for inclusion on the NRHP, an entity must also exhibit "integrity of location, design, setting, materials, workmanship, feeling, and association" per 36 CFR Part 60. As with other historic properties, a TCP that once had traditional cultural significance can lose its significance through physical alteration of its location, setting, design, or materials (Parker and King, 1998). This loss can occur if the traditional, spiritual, or ceremonial values upon which the TCP might achieve NRHP eligibility have been significantly altered by severe erosion, post-use damage, or surrounding land-use developments inconsistent with the setting of the TCP.

- The final step in the evaluation process is to assess the TCP in terms of four NRHP criteria (A – D) found in 36 CFR Part 60.4. All TCPs in the Ross Project area have been evaluated under Criterion A, which refers to an "association with events that have made a significant contribution to the broad patterns of our history." As applied to the Ross Project TCPs, Criterion A has been met if the TCP is associated with significant traditional events reflecting a broad pattern or theme in a Native American group's history. Criterion A applies where the cultural practices or beliefs of a living community (*e.g.*, a Tribe) 1) are rooted in that community's history and 2) are important in its maintaining continuing cultural identity of the community (Parker and King, 1998).

The NRC staff invited the Consulting Tribes identified for the Ross Project to participate in a field survey in the Project area. Such a field survey, designed to identify and evaluate the NRHP significance of TCPs in the Ross Project area, was performed by the representatives of six Tribes on May 13 – 16, 2013. The six Tribes participating in the May field survey included:

- Santee Sioux Tribe of Nebraska (Niobrara, Nebraska)
- Crow Creek Sioux Tribe (Fort Thompson, South Dakota)
- Rosebud Sioux Tribe (Rosebud, South Dakota)
- Yankton Sioux Tribe (Wagner, South Dakota)
- Northern Cheyenne Tribe (Lame Deer, Montana)
- Turtle Mountain Band of Chippewa Indians (Belcourt, North Dakota)

A second field survey for identification and evaluation of TCPs was performed by the representatives of four Tribes on June 3 – 6, 2013. The four Tribes participating in the June field survey included:

- Cheyenne and Arapaho Tribes of Oklahoma (Concho, Oklahoma)
- Northern Arapaho Tribe (Fort Washakie, Wyoming)
- Fort Belknap Indian Community (Harlem, Montana)
- Eastern Shoshone Tribe (Fort Washakie, Wyoming)

As a result of the May and the June 2013 field surveys, 18 TCP sites were located, recorded, and evaluated for NRHP eligibility in the Ross Project area. Based upon the recommendations provided by the Tribes, the NRC has determined that 13 TCP sites in the Ross Project area are eligible for inclusion on the NRHP under Criterion A: Site Nos. 48CK2070, 48CK2080, 48CK2087, 48CK2089, 48CK2214, 48CK2215, 48CK2216, 48CK2217, 48CK2218, 48CK2219, 48CK2220, 48CK2222, and 48C2227. The latter site, Site No. 48CK2227, is determined to be eligible as an NRHP District. The NRHP eligibilities of two sites are unevaluated: Site Nos. 48CK2223 and 48CK2224. The NRC has determined that the remaining three sites—Site Nos. 48CK2221, 48CK2225, and 48CK2226—are not eligible for listing on the NRHP.

A report documenting the NRC staff's eligibility determinations for the 18 TCP sites will be submitted to the WYSHPO for concurrence. The Section 106 consultation process between the NRC and the WYSHPO, the Ross Project Consulting Tribes, the BLM, the ACHP, and the Applicant is ongoing and will be completed in accordance with the Programmatic Agreement for the Ross Project, the draft of which was issued for comment in January 2014 and is included as Appendix E to this SEIS.

3.9.3 Cultural Resources

The NRC, in consultation with WYSHPO, as provided at 36 CFR Parts 800.4(a) and 800.16(d), established the APE for the undertaking as the area at the Ross Project site and its immediate environs (see Figure 3.1), which may be impacted by activities associated with the construction and operation of the proposed Ross Project. The direct APE is comprised of the areas within the Ross Project boundaries that could be directly affected by physical ground disturbance and the construction of the Project, and the indirect APE is comprised of the area within three miles of the Ross Project boundaries wherein potential visual and audible effects to historic properties could occur.

3.9.3.1 Tribal Consultation

According to EO 13175, "Consultation and Coordination with Indian Tribal Governments," the NRC is encouraged to "promote government-to-government consultation and coordination with Federally-recognized Tribes that have a known or potential interest in existing licensed uranium-recovery facilities or applications for new facilities" (NRC, 2009b). Although the NRC, as an independent regulatory agency, is explicitly exempt from the Order, the NRC remains committed to EO's spirit. The Commission has demonstrated a commitment to achieving the Order's objectives by implementing a case-by-case approach to interactions with Native American Tribes. The NRC's case-by-case approach allows both the NRC and the Tribes to initiate outreach and communication with one another.

As part of its obligations under Section 106 of the NHPA and the regulations at 36 CFR Part 800.2(c)(2)(B)(ii)(A), the NRC must provide Native American Tribes "a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties and evaluation of historic properties, including those of religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects." Tribes that have been identified as potentially having concerns about actions in the Powder River Basin include the Assiniboine and Lakota (Montana), Blackfoot, Blood (Canada), Crow, Cheyenne River Lakota, Crow Creek Lakota, Devil's Lake Lakota, Eastern Shoshone, Flandreau Santee Dakota, Kootenai and Salish, Lower Brule Lakota, Northern Arapaho, Northern Cheyenne, Oglala Lakota, Pigeon (Canada), Rosebud Lakota, Sisseton-Wahpeton Dakota, Southern Arapaho, Southern Cheyenne, Standing Rock Lakota, Three Affiliated Tribes, Turtle Mountain Chippewa, and Yankton Dakota (NPS, 2010). On February 9, 2011, the NRC staff formally invited 24 Tribes (see SEIS Section 1.7.3.8) to participate in the Section 106 consultation process for the proposed Ross Project.

The NRC staff invited the Tribes to participate as consulting parties (as Consulting Tribes) in the NHPA Section 106 process and sought their assistance in identifying Tribal historic sites and cultural resources that may be affected by the Proposed Action.

3.10 Visual and Scenic Resources

The Ross Project area is located in a landscape of gently rolling topography and large, open expanses of upland grasslands, pasturelands, haylands, sagebrush shrublands, and intermittent riparian drainages. Intermittent streams are fed by ephemeral drainages that seasonally drain the adjacent uplands. A mountainous landscape east of the Ross Project can be seen; this landscape includes Devils Tower and the Missouri Buttes.

What are the objectives for the visual resource classes?

Class I: To preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

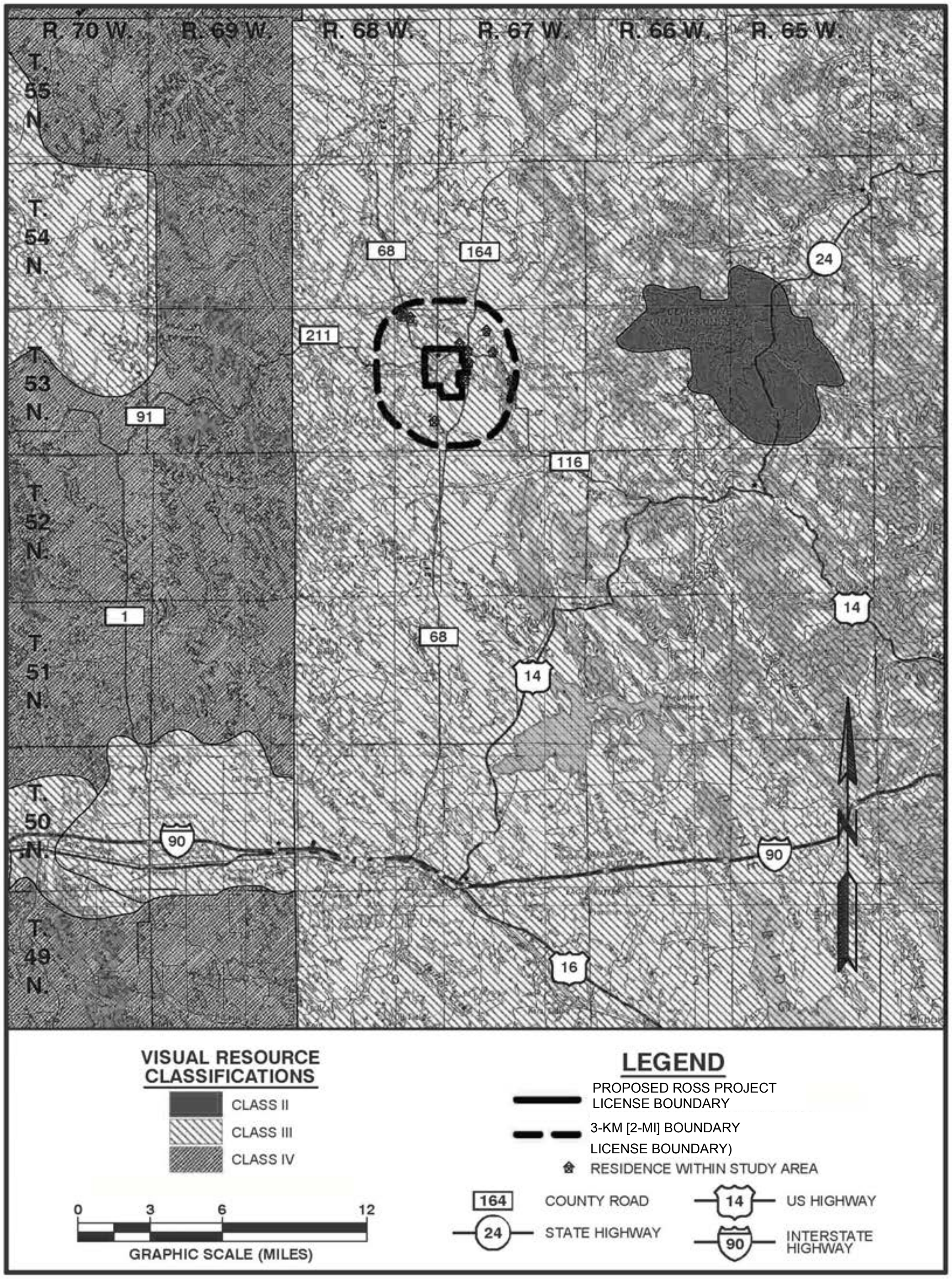
Class II: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III: To retain partially the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV: To provide for management activities that require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

To quantify visual and scenic resources on the land it administers, the BLM has established an evaluation methodology that defines the visual and scenic quality of land through a Visual Resource Inventory (VRI). The VRI process provides a means for determining visual values. The VRI consists of a scenic-quality evaluation, sensitivity-level analysis, and a delineation of distance zones. Based upon these three factors, BLM-administered lands are placed into one of four VRI classes. These classes represent the relative value of the visual resources.

Classes I and II are designated as the most valued, Class III represents a moderate value, and in Class IV, visual resources are of the least value. The VRI classes provide the basis to assess visual values during the resource management planning (RMP) process conducted for all BLM-administered lands (see Figure 3.20) (BLM, 2010b). The VRI classes are considered in addition to other land uses, such as livestock grazing, recreational pursuits, and energy development when the BLM establishes its Visual Resource Management (VRM) classes during the RMP process. All public lands must be placed into one of the four VRM classes. VRM classes may or may not reflect the VRI classes, depending upon other resource considerations (i.e., a VRI Class II area could be managed as a VRM Class III, or vice versa). The text box above describes the VRM classes and the BLM objectives for each visual classification (BLM, 2007c).



Sources: BLM, 2000; BLM, 2001; Strata, 2011a.

Note: Most of the Ross Project Area is categorized as VRM Class III, but there are some Class II areas identified around Devils Tower National Monument (i.e., Bear Lodge) and the Black Hills National Forest along the Wyoming-South Dakota border.

Figure 3.20
Regional Visual Resources Management Classifications

3.10.1 Regional Visual and Scenic Resources

Five areas of visually managed land are located within approximately 32 km [20 mi] of the Ross Project area, including Devils Tower (16 km [10 mi]) and the Missouri Buttes to the east of the Ross Project; Thunder Basin National Grassland (9 km [6 mi]) to the west and south; Keyhole State Park (18 km [11 mi]) to the southeast; and Black Hills National Forest (64 km [40 mi]) to the east (Strata, 2011a). These monuments, parks, and forests in the general vicinity of the Ross Project are indicated in Figure 3.21 (Strata, 2011a).

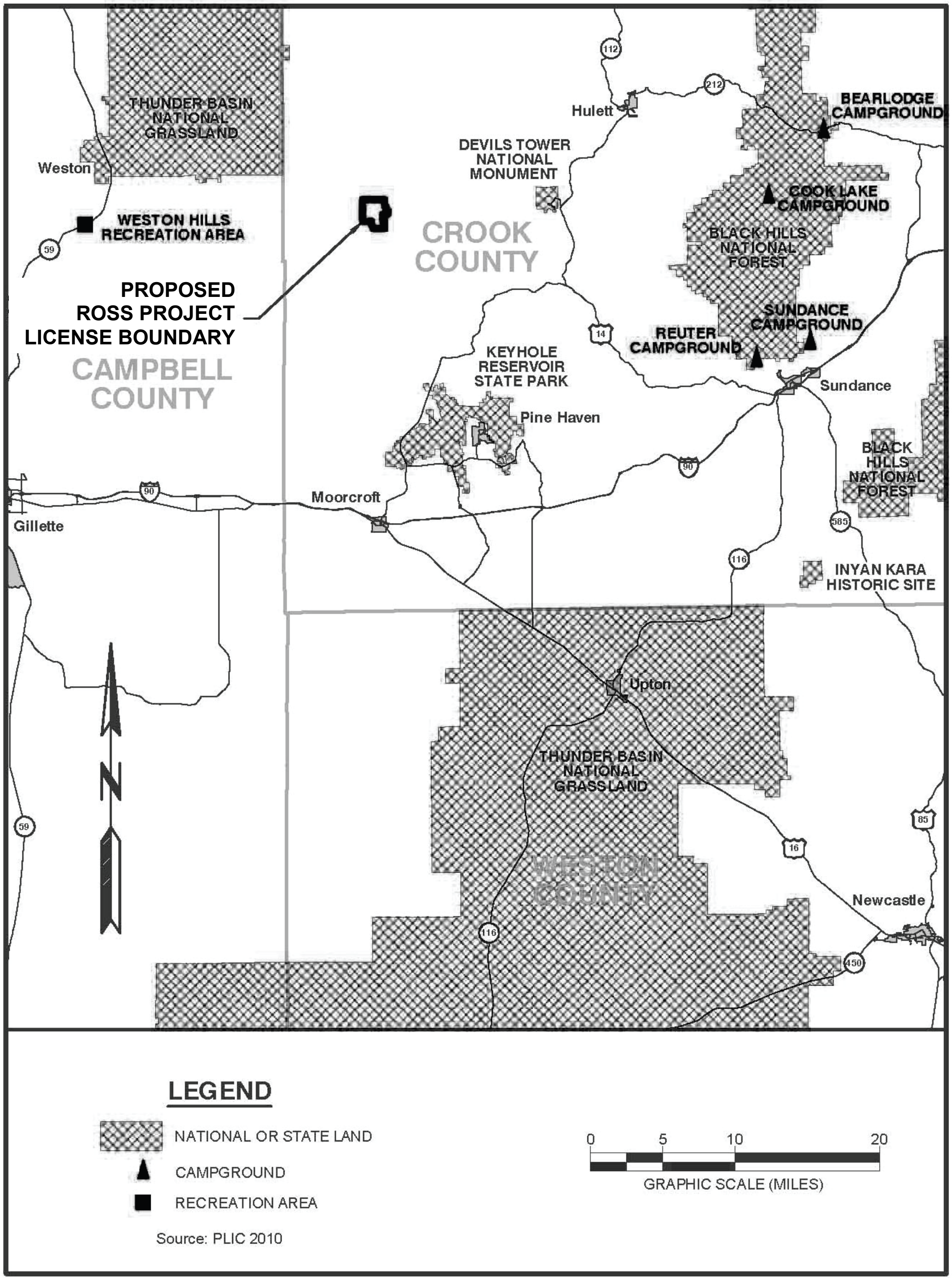
President Theodore Roosevelt established Devils Tower as a National Monument on September 24, 1906. The Monument rises 386 m [1,270 ft] above the Belle Fourche River and is visible for at least 16 km [10 mi]. Devils Tower is visible from a portion of the Ross Project area but, conversely, the Project area is not visible from the base of Devils Tower or its Visitor Center. Devils Tower and the surrounding countryside of pine forest, woodlands, and grasslands attract visitors from around the world. The 545-ha [1,350-ac] park allows climbing, hiking, backpacking, and picnicking. Recreational climbing at Devils Tower has increased significantly in recent years. In 1973, there were approximately 312 climbers; currently, there are approximately 5,000 – 6,000 climbers a year (NPS, 2008). As noted above, the BLM VRM classification for Devils Tower is Class II. Beginning in 1995, climbers have enacted a voluntary closure, or a “no climbing period,” for the entire month of June as an act of respect for Native American cultural values (NPS, 2008) (see SEIS Section 3.9.1.2).

The Black Hills National Forest (VRM Class II) encompasses streams, lakes, reservoirs, canyons and gulches, caves, varied topography, and vegetation, all of which provide habitat for an abundance of wildlife (Strata, 2011a). Keyhole State Park (VRM Class III) is home to a variety of wildlife. Keyhole Reservoir is the primary attraction to the Park and provides visitors many recreational opportunities including fishing, camping, and hiking (Strata, 2011a). The Thunder Basin National Grassland (VRM Class IV) also provides many opportunities for recreation, including fishing, hiking, and bicycling. Lush, green pastures at the Grassland provide abundant wildlife habitat. The U.S. Forest Service (USFS) manages the Grassland to conserve the natural resources of grass, water, and wildlife habitats (Strata, 2011a).

3.10.2 Ross Project Visual and Scenic Resources

The Applicant conducted a site-specific scenic-quality inventory and evaluation of the Ross Project area in October 2010, using the BLM’s VRI methodology (BLM, 2010b). The scenic-quality evaluation for the visual-resource study area was evaluated based upon the key factors of landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modifications. The average scenic-quality index for the Ross Project area was determined by a rating of the scenic quality of four individual aspects (the cardinal compass points) viewed from a high point in the center of the Ross Project. The individual scores were averaged to get a scenic-quality score for the entire Ross Project area. The scenic-quality evaluation presented in Table 3.19 shows that the visual-resource evaluation rating calculated for the Ross Project area is a 10.5 out of a possible 32. More explicit information on (e.g., photographs of) the Ross Project area’s scenic-quality inventory and evaluation can be found in Appendix D to this SEIS.

The BLM VRM classifications for the lands within and near the Ross Project area are shown on Figure 3.21 (BLM, 2000; BLM, 2001). The land west of the Ross Project is located in Campbell



Source: PLIC, 2010, as shown in Strata, 2011a.

Figure 3.21
Roads, National Parks, National Monuments, and Forests in Vicinity of Ross Project Area

Table 3.19
Scenic-Quality
Inventory and Evaluation
(Arithmetic Average of Four Views)

Key Factor	Score
Landform	2.00
Vegetation	3.00
Water	0.50
Color	2.50
Influence of Adjacent Scenery	1.25
Scarcity	2.00
Cultural Modifications	-0.75
TOTAL	**10.50**

Source: Strata, 2011a.

County and is categorized as VRM Class IV, while the land surrounding the Ross Project in Crook County to the east is categorized as VRM Class III. The areas studied for visual resources include the Ross Project and the 3-km [2-mi] surrounding vicinity. Thus, this visual-resources area is located entirely within Crook County, and it is consequently categorized as VRM Class III. The level of change allowed by the BLM to the characteristic landscape in Class III management areas would be moderate (BLM, 2010b).

No developed parks or recreational areas are located within the Ross Project and the 3-km [2-mi] area around the Project (Strata, 2011a). Within this vicinity, there are 11 residences in addition to storage tanks; pump jacks; small maintenance buildings; public and private roads and road signage; utilities and poles (e.g., power and other utility lines); agricultural features (e.g., fences, livestock, stock tanks, and cultivated fields), and environmental-monitoring installations are prominent in the immediate foreground, and they are often noticeable in foreground views by the casual observer.

Of the 11 residences within the visual-resources study area, 4 residences have unobstructed views to the Ross Project area where the uranium-recovery facility and wellfields would be constructed, and they are in close proximity to the Ross Project in general. The closest residence is 210 m [690 ft] from one Ross Project boundary (see also Figure 3.1). Of the 11 residences, 7 are located to the east of the Project area with views to the east (e.g., Devils Tower) and 3 of the 11 residences are northwest of the Ross Project area. Figure 3.22 indicates the areas where the Ross Project facility (i.e., CPP and surface impoundments) would be visible, and Figure 3.23 indicates the potential areas where light pollution from the Ross Project could impact. Photographs used to document the visual-resource study are included in Appendix D.

3.11 Socioeconomics

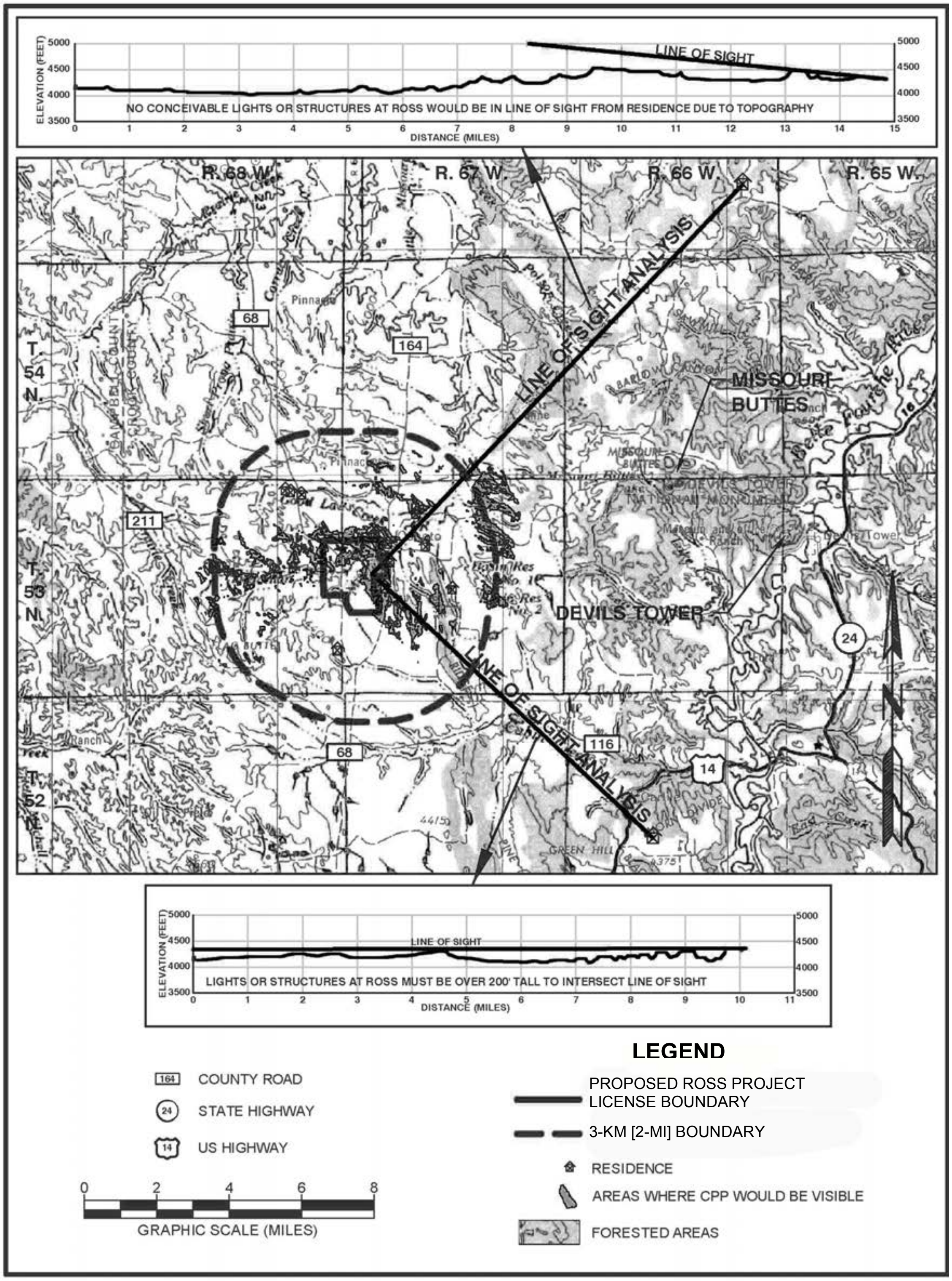
The Ross Project's socioeconomics region of influence (ROI) is defined as the area within which the Ross Project's socioeconomic impacts and benefits would be reasonably anticipated to be concentrated. The Ross Project would be located in Crook County, but that location is close enough to the Campbell County line that both Counties are within this ROI, or the region of potential impacts. The ROI extends approximately 92 km [57 mi] to the eastern boundary of Crook County, 66 km [41 mi] to the northern boundary of Crook County, 185 km [115 mi] to the western boundary of Campbell County, and 195 km [121 mi] to the southern boundary of Campbell County. The ROI would include all of the towns and unincorporated areas within Crook County, in which the Project's facility and wellfields would be located and, therefore, would benefit from mineral-production (e.g., uranium recovery) tax revenues. It would also include adjacent Campbell County, which hosts the nearest, largest urban area (i.e., Gillette) and would be, consequently, a potential source of labor, services, and materials to support the Ross Project.

3.11.1 Demographics

In Campbell County, Gillette, Wyoming, is the nearest urban area to the Ross Project; it is approximately 53 km [33 mi] to the southwest of the Project. Gillette would likely serve as a regional logistics hub as well as a source of personnel and supplies for the Ross Project (Strata, 2011a). Moorcroft, Wyoming, is approximately 35 km [22 mi] from the Ross Project area and could be a source of personnel as well as a place of residence for Project staff (Strata, 2011a).

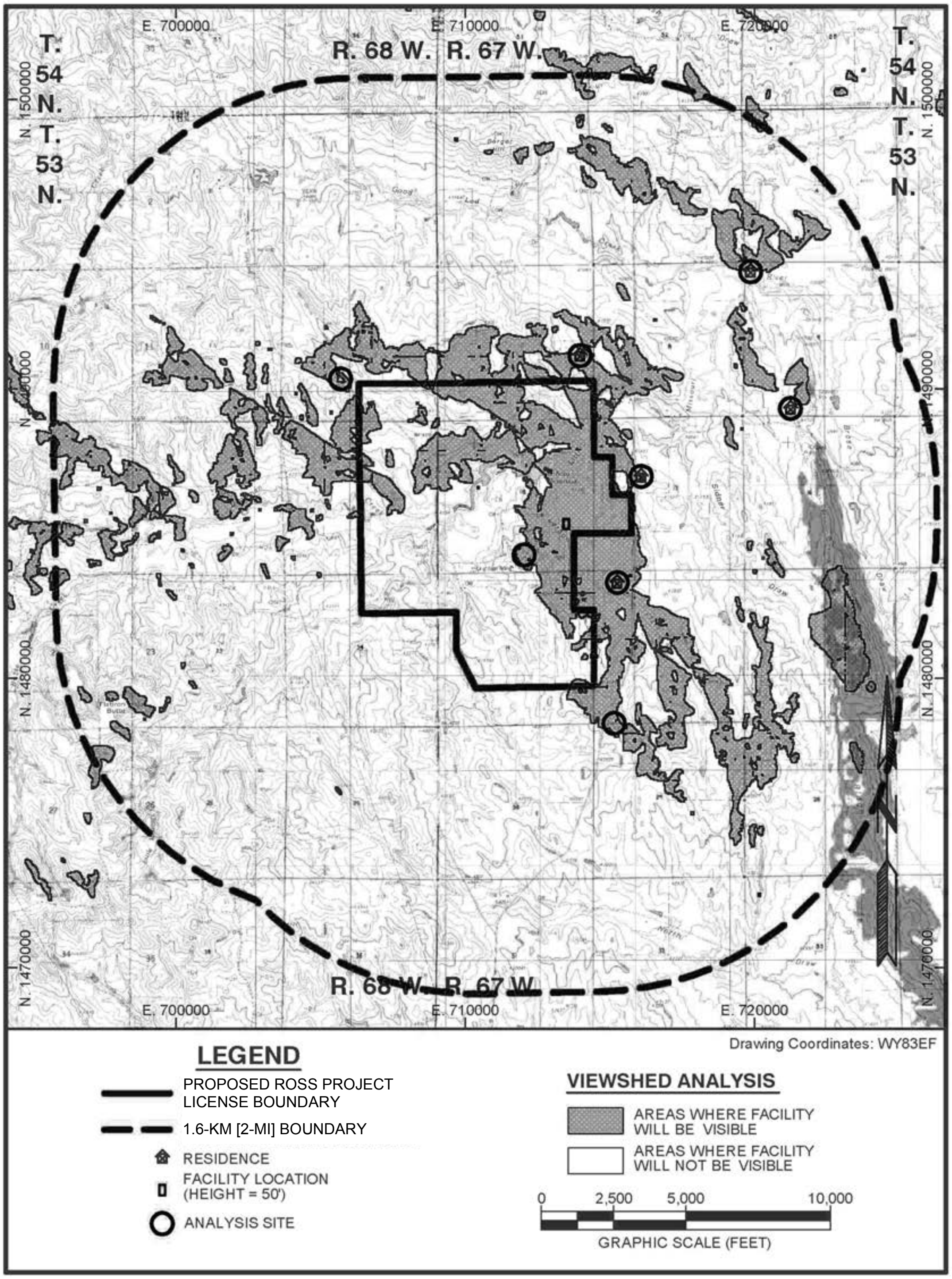
Table 3.20 presents the 2000 and 2010 population data for the potentially affected jurisdictions in the ROI. The population in Crook County was 7,083 persons as of 2010, having increased 20.3 percent over 2000 levels (USCB, 2012). The population in Campbell County was 46,133 persons as of 2010, having increased 36.9 percent over 2000 levels. In contrast, the population of Wyoming as a whole increased only 14.1 percent between 2000 and 2010. Crook County is the third least populous county in Wyoming, whereas Campbell County is the third most populous.

Between 2000 and 2010, Gillette grew by 48.1 percent, faster than the County as whole and much faster than the entire State. This is largely attributable to the growth in the energy sector, conventional oil, gas, and coal extraction, and power-plant construction.



Source: Strata, 2012a.

Figure 3.22
Viewshed Analysis of Ross Project Area



Source: Strata, 2012a.

Note: Prior to construction of the Ross Project, additional monitoring for potential light pollution would be conducted at eight sites.

Figure 3.23
Light-Pollution Study Area

The population of Campbell County is younger than the Wyoming average, has more people per household, more households with individuals under 18 years of age, fewer households with individuals over 65 years of age, and slightly more female householders with no husband present and with their own children under 18 years old (USCB, 2012). Conversely, the population of Crook County is older than the Wyoming average with a higher median age, smaller percentage of households with individuals under 18 years of age, and a higher percentage of households with persons 65 years of age or older.

Table 3.20
Populations in Crook County, Campbell County, and Wyoming
2000 and 2010

Jurisdiction	2000	2010	Change	Total Change (percent)	Annual Average Change (percent)
Crook County	5,887	7,083	1,196	20.3%	1.9%
Hulett	408	383	-25	-6.1%	-0.6%
Moorcroft	807	1,009	202	25.0%	2.3%
Pine Haven	222	490	268	120.7%	8.2%
Sundance	1,161	1,182	21	1.8%	0.2%
Campbell County	33,698	46,133	12,435	36.9%	3.2%
Gillette	19,646	29,087	9,441	48.1%	4.0%
Wright	1,347	1,807	460	34.1%	3.0%
TOTAL ROI	39,585	53,216	13,631	34.4%	3.0%
TOTAL WYOMING	493,782	563,626	69,844	14.1%	1.3%

Source: USCB, 2012

3.11.2 Income

Per capita personal income in Crook County was $45,843 per person in 2009 and was $49,986 per person in Campbell County (USBEA, 2011). By comparison, per capita personal income in Wyoming was $49,887 and $40,936 in the U.S. (USBEA, 2011). Based upon the population characteristics discussed above, total personal income in the two-County area was $2.6 billion. Per capita income in Crook and Campbell counties grew at an average annual rate of 3.9 percent over the 2000 – 2009 period (USBEA, 2011). In contrast, per capita personal income in Wyoming grew at a slightly lower rate of 3.4 percent per year, while the rate of growth in the U.S. over the same period was only 0.8 percent.

Average earnings per job in Crook County were $35,371 in 2009, having increased 2.9 percent annually since 2000. Average earnings per job in Campbell County are almost twice as high as in Crook County and were $64,612 in 2009, having increased 2.9 percent annually since 2000. In contrast, earnings per job State-wide were $46,831 and $52,358 in the U.S. for the same period.

3.11.3 Housing

As of 2010, there were 18,955 housing units in Campbell County (USCB, 2012). Of these, 1,783 were vacant housing units, representing an overall vacancy rate of 9.4 percent (USCB 2012). Of the 1,783 vacant units, 689 of the vacant units were for rent. In contrast, there were only 3,595 housing units in Crook County in 2010. Of these, 674 were vacant housing units, for an overall vacancy rate of 18.7 percent. Of the vacant units, only 54 vacant units were for rent.

Homeownership rates in the two Counties are high by State and national standards. Owner-occupied units accounted for 73.3 percent of all occupied units in Campbell County and 79.3 percent of all occupied units in Crook County (USCB, 2012). Homeownership for the State is 69.2 percent of the population, compared to the entire U.S. where homeownership is 65.1 percent of the population.

3.11.4 Employment Structure

Wyoming State Data

In October 2009, the seasonally adjusted unemployment rate in Wyoming reached 7.4 percent for the first time since September 1987. Unemployment rates have been on the decline since that time, with the August 2011 rate reported at 5.5 percent (BLS, 2011; WDWS, 2011a).

State-wide employment grew 6.5 percent between the years 2000 – 2010 and stood at 273,313 employed persons in 2010 (WDWS, 2011a). By August 2011, employment was 296,424 persons, up from 277,625 persons in August 2010.

Trade, transportation, and utilities employment represent the largest employment sector in Wyoming, with 24.0 percent of employed persons as of 2010 (WDWS, 2011a); in the U.S. the average is 23.0 percent. State-wide employment in the natural resources and mining sector amounted to 13.4 percent of all employment, significantly higher than the U.S. average of 1.7 percent.

Crook and Campbell County Data

Employment in Crook County over the past decade has typically been in the 3,000 – 3,400 range, with peak employment registered at 3,404 persons in 2008 (WDWS, 2011a). Average annual employment in 2010 was 3,284 persons. The August 2011 monthly level was 3,475 persons, down slightly from the August 2010 level of 3,527 persons.

Unemployment rates in Crook County have been typically low by national standards, ranging from 2.7 percent to 4.3 percent over the 2000 – 2007 period, but subsequently rose to 5.8 percent in both 2009 and 2010 (BLS, 2011). The unemployment rate as of August 2011 stood at a slightly reduced level of 5.0 percent, representing 175 unemployed persons.

In contrast to Crook County, employment in Campbell County over the past decade has typically been in the 20,000 – 28,000 range, with peak employment registered at 28,492 persons in 2009 (WDWS, 2011a). Employment dropped slightly in 2010 to 27,531 persons and the August 2011 level was 25,542 persons, up slightly from the comparable period in 2010 but still down from 2010 averages.

Unemployment rates in Campbell County also have been typically low by national standards, ranging from 2.0 – 3.7 percent over the 2000 – 2008 period, but the rates subsequently rose to 5.5 percent in 2009 and 6.0 percent in 2010 (BLS, 2011). The unemployment rate as of August 2011 stood at a reduced level of 4.4 percent, representing 1,166 unemployed.

3.11.5 Finance

Wyoming does not levy a personal or corporate income tax, nor does Wyoming impose a tax on intangible assets such as bank accounts, stocks, or bonds (Strata, 2011a). In addition, Wyoming does not assess any tax on retirement income earned and received from another state. Revenues to Wyoming come from three sources: 1) taxes on mineral production, 2) earnings on investments, and 3) general-fund revenues. Taxes on mineral production include property taxes on the assessed value of production, severance taxes, royalties on production of State-owned minerals, and the State's share of Federal mineral royalties. General-fund revenues include sales (at 4 percent) and use taxes, charges for sales and services, franchise taxes, and cigarette taxes. The third source of State revenues is earnings from the Wyoming Permanent Mineral Trust Fund and pooled investments.

Wyoming cities and counties receive revenues in the form of property taxes as well as local sales and use taxes up to 2 percent, including special assessments such as capital-facilities taxes and revenue sharing by the State. Local governments are responsible for collection of property taxes, which are the primary source of funding for public schools and for municipalities, counties, and other local government units. Although Crook County has a slightly higher average mill levy than Campbell County, the mill levy is applied to a much lower evaluation; thus, the property taxes raised in Crook County amounted to only a little more than 4 percent of those raised in Campbell County in fiscal year 2010 (Strata, 2011a).

3.11.6 Education

Kindergarten through 12th grade (K – 12) public schools in Wyoming are generally organized at the county or sub-county level by school district. Campbell and Crook counties each have one public-school district. Campbell County School District operates 16 elementary schools, 2 junior high schools, 2 high schools, and 1 combined junior/high school (Strata, 2011a). Crook County operates a single K – 12 school, 2 elementary schools, 2 secondary (grades 7 – 12) schools, and 1 high school (grades 8 – 12).

Campbell County has higher school-attendance rates than Wyoming as a whole at all grade levels, except college or graduate school (Strata, 2011a). The student:teacher ratio is 19.6:1 (Campbell County School District, 2012). Crook County is below the State average at the nursery and preschool ages as well as at the kindergarten and college/graduate school levels, but it is well above the State average at elementary (grades 1 – 8) and high-school levels. The student:teacher ratio is 11:1 (Education.com, Inc., 2012).

Wyoming also has seven community-college districts. The Northern Wyoming Community College District consists of the main campus in Sheridan, Wyoming, a satellite campus in Gillette, Wyoming, and outreach centers in Buffalo, Kaycee, and Wright, Wyoming. The Gillette campus is the nearest post-secondary school to the Ross Project area (Strata, 2011a).

3.11.7 Health and Social Services

Campbell County Memorial Hospital is the principal health-care provider in northeast Wyoming and offers a full range of health services, including emergency room and outpatient surgery services (Strata, 2011a). It is located approximately 65 miles (i.e., driving distance) from the Ross Project area. The Heptner Radiation Oncology Center was completed in 2002, and an expansion of oncology services was completed in 2008, to form the Cancer Care Center at Campbell County Memorial Hospital. An approximately 560-m^2 [6,000-ft^2] expansion of the Emergency Department was completed in 2009 and an extensive laboratory was completed in late 2009. A $68-million expansion project on the Hospital began in June 2009, with construction of a 3.5-levels, 294-space parking structure adjacent to the main entrance of the Hospital. Construction began on a three-levels Hospital addition, capable of supporting three additional levels, in 2010. In addition to Memorial Hospital, Campbell County also has outpatient and walk-in clinics, surgery and rehabilitation centers, and numerous senior-residence facilities.

The Crook County Medical Services District consists of Crook County Memorial Hospital and a clinic located in Sundance, Wyoming, as well as clinics located in Moorcroft and Hulett, Wyoming. The District also provides a long-term-care facility attached to the Hospital in Sundance (Strata, 2011a).

Sundance, Moorcroft, and Hulett have an ambulance service to cover each town and the surrounding vicinities. Each service has Emergency Medical Technician (EMT) Intermediates, EMT Basics, and Emergency Medical Responders (EMRs) serving on their teams. Of these, Moorcroft's is nearest to the Ross Project area.

A community survey of needs and services was published in June 2010 by the Campbell County CARE Board. The primary purpose of this needs assessment was to better understand the needs of people who are living in poverty in Campbell County. This survey indicated that both low-income clients and agencies ranked the following services as the most highly rated needs of the County (in order):

- Emergency Services
- Housing
- Health
- Nutrition/Food
- Employment and Training

3.12 Public and Occupational Health and Safety

The pre-licensing, site-characterization conditions with respect to both radiological and chemical health and safety that currently exist at the Ross Project area today are discussed below.

3.12.1 Existing Site Conditions: Radiological

As required by 10 CFR Part 40, Appendix A, Criterion 7, the Applicant has conducted one year of pre-licensing, site-characterization radiological monitoring at the Ross Project area. This monitoring began in August 2009. The resulting radiological environmental- and radiation-monitoring data characterize the Ross Project area prior to NRC's issuing a final license to Strata. These pre-licensing, site-characterization environmental- and radiation-monitoring efforts were developed and implemented in accordance with the following NRC guidelines:

- NRC Regulatory Guide 4.14, *Radiological Effluent and Environmental Monitoring at Uranium Mills*, Revision 1 (NRC, 1980).
- NRC Regulatory Guide 3.46, *Standard Format and Content of License Applications, Including Environmental Reports, For In Situ Uranium Solution Mining*, Section 2.9, "Radiological Background Characteristics" (NRC, 1982a).
- NRC Regulatory Guide 3.8, *Preparation of Environmental Reports for Uranium Mills* (NRC, 1982b).
- NUREG–1569, *Standard Review Plan For In Situ Leach Uranium Extraction License Applications* (NRC, 2003b).

These pre-licensing, site-characterization radiological data represent the environmental conditions at the Ross Project area prior to any NRC-licensed construction or development of any Ross Project facility, wellfield, or any other structural improvements, other than preconstruction activities (see SEIS Section 2.1.2). These data would support future assessments of the environmental impacts that could be a result of the Ross Project's construction, operation, and decommissioning, including accidental spills, leaks, or other releases.

Note that, in the case of ground-water resources, however, additional post-licensing, pre-operational radiological data would be collected (i.e., after a Source and Byproduct Materials License has been issued by the NRC to Strata, but before actual uranium recovery in a particular wellfield is initiated). These post-licensing, pre-operational data sets, which would be established for each wellfield prior to uranium recovery in that respective wellfield, would serve as a benchmark for the Applicant to determine whether an excursion has occurred (i.e., by way of the UCLs established for that particular wellfield) and/or whether the ground water in a wellfield has been restored to the respective target values during the aquifer-restoration phase of the Project. These additional sampling and analysis efforts are discussed further in SEIS Sections 2.1.1.1 and 3.5.3.

> **How are potential radiation exposures and doses calculated?**
>
> Radiation dose estimates are quantified in units of either **Sievert** or **rem** and are often referred to in either milliSieverts (mSv) or millirem (mrem) where 1,000 mSv = 1 Sv and 1,000 mrem = 1 rem (Sv = 100 rem). These units are used in radiation protection to quantify the amount of damage to human tissue expected from a dose of ionizing radiation.
>
> **Person-Sv** (or person-rem) is a metric used to quantify population radiation dose (also referred to as collective dose). It represents the sum of all estimated doses received by each individual in a population and is commonly used in calculations to estimate latent cancer fatalities in a population exposed to radiation.

As discussed in SEIS Section 3.5.3, results from site-characterization ground-water samples can be compared to the specific regulatory standards promulgated by the NRC, the EPA and the WDEQ/WQD for radiological constituents (primarily by the NRC). However, most of the analytical results discussed in this section cannot be compared easily to existing standards because the standards are specified in units other than those reported by the laboratory. That is, for example, gross-alpha results are reported in picoCuries per volume (pCi/L) (e.g., Becquerels/volume [Bq/L]) or picoCuries per mass (pCi/kg [Bq/kg]) (i.e., in liquid or solid matrices, respectively). These units are measurements of the radioactivity in a particular sample (such as ground water or soil). However, the units of radiation-dose standards are specified in radiation dose per time (Sievert or millirem [Sv or mrem]/ time), and pCi/L or pCi/kg concentrations cannot be straightforwardly converted to mrem/time, which is a standard for a human's radiation dose, without extensive modeling (including the conversion to a Total Effective Dose Equivalent [TEDE] which is one of the units also used in radiation-protection regulations) (see SEIS Section 4.13). The NRC staff has taken the pre-licensing, site-characterization data supplied by the Applicant and reviewed the modeling that the Applicant performed to determine the respective total radiation dose currently, naturally present at the Ross Project area, given the radioactivity-concentration values included in Strata's license application (Strata, 2011b; Strata, 2012b). The modeling and the pre-licensing, site-characterization monitoring results obtained by the Applicant indicate that the existing conditions at the Ross Project area do not exceed any radiation-dose guidelines or standards.

Radiation dose is a measure of the amount of ionizing energy that is deposited in a human body. Ionizing radiation is a natural component of the environment and ecosystem, and members of the public are exposed to natural radiation continuously. Radiation doses to the general public occur as a result of the radioactive elements found in the Earth's soils, rocks, and minerals (including those in the Ross Project area). For example, Rn-222 is a radioactive gas that escapes into ambient air as a result of the decay of uranium (and its progeny Ra-226), which is found in most soils and rocks. Naturally occurring low levels of uranium and radium are also found in drinking water and foods. Cosmic radiation from space is another natural source of radiation. In addition to these natural sources, there are also artificial or human-made sources that contribute to the radiation dose the general public routinely receives. For example, medical diagnostic procedures using radioactive material(s) and x-rays are the primary human-made source of radiation the general public receives. For comparison, the National Council for Radiation Protection estimates the average dose to the public from all natural radiation sources (i.e., terrestrial and cosmic) is 3.1 milliSieverts (mSv) [310 mrem] per year. In Wyoming, this figure is approximately 3.15 mSv/year [316 mrem/yr] (NRC, 2009b).

Pre-Licensing, Site-Characterization Radiological Conditions

Table 3.21 presents the range (i.e., the minimum and maximum values) of selected pre-licensing, site-characterization data for some of the radiological constituents required by the NRC's Regulatory Guide 4.14, Revision 1 (Strata, 2011b; NRC, 1980). Individual, reported values for the various radiological parameters can be found in the Applicant's TR (Strata, 2011b).

Pre-Licensing, Site-Characterization Sample Matrices, Locations, and Results

The Applicant's pre-licensing, site-characterization environmental-monitoring program was conducted under rigorous sampling-and-analysis procedures and quality-control methods (Strata, 2011b). During the Applicant's environmental-monitoring efforts, local surface and ground waters were sampled and analyzed as were samples of soils, sediments, air, vegetation, wildlife, and fish. Direct gamma ("γ") radiation was also measured. The pre-licensing, site-characterization monitoring program included the Applicant's obtaining samples of the matrices described below, at the specified locations, and then having the samples analyzed for the radiological parameters shown in Table 3.21. The range of the values obtained by laboratory analyses of these samples is presented in Table 3.21 as well.

Surface Water

The surface water at the Ross Project area was sampled by the Applicant quarterly from March 2010 – 2011 at 14 locations. These locations included one from the Oshoto Reservoir, one from Deadman Creek, and two from the Little Missouri River. Ten other reservoirs within or just outside of the Ross Project area were sampled as well. Three locations on the Project area are currently set up to automatically collect samples during any significant runoff events, although none occurred during the monitoring period (Strata, 2011b). Figure 3.12, presented earlier in SEIS Section 3.5.1, shows these locations.

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Water					
	Surface Water[†,††]				
		Lead-210	<1 – 3.3	pCi/L	Yes
		Polonium-210	<1**	pCi/L	No
		Radium-226	< 0.02 – 0.46	pCi/L	Yes
		Radium-228	<1 – 1.7	pCi/L	Yes
		Thorium-230	<0.2	pCi/L	No
		Uranium[a]	< 0.001 – 0.087	mg/L	Yes

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Water *(Continued)*					
	Surface Water[†,††] *(Continued)*				
		Gross Alpha	< 2 – 48.7	pCi/L	Yes
	Ground Water[†,††]				
		SA Zone			
		Lead-210	<1 – 1.4	pCi/L	Yes
		Polonium-210	<1	pCi/L	No
		Radium-226	<0.2 – 0.5	pCi/L	Yes
		Radium-228	<1 – 1.8	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.007	mg/L	Yes
		Gross Alpha	< 6 – 13.8	pCi/L	Yes
		SM Zone			
		Lead-210	< 1 – 5.2	pCi/L	Yes
		Polonium-210	< 1 – 1.9	pCi/L	Yes
		Radium-226	< 0.2 – 3.7	pCi/L	Yes
		Radium-228	< 1 – 2.27	pCi/L	Yes
		Radon-222	< 28 – 443	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.004	mg/L	Yes
		Gross Alpha	< 7 – 12.2	pCi/L	Yes
		Ore Zone			
		Lead-210	< 1 – 13.6	pCi/L	Yes
		Polonium-210	< 1 – 22.9	pCi/L	Yes
		Radium-226	0.6 – 12.1	pCi/L	Yes
		Radium-228	< 1 – 1.6	pCi/L	Yes
		Radon-222	4,580 – 35,100	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	0.005 – 0.109	mg/L	Yes
		Gross Alpha	< 5 – 222	pCi/L	Yes
		DM Zone			
		Lead-210	< 1 – 1.2	pCi/L	Yes
		Polonium-210	< 1 – 1.3	pCi/L	Yes
		Radium-226	< 0.2 – 0.7	pCi/L	Yes
		Radium-228	< 1 – 2.2	pCi/L	Yes

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Water *(Continued)*					
	Ground Water†,†† *(Continued)*				
		DM Zone (Continued)			
		Radon-222	< 25 – 242	pCi/L	Yes
		Thorium-230	< 0.2 – 0.24	pCi/L	Yes
		Uranium	< 0.0003 – 0.003	mg/L	Yes
		Gross Alpha	< 14 – 28.3	pCi/L	Yes
	Piezometers in SA Zone				
		Lead-210	< 1 – 5.5	pCi/L	Yes
		Polonium-210	< 1 – 1.4	pCi/L	Yes
		Radium-226	< 0.2 – 1.3	pCi/L	Yes
		Radium-228	< 0.01 – 2.5	pCi/L	Yes
		Thorium-230	< 0.2 – 0.7	pCi/L	Yes
		Uranium	< 0.0067 – 0.264	mg/L	Yes
		Gross Alpha	< 15 – 218	pCi/L	Yes
	Existing Water Supply Wells				
		Lead-210	< 1 – 17.4	pCi/L	Yes
		Polonium-210	< 1 – 6.4	pCi/L	Yes
		Radium-226	< 0.2 – 47.23	pCi/L	Yes
		Radium-228	< 1 – 3.2	pCi/L	Yes
		Radon-222	390 – 18,000	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.388	mg/L	Yes
		Gross Alpha	< 6 – 324	pCi/L	Yes

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Water					
	Surface Water[†,††]				
		Lead-210	<1 – 3.3	pCi/L	Yes
		Polonium-210	<1**	pCi/L	No
		Radium-226	< 0.02 – 0.46	pCi/L	Yes
		Radium-228	<1 – 1.7	pCi/L	Yes
		Thorium-230	<0.2	pCi/L	No
		Uranium[a]	< 0.001 – 0.087	mg/L	Yes
		Gross Alpha	< 2 – 48.7	pCi/L	Yes
	Ground Water[†,††]				
		SA Zone			
		Lead-210	<1 – 1.4	pCi/L	Yes
		Polonium-210	<1	pCi/L	No
		Radium-226	<0.2 – 0.5	pCi/L	Yes
		Radium-228	<1 – 1.8	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.007	mg/L	Yes
		Gross Alpha	< 6 – 13.8	pCi/L	Yes
		SM Zone			
		Lead-210	< 1 – 5.2	pCi/L	Yes
		Polonium-210	< 1 – 1.9	pCi/L	Yes
		Radium-226	< 0.2 – 3.7	pCi/L	Yes
		Radium-228	< 1 – 2.27	pCi/L	Yes
		Radon-222	< 28 – 443	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.004	mg/L	Yes
		Gross Alpha	< 7 – 12.2	pCi/L	Yes
		Ore Zone			
		Lead-210	< 1 – 13.6	pCi/L	Yes
		Polonium-210	< 1 – 22.9	pCi/L	Yes
		Radium-226	0.6 – 12.1	pCi/L	Yes
		Radium-228	< 1 – 1.6	pCi/L	Yes
		Radon-222	4,580 – 35,100	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	0.005 – 0.109	mg/L	Yes

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Water (*Continued*)					
	Ground Water[†,††] (*Continued*)				
		Ore Zone (Continued)			
		Gross Alpha	< 5 – 222	pCi/L	Yes
		DM Zone			
		Lead-210	< 1 – 1.2	pCi/L	Yes
		Polonium-210	< 1 – 1.3	pCi/L	Yes
		Radium-226	< 0.2 – 0.7	pCi/L	Yes
		Radium-228	< 1 – 2.2	pCi/L	Yes
		Radon-222	< 25 – 242	pCi/L	Yes
		Thorium-230	< 0.2 – 0.24	pCi/L	Yes
		Uranium	< 0.0003 – 0.003	mg/L	Yes
		Gross Alpha	< 14 – 28.3	pCi/L	Yes
	Piezometers in SA Zone				
		Lead-210	< 1 – 5.5	pCi/L	Yes
		Polonium-210	< 1 – 1.4	pCi/L	Yes
		Radium-226	< 0.2 – 1.3	pCi/L	Yes
		Radium-228	< 0.01 – 2.5	pCi/L	Yes
		Thorium-230	< 0.2 – 0.7	pCi/L	Yes
		Uranium	< 0.0067 – 0.264	mg/L	Yes
		Gross Alpha	< 15 – 218	pCi/L	Yes
	Existing Water Supply Wells				
		Lead-210	< 1 – 17.4	pCi/L	Yes
		Polonium-210	< 1 – 6.4	pCi/L	Yes
		Radium-226	< 0.2 – 47.23	pCi/L	Yes
		Radium-228	< 1 – 3.2	pCi/L	Yes
		Radon-222	390 – 18,000	pCi/L	Yes
		Thorium-230	< 0.2	pCi/L	No
		Uranium	< 0.0003 – 0.388	mg/L	Yes
		Gross Alpha	< 6 – 324	pCi/L	Yes

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Soil					
	Surface and Subsurface Soils				
		Lead-210	<0.2 – 2.0 ± 0.7	pCi/g	Yes
		Radium-226	<0.005 – 14.4 ± 2.0	pCi/g	Yes
		Thorium-230	<0.2 – 1.29 ± 0.59	pCi/g	Yes
		Uranium	<0.004 – 2.80	mg/kg	Yes
		Gross Alpha	<1 – 3.6 ± 1.7	pCi/g	Yes
		Lead-210	<0.2 – 2.0 ± 0.7	pCi/g	Yes
		Radium-226	<0.005 – 14.4 ± 2.0	pCi/g	Yes
		Thorium-230	<0.2 – 1.29 ± 0.59	pCi/g	Yes
		Uranium	<0.004 – 2.80	mg/kg	Yes
		Gross Alpha	<1 – 3.6 ± 1.7	pCi/g	Yes
	Sediments				
		Lead-210	<1 – 471 ± 6.1	pCi/g	Yes
		Radium-226	0.8 ± 0.1 – 1.5 ± 0.1	pCi/g	Yes
		Thorium-230	0.39 ± 0.14 – 371 ± 58	pCi/g	Yes
		Uranium	0.876 – 2.24	mg/kg	Yes
		Gross Alpha	1.1 ± 0.4 - 2.8 ± 0.6	pCi/g	Yes
Air					
	Particulates				
		Lead-210	1.51×10^{-6} – 2.54×10^{-5}	pCi/L	Yes
		Radium-226	<Detection Limits – 2.08×10^{-8}	pCi/L	Yes
		Thorium-230	<Detection Limits – 2.07×10^{-7}	pCi/L	Yes
		Uranium	<Detection Limits – 3.59×10^{-7}	pCi/L	Yes
	Radon				
		Average Radon[b]	0.2 ± 0.02 – 2.0 ± 0.13	pCi/L	Yes
Vegetation					
	Grazing Vegetation				
		Lead-210	3.9 ± 0.5 – 264 ± 19.1	pCi/kg	
		Polonium-210	0.225 ± 0.51 – 23.4 ± 7.2	pCi/kg	
		Radium-226	1.12 ± 0.08 – 1,530 ± 0.4	pCi/kg	
		Thorium-230	<0.2 – 89.5 ± 16.4	pCi/kg	
		Uranium	0.0017 – 13.9	mg/kg	
		Lead-210	9.07 ± 4.1 – 43.1 ± 6.1	pCi/kg	

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Vegetation (*Continued*)					
	Grazing Vegetation				
		Polonium-210	1.87 ± 1.7 – 5.88 ± 2.8	pCi/kg	
	Wetland Vegetation				
		Radium-226	0.3 ± 0.1 – 11.4 ± 0.5	pCi/kg	
		Thorium-230	<0.2 – 3.9 ± 1.5	pCi/kg	
		Uranium	0.0005 – 0.0019	mg/kg	
	Hay[c]				
		Lead-210	122 ± 13	pCi/kg	
		Polonium-210	11.3 ± 4.7	pCi/kg	
		Radium-226	123 ± 1.1	pCi/kg	
		Thorium-230	0.96 ± 0.23	pCi/kg	
		Uranium	3.10	mg/kg	
	Vegetable[c]				
		Lead-210	2.95 ± 4.9	pCi/kg	
		Polonium-210	2.55 ± 1.8	pCi/kg	
		Radium-226	<0.05	pCi/kg	
		Thorium-230	0.40 ± 0.90	pCi/kg	
		Uranium	0.0001	mg/kg	
Animal					
	Livestock (Beef)[c]				
		Lead-210	3.12 ± 4.8	pCi/kg	
		Polonium-210	<1.0	pCi/kg	
		Radium-226	0.288 ± 0.05	pCi/kg	
		Thorium-230	<0.2	pCi/kg	
		Uranium	<0.001	mg/kg	
	Wildlife (Deer)[c]				
		Lead-210	13.0 ± 7.5	pCi/kg	
		Polonium-210	3.68 ± 3.75	pCi/kg	
		Radium-226	1.8 ± 1.5	pCi/kg	
		Thorium-230	7.6 ± 4.2	pCi/kg	

Table 3.21
Range of Analytical Results of Pre-Licensing Site-Characterization Samples*
All Sample Matrices
(*Continued*)

Matrix	Type	Selected Parameters	Range (If Any) of Results** (Minimum to Maximum)	Units	Any Samples Greater than Detection Limit?
Animal (*Continued*)					
	Wildlife (Deer)[c] (*Continued*)				
		Uranium	<0.001	mg/kg	
	Fish[c]				
		Lead-210	60.4 ± 93.6	pCi/kg	
		Polonium-210	<1.0	pCi/kg	
		Radium-226	175 ± 15	pCi/kg	
		Thorium-230	0.6 ± 0.6	pCi/kg	
		Uranium	0.0160	mg/kg	
Direct Gamma					
	Gamma Survey		5.3 – 25.3 ± 1.54	μR/hr	
	TLD Exposure[d]		0.269 – 0.340	mrem/day	

Source: Strata, 2011b.

Notes:

- * = As suggested by NRC's Regulatory Guide 4.14.
- ** = "<" = "Less than," where the value following the "<" value is the detection limit.
- † = Results also discussed in SEIS Sections 3.5.1 and 3.5.3, Water Quality.
- †† = all metals concentrations in water matrices reported as dissolved concentrations (i.e., the samples were filtered).
- a = All uranium concentrations were obtained by wet-chemistry analysis, not isotope speciation by alpha or gamma spectrometry.
- b = Averages are radon concentrations taken over three months at each monitoring station.
- c = One sample only.
- d = Daily radiation-dose rates derived from values recorded by thermo-luminescent dosimeters (TLDs) at 17 positions around the Ross Project area over approximately 3 calendar quarters.

Ground Water

Ground-water samples were collected during the Applicant's pre-licensing, site- characterization monitoring efforts at the Ross Project area. The samples were collected by the Applicant at six locations within or near the Project area, using monitoring wells screened at various units within the Lance and Fox Hills aquifers from onsite and from nearby privately owned water-supply wells. The Applicant's sampling methodology and the corresponding analytical results of all water samples are more fully discussed in SEIS Section 3.5.3. Note that for samples where metals, including uranium, were to be analyzed, these samples were filtered, yielding "dissolved" concentrations in the data reported. This methodology is described in SEIS Section 3.5.3.

As discussed in the Applicant's license application and in SEIS Section 3.5.3, several ground-water samples exceeded radiological standards specified by the EPA for its drinking-water MCLs, and some exceeded more than one of the standards. The three radiological MCLs are:

- Uranium = 30 µg/L
- Radium-226+228 = 5.1 pCi/L [0.19 Bq/L]
- Gross Alpha (α) = 15 pCi/L [0.56 Bq/L]

Monitoring Wells and Piezometers

Six well clusters were used by the Applicant to sample ground water quarterly in 2010 and 2011 (Strata, 2011a). An additional four piezometers in the CPP area were also used quarterly beginning in May 2010. (A piezometer is a device that measures the pressure [more precisely, the piezometric head] of ground water at a specific location.) As described in SEIS Section 2.1.1.1, the six well clusters allowed access to four different ground-water systems in the SA, SM, OZ, and DM aquifers.

Water-Supply Wells

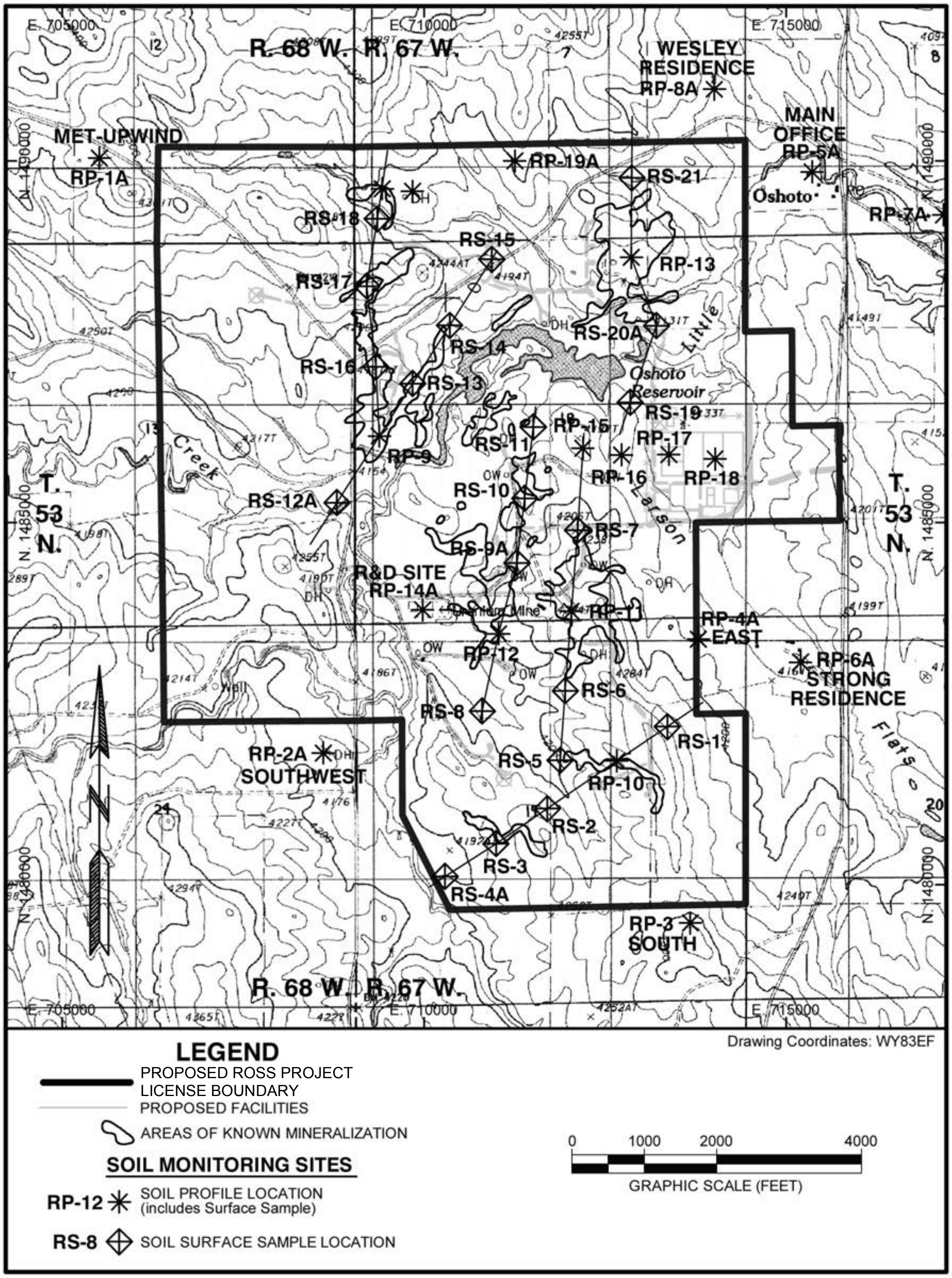
As described in SEIS Section 3.5.3, 29 local drinking-water wells were also sampled quarterly, beginning in July 2009. Some of this sampling could not always take place because some of the wells were inaccessible during the winter, the respective landowner's permission could not be obtained, or the well was non-functioning (see SEIS Section 3.5.1) (Strata, 2011a).

Sediments

The sediments at Oshoto Reservoir as well as those at the three surface-water monitoring stations were sampled in August 2010 (see Figure 3.12) (Strata, 2011b). Two cups of sediment were sampled at each location and analyzed for uranium, Ra-226, Th-230, Pb-210, and gross alpha. One sediment sample analyzed had elevated Pb-210 and Th-230 concentrations, as noted in Table 3.21. However, the Applicant attributed these anomalous results (in only one sample) to analytical error. The Applicant re-analyzed additional samples in 2011 and none of the results replicated the high concentrations found in the one earlier sample.

Soil

Surface-soil samples at the Ross Project area were obtained from 39 locations; 18 of these locations were sampled both at the surface and subsurface (Strata, 2011b). Figure 3.24 indicates the locations of the soil-sampling activities. These include the nearest residences, Strata's Oshoto Field Office, the potential locations of the surface impoundments and the CPP, and locations over the delineated major ore bodies where injection, recovery, and other monitoring wells would be located during active uranium-recovery operations.



Source: Strata, 2011b.

Figure 3.24
Soil Sampling Locations at Ross Project Area

Air

Particulates

Samples of airborne particulates (e.g., fugitive dust) were collected by the Applicant at the six air-sampling stations shown in Figure 3.25. Five of these stations commenced operation in January 2010; the sixth began operating in November 2010. The filters at each air-sampling location were collected weekly and then later consolidated (or "composited") for analysis (i.e., the filters from each sampling station were composited with the filters from only that respective station, the filters having been collected weekly over an entire quarter for a total of approximately 13 filters per composite sample) (Strata, 2011b).

Radon

Seventeen radon-sampling locations were established by the Applicant, and the results at each were collected quarterly beginning in January 2010; two of these stations were established in mid-2010, resulting in fewer samples. The radon (i.e., a potential gaseous emission) samplers were situated at each of the particulate-sampling locations as well as in the proposed CPP and surface-impoundment areas, the nearest residences, the former Nubeth research and development operation, and over two ore bodies that have been identified for potential uranium recovery (Strata, 2011b).

Vegetation

Vegetation at the Ross Project area was sampled by the Applicant in cooperation with the neighboring landowners after a field study to determine the best vegetation-sample locations was conducted in 2010. Eleven vegetation samples were ultimately collected at downwind locations and near the potential locations of the CPP and surface impoundments as well as along the major ore bodies in the mid- to late summer of 2010. In addition, the Applicant sampled vegetation from the wetlands near the confluence of Oshoto Reservoir and the Little Missouri River. Finally, food-crop samples obtained by the Applicant included hay as well as vegetables from one personal garden adjacent to the Project area.

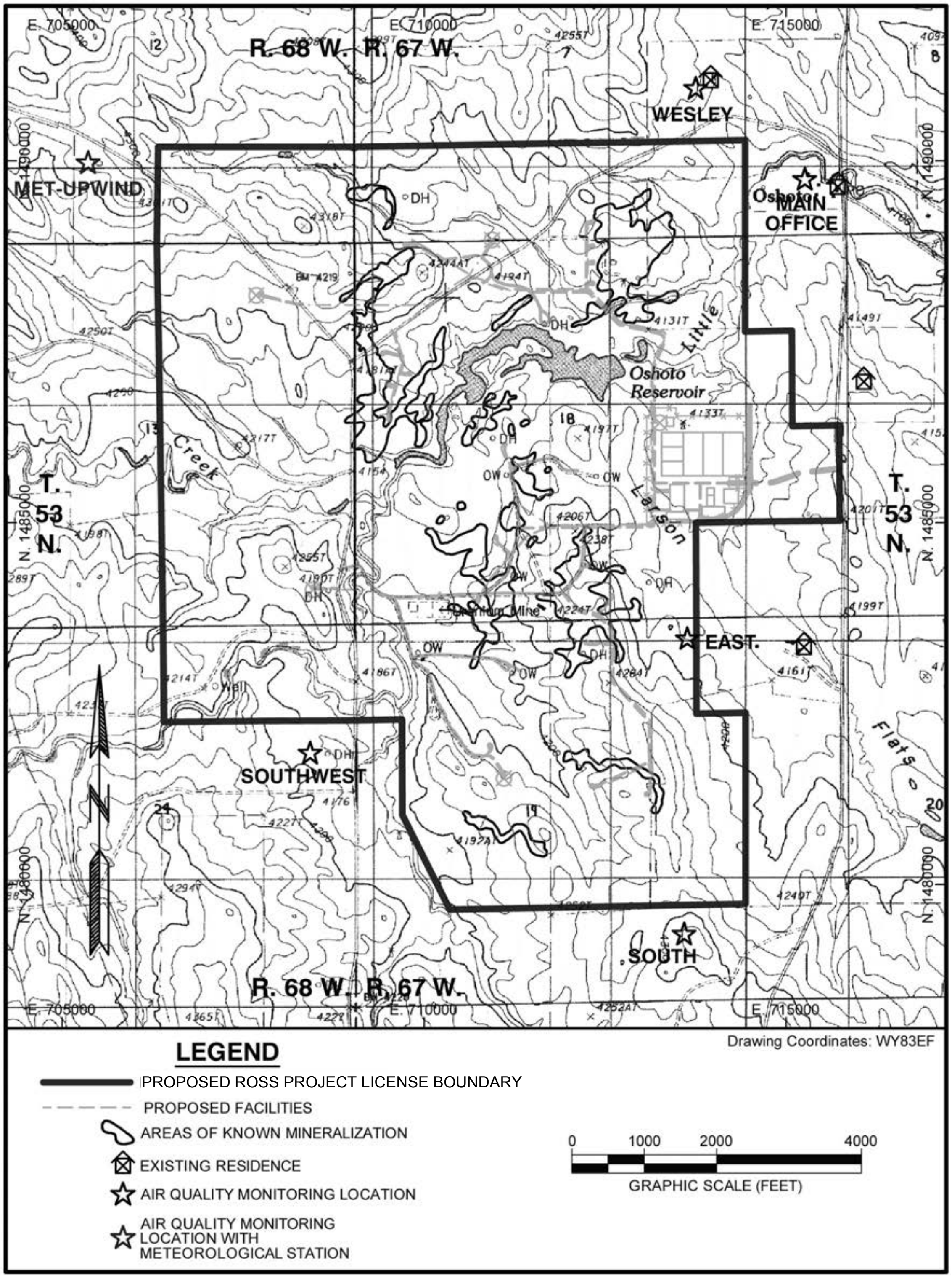
Animals

Livestock

Beef from locally raised cattle were sampled in cooperation with nearby landowners. Because horses are not raised in the area for human consumption, no horse-meat samples were obtained. A single beef sample was collected in July 2010 (Strata, 2011b).

Wildlife

Based upon the wildlife surveys described in SEIS Section 3.6, the only wildlife species potentially hunted at or near the Ross Project area for human consumption are deer and pronghorn antelope. One deer-meat sample was obtained from a local landowner who had hunted the deer in the Project's vicinity during the 2010 hunting season (Strata, 2011b).



Source: Strata, 2011b.

Figure 3.25
Air-Particulate Sampling Stations at Ross Project Area

Fish

A single composite sample from 99 fish that were caught at the Oshoto Reservoir was analyzed. Although it is reported by local landowners that fish from the Reservoir are not consumed by humans (Strata, 2011b), this sample was nonetheless submitted for analysis in September 2010.

Direct* (*Gamma*) *Radiation

Gamma Field Survey

A field survey performed by a contractor to the Applicant was conducted during July 19 – 22, 2010. During this survey, gamma radiation was surveyed at a total of 80,833 points (Strata, 2011a). In addition, ten soil samples were obtained for an evaluation of the potential relationship between radiation levels and radium concentrations in the corresponding soils (Strata, 2011b). The survey was performed according to the *Multi-Agency Radiation Survey and Site Investigation Manual* (MARSSIM), which is the generally accepted methodology for gamma field surveys.

Long-Term Gamma Study

A long-term study to measure long-term gamma radiation by thermo-luminescent dosimeters (TLDs) was implemented by the Applicant at the same time the radon monitoring stations were established. Ultimately, a total of 17 TLDs (and 2 controls) were installed around the Ross Project area to measure quarterly gamma exposures.

3.12.2 Public and Occupational Health and Safety

The exposure of members of the public to hazardous chemicals is regulated by the EPA and by Wyoming under a variety of statutes, regulations, and guidance. The NRC, however, has the statutory responsibility, under the *Atomic Energy Act of 1954* (AEA), to protect public and occupational health and safety with respect to radioactive materials, radiation exposures, and radiation doses. NRC regulations at 10 CFR Part 20 specify annual radiation-dose standards to members of the public of 1 mSv [100 mrem] TEDE and 0.02 mSv [2 mrem] per hour from any external radiation sources (see SEIS Section 3.12.1 for a discussion of the units of radiation dose) (10 CFR Part 20). The existing public and occupational health and safety concerns that exist at the Ross Project area today, where it currently presents minimal chemical and radiation exposures, are discussed below.

3.12.2.1 Public Health and Safety

A factor in any assessment of risk to public health and safety, including both chemical and radiation exposures, is the proximity of potentially impacted populations and the nearest receptors. As described in SEIS Section 3.2, the Ross Project area is located in a sparsely populated area of western Crook County (Strata, 2011a). The nearest community is Moorcroft, Wyoming, 35 km [22 miles] to the south, with an estimated population of approximately 1,000 persons. The Ross Project area is adjacent to the unincorporated ranching community of Oshoto. There are no residences within the proposed Ross Project area; however, within 3 km [2 mi], there are 11 residences with approximately 30 residents. The nearest residence to the

Ross Project's boundary is approximately 210 m [690 ft] away, and the nearest residence to the CPP is about 760 m [2,500 ft] away (see SEIS Sections 3.2 and 3.8).

In addition, access to the Ross Project by non-local members of the public is very limited because much of it is privately owned land; there are few public roads that enter the area; and there are no actual public attractions or recreational activities within the Ross Project area or its immediate environs. Moreover, as described in SEIS Section 3.12.1, the hazardous substances known to be present at the Ross Project area are crude oil, associated oil-contaminated water and trash, propane and methanol, and, potentially, polychlorinated biphenyls (PCBs) (Strata, 2011a). Thus, there are presently very limited non-radiological public health and safety concerns at the Ross Project area because there are: 1) few close residential receptors, all of whom are located offsite; 2) few, if any, members of the public who can access the Project area; and 3) very few hazardous materials are present.

With respect to the existing radiological hazards that are present at the Ross Project area, the same limitations exist as described above for nonradiological hazards: few nearby residents, no public access, and few sources of radiation. The pre-licensing, site-characterization results presented in Table 3.21 indicate exposures to only common radiation values as described in SEIS Section 3.12.1. Soil results presented in Table 3.21 indicate the radionuclide concentrations in soils that are naturally occurring, including the decay products (i.e., progeny) of the naturally occurring uranium, thorium, and radium. The surface- and ground-water pathways, as described above (see SEIS Section 3.12.1), yield little, if any, radiation exposure to those receptors located offsite because the analytical results of surface- and ground-water samples indicate concentrations of radionuclides that are essentially at or below the respective detection limits and/or below regulatory guidelines. Finally, animal samples indicate limited concentrations of naturally occurring radionuclides. Thus, there are very limited public health and safety concerns at the Ross Project area as it is currently characterized.

3.12.2.2 Occupational Health and Safety

Nonradiological

Occupational health and safety (i.e., industrial safety) is regulated by Wyoming under the Occupational Safety and Health Administration Program. However, occupational health and safety hazards within the Ross Project area are limited by the existing land uses, which are primarily grazing, agriculture, and oil production (see SEIS Section 3.2). Known occupational health and safety concerns include common physical health and safety hazards as well as, potentially, exposures to hazardous substances. Occupational exposures could include normal, industrial, airborne hazardous substances associated with servicing equipment (e.g., vehicles); fugitive dust generated by agricultural activities and by access-road use during well-drilling activities; and various chemicals used in agriculture or during oil extraction.

Another common type of occupational hazard includes injuries and illnesses. According to the Wyoming Department of Workforce Services (WDWS), the most common lost-day injuries among mineral-extraction workers, including oil-production workers (currently the only type of consistent occupational worker present at the Ross Project area), were from strains and sprains that often resulted from slips, trips, falls, or lifting. The Bureau of Labor Statistics (BLS) compiles annual reports of incidence rates of nonfatal occupational injuries and illnesses by industry and case types. The most recent reports include data from 2009 and 2010. For the category "uranium-radium-vanadium ore mining," annual average employment is given as 1,000 and 900 in 2009 and 2010, respectively. For both years, no total recordable cases either during work or not during work were reported (BLS, 2009; BLS, 2010).

Radiological

The occupational radiation-dose standard promulgated by the NRC is 50 mSv [5 rem] for TEDE over the entire human body (other limits pertain to exposures other than whole body). In addition, all radiation exposures are to be limited to "as low as reasonably achievable" (ALARA). However, only a few preconstruction activities are currently taking place at the Ross Project area—activities such as drillhole plugging and abandonment, monitoring-well installation, and environmental-monitoring sample collection by the Applicant's workers. As the pre-licensing, site-characterization data demonstrate (Strata, 2011a), little radioactivity is available to come into contact with these personnel at the Ross Project area today. As a result, there is currently only a small occupational exposure to radiation (i.e., there are few personnel to be exposed and few sources of radiation that yield measureable doses).

3.13 Waste Management

Few wastes, either liquid or solid, are generated at the Ross Project area at the present time. Those that are generated are described below.

3.13.1 Liquid Waste

Sources of liquid wastes generated at the Ross Project area currently include uranium-delineation drilling, monitoring-well drilling and installation, and oil production (Strata, 2011a).

Drilling the many uranium-delineation drillholes on the Ross Project generates drilling fluids and muds (i.e., cuttings). These wastes are classified as technologically enhanced naturally occurring radioactive material (TENORM); they are defined by EPA as "[n]aturally occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing" (EPA, 2008). Drilling wastes (i.e., fluids, muds, cuttings) are collected and disposed of by the Applicant in onsite excavated pits, or mud pits, that are dug for this specific purpose pursuant to the various EPA regulations governing TENORM and that are constructed adjacent to the individual drilling pads. The drilling wastes are allowed to evaporate and dry, and then the dried pits are reclaimed according to WDEQ/LQD requirements, usually within one construction season.

Drilling fluids and muds similar to those created during uranium-delineation drilling are also generated during the Applicant's drilling of its preconstruction monitoring wells and drillholes that it is using to support its license application to the NRC (Strata, 2011a). These fluids are contained and evaporated in mud pits in the same manner as those described above (Strata, 2011b). An average of 23,000 L [6,000 gal] of ground water, in addition to 12 m^3 [15 yd^3] of drilling muds, are produced during the development and sampling of monitoring wells (Strata, 2011b).

Ground water has also been produced during well testing conducted to characterize aquifer properties (Strata, 2011a). This TENORM liquid waste is discharged under a temporary WYPDES Permit No. WYG720229 (WDEQ/WQD, 2011a).

Crude oil and water used in its production could be present at the three oil-producing wells on the Ross Project area. These wastes are categorized by EPA as "special wastes" and are exempt from the Federal hazardous-waste regulations under Subtitle C of the *Resource Conservation and Recovery Act* (RCRA).

3.13.2 Solid Waste

Few solid wastes are currently generated at the Ross Project area; no AEA-regulated wastes are presently generated. The solid wastes currently generated include predominantly miscellaneous trash from the existing agricultural and oil-production activities that presently take place at the Project area. Agricultural wastes are either disposed of at private landfills or at the local State-permitted landfill in Moorcroft; no private landfills have been identified at the Ross Project area (Strata, 2011a).

Oil-production solid wastes, such as oil-contaminated rags, propane, or methanol, are "special wastes" according to EPA regulations (i.e., they are generated in the production of crude oil) and are also exempted from the EPA's hazardous-waste regulations under Subtitle C of RCRA (Strata, 2011a). There is one existing stockpile of discarded oil-production tubing that has been identified on the Ross Project area.

3.14 References

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4 ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES

4.1 Introduction

As discussed in this *Final Supplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]), Sections 1, 2, and 3, the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), NUREG–1910, evaluated the potential environmental impacts of in situ uranium-recovery (ISR) projects in four distinct geographic regions, including the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR), where the proposed Ross Project area is located (NRC, 2009b). Four project phases were evaluated in the GEIS for each of the geographic regions (i.e., construction, operation, aquifer restoration, and decommissioning). The activities that would occur during the four Project phases at the Ross Project and their timeframes are described in SEIS Section 2. Because of the similarities between the ISR projects examined in the GEIS and the proposed Ross Project, many of the conclusions found in the GEIS can be used to identify and rate the relative impacts of the Proposed Action in this SEIS (see Section 1.4.1). However, if the results of the GEIS's impact analyses indicated a wide range of impacts on a particular resource area (e.g., from SMALL to LARGE), then that resource area was evaluated in greater detail within this site-specific SEIS.

The information that has been used to perform these site-specific impact analyses has been obtained from Strata Energy, Inc.'s (Strata) (herein also referred to as the "Applicant") license-application documents, including the *Environmental Report* (ER) and the *Technical Report* (TR), submitted by the Applicant to the United States (U.S.) Nuclear Regulatory Commission (NRC) in early 2011 as well as subsequent information provided by the Applicant in 2012 (Strata, 2011a; Strata, 2011b; Strata, 2012a; Strata, 2012b). The NRC staff has compiled related information from publicly available sources as well (see SEIS Section 2.1). All of this information has allowed the NRC to perform site-specific assessments of the environmental impacts of the proposed Ross Project facility and wellfields, as needed, and to evaluate the measures that would successfully mitigate those impacts.

The NRC has established a standard of significance for its analyses of environmental impacts during the conduct of its environmental reviews, as described in the NRC's *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, NUREG–1748 (NRC, 2003b). This standard is summarized as follows:

SMALL: The environmental impacts are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental impacts are sufficient to alter noticeably, but not destabilize, important attributes of the resource considered.

LARGE: The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

This section of this Ross Project SEIS analyzes the four lifecycle phases (i.e., construction, operation, aquifer restoration, and decommissioning) of the proposed Ross Project, consistent with the analytical approach used in the GEIS (NRC, 2009b). This assessment is conducted for the Proposed Action and the two Alternatives: No-Action—Alternative 2—and North Ross Project—Alternative 3. The impacts are organized by the environmental resource and management areas commonly examined for the satisfaction of the *National Environmental Policy Act of 1969* (NEPA) requirements. These areas include:

- Land Use
- Transportation
- Geology and Soils
- Water Resources (Surface and Ground Waters)
- Ecology
- Air Quality
- Noise
- Historical, Cultural, and Paleontological Resources
- Visual and Scenic Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety (Radiological and Nonradiological)
- Waste Management

The respective mitigation measures that would moderate the identified environmental impacts are also discussed in this section for each resource and management area. Many types of mitigation measures can be considered when any particular resource or management area's impacts are evaluated. Some of the mitigation measures that are described in this section of the SEIS include:

- Permit and License Requirements
- Regulatory Requirements and Standards
- Facility Design Criteria and Modifications
- Process and System Adjustments
- Engineering and Management Techniques
- Best Management Practices (BMPs)
- Standard Operating Procedures (SOPs)
- Management and Operating Plans
- Training Prerequisites
- Scheduling and Phasing Variations

The respective environmental impacts and associated mitigation measures identified and evaluated in this section are also summarized in Section 8, "Summary of Environmental Impacts and Mitigation Measures," in Table 8.1.

4.2 Land-Use Impacts

The Proposed Action could impact local land use during all phases of the Project's lifecycle. Potential land-use impacts could result from land-surface disturbances during, especially, the Ross Project's construction and decommissioning phases; from grazing and area-access restrictions; and from competing access for mineral rights. These potential impacts are sometimes greater in areas where there are higher percentages of private landownership, like the Ross Project area, as some of the current uses (e.g., dryland crop production) could not continue once the Ross Project is constructed. As shown in Table 2.1 in Section 2.1.1, the surface owners of the Ross Project area include private owners (553.2 ha [1,367 ac]), the State of Wyoming (Wyoming) (127 ha [314 ac]), and the U.S. Bureau of Land Management (BLM) (16 ha [40 ac]). At the end of operations, final site restoration and reclamation would occur during the decommissioning phase, and all lands would be returned to their current land use. These current land uses include livestock grazing, crop agriculture, and wildlife habitat. Detailed discussion of the potential environmental impacts to land use during construction, operation, aquifer restoration, and decommissioning and site restoration for the proposed Ross Project are provided in the following sections.

4.2.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields.

4.2.1.1 Ross Project Construction

The GEIS identified potential land-use impacts during construction resulting from land-surface disturbances and site-access restrictions that could impact other grazing, mineral extraction, or recreational activities (NRC, 2009b). As discussed in GEIS Section 4.4.1, potential impacts from the construction of an ISR project to most aspects of land use would be SMALL (NRC, 2009b). This is because the amount of area disturbed by facility and wellfield construction would be small in comparison to the available land; the majority of the site would not be fenced; potential conflicts over mineral access would be expected to be negotiated and agreed upon; only a small portion of the available land would be restricted from grazing; and the open spaces for hunting and offroad vehicle access would be minimally impacted by the fencing associated with the ISR facility. The GEIS defined land-use impacts to be SMALL when they ranged from 49 – 761 ha [120 – 1,880 ac] (NRC, 2009b).

What are mineral rights, oil rights, and drilling rights?

Rights may be conferred to remove minerals, oil, gas, or sometimes water that may be present on and under some land. In jurisdictions supporting such rights, they may be separate from other rights to the land. The rights to develop minerals, and the purchase and sale of those rights, are contractual matters that must be agreed between the parties involved.

Construction-phase activities during the Proposed Action would include construction of buildings, other auxiliary structures, and surface impoundments; wells, wellfields, and pipelines; and transportation and utility infrastructure (e.g., roads and lighting). The Applicant estimated that construction activities would disturb a total of 114 ha [282 ac] of land, which represents 16 percent of the Ross Project area. The impacts on specific areas of the Proposed Action by construction activities are summarized in Table 4.1.

Table 4.1
Summary of Land Disturbance during Construction of Proposed Action

Activity	Total Area Impacted by Proposed Action (ha [ac])	Total Area Impacted in the Year Preceding Proposed Action Operation (ha [ac])	Primary Current Use
Central Processing Plant	22 [55]	22 [55]	Dryland crop production Pasture
Wellfield Modules	65 [160]	14 [85]	Livestock grazing Oil and gas production

Table 4.1
Summary of Land Disturbance during Construction of Proposed Action
(*Continued*)

Activity	Total Area Impacted by Proposed Action (ha [ac])	Total Area Impacted in the Year Preceding Proposed Action Operation (ha [ac])	Primary Current Use
Access Roads	12 [30]	5 [12]	Livestock grazing
UIC Class I Deep-Injection Wells	3 [7]	1 [3]	Livestock grazing
Pipelines	6 [15]	2 [5]	Various
Utilities	6 [15]	2 [5]	Various
TOTAL	~ 114 [282]	~ 47 [116]	

Source: Strata, 2011a.

The Applicant would mitigate short-term impacts resulting from construction activities by phasing its activities and limiting the amount of land disturbance at any one time; promptly restoring and reseeding disturbed areas; coordinating efforts with the oil-production company currently operating within the Ross Project area (i.e., Merit Oil Company [Merit]); using existing roads wherever possible; following existing topography during access-road construction to minimize the need to cut and fill; minimizing secondary and tertiary access-road widths; and locating access roads, pipelines, and utilities in common corridors. In addition, the Applicant would establish surface-use agreements with surface owners/lessees to mitigate and/or to compensate for their temporary loss of use in areas where livestock grazing or crop production is the current land use. Cultivated fields would be specifically avoided, where possible, during facility construction and wellfield installation.

As shown in Table 2.1, of the 16 ha [40 ac] of BLM-administered surface land within the Ross Project area, 0.53 ha [1.3 ac] would be disturbed by the Proposed Action. This disturbance would take place during the construction phase. The Applicant would restrict hunting throughout the lifecycle of the Project in order to protect its workers and visitors. Hunting and recreation are not presently major land-use activities within the Ross Project area, and there is no straightforward access to BLM land via public roads; therefore, land-use impacts would be minimal.

All of the construction activities at the Ross Project would result in temporary, short-term impacts, with the current use restored following construction, except for the area where the Central Processing Plant (CPP) and surface impoundments (i.e., the “facility”) would be constructed. The current land uses of the Ross Project area, however, could be restored after all uranium-recovery activities have ceased. The area of surface disturbance the Applicant estimates for the Proposed Action is less than that identified in the GEIS, and no site-specific impacts have been identified for the Proposed Action that would change the magnitude of the impacts identified by the GEIS (NRC, 2009b). Thus, the land-use impacts resulting from the construction of the Ross Project would be SMALL.

4.2.1.2 Ross Project Operation

The primary land-use impact during the Ross Project's operation would be due to the Applicant's installing additional wellfields and operating the processes and circuits located in the CPP; however, these impacts are generally the same as those addressed in the construction-phase analysis above. Additionally, the affected area would be reclaimed over the longer term.

As during the construction phase, the Applicant would reduce ongoing impacts to livestock grazing by fencing less than 12 percent of the Ross Project area at any one time, including the CPP and wellfields, during active operation of the Ross Project. In addition, the Applicant would continue to work with Merit, as discussed above, so as not to impact its oil-recovery operation.

No further land-use impacts have been identified for the Ross Project beyond those identified in the GEIS. Thus, the land-use impacts resulting from the operation of the Proposed Action would be SMALL.

4.2.1.3 Ross Project Aquifer Restoration

Land-use impacts during aquifer restoration would be similar to those during construction, as they would involve temporary access restrictions, and would be SMALL according to GEIS Section 4.4.1 (NRC, 2009b). The impacts to land use during the Proposed Action's aquifer-restoration phase would be similar to those during the construction and operation phases, and they are consistent with the GEIS. These impacts could involve temporary access restrictions, but they would be few. Mitigation measures during the Proposed Action's aquifer-restoration phase would be identical to those identified for its construction and operation. Therefore, the land-use impacts resulting from aquifer-restoration activities at the Ross Project would be SMALL.

4.2.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.1, land-use impacts would temporarily increase during decommissioning and related site restoration of a uranium-recovery facility due to the additional equipment that would be used for dismantling and removal of wellfields, pipelines, and other wellfield components as well as the demolition of the processing plant itself and any surface impoundments. In addition, the reclamation of the site would involve heavy equipment and significant earth disturbance. However, these short-term impacts would not be greater than those experienced during the construction phase. Therefore, the GEIS concluded that the land-use impacts that result from the decommissioning an ISR facility would be SMALL (NRC, 2009b).

During decommissioning, the Ross Project area would be returned to its approximate preconstruction state, including surface topography and drainage patterns. All roads and wellfields would be decommissioned and the land restored and reclaimed. Topsoil would be salvaged and redistributed on disturbed areas to a depth approximately equal to the site before pre-licensing, site-characterization activities. Additional subsoil would be ripped as needed to minimize soil compaction prior to revegetation. Revegetation would be completed in accordance with an approved restoration action plan (RAP) and/or decommissioning plan (DP), which would be required as part of Strata's Permit to Mine and the Source and Byproduct Materials License (see the Draft License at NRC, 2014b). A seed mixture approved by Wyoming Department of Environmental Quality (WDEQ)/Land Quality Division (LQD) and the landowners would be used. Seeding would be conducted by either drill or broadcast methods, as appropriate. Once vegetation has been re-established (and all byproduct material has been removed), the Project area would be released for unrestricted use and would no longer require a license from the NRC. Figure 4.1 indicates the land uses to be restored during the decommissioning phase of the Ross Project.

The land-use impacts resulting from the decommissioning of the Proposed Action would be SMALL and the site's restoration would ameliorate all land-use impacts caused by earlier phases of the Proposed Action.

4.2.2 Alternative 2: No Action

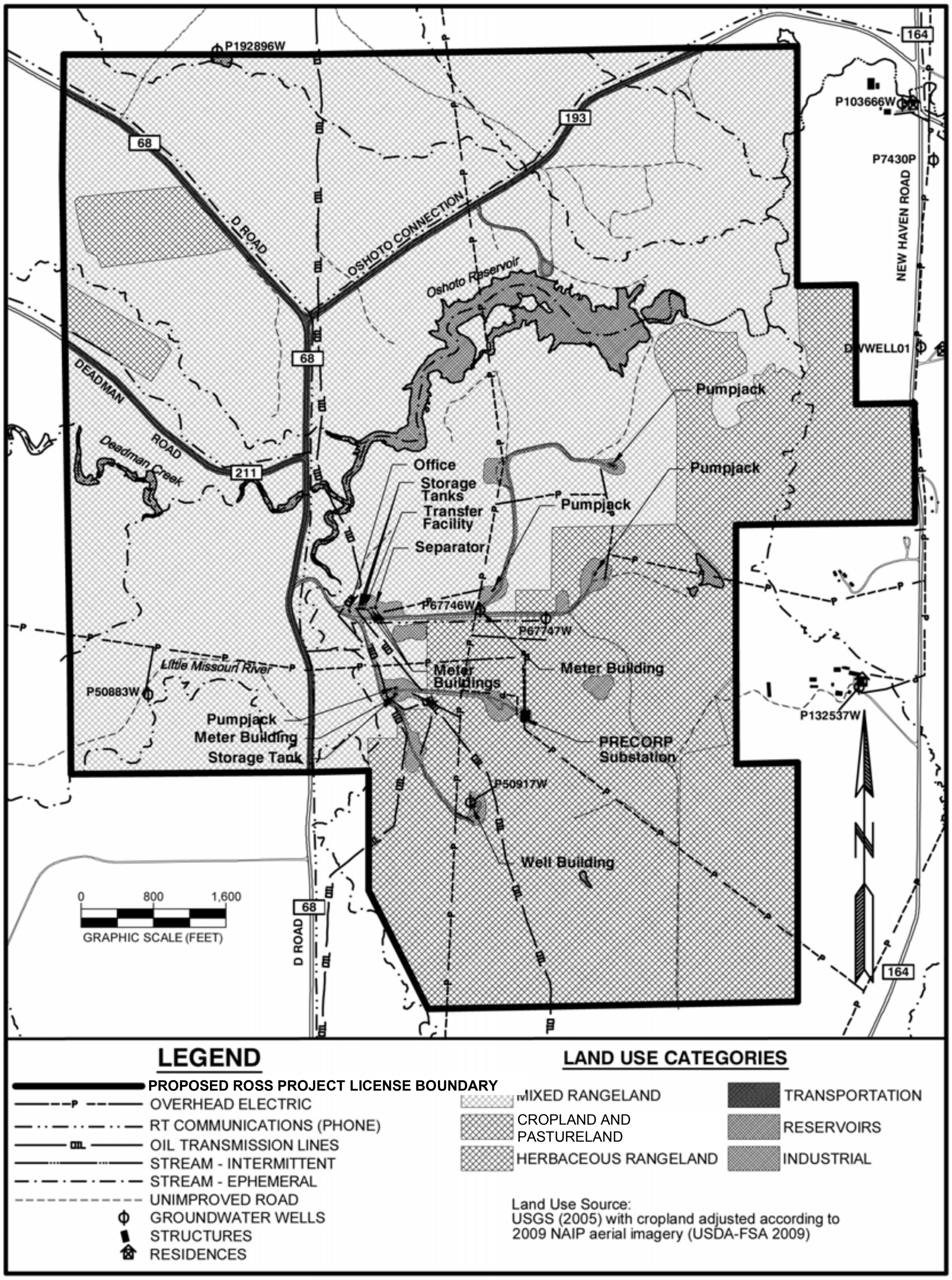
Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Although the Applicant could conduct limited preconstruction activities, the 114 ha [282 ac] of land surface potentially disturbed during the Proposed Action would remain mostly undisturbed. No pipelines would be laid and no additional access roads would be constructed. The Applicant could continue with some preconstruction activities, such as abandonment of exploration drillholes and the collection of environmental-monitoring data, but these activities would have little land-use impact.

The current land uses of natural-resource extraction and livestock grazing would continue with no access restrictions within the Ross Project area. Impacts to current land uses from the continued oil-production activities could also occur from accidental breaks or failures in equipment and infrastructure; however, these impacts would be no different than would occur whether or not the Proposed Action were to be licensed, constructed, or operated. There would be no impact from activities associated with construction and operation of the Proposed Action under the No-Action Alternative.

Under the No-Action Alternative, there would also be no impacts due to aquifer-restoration or decommissioning activities at the Ross Project area, because no wells would have been installed nor wellfields developed for uranium recovery. Thus, there would be no impact to the current land uses. There would be no impact to land use from decommissioning activities because the Ross Project would not have been licensed, constructed, or operated. No buildings would require decontamination and dismantling; no topsoil would need to be reclaimed; and no land would need to be revegetated. The land-use impacts of the No-Action Alternative would be SMALL.

4.2.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The facility at the north site would be located approximately 900 m [3,000 ft] northwest of that in the Proposed Action. Construction activities would still disturb an approximate total of 114 ha [282 ac] of land, which represents 16



Source: Strata, 2012a.

Figure 4.1
Ross Project Design Components to be Decommissioned and Land Uses to be Restored

percent of the total Ross Project area. The impacts from each activity would be approximately the same as those summarized in Table 4.1, except that construction of the surface impoundments at the north site could require additional engineering, while the containment barrier wall (CBW) would not need to be constructed.

For Alternative 3, the CPP would not be located in an area where dryland agriculture or pastureland grazing is conducted. Therefore, Alternative 3 would cause fewer impacts to these land uses if the CPP and surface impoundments were to be constructed at the north site. Nonetheless, there would be an increased loss of wildlife- and livestock-grazing opportunities during the construction and operation phases of Alternative 3, just as in the Proposed Action; these impacts would result from the construction of access roads and installation of wells, pipelines, and utilities. The total land area disturbed would be essentially the same (approximately 114 ha [282 ac]). During Alternative 3's operation, aquifer restoration (of the ore-zone aquifer), and decommissioning, the impacts would be the same as those discussed earlier for the Proposed Action, because the area of land-use disturbance would generally be the same. Finally, because the impacts to land use would generally be the same in Alternatives 1 and 3, the mitigation measures for Alternative 3 would be the same, as would be their effectiveness, as those described for Alternative 1. Based upon this analysis, the land-use impacts resulting from Alternative 3 would be SMALL.

4.3 Transportation

The Proposed Action could impact transportation during all phases of the Project's lifecycle. Transportation impacts would result from workers commuting to and from the Ross Project area; visitors, such as regulatory personnel, travelling to and from the Project; from shipments to the Ross Project area of supplies, materials, and chemicals used during the uranium-recovery and milling processes; from shipments of other materials including uranium-loaded (or "uranium-bearing" or "pregnant") ion-exchange (IX) resin from future satellite areas within the Lance District (which are considered in SEIS Section 5.2) and/or other offsite ISR or waste-water treatment facilities (i.e., toll milling); and shipments of yellowcake and wastes from the Ross Project area to other, offsite facilities such as a uranium-conversion facility or licensed waste-disposal facilities.

Transportation impacts could also include increased fugitive dust that would be released during the increased traffic, increased traffic accidents, increased noise, and increased incidental wildlife or livestock mortalities, compared to current area conditions. Fugitive-dust impacts are evaluated as air-quality impacts in SEIS Section 4.7; noise impacts are evaluated in SEIS Section 4.8; public and occupational health and safety impacts are assessed in SEIS Section 4.13; and wildlife and livestock mortalities are evaluated as potential ecological-resource impacts in SEIS Section 4.6. Detailed discussion of the other potential environmental impacts from Project-related transportation to and from the Ross Project area during construction, operation, aquifer restoration, and decommissioning is provided in the sections below.

4.3.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. During the Proposed Action, transportation impacts for all phases of the Ross Project would result from the increased traffic on roads compared to current (2010) levels. Figures 2.1 and 3.4 present the local roads (see Figure 2.1) and highways (see Figure 3.4) which service the Project area and its surrounding area. The respective traffic increases are summarized in Table 4.2.

Table 4.2
Estimated Number of Workers and Traffic Volumes for Ross Project

Project Phase	Average No. Daily Workers	Traffic	
		Passenger Vehicles per Day	Trucks per Day
Construction	200	400	24
Operation	60	120	16
Aquifer Restoration	20	40	12
Decommissioning and Site Restoration	90	180	10

Source: Strata, 2011a.

Note: Vehicle counts are to and from the Ross Project (two one-way trips per vehicle per day) and each assume that each worker would be in a separate passenger vehicle.

4.3.1.1 Ross Project Construction

As described in GEIS Section 4.4.2, the increase in daily traffic on most roads that would be used for construction-supply transport and workforce commutes would not be significant and, therefore, traffic-related impacts would be SMALL (NRC, 2009b). Roads with the lowest average annual daily traffic volumes, such as local County Roads (CRs), would have higher (i.e., MODERATE) potential impacts, particularly when the ISR facilities are experiencing peak employment (NRC, 2009b). The limited duration of construction activities (i.e., 12 – 18 months), suggests that impacts would be of short duration in many areas where such a facility would be sited.

The highest traffic volumes resulting from the proposed Ross Project would occur during the construction phase of the Proposed Action because of the relatively large workforce (i.e., 200 persons) and the frequent material and equipment shipments. The increased traffic is expected to be 400 passenger cars and 24 trucks per day, which, compared to 2010 levels, represents a traffic increase of approximately 400 percent on the New Haven Road south of the Ross Project area, which would be the workers' primary route to the Project area (Strata, 2011a). This volume is higher than that assumed in the GEIS (NRC, 2009b). This significant increase in traffic could result in more traffic accidents as well as wear and tear on the road surfaces. It is expected that additional road-maintenance activities would be needed. Due to the increased projected traffic volumes on the local and county roads between Interstate (I)-90 and the Ross Project area, the construction impacts would be MODERATE to LARGE with respect to the traffic levels and the road-surface wear and tear on local and county roads.

The increase in traffic on I-90 itself would be approximately 10 percent when compared to 2010 volumes. This increase to traffic on the Interstate-highway system would be small, and such impacts would mostly be related to increased traffic volume. However, the Interstate-highway system has been built to accommodate additional capacity and, therefore, the resulting impacts, if any, would be minor. Thus, the impacts to the Interstate-highway system would be SMALL.

As noted above, traffic impacts to local roads are expected to be greatest during the Proposed Action's construction, and the Applicant identifies the following mitigation measures it would expect to undertake (Strata, 2011a):

- Improve signage, including speed-limit signs, on D and New Haven Roads.
- Implement a policy to enforce speed limits for Strata employees and contractors. The Applicant and Crook County have already executed a Memorandum of Understanding (MOU) that specifies the activities that Strata would undertake to assist with speed-limit controls, among other requirements (Strata, 2011d).
- Perform a safety analysis of the CRs where increased traffic would occur. Potential enhancements could include a decreased truck speed on D and New Haven Roads or the assignment of "daytime headlight sections" to increase safety.
- Perform routine assessments of road conditions. The MOU between the Applicant and Crook County also includes a maintenance agreement to address road-maintenance needs.
- Explore a coalition with other companies operating heavy trucks on the CRs (e.g., the haulers of bentonite from the nearby mine) to provide additional assistance to Crook County for safety and maintenance needs.
- Work with Crook County to upgrade some portions of the roads by adding gravel to specifically identified sections.
- Evaluate the feasibility of an employee carpooling program, or a park-and-ride system, in Gillette or Moorcroft. Alternatives could also include a van-pool system.

These mitigation measures would substantially reduce the transportation impacts associated with the Proposed Action's construction; with mitigation, the impacts of transportation, especially on local roads and CRs, would be SMALL to MODERATE.

4.3.1.2 Ross Project Operation

As discussed in GEIS Section 4.4.2, during the operation phase at an ISR facility, the facility-related traffic volume would be unlikely to generate any significant environmental impacts greater those expected during the construction phase. Dust, noise, and possible incidental wildlife- or livestock-mortality impacts on or near a facility's access roads could continue to occur. The GEIS concluded that the potential impacts from transportation during facility operation could range from SMALL to MODERATE (NRC, 2009b).

What are "best management practices"?

Best management practices (BMPs) are techniques, methods, processes, activities, or incentives that are effective at delivering a particular outcome. BMPs can also be defined as efficient and effective ways of meeting a given objective based upon repeatable procedures that have proven themselves over time. Well-designed BMPs combine existing managerial and scientific knowledge with knowledge about the resource being protected. The Wyoming Department of Environmental Quality (WDEQ) defines best practicable technology as a "technology-based process determined by WDEQ as justifiable in terms of existing performance and achievability (in relation to health and safety) which minimizes, to the extent safe and practicable, disturbances and adverse impacts of the operation on human or animal life, fish, wildlife, plant life and related environmental values." (WDEQ, 2007, as cited in NRC, 2009b).

The GEIS also assessed the potential for accidents and their consequences when the accidents involve the transportation of hazardous chemicals or radioactive materials. The GEIS recognized the potential for high consequences from a severe accident involving transportation of hazardous chemicals in a populated area. The GEIS stated that the probability of such accidents is low because of the small number of shipments, comprehensive regulatory controls, and the uranium-recovery facility operator's use of BMPs. For byproduct and/or source materials shipments (for example, yellowcake product, uranium-loaded IX resin, or byproduct-material-contaminated wastes), compliance with transportation regulations would be expected to limit radiological risk during normal ISR facility operations. The GEIS concluded there would be a low radiological risk in the unlikely event of an accident. Moreoever, the use of emergency-response protocols, which have been dessiminated to local emergency-response personnel, would help to mitigate the consequences of severe accidents that involve the release of any radioactive materials (NRC, 2009b).

During the operation phase, increased traffic over that in 2010 would be present due to employee traffic; shipments of process chemicals, uranium-bearing IX resin, yellowcake, and vanadium; and shipments of solid and hazardous wastes and byproduct material to and from the CPP and/or wellfields. These shipments are included in the truck count in Table 4.2. Potential impacts to other resources could again occur during uranium-recovery operation, as discussed earlier. Impacts to local roads would be less significant during operation than during construction due to the lower traffic associated with facility and wellfield operation, although the traffic on these roads would still be double that in 2010 (Strata, 2011a). In total, the increase in anticipated traffic during the Ross Project's operation phase is significant when compared to current levels, although there are low and manageable risks associated with yellowcake, process-chemical, and waste transportation. Consequently, the transportation impacts during the operation phase would be less significant than during construction and would nonetheless be SMALL (Interstate-highway system) to MODERATE to LARGE (local roads and CRs). However, the magnitude of these impacts would be mitigated by the same measures used during the construction phase. Thus, with mitigation, transportation impacts would be SMALL (Interstate-highway system) to SMALL to MODERATE (local roads and CRs).

GEIS Section 4.2.2.2 evaluated the transportation of yellowcake from ISR facilities, and it assumed shipment volumes would range from 34 – 145 yellowcake shipments per year. The Applicant estimates that there would be 75 shipments of yellowcake per year from the Ross Project based upon the maximum annual production rate (i.e. including yellowcake produced from toll milling), which is within the range of the GEIS analysis (Strata, 2011a). The GEIS indicated that 145 yellowcake shipments per year from a single ISR facility could result in 0.04 and 0.003 cancer deaths per year, depending upon the amount of yellowcake released during a transportation accident (NRC, 2009b). To minimize the risk of an accident involving yellowcake transport associated with the Proposed Action, the material would be transported in accordance with U.S. Department of Transportation (USDOT), Wyoming Department of Transportation (WYDOT), and NRC regulations, and it would be managed as a "low-specific activity" (LSA) material and shipped on exclusive-use vehicles. Only properly licensed and trained drivers would transport LSA materials. Should a transportation accident occur, the NRC concluded that the consequences of such accidents would be limited because the Applicant would develop emergency-response protocols for yellowcake and other transportation accidents and share those with local first responders. Also, shipping companies would ensure their personnel receive proper emergency-response training. Emergency-response protocols would include communication equipment and emergency-spill cleanup kits on each vehicle and at the shipping and receiving facilities (Strata, 2011a). Based upon this analysis, the impacts due to a potential accident involving the transportation of yellowcake during the operation phase of the proposed Ross Project would be SMALL.

The Applicant estimates that approximately four bulk-chemical, fuel, and other supply and material deliveries would be made per day throughout the operation phase of the Ross Project (Strata, 2011a). This number of shipments is greater than the daily number of chemical-supply shipments considered in GEIS Section 4.4.2, which were estimated to be approximately one per day; however, these shipments would be made in accordance with the applicable USDOT hazardous-materials-shipping requirements and spill-response protocols would be similar to those for yellowcake-shipments accidents.

In addition, the Applicant conducted an analysis, using the injury rate of 4.3×10^{-7} per mile, to determine the risk of an injury to a member of the general public that could result from a transportation accident involving the shipment of anhydrous ammonia. The Applicant found that these shipments could result in 0.002 injuries per year. The NRC staff reviewed the Applicant's analysis and verified that reasonable input parameters were used. Chemical shipments would be conducted safely and the probability of an accident involving these shipments would be small. As described in GEIS Sections 4.4.2.2 and 4.2.2.2, the likelihood of an incident in a populated area would be small, given the precautions that would be taken with hazardous-chemical shipments. Therefore, the potential environmental impacts of accidents involving chemical transportation during Ross Project operations would be SMALL.

The CPP is designed to process more yellowcake than is expected to be recovered at the proposed Ross Project (Strata, 2011a). The Applicant has proposed to accept uranium-loaded IX resin from other ISR operations as well as, potentially, those from offsite water-treatment facilities as noted in SEIS Section 2.1.1. The Applicant would expect to receive four shipments of resin per day. GEIS Section 4.2.2.2 concluded that the potential radiological impacts of IX-resin shipments would be lower than the risks from yellowcake shipments based upon the less concentrated nature of the resin; the uranium being chemically bound to the resin, which would limit dispersion in the event of a spill; and the small transport distance relative to yellowcake shipments. Although the number of shipments proposed by the Applicant is higher than the one truck per day assumed in the GEIS, the other three factors evaluated in the GEIS would ensure that the probability of an accident that involves uranium-bearing IX resin would be small. Compliance with the applicable NRC and USDOT regulations for shipping IX resin would also reduce the risk of accidents involving these shipments. Therefore, the environmental impacts of accidents involving shipments of IX resin during Ross Project operations would be SMALL.

The vanadium extracted by the Applicant in the CPP's vanadium circuit is considered a hazardous material by USDOT and would be shipped in sealed transport vehicles to an offsite processing facility in accordance with USDOT regulations (see SEIS Section 2.1.1) (Strata, 2011a). It is anticipated that there would be 45 shipments of vanadium from the Ross Project each year. Due to the low number of shipments, the probability of an accident involving vanadium shipments would also be small. Because of the less hazardous nature of vanadium as compared with yellowcake, the environmental impacts of accidents involving shipments of vanadium would be SMALL.

The operation of the Ross Project would also generate waste byproduct material. Such wastes would be shipped in 210-L [55-gal] drums inside sealed roll-off containers in accordance with applicable USDOT regulations. Only five such waste shipments are anticipated during a year; given the infrequent nature of these shipments, they do not represent a significant impact to local traffic conditions or a significant increased risk of accidents. Thus, the impacts of the shipment of byproduct or source material to transportation would be SMALL.

Other solid wastes would be transported to a local municipal landfill in Moorcroft, Sundance, and/or Gillette, Wyoming. The Applicant estimates that one trip per week would be required to remove solid waste from the Ross Project. This number would represent a SMALL impact to the local roads, both in terms of traffic volume and local-road maintenance. Finally, the Applicant anticipates that there would be one shipment of hazardous wastes from the Ross Project each month. The hazardous waste would include oil-contaminated soil, oily rags, used batteries, expired laboratory reagents, fluorescent light bulbs, spent solvents, and degreasers. Given the low number of shipments, this represents a SMALL impact to the local traffic and the local roads. All of these infrequent waste shipments would also have SMALL impacts in the case of an accident, due to the small waste volumes generated at the Ross Project.

To mitigate transportation impacts, many of the mitigation measures instituted during the Ross Project's construction would continue during the operation phase. Additional mitigation measures would be implemented for the shipment of materials, such as yellowcake, uranium-loaded IX resin, and vanadium as well as solid and hazardous wastes, and byproduct and source materials. Two mitigation measures that would address all such shipments would be 1) the Applicant's coordination with local emergency-response personnel and 2) the requirement that only appropriately licensed transporters would be used. The Applicant would develop a protocol, or a SOP, to provide ongoing training to local emergency-response personnel, including EMTs, firefighters, and municipal and county law-enforcement personnel. For each type of material, specific information would be provided about the physical and chemical characteristics of the substances being shipped, the related hazards, the potential exposure pathways, and appropriate spill-response, containment, and cleanup procedures. This training would be ongoing and would include updates on a routine schedule or as new substances are transported to or from the Ross Project. All shipments would be made by appropriately licensed transporters in accordance with USDOT and WYDOT hazardous-material regulations and requirements.

The release of a radioactive material as a result of a transportation-related incident would prompt the activities described in USDOT's hazardous-materials regulations at 49 *Code of Federal Regulations* (CFR) Part 171, Subpart B, "Incident Reporting [and] Notification." Among other activities, these regulations require immediate notice of certain incidents, preparation of detailed incident reports, submission of examination reports, and assistance with investigations and special studies. Should an accident occur that results in a release of any yellowcake or other source or byproduct material to the environment, the Applicant would perform a post-cleanup radiological survey of the affected area to ensure that there are no long-term hazards associated with the released radioactive material or with spill-response and cleanup activities.

4.3.1.3 Ross Project Aquifer Restoration

As discussed in GEIS Section 4.4.2, the potential transportation impacts during aquifer restoration would be equal to or less than the potential impacts during the ISR facility operation phase (NRC, 2009b). At the Ross Project, the number of uranium-recovery workers, and therefore the number of personal vehicles, would decline significantly during aquifer restoration from the construction and operation phases (from 200 to 60 to 20 workers). Thus, the potential transportation impacts discussed above for the Ross Project's construction and operation phases would be reduced due to the anticipated smaller traffic volume during this phase of the Project.

Yellowcake, vanadium, and uranium-loaded IX-resin shipments could remain the same if the CPP continues to process uranium-bearing IX resin during Ross Project wellfields' aquifer restoration. The shipments of process chemicals would similarly depend upon whether the CPP would continue to process uranium-loaded resin after the Ross Project wellfields are no longer engaged in uranium recovery. Should the CPP continue to process pregnant IX resin, there would not be a reduction in worker commuting as discussed above.

The impacts to local roads and CRs during the aquifer-restoration phase would be SMALL to MODERATE due to the lesser workforce of 20 rather than the 60 workers during the operation phase. Mitigation measures implemented during aquifer restoration at the Ross Project would be identical to those implemented during its construction and operation phases, yet the impacts would continue to be SMALL to MODERATE for local roads and SMALL for the Interstate-highway system.

4.3.1.4 Ross Project Decommissioning

During ISR facility decommissioning, the GEIS concluded that transportation impacts as a result of worker commutes would steadily decrease, but initially there would be a large increase in decommissioning-phase workers. GEIS Section 4.4.2 also concluded that, based upon the concentrated nature of yellowcake when shipped, the longer distance of the yellowcake shipments when compared to waste shipments, and the number of shipments when compared to byproduct-material waste shipments, the potential radiological risks from transportation accidents involving byproduct waste shipments during decommissioning would be bounded by the yellowcake transportation risks during operations. Overall, according to GEIS Section 4.4.2, transportation impacts would be SMALL (NRC, 2009b).

During the decommissioning phase of the Ross Project, the Applicant expects that the workforce would initially increase to approximately 90 workers (up from 20 workers during aquifer restoration). Traffic on the local roads would thus increase over that of the aquifer-restoration phase, but it would still be less than half of that expected during the Proposed Action's construction phase. Fuel shipments would increase due to the operation of heavy equipment during decommissioning activities. Little or no yellowcake or vanadium would be shipped during the decommissioning phase; however, Project decommissioning would result in an increase in shipments of solid waste or waste source and byproduct materials. The Applicant estimates that the frequency of waste, byproduct-material, or source-material shipments would increase from the approximately 5 per year during the operation and aquifer-restoration phases, to between 100 – 200 shipments per year during the decommissioning phase (Strata, 2011a). These shipments would still be relatively infrequent compared to passenger vehicular traffic, and they would have only a small impact on traffic volume. Solid-waste shipments are expected to increase from approximately one per week during operation and aquifer restoration to about two per week during decommissioning. Hazardous-waste shipments are expected to remain unchanged at approximately one per month throughout all four Ross Project phases.

As anticipated in the GEIS, the potential radiological risks associated with transportation accidents involving waste-byproduct-material shipments during the decommissioning phase at the Proposed Action would be bounded by the risks associated with the transportation of yellowcake during the operation phase. The GEIS assumed that the distance between the yellowcake-conversion facility and a ISR facility would be greater than the distance between the waste-disposal facility and the proposed facility. Consistent with the GEIS, the distance from the Ross Project area to the uranium-hexaflouride (UF_6) conversion facility in Metropolis, Illinois, that would potentially accept the yellowcake is 2,030 km [1,260 mi], whereas waste byproduct material would travel between 378 km [235 mi] to 1,600 km [1,000 mi] to a disposal facility. The GEIS also assumed that there would be up to 145 yellowcake shipments per year and a total of 300 byproduct-material shipments during decommissioning (based upon 4,593 m^3 [6,008 yd^3] of waste byproduct-material generated during decommissioning and each shipment containing 15 m^3 [20 yd^3] of byproduct material), which would result in more yellowcake shipments than byproduct material shipments overall. The Applicant estimates that there would be 75 shipments of yellowcake per year during operations and 3,800 m^3 [5,000 yd^3] of waste byproduct-material generated during decommissioning (250 total shipments of waste byproduct-material during decommissioning), which would also result in more yellowcake shipments than waste byproduct-material shipments overall.

Potential transportation impacts would be less during decommissioning than those occurring during construction; however, they would be still be MODERATE to LARGE on local roads and CRs due to the increased workforce required for decommissioning (approximately 90 workers). To the Interstate-highway system, the impacts during the decommissioning phase would be SMALL. Mitigation measures implemented during the Proposed Action's decommissioning would be identical to those that would be implemented during all of the other phases of the Ross Project. Therefore, the impacts of transportation on local roads and CRs, would be SMALL to MODERATE.

4.3.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed. However, traffic volumes and patterns would likely increase from those measured in 2010, as discussed in SEIS Section 3.3, because additional residences could be expected to be built near the Ross Project over time. The Applicant has projected that volumes would increase approximately 2 percent per year, even without the Ross Project's construction and operation (Strata, 2011a). There would be no transportation of materials of any kind to or from the Ross Project to support uranium-recovery operations. There would be no transportation of either radioactive or solid wastes from the Proposed Action because the Ross Project would neither be licensed nor constructed and operated. The current transportation activities to support ongoing oil production and bentonite mining would be the same. In addition, the Applicant could continue with some preconstruction activities, such as abandonment of exploration drillholes and collection of environmental-monitoring data. These activities are similar to those currently occurring at the Ross Project area, and, although short-term increases in activity could occur, these impacts would be SMALL.

4.3.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally look the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. This change in facility location would cause a change in the impacts to local roads as compared to current conditions, because additional roads would be used that would not be used during the Proposed Action at the south site—most notably, the Oshoto Connection and the D Road north of the D Road/New Haven Road intersection (see Figure 2.1 in SEIS Section 2.1). There would likely be less localized impact to the New Haven Road, as it is anticipated that the majority of the traffic from the Proposed Action would access the Ross Project area by travelling along D Road to the Oshoto Connection (Strata, 2011a). Although this change would minimize impacts to the New Haven Road, it would nevertheless cause a corresponding increase in impacts to the D Road and the Oshoto Connection as both roads are similarly constructed and maintained. Since the total traffic counts would remain the same during all phases of Alternative 3 as those for the Proposed Action, the transportation impacts would be the same as those described earlier for Alternative 1, SMALL (Interstate-highway system) to MODERATE to LARGE (local roads and CRs). As the same mitigation measures discussed for the Proposed Action would be employed for Alternative 3, the resulting transportation impacts would be SMALL to MODERATE.

4.4 Geology and Soils

4.4.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

4.4.1.1 Ross Project Construction

As described in GEIS Section 4.3.3 and 4.4.3, the principal impacts to geology and soil during construction would result from disturbance of soil and surficial bedrock by construction activities (NRC, 2009b). These activities include the Applicant's clearing ground or topsoil, eliminating the vegetation that is present; cutting, filling, and grading the ground surface, preparing it for the construction of the CPP, surface impoundments, access roads, utility corridors, and wellfields; excavating and backfilling trenches for pipelines and other subsurface design components; and excavating the mud pits, CBW, and flood-control diversion channel (NRC, 2009b; Strata, 2011a). As the GEIS noted, the impacts on geology and soils from construction activities depend upon local topography, surface bedrock geology (i.e., the rock immediately below the soil), and soil characteristics. The GEIS concluded that, with the implementation of appropriate BMPs, the impacts on geology and soils would be SMALL, if less than 15 percent of an ISR project's area would be affected. As described earlier in SEIS Section 4.2, approximately 114 ha [282 ac] of land, or about 16 percent of the Ross Project area, would be disturbed during the lifecycle of the Project (Strata, 2011b). This area is slightly larger than that identified in the GEIS; thus, a site-specific analysis is provided here.

Geology

Construction activities are not expected to encounter bedrock, except for localized impacts to the surficial bedrock by construction of the CBW. The wall would be a 0.6-m- [2-ft] wide barrier of a soil-bentonite mixture extending from the surface to at least 0.6 m- [2 ft-] into bedrock. The impacts of the CBW's construction would be SMALL, due to the relatively small and localized effects on the bedrock below it.

The impacts from the Applicant's drilling and developing injection, recovery, and monitoring wells as well as installing the Underground Injection Control (UIC) Class I deep-injection wells are discussed in SEIS Section 4.5.

Soils

The impacts on soils would occur largely during the construction phase of the Proposed Action, when most of the ground disturbance takes place. Potential soils impacts include soils loss (by wind and water erosion), soils compaction, increased salinity, soils-productivity loss, and soils contamination. Surface-disturbing activities would expose the soils and subsoils at the Ross Project area and would temporarily increase the potential for soil loss because of wind and water erosion. As described in SEIS Section 3.4.2, the soils in the Ross Project area have a moderate to severe potential to be affected by wind erosion. One soil type, Vona fine sandy loam—which makes up less than 3 percent of the entire Ross Project area—has a severe potential for wind erosion. Water-erosion hazards range from negligible to moderate for the soil types found within the Ross Project area.

Soils at the Ross Project also have the potential to become compacted, particularly during construction activities where heavy equipment is being operated. Soil compaction could result in a decrease in water infiltration, thereby increasing runoff. To decrease the potential for compaction, existing roads would be used where possible; secondary access-road widths would be minimized, and a one-way-in/one-way-out policy would be implemented by the Applicant to access wellfields. Compacted soils would be further addressed in the DP or RAP that the Applicant would be required to submit to the NRC (Strata, 2011a).

During preconstruction activities, the Applicant has been employing various methods of soil reclamation, according to landowner preference. These methods have included Strata's "ripping" compacted soil with the teeth of a grader, loosening compacted soil with a disk, or simply replacing topsoil and reseeding. These techniques would continue to be refined and coordinated with WDEQ/LQD and the respective landowners during the Proposed Action.

Saline soils are very susceptible to soil loss. Saline soils were not found on the Ross Project during the Applicant's soil surveys. However, the use of magnesium chloride for dust control could increase the salinity of the local soils (Strata, 2011a). If magnesium chloride were to be used on access roads for fugitive-dust control or if a salt and sand mixture were to be used for traction on primary access roads during the winter, the Applicant would sample the soils beneath and adjacent to access roads for salinity during the Proposed Action's decommissioning phase. Any salt-impacted soils would be removed at that time.

Loss of topsoil and disturbance of soils could affect the soils' structure and microbial activity. In turn, these changes could reduce soil productivity. Based upon the total anticipated disturbance area of 114 ha [282 ac] and the average topsoil depth of 0.53 m [1.7 ft], the volume of topsoil stockpiled during the life of the Proposed Action is estimated to be up to approximately 600,000 m^3 [800,000 yd^3] (Strata, 2011b). This estimate could be conservatively high because most of the wellfields and access roads would be located outside of the 100-year floodplain at the Ross Project area, where topsoil would be thinner than average. The thickness of topsoil removed from unconstructed, two-track access roads, including tertiary access roads and temporary access roads, would generally be less than the average topsoil depth. Much of the topsoil removed for pipeline and utility-corridor trenching would be replaced promptly and not stockpiled.

To mitigate the potential loss of top soil as well as soil productivity, topsoils would be salvaged and stockpiled for wellfield-decommissioning and site-restoration activities. Sequential wellfield decommissioning is anticipated by the Applicant; once a wellfield is depleted, it would be decommissioned and the field's wells properly abandoned. This decommissioning would occur as each wellfield is taken out of service; it would not be delayed until the end of the entire Ross Project's lifecycle.

The Applicant proposes to locate a relatively large topsoil stockpile near the CPP (see Figure 2.5 in SEIS Section 2.1.1) (Strata, 2011a). Any topsoil that is stripped before the construction of roads would be stockpiled throughout the wellfields in piles, typically spaced approximately 600 m [2,000 ft] apart along access roads to minimize the soil compaction, fugitive dust, combustion gases, and noise associated with long topsoil hauls.

Related mitigation measures designed to minimize soil loss, and to diminish fugitive dust (see SEIS Section 4.7.1.1) would include the Applicant: 1) constructing topsoil stockpiles on the leeward side of hills, where possible; 2) constructing topsoil stockpiles away from ephemeral-stream channels or any other flood-prone areas; 3) avoiding construction within areas susceptible to flooding; 4) minimizing the disturbance of surface-water drainages (i.e., roads and pipelines would cross drainages perpendicular to the flow direction [as described in SEIS Section 3.4.2]); 5) wetting exposed soils during construction to minimize soil loss from wind erosion; 6) employing sediment-control BMPs, such as silt fences, sediment logs, and straw-bale check dams in all disturbed areas; 7) implementing additional sediment-control BMPs for topsoil stockpiles, including seeding and installing a perimeter ditch and water-collection sump to trap storm water and sediment; and 8) restoring and reseeding disturbed areas as quickly as possible, typically within a single construction season (Strata, 2011a; WDEQ/LQD, 2005). Many of these BMPs are consistent with those identified by the NRC in the GEIS in Section 7.4 and are commonly used at other ISR facilities (Strata, 2011a; NRC, 2009b).

To minimize soil-productivity impacts, the Applicant would use corresponding BMPs including several of the mitigation measures identified above to prevent soil loss. These BMPs include the Applicant 1) protecting topsoil stockpiles from wind and water erosion; 2) seeding topsoil stockpiles during inactive periods with an appropriate perennial seed mix; 3) redistributing topsoil and applying a permanent seed mixture approved by WDEQ/LQD during the Proposed Action's decommissioning phase; and 4) using information gathered from reference areas over the long term to perform statistical, quantitative, and qualitative comparisons approved by WDEQ/LQD.

Although the subsurface would be exposed during the Applicant's excavation of mud pits and pipeline trenches, the primary area of subsoil disturbance would be where the CPP and surface impoundments are to be constructed. The subsoils there would be disturbed by the cut, fill, and grading activities necessary to create a relatively level site and by the excavations for the surface impoundments, CBW, and flood-control diversion channel. The quantity of excess subsoils generated from construction of the CPP and surface-impoundment area is estimated to be approximately 60,000 m^3 [80,000 yd^3]. This material could be used to provide a slightly elevated and relatively level primary access road, or it could be stored in a subsoil stockpile separate from the topsoil stockpiles.

During the Proposed Action's construction, additional potential soil impacts could occur from the introduction of drilling fluids and muds to the soils near the recovery, injection, and monitoring wells. However, the volume of these drilling fluids would be small, and these fluids and muds would be contained within the mud pits excavated near each drillhole's drilling pad. Other potential soil impacts could also occur from spills and leaks of fuel or lubricants from heavy-construction equipment and passenger vehicles that would be operated during construction of the Ross Project. However, such spills and leaks would be contained and cleaned up immediately if they were to occur. Oil- or lubricant-contaminated soil would be disposed offsite in an appropriately permitted facility.

During construction, up to five Class I deep-injection wells would be installed in aquifers approximately 2,669 m [8,755 ft] below ground surface (bgs). These wells would be used for the disposal of process solutions. The Applicant's drilling of these wells and their completion and testing would be governed by the UIC Class I Permit from WDEQ (WDEQ/WQD, 2011b). Thus, the surface and subsurface area disturbed by these particular wells would be very limited.

Therefore, the potential impacts of the Proposed Action's construction to soils would be SMALL.

4.4.1.2 Ross Project Operation

As described in GEIS Section 4.4.3, the potential impacts to geology and soils during the operation of an ISR facility could include: 1) soil loss due to surface-water runoff and erosion; 2) soil compaction as described above; 3) increased soil salinity due to the use of magnesium chloride for dust control; 4) soil contamination caused by spills and leaks of lixiviant, as the solution moves through pipelines between the wellfields and the CPP; 5) transportation accidents, which could involve liquids, as well as other accidental spills and leaks associated with waste management; 6) changes to the uranium-bearing formations as a result of uranium-recovery activities; and 7) changes to the deep aquifers from the disposal of brine and other liquid byproduct material in the UIC Class I deep-injection wells. The GEIS concluded that the impacts on geology and soils from an ISR operation would be SMALL (NRC, 2009b).

Geology

During uranium-recovery operation, the lixiviant dissolves the uranium-mineral coatings on the sandstones in the targeted ore zone; this geochemical change in the rock would result in mineralogical changes to the ore zone, but it would not affect the rock matrix nor rock structure. The thickness and depth of the ore zone at the Ross Project are similar to the ore zones evaluated in the GEIS (NRC, 2009b). The GEIS concluded that it is unlikely that geochemical alteration of the ore zone would result in any compression or subsidence that would be translated to the ground surface.

Based upon historical uranium-recovery operations in the NSDWUMR and WEUMR, reactivation of geologic faults would not be anticipated (NRC, 2009b; Strata, 2011b). As established in SEIS Section 3.4.4, earthquake activity in the area of the Ross Project is very low. Potential impacts associated with increased earthquake risk because of the operation of UIC Class I injection wells would be avoided by Applicant's maintaining the injection pressure at a level that does not exceed the fracture pressure of the receiving rock formation, as specified in the WDEQ/Water Quality Division (WQD) permit. See SEIS Section 2.1 for a related discussion of how in situ uranium recovery is different than hydrofracking and poses no risk of triggering earthquakes.

The potential impacts from the operation of the Proposed Action to Ross Project site geology would be SMALL.

Soils

During the operation of the Proposed Action, potential impacts from soil loss would be minimized by proper design and operation of surface-runoff features and implementation of BMPs, as described for those during construction. Soil compaction would be minimal during the Proposed Action's operation, due to low density of roads across the Ross Project area. Mitigation measures to minimize soil compaction and to diminish increases in soils salinity would be the same as those identified for the construction phase of the Proposed Action. The probability of a transportation accident that releases yellowcake or IX resin has been determined by NRC to be small (NRC, 2009b); however, the magnitude of the impacts of this type of accident is described in SEIS Section 4.3.1.2.

In the event of releases of process solutions from pipelines, module buildings, process vessels, or surface impoundments, the process-control system described in SEIS Section 2.1.1.2 would quickly alert an operator, who could then take action including a full shutdown of the leaking components as well as initiating immediate containment and cleanup. As noted in GEIS Section 4.4.3.2, during 1996, the operator of the Crow Butte Uranium Project in Dawes County, Nebraska, logged 27 spill incidents of process solutions, with volumes ranging from 45 – 65,507 L [12 – 17,305 gal] (NRC, 2009b). This potential for soil contamination at the Ross Project would be minimized by the Applicant: 1) adhering to the NRC and WDEQ design criteria for uranium-recovery facilities; 2) designing successful spill-containment and leak-detection systems; 3) training employees on monitoring process parameters and recognizing potential upset conditions before spills or leaks occur; 4) training employees on inspection SOPs, spill-control BMPs, and a storm-water pollution prevention plan (SWPPP); 5) frequently inspecting waste-management systems and effluent-control systems; and 6) training all employees on spill detection, containment, and cleanup procedures (Strata, 2011a). Additional information on the excursion-monitoring and spill-detection systems incorporated into the design of the Ross Project is presented in SEIS Section 2.1.1.

The design criteria for the Proposed Action include leak-detection capability in each wellfield module building, where an alarm inside the CPP would signal the on-duty operator that a spill has occurred (the CPP would be staffed 24 hours a day). In addition, routine, weekly inspections of wellfield module buildings and wellheads would be conducted by Strata personnel. Such inspections would ensure that all pipelines and equipment, wellheads, and valve manholes are visually inspected (Strata, 2011b). Other wellfield leak-detection monitoring and control measures would include the continuous measurement of flows and pressures for injection and recovery trunk lines and feeder lines as well as the presence of leak-detection sensors in valve manholes and in the protective box around each wellhead. In addition, all pipelines would have been hydrostatically tested during construction, and the Applicant would institute weekly inspections to document leaks and other abnormalities (Strata, 2011b; NRC, 2014b).

To minimize the potential for subsurface pipeline leaks, the WDEQ/WQD requirements for potable-water stream crossings would be incorporated into the design and construction of all pipeline stream crossings. These requirements include the Applicant: 1) providing a minimum of 0.6 m [2 ft] of soil cover (at the Ross Project, 1.2 – 1.8 m [4 – 6 ft] would typically be used) over the respective pipelines to guard against damage from livestock and to protect them from freezing; 2) using pipes with flexible, watertight joints, such as polyvinyl chloride (PVC) or high-density polyethylene (HDPE); and 3) installing accessible isolation valves at both ends of water crossings so that the section could be isolated for testing or repair.

Two levels of engineering controls would also minimize potential impacts to soils from the unintended release of process solutions within the CPP itself. The first level of protection is the primary containment accomplished by pipelines, vessels, and surface impoundments, all of which would be tested for leaks during construction. The second level of protection is the secondary containment that is provided by curbs, berms, and sumps for all chemical-storage tanks, process vessels, and all pipelines and equipment inside the CPP building (Strata, 2011a).

The design and operation of the surface impoundments would also minimize the likelihood of liquid releases. The surface impoundments would include a double-liner and leak-detection system, and they would be operated so as to maintain sufficient reserve capacity to permit the Applicant to transfer the contents of a surface-impoundment cell to another in the event of a leak, in order to facilitate repair or replacement. To minimize the likelihood of releases, impoundment embankments and the leak detection system would be monitored and inspected daily by the Applicant (Strata, 2011a; NRC, 2014b).

Further, to minimize the potential impacts of soil contamination, such as short-term, elevated concentrations of radiological parameters and other associated chemical constituents above pre-licensing, site-characterization levels, the Applicant would be required to establish SOPs for immediate spill detection, response, containment, and cleanup protocols (NRC, 2009b; NRC, 2014b). For example, immediate spill responses could include the Applicant's shutting down the leaking pipeline, recovering as much of the spilled fluid as possible, and collecting samples of the impacted soils for comparison of constituent-concentration values (e.g., uranium, radium, and other indicators) to pre-licensing, site-characterization levels. Soils contaminated by spills or leaks would be removed in accordance with Criteria 6(6) of Appendix A to 10 CFR Part 40, which requires that soil concentrations not exceed those concentrations by more than 0.2 Bq/g [5 pCi/g] of radium-226, averaged over the first 15 cm [5.9 in] below the ground's surface. Analytical tests would be required to demonstrate that no such residual contamination exists. Respective concentrations have been established by the Applicant through its pre-licensing, site-characterization monitoring program (see SEIS Section 3.12.1), and additional determination of values would be established by a "post-licensing, pre-operational" environmental-monitoring program prior to major Ross Project construction and operation. Soils contaminated by spills or leaks would be properly disposed of at an offsite properly licensed and permitted disposal facility (Strata, 2011a).

The NRC's monitoring requirements specify that licensees must maintain documentation of spills of source or byproduct material and report designated types and volumes spills to the NRC within 24 hours (NRC, 2009b; NRC, 2014b, License Condition No. 11.6). These spills include those that cause unplanned contamination that meets the criteria at 10 CFR Part 40.60 as well as those spills that could cause public or occupational exposures that exceed the limits established in 10 CFR Part 20, Subpart M (see SEIS Section 4.13). All of these spill-response protocols would be implemented if other liquid byproduct material, chemicals, or wastes were to be spilled, or if solid radiologically and/or chemically contaminated materials or wastes were to be dispersed.

Potential impacts to the soils at the Ross Project would be mitigated by the Applicant's implementation of BMPs and other spill-related procedures, plans, and programs that will be required in its Source and Byproduct Materials License. As noted above, all contaminated soils would be removed and disposed of according to the requirements of 10 CFR Part 40, Appendix A. These mitigation measures would substantially minimize the impacts to the soils and sediments of the Ross Project area; these impacts would be SMALL.

4.4.1.3 Ross Project Aquifer Restoration

As described in GEIS Section 4.4.3.3, aquifer restoration would not result in the removal of the rock matrix or the structure of the ore zone, and therefore no significant matrix compression or ground subsidence would be expected to occur. With respect to soils, the potential for accidental spills and leaks would be similar, but less than those described for the operation phase. Lixiviant would not be used during aquifer restoration so there would not be potential impacts to geology from dissolution of uranium and other constituents from the ore zone. As the quality of ground water from the exempted aquifer improves during restoration, the potential impacts of process-solution spills or leaks from pipes and pumps would decrease compared to potential impacts during operations. GEIS Section 4.4.3.3 determined that the potential impacts to geology and soils would be SMALL.

The potential impacts to Ross Project geology and soils associated with aquifer restoration at the Ross Project would be similar, but less, than those associated with its operation. The relative magnitude of impacts would be less because the concentrations of radionuclides, metals, and total dissolved solids (TDS) in the water moving through the pipes, pipelines, and injection and recovery wells would be lower during aquifer restoration than during uranium-recovery operation. Also, there would less transport of uranium-bearing solutions and fewer shipments of yellowcake and vanadium; thus, less potential for spills and leaks than during operation. As previously described for the operation phase of the Ross Project, impacts to soils resulting from spills would be measured by the concentrations of radionuclides and other chemical constituents above pre-licensing, site-characterizations levels, but these elevated concentrations would be eliminated upon spill cleanup. Thus, the potential impacts of the Proposed Action's aquifer restoration to geology and soils would be SMALL.

4.4.1.4 Ross Project Decommissioning

GEIS Section 4.4.3.3 described the activities associated with the decommissioning of an ISR facility, including decontamination of surfaces, dismantling of process components and associated structures, demolishing buildings and other structures, removal of buried pipelines, and plugging and abandonment of wells and wellfield components (NRC, 2009b). The GEIS determined that most of the impacts to geology and soils during the decommissioning phase would be short-term and SMALL. In fact, because the goal of decommissioning and site restoration is to restore, to the extent practical, the environment to preconstruction conditions through activities such as redistributing, seeding, and contouring soil that would have been stockpiled during the earlier phases of the Ross Project, the overall long-term impacts to geology and soils would be SMALL (NRC, 2009b).

Geology

The potential impacts to the geology of the ore zone at the Proposed Action would depend upon the density of plugged and abandoned drillholes and wells. At the end of the life of the Ross Project, the wellfields (whether recently operated or decommissioned some time ago) would contain approximately 3,000 drillholes and wells; these would include those drillholes from Strata's ore-zone delineation efforts and geotechnical investigations, ground-water monitoring wells used for site characterization, the injection and recovery wells from uranium-recovery activities, and Nubeth Joint Venture (Nubeth) drillholes and wells. Although the wells would not be evenly distributed across the Project area, the number of wells and drillholes would represent an average density of approximately 4.3 wells/ha [1.7 wells/ac]. All of these drillholes and wells constructed by the Applicant and the Nubeth holes that are located would be properly abandoned with cement or a similar material. As discussed in Section 2.1.1.1 of this SEIS, Condition No. 10.12 of the Draft Source and Byproduct Materials License would require the Applicant to attempt to locate and abandon all historic drill located within the ring of perimeter-monitoring wells around each wellfield (NRC, 2014b). Each drillhole and well would be required to be filled with a cement slurry or bentonite grout up to 15 cm [6 in] in diameter, through the entire depth of the drillhole or well (WDEQ/LQD, 2005). The density of this concrete or bentonite is not great enough to alter the geology of the ore zone nor the surrounding stratigraphy. As described in SEIS Section 2.1.1.1, well-abandonment records would be maintained onsite at the Ross Project until termination of its Source and Byproduct Materials License. The impacts to ground water from improperly abandoned drillholes and wells are discussed in SEIS Section 4.5.

The surficial bedrock would be affected locally by the actions necessary to breach the CBW to re-establish aquifer flow. The potential impacts from these relatively small and local effects on bedrock beneath the CBW would be SMALL as would all impacts related to geology.

Soils

The potential impacts to Ross Project area soils during the decommissioning of the Proposed Action would result from activities associated with land reclamation and site restoration, including the excavation and cleanup of contaminated soils. These decommissioning impacts would be similar to those resulting from construction of the Proposed Action. The BMPs, SOPs, and other mitigation measures described earlier for the construction and operation phases would continue to be implemented. Thus, the potential impacts from decommissioning activities to the local soils would be SMALL.

4.4.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, until that decision is made by the NRC, the impacts of soils compaction and soils loss by heavy equipment and vehicular traffic across the Ross Project area could occur during the Applicant's continuing conduct of: 1) different types of surveys (e.g., continued ecological surveys); 2) boring of exploration and geotechnical drillholes; 3) drilling and monitoring of all types of ground-water wells; 4) locating and abandoning Nubeth drillholes and wells; and 5) installing and observing surface-water and meteorological monitoring stations.

As of August 2011, the Applicant had drilled and then plugged approximately 612 holes it installed during site characterization, geotechnical investigation, and ore-zone delineation; an additional 51 were also drilled and are now used as pre-licensing, site-characterization ground-water monitoring wells. The Applicant has also located and properly abandoned 55 Nubeth wells. Under the No-Action Alternative, the 51 drillholes would need to be responsibly abandoned by the Applicant, plugging the full depth of the drillhole or well with concrete. However, the potential impacts of all of these preconstruction and current activities would be short-term, and the related traffic over the Ross Site area would be low density and minimal. Thus, neither the geology nor the soils would sustain significant impacts; the impacts to the geology and soils as a result of Alternative 2 would be SMALL.

4.4.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The geology and soils at the north site are similar, but there are a few important differences. The most important difference is that the north site slopes to the southeast at a grade of 5 – 15 percent, where the slope at the Proposed Action’s facility location, the south site, has a significant percentage of ground surface with less than 1 percent slope. Given that the cells in the surface impoundments have approximate dimensions of 76 m x 165 m [250 ft x 540 ft], significant additional grading would be necessary to construct the surface impoundments at the north site as compared to the south site’s location. Also, given that the use of above-grade embankments (to minimize the volume of release during a catastrophic failure) should be minimized from engineering and environment-protection points of view, then the maximum depth of excavation to create each impoundment at the north site would be on the order of 4 – 12 m [13 – 40 ft], with an impoundment depth of 4.6 m [15 ft] and slopes of 5 – 15 percent. It is estimated that the north site would require the grading of an additional 0.4 – 1.2 ha [1 – 3 ac] to accommodate the sloping site.

The additional construction effort associated with these deeper cuts and larger disturbed areas would result in greater soils impacts than those resulting from Alternative 1, the Proposed Action. In addition, these deep cuts would likely encounter bedrock within 1.5 – 7.6 m [5 – 25 ft], increasing the cost and complexity of the construction activities. Embankments could reduce the depths of the excavations, but they would increase the volume of a potential release of process solutions and other liquid byproduct wastes if a catastrophic release were to occur.

Another important difference between Alternative 3 and the Proposed Action is that the north site is not underlain by shallow ground water and, thus, a CBW would not be required. As a result, the soils loss and soils compaction associated with construction of the CBW at the south site would not occur under Alternative 3.

The potential impacts to geology and soils from construction of Alternative 3 would be SMALL and similar to the Proposed Action. In addition, the potential impacts to geology and soils from the operation and aquifer restoration of Alternative 3 would be the same as those of the Proposed Action and would be SMALL.

Alternative 3 would also result in similar impacts to the geology and soils of the Ross Project area during the Proposed Action's decommissioning, except for activities associated with the decommissioning of the surface impoundments. The larger surface impoundments would require larger areas of recontouring and revegetation during site restoration, which would result in a marginally greater potential for the soils loss and soils compaction. However, the impacts to the surficial geology and soils as a result of the Applicant's cutting through the CBW to re-establish aquifer flow in the Proposed Action would be eliminated. In total, the potential impacts to geology and soils during the decommissioning of Alternative 3 would be SMALL.

4.5 Water Resources

The Proposed Action could impact water resources, both surface and ground waters, during all phases of the Project's lifecycle. As discussed in Section 3.2.4, surface and ground waters in the Ross Project area are currently used for livestock and wildlife watering, crop irrigation, and enhanced oil recovery (EOR). The largest water right within 3 km [2 mi] of the Ross Project area is Permit No. P6046R for the Oshoto Reservoir with a permitted capacity of 21 ha-m/yr [173 ac-ft/yr]. The Applicant proposes to convert this water right for use at the Ross Project (Strata, 2011a). As discussed in Section 2.1.1.1 of this SEIS, the Applicant may have to provide alternative sources of water to supply the EOR operation. This section describes the potential impacts to water resources and the corresponding mitigation measures the Applicant proposes throughout the Proposed Action's lifecycle as well as those of the two other Alternatives.

4.5.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields.

The Ross Project has the potential to impact quantity and quality of surface and ground waters to varying degrees during each phase of the Project. The Applicant intends to use local water for the construction of the facility and wellfields as well as for its operation of the Ross Project including during the aquifer restoration, and decommissioning phases. Consumptive ground-water use would result from the Applicant's injecting an estimated average of 1.25 percent less water than is withdrawn during uranium-recovery operation. Rates of surface- and ground-water use for domestic requirements, dust control, and agricultural irrigation are provided in Table 4.3. Use of ground water for production by the ISR process is discussed in subsequent paragraphs of this SEIS.

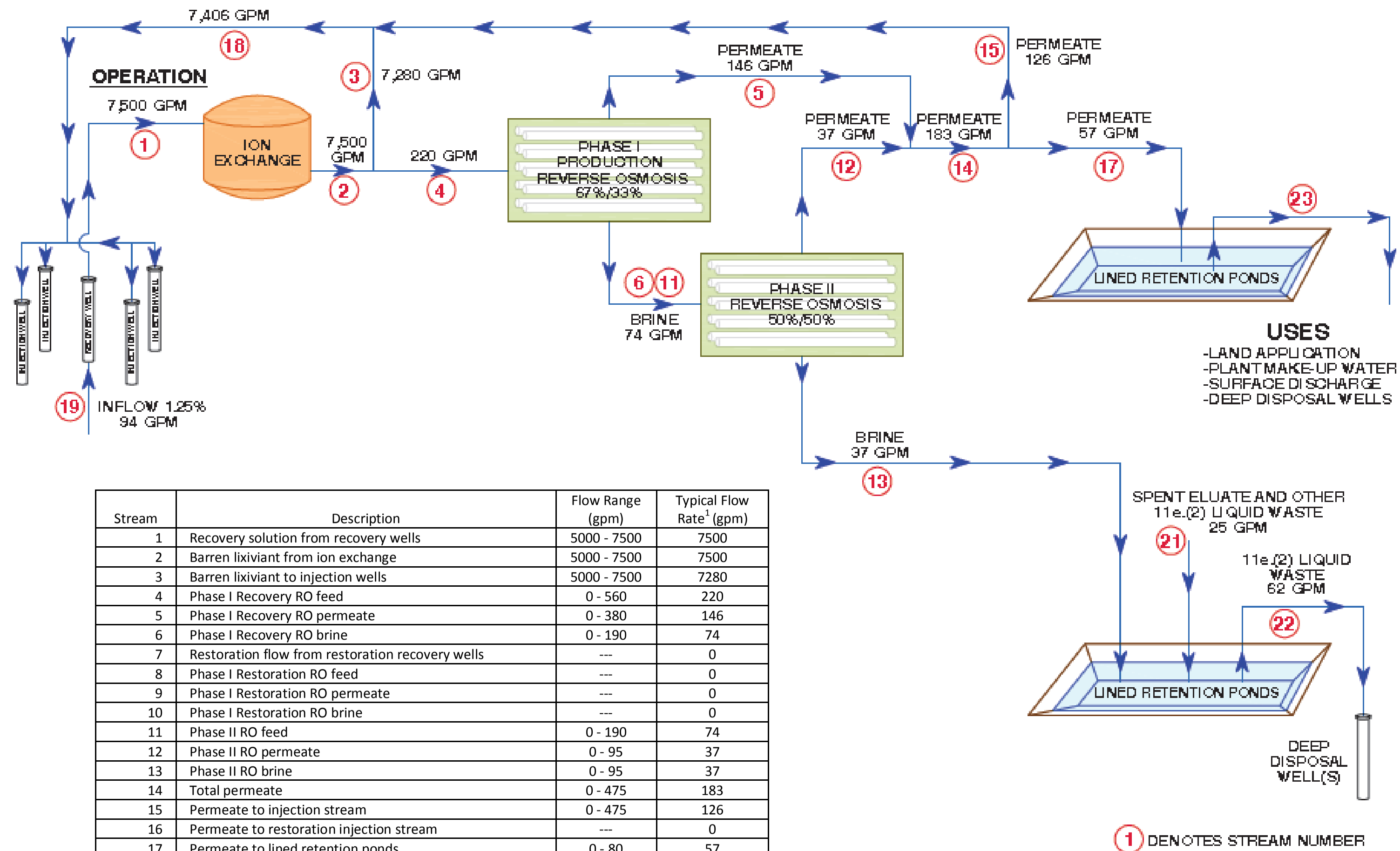
Table 4.3
Estimated Non-Production Water Use

Type of Use	Source	Typical Water Usage (L/s [gal/min]) Construction	Operation	Restoration	Decommissioning
Domestic	Ground Water	0.06 [0.9]	0.12 [1.9]	0.1 [1.6]	0.11 [1.8]
Dust Control	Surface Water	0.45 [7.2]	0.23 [3.6]	0.23 [3.6]	0.45 [7.2]
Irrigation	Ground Water	0.006 [0.1]	0.006 [0.1]	0.006 [0.1]	0.006 [0.1]
Construction	Surface Water	1.003 [15.9]	0.24 [3.8]	0.0	0.24 [3.8]
	TOTAL	1.52 [24.1]	0.877 [13.9]	0.33 [5.3]	0.817 [12.9]

Source: Modified From Strata, 2011a; Strata, 2012a.

The Applicant anticipates that ground water from the shallow-monitoring (SM) zone would be used for domestic purposes and agricultural irrigation, while surface water from either the Oshoto Reservoir or the Little Missouri River would be used for road and construction dust control. Although GEIS Section 4.4.4.1 did not address consumptive use of surface water, and it assumed that all required water uses would be provided by ground water, the analysis of impacts to ground water and surface water is nonetheless applicable due to the fact that process water from ground water is the largest component of Ross Project water use.

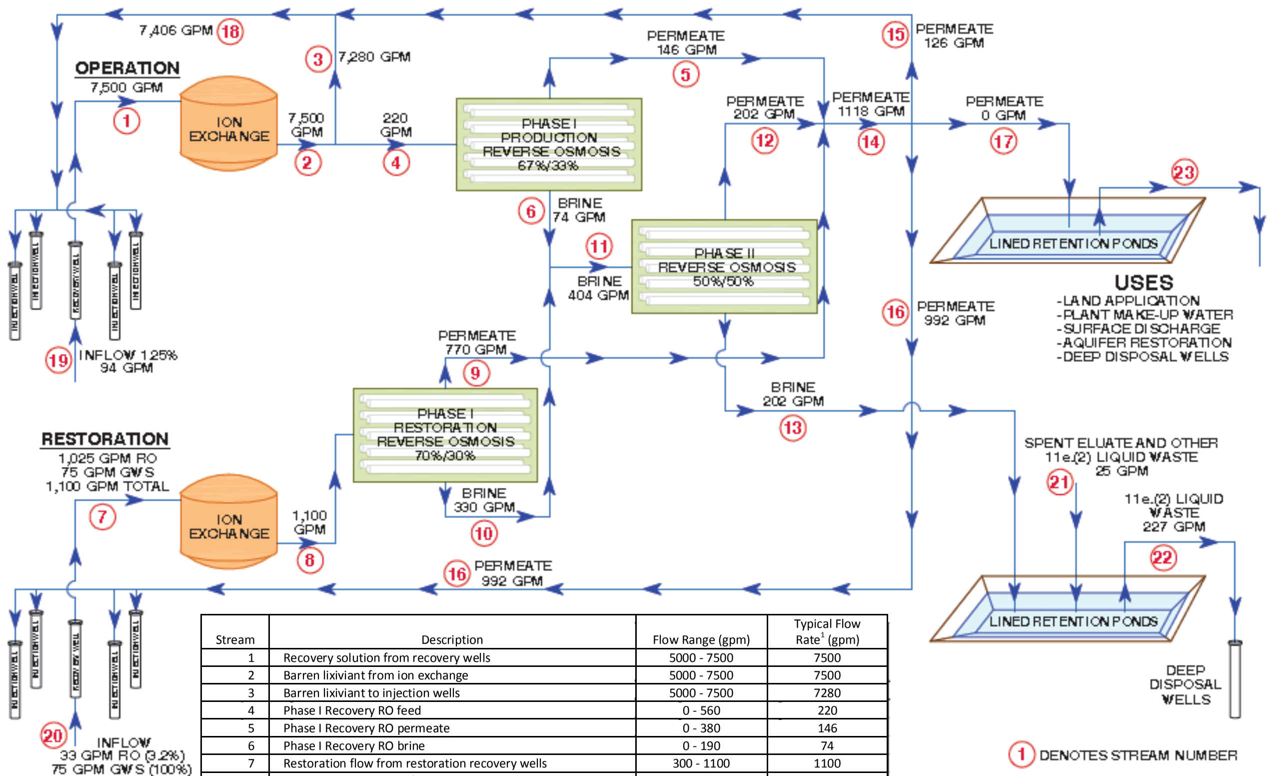
The water balances of the ground water used in the process for operation and aquifer-restoration phases of the Ross Project are illustrated in Figures 4.2, 4.3, and 4.4. As described in SEIS Section 2.1.1.5, permeate produced from the RO treatment would be reused, generally by re-injection into the wellfield. During only the first two and one-half years of operation before aquifer restoration begins and only during two months of ground-water sweep in the first wellfield to undergo restoration would excess permeate be generated and require disposal. The rate of ground-water consumption would be primarily the rate of brine production that is produced by RO treatment and disposal into the UIC Class I deep-injection well. As shown in Figures 4.2, 4.3, and 4.4 consumptive use of ground water during operation only would be 3.6 L/s [57 gal/min] of excess permeate and 3.9 L/s [62 gal/min] of brine. During concurrent operation and aquifer restoration, which would be the wellfields' condition for most of the Project, consumptive use would be 14.3 L/s [227 gal/min] (see Figure 4.3). During aquifer restoration only over the last two years of the Project, consumptive use would be 12 L/s [190 gal/min].



Stream	Description	Flow Range (gpm)	Typical Flow Rate[1] (gpm)
1	Recovery solution from recovery wells	5000 - 7500	7500
2	Barren lixiviant from ion exchange	5000 - 7500	7500
3	Barren lixiviant to injection wells	5000 - 7500	7280
4	Phase I Recovery RO feed	0 - 560	220
5	Phase I Recovery RO permeate	0 - 380	146
6	Phase I Recovery RO brine	0 - 190	74
7	Restoration flow from restoration recovery wells	---	0
8	Phase I Restoration RO feed	---	0
9	Phase I Restoration RO permeate	---	0
10	Phase I Restoration RO brine	---	0
11	Phase II RO feed	0 - 190	74
12	Phase II RO permeate	0 - 95	37
13	Phase II RO brine	0 - 95	37
14	Total permeate	0 - 475	183
15	Permeate to injection stream	0 - 475	126
16	Permeate to restoration injection stream	---	0
17	Permeate to lined retention ponds	0 - 80	57
18	Total flow to injection stream	4900 - 7460	7406
19	Recharge to wellfield (0.5% to 2% production bleed)	25 - 150	94
20	Recharge to restoration wellfield	---	0
21	Spent eluate and other 11e.(2) liquid waste	10 - 40	25
22	Brine and other 11e.(2) liquid waste to disposal	25 - 140	62
23	Permeate to beneficial uses and disposal	0 - 80	57
1	Typical flow rate at 7,500 gpm recovery flow, 1.25% bleed		

Source: Strata, 2012a.

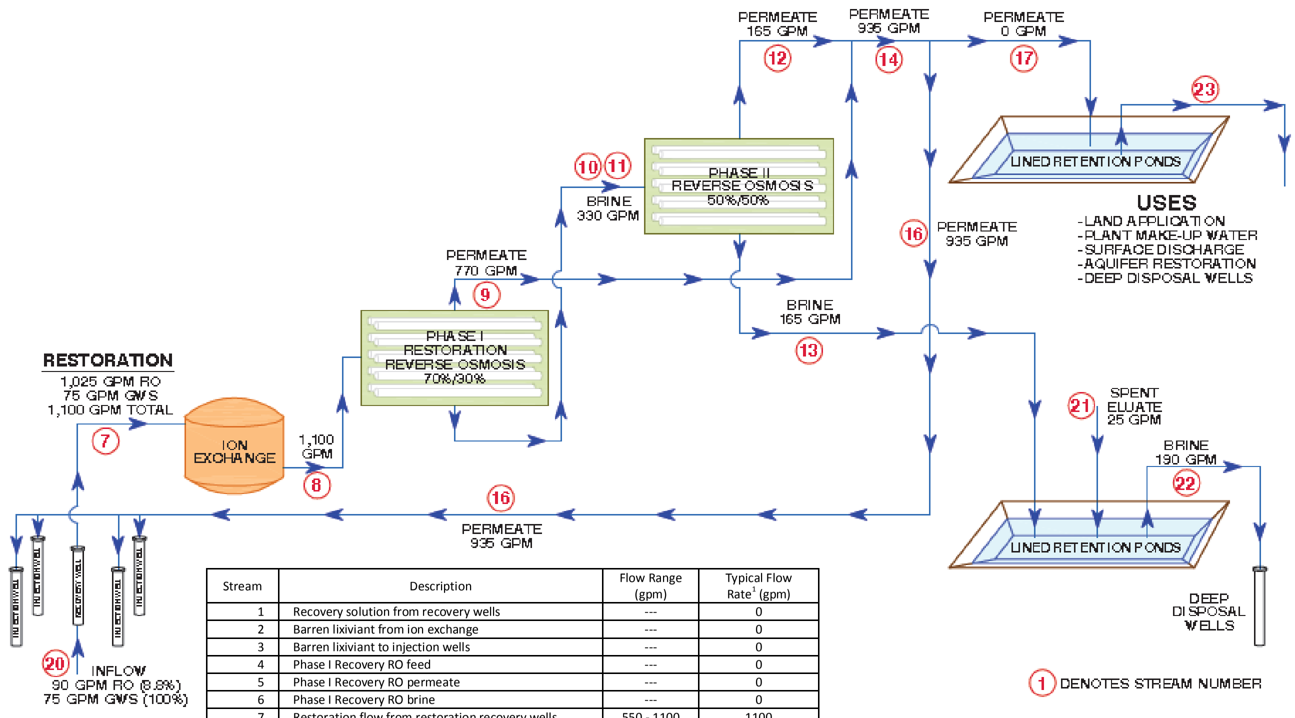
Figure 4.2
Typical Water Balance during Operation Only



Stream	Description	Flow Range (gpm)	Typical Flow Rate[1] (gpm)
1	Recovery solution from recovery wells	5000 - 7500	7500
2	Barren lixiviant from ion exchange	5000 - 7500	7500
3	Barren lixiviant to injection wells	5000 - 7500	7280
4	Phase I Recovery RO feed	0 - 560	220
5	Phase I Recovery RO permeate	0 - 380	146
6	Phase I Recovery RO brine	0 - 190	74
7	Restoration flow from restoration recovery wells	300 - 1100	1100
8	Phase I Restoration RO feed	300 - 1100	1100
9	Phase I Restoration RO permeate	210 - 770	770
10	Phase I Restoration RO brine	90 - 330	330
11	Phase II RO feed	90 - 520	404
12	Phase II RO permeate	45 - 260	202
13	Phase II RO brine	45 - 260	202
14	Total permeate	255 - 1410	1118
15	Permeate to injection stream	0 - 470	126
16	Permeate to restoration injection stream	0 - 1000	992
17	Permeate to lined retention ponds	0 - 320	0
18	Total flow to injection stream	4900 - 7460	7406
19	Recharge to wellfield (0.5% to 2% production bleed)	25 - 150	94
20	Recharge to restoration wellfield	80 - 300	108
21	Spent eluate and other 11e.(2) liquid waste	10 - 40	25
22	Brine and other 11e.(2) liquid waste to disposal	90 - 300	227
23	Permeate to beneficial uses and disposal	0 - 320	0
1	Typical flow rate at 7,500 gpm recovery flow, 1.25% bleed, 0.5 PVD groundwater sweep and 7.0 PVD RO		

Source: Strata, 2012a.

Figure 4.3
Typical Water Balance during Concurrent Operation and Aquifer Restoration



Stream	Description	Flow Range (gpm)	Typical Flow Rate[1] (gpm)
1	Recovery solution from recovery wells	---	0
2	Barren lixiviant from ion exchange	---	0
3	Barren lixiviant to injection wells	---	0
4	Phase I Recovery RO feed	---	0
5	Phase I Recovery RO permeate	---	0
6	Phase I Recovery RO brine	---	0
7	Restoration flow from restoration recovery wells	550 - 1100	1100
8	Phase I Restoration RO feed	550 - 1100	1100
9	Phase I Restoration RO permeate	385 - 770	770
10	Phase I Restoration RO brine	165 - 330	330
11	Phase II RO feed	165 - 330	330
12	Phase II RO permeate	80 - 165	165
13	Phase II RO brine	80 - 165	165
14	Total permeate	465 - 935	935
15	Permeate to injection stream	---	0
16	Permeate to restoration injection stream	465 - 935	935
17	Permeate to lined retention ponds	0 - 50	0
18	Total flow to injection stream	---	0
19	Recharge to wellfield (0.5% to 2% production bleed)	---	0
20	Recharge to restoration wellfield	80 - 170	165
21	Spent eluate and other 11e.(2) liquid waste	10 - 40	25
22	Brine and other 11e.(2) liquid waste to disposal	90 - 210	190
23	Permeate to beneficial uses and disposal	0 - 50	0
1	Typical flow rate at 1,100 gpm restoration flow, 0.5 PVD groundwater sweep and 7.0 PVD RO		

Source: Strata, 2012a.

Figure 4.4
Typical Water Balance during Aquifer Restoration Only

In addition, the Applicant proposes BMPs consistent with those identified by the NRC as commonly employed at ISR facilities, which are summarized in GEIS Section 7.4 (Strata, 2011a; NRC, 2009b). These BMPs would include procedures for the Applicant to minimize surface-water impacts by limiting soil disturbance and compaction, diverting and controlling runoff, avoiding or promptly detecting and correcting accidental spills and leaks, and completing reclamation in a timely manner. Mitigation measures to minimize ground-water-quality impacts in the overlying and underlying aquifers include the Applicant's properly abandoning exploration and delineation drillholes, limiting over-penetration during drilling, employing onsite engineering/geologic supervision during well drilling and development, using proper well construction techniques, implementing an approved mechanical integrity testing (MIT) program, and the excursion monitoring program. Potential ground-water-quantity impacts in the ore zone would be mitigated by the Applicant's minimizing consumptive use (e.g., monitoring nearby stock and domestic wells, designing balanced wellfields, and minimizing the production bleed). Impacts to ground-water quality in the ore-zone aquifer would be mitigated by ground-water restoration, and excursion monitoring.

4.5.1.1 Ross Project Construction

Surface Water

As described in GEIS Sections 4.2.4.1.1 and 4.4.4.1.1, the potential impacts to surface waters that could result from the construction of the Proposed Action include land clearance and disturbance for buildings and auxiliary structures as well as the surface impoundments, wellfields, pipelines, access roads, and utilities; stream-channel disturbance for limited periods and minor wetland encroachment. In addition, spills and leaks of fuels and lubricants as well as the discharge of well-drilling fluids from installation, development, and testing of wells could potentially impact surface-water quality. The potential for these impacts would be mitigated through proper planning, thoughtful design, sound construction methods, permit requirements, and BMPs as described in GEIS Section 7.4 (NRC, 2009b). The GEIS considered that changes to stream flow (from land grading and other topographic changes) and to natural drainage patterns would be mitigated or restored after the ISR facility's construction phase is complete.

Additionally, while impacts from incidental spills into surface water drainages could occur, they would be expected to be temporary. The limits on the quality of storm water that is discharged during the construction phase would be specified in permits from the WDEQ/WQD. The GEIS concluded that potential impacts to surface water during the construction phase of an ISR facility would be expected to be SMALL to MODERATE, depending upon site-specific conditions.

The Applicant intends to use approximately 1.5 L/s [23 gal/min] of surface water from either the Oshoto Reservoir or the Little Missouri River for dust control and construction-activity dust suppression (see Table 4.3). These uses equate to an annual use of 4.6 ha-m [37 ac-ft/yr], which is significantly less than the currently permitted annual appropriation for Oshoto Reservoir of 21 ha-m [173 ac-ft/yr]. As described in Section 2.1.1. of this SEIS, the Applicant may be required to replace the water Merit withdraws from the Fox Hills Formation for EOR. Some portion or all of this water, approximately 2.81 L/s [44.6 gal/min], could be from the Oshoto Reservoir. Although the volume of water taken from the reservoir could increase over the amount used for construction, the total volume would still be significantly less than the currently permitted annual appropriation for Oshoto Reservoir. Thus, the potential impacts of the Proposed Action's construction to surface-water quantity would be SMALL.

Suspended-sediment concentrations in storm water at the Ross Project area could be increased due to vegetation removal and soil disturbance during construction of the Proposed Action. The Applicant estimates that 45 ha [110 ac], or 7 percent of the Ross Project area, would be disturbed by the end of the construction phase (Strata, 2011a). The quality of storm water discharged during the construction phase of the Ross Project would be controlled in accordance with the general construction WYPDES Storm Water Permit No. WYR104738 issued by WDEQ/WQD. Under this Permit, the Applicant would be required to implement a SWPPP to address storm-water runoff during construction activities. The SWPPP would describe the nature and sequence of construction activities, identify potential sources of pollution, and describe the BMPs that must be used, including erosion and sediment controls (e.g., silt fences, sediment logs, and/or straw-bale check dams) and operational controls (e.g., housekeeping, signage, and/or hydrocarbon storage requirements).

In addition, the construction of a single well (injection, projection, or monitoring) would generate a quantity of drilling fluid estimated at 22,700 L [6,000 gal] and about 11 m^3 [15 yd^3] of drilling muds. 1,400 – 2,200 wells would be drilled and the wastes generated could potentially impact water quality. The wells would be drilled at different times throughout the Project. The drilling fluids and muds would be contained in a mud pit constructed near the well that is being installed to prevent discharge to surface water. These wastes would then be evaporated and dried over time followed by reclamation of the mud pit.

Other potential surface-water impacts could occur from leaking fuel or lubricants from heavy construction equipment and passenger vehicles that would be operated during the construction phase of the Proposed Action. Any such leaks of equipment fluids would be mitigated by the Applicant locating construction activities away from surface-water features, when possible, and rapidly responding to leaks by properly sealing the equipment as needed and by containing and cleaning up the leakage.

Stream channels within the Ross Project would be potentially impacted when crossed by roads, pipelines, and utilities. The Applicant estimates that three stream-channel crossings would be constructed and one existing stream-channel crossing would need to be rehabilitated during the construction phase of the Proposed Action. In addition, there are several instances where tertiary roads would access wellfields and would cross ephemeral drainages. To mitigate impacts, these channel crossings would consist of unconstructed, two-track roads that would be constructed away from drainages where possible; ephemeral channel crossings would involve minimal land disturbance, and they would not be used during flow events. In the instances where it is necessary to cross a stream channel, the crossing would be made perpendicular to the channel and would include a culvert capable of passing the runoff resulting from a 10-year, 24-hour precipitation event. Sediment load would be mitigated by sediment-control BMPs. Pipeline crossings would be constructed in the same corridor as road crossings where possible to minimize disturbance. The impacts to surface-water flow from construction activities across a stream channel would also be minimized by the Applicant routing flow around active construction activities, storing the water in temporary sediment surface impoundments, or passing the water through sediment-control measures prior to discharge (Strata, 2011a). Given the site-specific mitigation measures to be implemented by the Applicant, the potential impacts of the Proposed Action's construction to surface-water quality would be SMALL.

The Applicant has applied for a permit with the U.S. Army Corps of Engineers (USACE) through USACE's Section 404 of the *Clean Water Act of 1972* (CWA) permitting process that, if granted, would authorize dredge and fill activities in waters of the U.S. and require the Applicant to mitigate the disturbance of wetlands. While the impacts to surface water could have MODERATE impacts before mitigation (NRC, 2009b), the Section 404 permit would establish conditions that could mitigate such impacts. The Applicant anticipates that it would be required to operate in accordance with a Nationwide Permit (NWP) for specific construction activities.

The Ross Project area hosts approximately 26 ha [65 ac] of potential wetlands mostly situated along the Little Missouri River and adjacent to the Oshoto Reservoir (Strata, 2011a). Construction of the Proposed Action would have the potential to impact up to 0.8 ha [2 ac] of wetlands. Prior to disturbing any USACE-verified wetlands, the Applicant would apply for coverage under a USACE permit for specific construction activities such as pipeline installation and access-road stream-channel crossings. For example, the Permit application would require the Applicant to provide a site-specific mitigation plan for construction-related disturbance of jurisdictional wetlands (i.e., wetlands regulated by the USACE under Section 404 of the CWA).

Depending upon the nature of the anticipated wetlands disturbance, mitigation could include the Applicant re-establishing temporarily disturbed wetlands in place, enhancing other existing wetlands, or constructing additional wetland areas for circumstances where the disturbance would be long term. Mitigation measures would ensure that the Proposed Action does not result in a net loss of wetlands. Thus, while the impacts to wetlands could have MODERATE impacts before mitigation (NRC, 2009b), a USACE permit would establish conditions that could mitigate such impacts to wetlands. The potential impacts of the Proposed Action's construction to wetlands consequently would be SMALL.

Ground Water

As stated in GEIS Section 4.2.4.2.1 and 4.4.4.2.1, potential impacts to ground water during an ISR facility's construction are primarily from consumptive water use and contamination caused by: drilling fluids and muds during injection, recovery, and monitoring well drilling; and fuel and lubricant spills and leaks from construction equipment. It is further noted in the GEIS that ground-water use during an ISR facility's construction phase would be limited, and that ground water would be protected by implementing BMPs such as spill-prevention and spill-cleanup protocols. A limited amount of drilling fluids and muds would be introduced into the environment during well installation. Because of the limited nature of construction activities and the implementation of BMPs to protect shallow ground water, the GEIS concluded that construction impacts on ground water would be SMALL (NRC, 2009b).

Although construction of the CBW during the Proposed Action is not part of the typical ISR design considered in the GEIS, the analysis of impacts to ground water provided in the GEIS are applicable because the effects of the CBW on shallow ground water are localized.

In the following sections, potential impacts and mitigation measures are considered for three aquifer units: 1) The unconfined shallow (near-surface) aquifers; 2) the confined aquifers hosting the ore-zone (OZ) as well as those above and below the ore zone (the shallow-monitoring [SM] and the deep-monitoring [DM]); and 3) the deeper aquifers below the DM aquifer.

Shallow Aquifers

Potential impacts to the quantity of water in the shallow aquifers during construction of the Proposed Action would be caused by water taken from the Oshoto Reservoir and the water affected by the installation of the CBW surrounding the facility (i.e., the CPP and surface impoundments). In the vicinity of the Oshoto Reservoir, the Reservoir stage (i.e., the volume of water it contains) and the shallow-aquifers water levels are closely related (Strata, 2012b). Although the Applicant anticipates an annual withdrawal of 4.6 ha-m/yr [37 ac-ft/yr] of water during construction, that volume is less than the permitted annual appropriation for the Oshoto Reservoir, 21 ha-m/yr [173 ac-ft/yr] (Strata, 2012b). Any changes in ground-water levels due to water usage from Oshoto Reservoir would be small and restricted to the area around the Reservoir.

Construction of the CBW (see SEIS Section 2.1.1.1) could impact the quantity of water in the shallow aquifer because the CBW would restrict flow in the shallow aquifer at the Ross Project facility. Preconstruction dewatering within the facility's area would lower water levels locally in the shallow aquifer, but the normal ground-water flow regime would not be disrupted. The Applicant anticipates that the construction dewatering following installation of the CBW would be a one-time event and require little continuing maintenance. Ground-water use would be mitigated by the design of the CBW, which would prevent seepage of ground water beneath the CBW into the subsurface below the CPP that would require removal by pumping. Thus, the potential impacts from the construction of the Proposed Action to ground-water quantity in the shallow aquifers would be SMALL.

In addition, shallow-aquifer water levels could increase slightly on the hydraulically up-gradient side of the CBW and could decrease slightly on the hydraulically down-gradient side of the CBW in response to the lower permeability of the CBW relative to the shallow aquifer. The changes in ground-water levels would be restricted to the area adjacent to the CBW (Strata, 2011a).

Potential water-quality impacts to the shallow aquifer that could occur during construction include spills or leaks from construction equipment and the introduction of drilling fluids. The potential for the shallow ground water to be impacted by drilling fluids and muds is minimal because of the small volume of fluids used, and because the fluids would be contained within a mud pit in accordance with WDEQ/LQD requirements. Impacts to ground water during well drilling would be further limited by the nature of the bentonite or polymer-based drilling additives in the drilling fluids. These additives are designed to limit infiltration in an aquifer (i.e., to a few inches) and to isolate the drillhole from the surrounding geologic materials via a wall-cake or veneer of drilling-fluid filtrate, further diminishing the potential for impacts. Thus, the potential impacts of the Proposed Action's construction to ground-water quality in the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

Ground water used for domestic uses and agricultural irrigation during the Proposed Action's construction is estimated to be 0.06 L/s [1.0 gal/min] (see Table 4.3). A water-supply well drawing water from the SM aquifer would be used to supply these needs. Based upon yields from wells in the region and other wells completed in the SM aquifer, ground-water modeling indicates that the aquifer could support this level of withdrawal with little drawdown (Strata, 2011b). The potential impacts of the Proposed Action's construction on the ground-water quantity available from the confined aquifers, therefore, would be SMALL.

Drilling for mineral delineation and well installation would potentially impact the SM aquifer, the OZ aquifer laterally adjacent to the ore zone, and the DM aquifer. Improperly abandoned drillholes, overly penetrating drillholes, or lack of well integrity could result in the mixing of industrial-use ground water from the OZ aquifer with the chloride-dominated ground water of the DM aquifer or the stock-water quality of the overlying SM aquifer. This mixing would be localized and any significant changes in water quality would be detected by monitoring wells.

To mitigate potential impacts to the confined aquifers from drilling, the Applicant proposes to continue to comply with WDEQ/LQD rules for well completion and drillhole abandonment (WDEQ/LQD, 2005). The Applicant would rely upon the geological model developed to determine total depths for drillholes, thus preventing over-penetration into underlying aquifers. Onsite geological and engineering supervision would continue throughout the construction phase. Wells installed for further hydrologic studies, during post-licensing and pre-operational monitoring, and production infrastructure would pass MIT prior to use (see SEIS Section 2.1.1.1). Consequently, the potential impacts from the Proposed Action's construction on the ground-water quality within the confined aquifers would be SMALL.

Deep Aquifers

Construction of the Ross Project would not impact the aquifers below the DM aquifer. The Flathead and Deadwood Formations would be tapped by the construction of the Class I injection well(s) discussed in SEIS Section 2.1.1.1, where that well(s) would be used for the disposal of brine and other byproduct liquid wastes during the Ross Project's operation, aquifer restoration, and decommissioning phases. The potential impacts of construction of the Proposed Action on the quantity and quality of ground water present within the deep aquifers would be SMALL.

4.5.1.2 Ross Project Operation

This section describes potential impacts and mitigation measures to surface and ground waters associated with operation of the Proposed Action.

Surface Water

As described in GEIS Sections 4.2.4.1.2 and 4.4.4.1.2, surface waters could be impacted by accidental spills during ISR operations. Spills from the CPP or wellfields as well as spills during transportation could impact storm-water runoff or contaminate shallow aquifers that are hydraulically connected to surface waters. The GEIS determined that surface-water monitoring and rapid spill response would limit the impacts of potential surface spills to SMALL; however, impacts of spills to surface waters that are connected to shallow aquifers would be SMALL to MODERATE, depending upon the specifics of an incident. Activities posing potential impacts to surface waters from uranium-recovery operation would be regulated by Federal agencies. According to the GEIS, the Applicant's use of BMPs, and implementation of required mitigation measures would moderate the impacts of the Proposed Action's operation from MODERATE to SMALL, depending upon local conditions.

The Applicant estimates that approximately 0.76 L/s [12 gal/min] of surface water from either the Oshoto Reservoir or the Little Missouri River would be used during the Proposed Action's operation for continuing construction activities in the wellfields and for dust control (see Table 4.3). The estimated annual use of 2.4 ha-m [19 ac-ft/yr] would be significantly less than the existing, permitted annual appropriation for Oshoto Reservoir of 21 ha-m [173 ac-ft/yr]. Ground water produced from developing, and testing wells that have not been affected by ISR activities would be discharged according to a temporary WYPDES Permit as described in SEIS Section 2.1.1.5. This water would either infiltrate into the ground or add to the surface water in the Little Missouri River. The Permit does not allow degradation of habitat for aquatic life, plant life, and wildlife nor does it allow discharges to adversely affect public water supplies or supplies intended for agricultural or industrial uses (WDEQ/WQD, 2011a). The mitigation measures proposed by the Applicant would ensure habitat and water-supply degradation do not occur.

Flow in the Little Missouri River could potentially be affected during operation. Water from the Little Missouri River infiltrates into the OZ aquifer where the river crosses the area of Fox Hills and Lance Formations exposure at the ground surface east of the Ross Project area (Strata, 2011a). The Applicant's ground-water model shows that infiltration would increase by approximately 0.095 L/s [1.5 gal/min], decreasing the average annual discharge of the Little Missouri River by less than 0.005 percent just downstream of the Wyoming-Montana border (Strata, 2011a). Thus, no mitigation measures would be warranted for this very small volume and the potential impacts of the Proposed Action's operation on surface-water quantity would be SMALL.

Storm-water runoff from impervious surfaces, including buildings, roads, and parking areas, could result in higher water flows, channel erosion, and increased sediment concentrations in surface waters. The Applicant predicts a peak flow of 1.4 m^3/s [50 ft^3/s] during a 100-year, 24-hour storm (Strata, 2011a). This peak flow represents an increase of less than 1 percent of the peak flow in the Little Missouri River of 170 m^3/s [6,000 ft^3/s].

Water quality impacts from surface-water runoff would be mitigated by the Proposed Action's storm-water-control system that would route all storm water to a sediment surface impoundment sized to hold runoff from the 100-year, 24-hour runoff event. A flood-control diversion channel around the CPP and surface impoundments (i.e., the facility itself) would prevent storm water originating in the ephemeral stream channel upstream of the facility from encountering process solutions or chemicals. In addition, BMPs would be implemented by the Applicant to reduce erosion and the likelihood of increased sediment loads. Mitigation measures employed by the Applicant to reduce soil erosion would also mitigate storm-water runoff across the Ross Project. Protection of wellheads and module buildings from large runoff events would typically be accomplished by placement on high ground out of the flood plain. When wells or other facility components must be placed within the 100-year-flood inundation area, appropriate engineering controls would be used to ensure safety and environmental protection. The injection, recovery, and monitoring wells would be protected from flooding by the installation of cement seals around the well casings and the use of watertight well caps.

Measures designed to mitigate the impacts of suspended sediment would be contained in a storm-water discharge Permit required by the WDEQ/WQD prior to uranium-recovery operation. The permit would include a requirement for a SWPPP that describes erosion and sediment controls as well as operational controls that would be used to ensure that storm-water discharges from the Ross Project facility do not cause a violation of Wyoming's surface-water quality standards (WDEQ/WQD, 2007). Storm-water BMPs would be inspected semiannually or as required by the WYPDES Storm Water Permit. The SWPPP would be updated as needed, such as when potential problems are identified during inspections or when there are changes in uranium-recovery operation (e.g., transition from operation to aquifer restoration).

Release of process solutions from uranium-recovery wellheads, pipelines, module buildings, or process vessels; accidental discharge from surface impoundments; or release of yellowcake or IX resin during a transportation accident could result in surface-water contamination if the release(s) reach a surface-water body. Potential impacts from accidential spills and releases will be mitigated by SOPs for operational and emergency procedures for managing radioactive and non-radioactive materials (NRC, 2014b, License Condition 10.4). Impacts from releases that do reach surface water(s) would be short-term, elevated concentrations of radionuclides and associated chemical constituents at levels above pre-licensing, site-characterization. Cleanup of contaminated sediments associated with a spill would follow the same requirements as those for soil cleanup efforts (see SEIS Section 4.4.1.2). Any impacts to surface waters remaining after cleanup would decline over time as the contaminated fluids are dispersed in the surface-water body.

The potential for release of process solutions will be mitigated by daily measurement of injection manifold pressure and flow rates as described in Section 2.1.1.1 of this SEIS (NRC, 2014b, License Condition 10.14). Accidental discharge from surface impoundments would be mitigated by the size and design of the impoundments and by regular inspections (NRC, 2014b, License Condition 10.8). Because roads would cross surface-water drainages in only a few, isolated locations, it is unlikely that a transportation accident would result in a release to any surface water. Further mitigation of impacts would be accomplished by the Applicant's personnel containing and cleaning up any release before the solution could migrate to a surface-water body. Therefore, given these mitigation measures, the potential impacts of the operation of the Proposed Action on surface-water quality would be SMALL.

The potential impacts of the Proposed Action's operation to the Ross Project area's wetlands would be the same as described for the Ross Project's construction-phase impacts and the impacts would be SMALL.

Ground Water

The GEIS concluded in GEIS Sections 4.2.4.2.1 and 4.4.4.2.1 that the amounts of ground water from shallow aquifers used in routine activities during operations such as dust suppression, cement mixing, and well drilling are small and would have a SMALL and temporary impact.

At an ISR facility, a network of buried pipelines would be used during in situ uranium recovery for transporting lixiviant between module buildings and the CPP as well as connecting injection and recovery wells to manifolds inside the module buildings. The failure of pipeline fittings or valves, or well mechanical-integrity failures, in shallow aquifers could result in spills or leaks of lixiviant, which could impact water quality in the shallow aquifers. Potential environmental impacts due to spills and leaks from pipelines could be MODERATE to LARGE depending upon site-specific conditions, including whether 1) the ground water in the shallow aquifers is close to the ground surface; 2) the shallow aquifers are important sources for local domestic or agricultural water supplies; or 3) the shallow aquifers are hydraulically connected to other locally or regionally important aquifers; or 4) the shallow aquifers have either poor water quality or yields that are not economically suitable for production (NRC, 2009b). The use of surface impoundments to manage process solutions generated during ISR activities could also impact shallow aquifers by failure of impoundment embankments or their liners. Thus, the GEIS concluded that impacts of the use of surface impoundments on ground water would be SMALL (NRC, 2009b).

As discussed in GEIS Sections 4.2.4.2.2.2 and 4.4.4.2.2.2, potential environmental impacts to ground-water resources in the OZ and surrounding aquifers include consumptive water use and changes to water quality (NRC, 2009b). Consumptive use arises from the fact that ISR operations withdraw on average 1.25 percent more water than is injected into the wellfields, which is referred to as "production bleed." Ground-water bleed ensures a net inflow of ground water into the wellfield to minimize the potential movement of lixiviant and its associated contaminants out of the wellfield. Bleed water is generally disposed of through a waste-water control system, and it is not re-injected into the ISR wellfields. The GEIS determined that the short-term impacts of consumptive use could be MODERATE, but temporary, if the OZ aquifer outside the exempted portion of ore zone is used locally. (Uranium-recovery requires exemption of the uranium-bearing aquifer as an underground source of drinking water (USDW) and is exempted through Wyoming's UIC Program administered by the WDEQ.) Therefore, the long-term consumptive-use impacts would be expected to be SMALL in most cases, depending upon site-specific conditions.

The GEIS noted that water quality in the OZ aquifer would be degraded during ISR operations (NRC, 2009b). A licensee would be required, by its WDEQ Permit to Mine and by its source and byproduct materials license, to conduct aquifer-restoration activities to restore the OZ aquifer to pre-operational conditions, if possible. If the aquifer cannot be returned to post-licensing, pre-operational conditions described in SEIS Section 2.1.1.1, the NRC would require that the aquifer meet the U.S. Environmental Protection Agency (EPA) maximum contaminant levels (MCLs) provided in 10 CFR Part 40, Appendix A, Table 5C or Alternate Concentration Limits (ACLs), as approved by NRC (10 CFR Part 40; NRC, 2009b). For these reasons, the NRC determined in the GEIS that potential impacts to water quality of the exempted aquifer (i.e., ore zone, production zone or unit, or mineralized zone) as a result of ISR operations would be expected to be SMALL and temporary (NRC, 2009b).

GEIS Section 4.2.4.2.2.2 discussed the potential for vertical and horizontal excursions of degraded ground water outside of the uranium-production zone (i.e., the ore zone). The impact of horizontal excursions could be MODERATE to LARGE, if a large volume of contaminated water leaves the ore zone and moves down-gradient and impacts an area outside the ore zone which is being used for consumption (NRC, 2009b). As discussed in GEIS Section 2.11.3, the historical record for several licensed ISR facilities indicates that excursions occur at ISR operations (NRC, 2009b). Most of the excursions are horizontal and were recovered within months after detection. Vertical excursions tend to be more difficult to recover than horizontal excursions, and in a few cases, remained on excursion status for as long as eight years. The vertical excursions were traced to thinning of the confining geologic unit below the ore zone and improperly abandoned drillholes from earlier exploration activities (NRC, 2009b).

To reduce the likelihood and consequences of potential excursions, the NRC requires licensees to identify preventive measures before starting ISR operations. In general, the potential impacts of vertical excursions to ground-water quality in surrounding aquifers would be SMALL if the vertical hydraulic-head gradients between the OZ aquifer and the adjacent aquifer are small; if the vertical hydraulic conductivities of the confining geologic units are low; and if the confining geologic units are sufficiently thick (NRC, 2009b). Environmental impacts, however, would be expected to be MODERATE to LARGE if the confining units are discontinuous, thin, or fractured (NRC, 2009b). The NRC requires assurance of the integrity of the confining units to minimize the potential impacts from vertical excursions into overlying and underlying aquifers.

As indicated in GEIS Sections 4.2.4.2.2.3 and 4.4.4.2.2.3, the potential environmental impacts from disposal of liquid effluents into deep aquifers below ore-bearing aquifers would be SMALL, if water production from the deep aquifers is not economically feasible; if the ground-water quality from these aquifers is not suitable for domestic or agricultural uses (e.g., high salinity); and if they are confined above by sufficiently thick and continuous low-permeability layers (NRC, 2009b). Under different environmental laws such as the CWA, the *Safe Drinking Water Act*, and the *Clean Air Act of 1970* (CAA), the EPA has statutory authority to regulate activities that could affect the environment. Underground injection of liquids requires a permit from the EPA or from an authorized State UIC program. As noted in SEIS Section 2.1, the WDEQ has been authorized to administer the UIC program in Wyoming.

In the following sections, the potential impacts and mitigation measures related to the Proposed Action's operation are considered for the three types of aquifers: 1) the unconfined shallow (i.e., near-surface) aquifers; 2) the confined aquifers hosting the ore zone as well as those above and below the ore zone (the SM and the DM aquifers); and 3) the deep aquifers below the DM aquifer. Conditions of the Source and Byproduct Materials License will mitigate potential impacts to surface water and ground water. The following Conditions of the Draft Source and Byproduct Materials License would require compliance with: Condition 10.5, mechanical integrity tests; Condition 10.6, ground-water restoration; Condition 10.7, a net inward hydraulic gradient; Condition 10.12, an attempt to locate and abandon all historic drillholes located within the perimeter-monitoring-well ring of a wellfield; Condition 10.13, a "hydrologic-test data package" for each wellfield; Condition 10.19, wellfields south of the Little Missouri River until the use of the Merit wells have ceased or diminished to an acceptable level; and Condition 10.20, a ground-water monitoring program for the surface impoundments. Conditions 11.1, 11.3, 11.4, and 11.5 of the Draft License would require excursion-monitoring and aquifer-restoration goals, and Condition 12.3 would require that protection of ground-water uses occur within 2 km [1.2 mi] outside of the all wellfields.

Shallow Aquifers

Potential impacts from operation to ground-water quantity in the shallow aquifers would be similar to those described for the Proposed Action's construction phase and would be SMALL.

During ISR operation, the water quality throughout the Ross Project has the potential to be impacted by accidental spills or leaks from chemical-storage areas, process-solution vessels, or the surface impoundments as well as by spills and leaks of lixiviant from failure of a pipeline or a shallow break in the casing of an injection or recovery well. To reduce the risk of pipeline failure, the Applicant would hydrostatically test all pipelines prior to use and install leak-detection devices in manholes along the pipelines as described in Section 2.1.1.1. The Applicant's implementation of BMPs during Ross Project operation would reduce the likelihood and magnitude of spills or leaks and facilitate expeditious cleanup.

Further, the Applicant would monitor recovery and injection pipelines and immediately shut-down affected pumps if a spill or leak were detected (Strata, 2011b). The CPP would include a control room where a master control-system would allow remote monitoring and control of ISR, wellfield, and deep-well-disposal operations (Strata, 2011b). Operators would be located in the CPP's control room 24 hours a day and would use a computer-based station to command the control system.

MIT would be conducted on all Class III injection wells, recovery wells, and monitoring wells (see SEIS Section 2.1.1.1). Construction of all wells and their respective MIT would comply with the pertinent WDEQ/LQD regulations (WDEQ/LQD, 2005).

The Applicant would also implement spill control, containment, and cleanup measures in the CPP and surface-impoundment areas (i.e., the facility). These measures would include secondary containment for process-solution vessels and chemical storage tanks, a geosynthetic liner beneath the CPP's foundation, dual liners with a leak-detection system for the surface impoundments, and a sediment impoundment to capture storm-water runoff. In the event of a surface-impoundment leak, sufficient capacity would be reserved in the other impoundments' cells to allow the contents of the leaking cell to be rapidly transferred, minimizing the volume of the release. In addition, the ground-water levels downgradient of the CBW would be maintained below the ground-water levels in the shallow aquifer outside the CBW. This would impose inward and upward hydraulic gradients and therefore minimize the potential for contaminated ground water to migrate into the regional system. The Applicant has committed that it would install and monitor additional wells in the SA-unit aquifer, and this commitment would be codified in the Source and Byproduct Materials License. Thus, the potential impacts of the Proposed Action's operation to ground-water quality in the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

Potential impacts from the consumptive use of ground water from the ore-zone and surrounding aquifers were evaluated by the Applicant using a regional numerical model (Strata, 2011b). The conditions simulated by the Applicant were for two ISR "mine units" operating simultaneously, as described in SEIS Section 2.1.1. Details of the ISR simulations and results of the modeling are provided in Addendum 2.7-H of the Applicant's TR (Strata, 2011b).

The simulations assumed no changes in flow rates within the stock and domestic wells within the model area. Estimated flow rates for the oil-field water-supply wells were developed based upon average historical flow rates for the last two years of recorded flow (i.e., 2008 and 2009). Three of the oil-field water-supply wells (Wells 22X-19, 19XX18, and 789V) are located immediately adjacent to Modules 2-6 and 2-7. The Applicant simulated two uranium-recovery scenarios. Scenario 1 assumed that an alternative water supply could be found, which would allow the Merit wells to be taken out of operation two years prior to uranium recovery at the Ross Project; the wells would be kept out of operation until uranium-recovery operation ceases. Scenario 2 assumed that an alternative water-supply source could not be located and that, during uranium-recovery operation, the Merit oil-field water-supply wells continued to operate at their assumed 2008 – 2009 average flow rates. The Applicant will not be able to develop wellfields south of the Little Missouri River until the use of oil-field water-supply wells has ceased or has diminished to an acceptable level (NRC, 2014b, License Condition 10.19). This acceptable level will be reviewed and verified by the NRC staff. Given this Draft License Condition, the ground-water-modeling results under Scenario 1 were the most applicable to the Proposed Action.

The most significant drawdown predicted by the ground-water model occurs in the Wesley No. TW02 well located in the SWSW Section 8, Township 53 North, Range 67 West. This well gets limited use, as it only supplies water to a structure that is currently used by the Applicant as its Field Office for the Ross Project and to provide water to livestock. At the end of the aquifer-restoration phase under Scenario 1, the model predicts 9.17 m [30.1 ft] of drawdown, or 42.4 percent of the available head in that well. This magnitude of drawdown is the worst case based upon conservative assumptions in the model.

Potential impacts to the SM-aquifer water quantity, because of drawdown during uranium recovery and aquifer restoration in the ore zone, were also evaluated by the regional ground-water model (Strata, 2011b). Under the two recovery scenarios evaluated, the estimated maximum amounts of drawdown ranged from 1.5 – 5 m [5 – 15 ft] within the Ross Project area following the Proposed Action’s operation and aquifer-restoration phases.

Impacts from consumptive use of ground water from the ore zone would be minimized by cessation of water withdrawals by the Merit oil-field water-supply wells as would be required by the Source and Byproduct Materials License (NRC, 2014b, License Condition 10.19). The ground-water model simulated a single operational sequence of wellfield development, recovery, and aquifer restoration. Different operational approaches could be more effective in reducing impacts, and the Applicant proposes to investigate these as wellfield installation and testing progresses.

In the event that uranium recovery at the Proposed Action prevents the full use of a well which provides water under a valid water right, the Applicant would commit to providing an alternative source of water of equal or better quality and quantity, subject to Wyoming water statute requirements.

In the regional numerical model, the model’s lower boundary was the base of the ore zone/top of the lower confining unit. As a result, potential impacts to the DM aquifer were not evaluated by the model. The DM aquifer supports only one well (Merit Well No. 22X-19), and it has only limited hydraulic conductivity and yield. Thus, as the model demonstrates, the potential impacts from the Proposed Action’s operation to ground-water quantity in the confined aquifers would be SMALL.

During the Proposed Action’s operation, the ground-water quality of the ore-zone aquifer within the wellfields would be impacted from uranium-recovery activities. The Applicant has received approval from EPA and WDEQ/LQD to exempt the ore-zone aquifer within the area of the wellfields from the requirements of a USDW, as described in SEIS Section 2.1.1.1. The uranium and vanadium in the ore-zone aquifer would be oxidized and mobilized by the introduction of lixiviant into the ore-zone aquifer through injection wells. In addition to the uranium and vanadium, other constituents would also be mobilized, including anions, cations, and trace metals (Strata, 2011b). These impacts to the water quality of the ore-zone aquifer within the wellfields would be short term because aquifer restoration that would be required by the Source and Byproduct Materials License would return these constituent concentrations to each wellfield's respective NRC-approved post-licensing, pre-operational concentrations, numeric water-quality criteria, or specific ACLs as approved by the NRC (NRC, 2014b License Condition 10.6; 10 CFR 40).

The quality of the non-exempted ore-zone aquifer (i.e., that which is outside the perimeter-monitoring-well ring in the wellfields) could be impacted by a horizontal excursion resulting from a local wellfield imbalance. A wellfield imbalance can occur when the rate of injected lixiviant exceeds the rate of extraction from the recovery wells, resulting in a potential migration of lixiviant laterally, away from the respective wellfield. There would also be the potential for water-quality impacts (i.e., vertical excursions) to the SM and DM aquifers from the lixiviant-fortified ground water during injection and withdrawal from the OZ aquifer. Condition No. 11.5 of the Draft Source and Byproduct Materials License would prescribe the excursion-monitoring program and the procedures for confirmation in the event that the monitoring signals an excursion as well as corrective actions that would be required to recover an excursion (NRC, 2014b).

Typical lixiviant circulating through the ore zone would contain concentrations of TDS up to 12,000 mg/L that consist primarily of sodium, bicarbonate, chloride, and sulfate and concentrations of uranium, vanadium, and radium greater than 100 mg/L (NRC, 2009b; Strata, 2011a; WDEQ/WQD, 2011b). As described in SEIS Section 3.5, the surrounding aquifers have lower TDS, averaging 1,145 mg/L, 1,574 mg/L, and 1,321 mg/L in the SM, OZ, and DM aquifers, respectively. These values are approximately 10 percent of the TDS contained in the proposed lixiviant. As described in Section 2.1.1.2 of this SEIS, chloride, conductivity, and total alkalinity would be measured twice monthly in the monitoring wells to detect excursions. These constituents move through the aquifer faster than other water-quality parameters, and therefore levels above these would indicate excursions before radionuclides and other elements move outside the production (i.e., uranium-recovery) zone.

Temporary increases in concentrations of TDS outside the production zone would occur in the event of an excursion. Levels of radionuclides and elements such as arsenic, selenium, and vanadium that are mobilized with the uranium may increase in aquifers outside the production zone if excursions were to occur, but corrective actions in response to increased TDS would likely prevent increases of these elements.

Measures proposed by the Applicant to mitigate the potential for horizontal excursions include a computer-based control system, which is staffed 24 hours a day at the CPP, to monitor injection pressures and recovery-well flow rates so that wellfield balance would be maintained. In addition, water level and water quality would be monitored in wells installed around the perimeter of each wellfield (Strata, 2011a).

In the event of an operational upset that could allow horizontal excursions, the ground-water model (discussed above in this section of the SEIS), integrated with injection- and recovery-well data, would allow the Applicant's staff to make a determination of potential migration paths as well as assisting the system operator's decision making with respect to the proper mitigating actions. The Applicant noted that the heterogeneous lithology of the sandstones produces lateral and vertical variations in permeability, with uranium mineralization concentrated in the higher-permeability sediments (Strata, 2011a). Lateral migration of lixiviant would therefore be limited by the less-permeable and un-mineralized zones within the ore-zone sandstones.

The potential for vertical excursions would be mitigated by the naturally confining units of fine-grained mudstones, siltstones, and claystones above and below the ore-zone aquifer (see SEIS Section 3.5). In addition, the Applicant's testing program would ensure the integrity of well casings in injection and recovery wells as well as in monitoring wells installed in the SA and DM aquifers.

The Applicant tested the integrity of the lower confining unit separating the OZ aquifer from the DM aquifer with six pump tests; in two of the six tests, pumping of the OZ aquifer showed a possible response in the DM aquifer (Strata, 2011a). NRC staff has determined that these responses were correctly interpreted by the Applicant as communication between the OZ and DM through improperly plugged drillholes from previous exploration programs that have not yet been properly abandoned (NRC, 2014a). Other aquifer tests by the Applicant as well as those conducted by Nubeth in 1978, recorded no response in the aquifers vertically adjacent to the ore zone. The different water qualities observed in the OZ and DM aquifers also support the premise of hydraulic separation. Stratigraphic sections created by the Applicant from the geologic logs of the drillholes have provided further support for the continuity and integrity of the shale confining units (Strata, 2011b). The thickness of the shale unit between the OZ and the DM aquifers is generally greater than 6 m [20 ft], except for an area along the southern edge of the Ross Project area where the unit thins to about 1.5 m [5 ft]. The Applicant would continue geologic evaluation and hydrologic testing to characterize the integrity of the lower confining unit, through observations of piezometric levels in the SM and DM aquifers. The upper confining unit would also continue to be monitored by the Applicant.

To ensure the integrity of confining layers, Condition No. 10.13 of the Draft License would require the Applicant to submit a hydrologic-test data package to the NRC staff for review and verification prior to conducting operations in a wellfield (NRC, 2014b). The hydrologic-test data package must adequately define ground-water-flow paths, demonstrate the lateral continuity of the OZ aquifer, provide an evaluation of the heterogeneities within the ore zone, and confirm the hydraulic isolation of the OZ aquifer (NRC, 2014b).

Breaches to the integrity of the confining unit from historical exploration and delineation drillholes will be minimized by the Applicant's locating and abandoning the drillholes within the wellfields (NRC, 2014b, License Condition 10.12). Hole plugging would be done with low-hydraulic-conductivity materials such as cement or heavily mixed bentonite grout according to methods approved by the WDEQ as described in SEIS Section 2.1 (Strata, 2011b). As of October 2010, the Applicant had located 759 of the estimated 1,682 holes from Nubeth exploration activities and had plugged 55 of them (Strata, 2011b). The number of historical drillholes located and plugged would increase as wellfields are developed. The Applicant would also implement a WDEQ-approved MIT program for all injection and recovery wells to ensure well-casing integrity (WDEQ/LQD, 2005).

As noted above, Condition No. 11.3 of the Draft License would require the Applicant to install monitoring wells around each wellfield at approved maximum spacing (NRC, 2014b). The perimeter-monitoring wells would allow the Applicant to monitor the OZ aquifer, while the monitoring wells in the overlying and underlying aquifers would allow monitoring of the SM and DM aquifers, respectively. The Applicant has committed to a maximum spacing of 120 m [400 ft] between the uranium-recovery wellfields and perimeter-monitoring-well ring as well as between monitoring wells in the perimeter ring itself (Strata, 2011b). Condition No. 11.5 of the Draft License would establish the requirements for the excursion-monitoring program (NRC, 2014b).

In addition to sampling the monitoring wells for water-quality parameters, the Applicant would measure water levels during the semi-monthly sampling to detect anomalous hydrostatic-pressure increases which may signal an operational upset. Condition No. 11.5 of the Draft License would require the Applicant to cease injecting lixiviant into the uranium production area surrounded by the perimeter-monitoring-well ring if a vertical excursion is detected during operation (NRC, 2014b). Operation would cease until the Applicant demonstrates that the vertical excursion cannot be attributed to leakage through any abandoned drillhole. Mitigation in the event of an excursion of lixiviant-containing ground water could require withdrawal and treatment of contaminated ground water from the adjoining aquifers.

The potential impacts of the operation of the Proposed Action to ground-water quality in the confined aquifers above and below the ore zone would, therefore, be SMALL. The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE. Detection of excursions through the network of monitoring wells, followed by the Applicant's pumping of ground water to "recover" the excursion would reduce long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL.

Deep Aquifers

The Applicant plans to dispose of brine and other liquid byproduct wastes into up to five UIC Class I deep-disposal wells that discharge to the Flathead and Deadwood Formations, which are defined as the Formations that occur beneath the base of the Icebox Shale member of the Winnipeg Group and above the top of the Precambrian basement. There are no porous and permeable zones below the Deadwood and Flathead Formations that would make suitable injection zones. Because of the depth, approximately 2,500 m [8,200 ft], at which these Formations occur and the apparent lack of oil or other hydrocarbons, there has been little exploration of these intervals, and few data are available for the Ross Project area. To improve its understanding of the targeted Formations, the Applicant plans to drill one deep well for hydraulic testing as a preconstruction activity (Strata, 2011a). If the capacity in the targeted Formation for injected solutions is less than anticipated by the Applicant, more wells than five may be needed.

The UIC Class I Permit issued by the WDEQ identified the confining unit immediately above the discharge zone as consisting of approximately 16 m [52 ft] of Icebox Shale. An additional confining unit immediately above the Icebox Shale is the Red River Formation, which consists of 96.9 – 140 m [318 – 460 ft] of cryptocrystalline to microcrystalline impermeable dolomite. The top of the injection zone occurs about 2,488 m [8,163 ft] below the ground surface, and the total thickness of the injection zone for the wells is estimated to be 180 m [592 ft]. In issuing the UIC Permit, the WDEQ/WQD determined that, at the depths and locations of the injection zones specified in the Permit, the use of ground water from the Flathead and Deadwood Formations is economically and technologically impractical (WDEQ/WQD, 2011b).

The data that are available for the Formations targeted for deep-well injection suggest that the ground water contains greater than 10,000 mg/L TDS. The estimated water quality of the brine, and liquid effluent that would be injected in the UIC Class I deep-injection wells, comprises the following constituent concentrations: 4,000 – 40,000 mg/L TDS; 5 – 25 mg/L uranium as U_3O_8; and 15 – 93 Bq/L [400 – 2,500 pCi/L] Ra-226 (WDEQ/WQD, 2011b). Its pH would be between 6 and 9. WDEQ concluded that the liquid effluents could be suitably isolated in the deep aquifers, and they would not affect any overlying underground sources of drinking water. The deep-injection wells would be installed and tested in accordance with WDEQ/WQD Class I disposal-well standards and the UIC Class I Permit. The Permit requires the Applicant to control effluent pressures at the wellhead to ensure that the fracture pressure of the Formation is not exceeded. Regular monitoring of the water quality of the injected brine is required by the Permit, and pH would have to be within the range of 2 – 11 established by the Permit to meet the respective upper control limits (UCLs) to be injected (WDEQ/WQD, 2011b). In addition, daily measurements of injection rates and pressures are required by the Permit as well as records of the monthly volume of fluid injected. The daily monitoring required by the UIC Class I Permit would allow detection of loss of integrity of a well’s casing. In response to a loss of integrity, injection into that deep-disposal well would be suspended for well repair, thus preventing impacts to the aquifers above the Deadwood/Flathead Formations. The Permit also prohibits injection of hazardous waste as defined by the EPA and the WDEQ. Thus, the potential impacts of the Proposed Action’s operation to ground-water quantity and quality in the deep aquifers would be SMALL. The conditions of the UIC Permit would mitigate potential impacts, including those described above.

4.5.1.3 Ross Project Aquifer Restoration

As described in Section 2.1.1.3 of this SEIS, the Proposed Action’s aquifer-restoration methodology would use a combination and sequence of: 1) ground-water transfer; 2) ground-water sweep; 3) RO treatment with permeate injection; 4) ground-water recirculation; and 5) stabilization monitoring. The Applicant proposes to use ground-water sweep selectively (i.e., around the perimeter of the wellfield) rather than throughout the entire wellfield to minimize the consumptive use of ground water (Strata, 2011a). After uranium recovery in the first wellfield is completed, the Applicant would conduct aquifer restoration concurrently with operation of subsequent wellfields.

<u>**Surface Water**</u>

As described in GEIS Sections 4.2.4.1.3 and 4.4.4.1.3, the activities occurring during aquifer restoration that could impact surface waters include management of waste water, permeate reinjection, storm-water runoff, and accidental spills and leaks (NRC, 2009b). The GEIS concluded that the potential impacts to surface water due to the management of ground water extracted during aquifer restoration would be SMALL. An ISR operator’s compliance with permit conditions, use of BMPs, and execution of mitigation measures would reduce impacts from storm-water runoff as well as accidental spills and leaks such that they would be SMALL to MODERATE, depending upon site-specific conditions.

At the Ross Project, the Applicant intends to use approximately 0.26 L/s [3.6 gal/min] of water obtained from either the Oshoto Reservoir or the Little Missouri River for dust control during aquifer restoration (see Table 4.3). Because of the lower surface water usage during restoration compared to construction and operations, the potential impacts would thus be comparable to those during the Proposed Action’s construction and operation phases.

Potential increases in sediment concentrations during the Proposed Action's aquifer-restoration phase would also be comparable to its operation phase. Potential risk of surface-water contamination associated with releases of process solutions and/or waste liquids as well as spills of other materials during aquifer restoration would be comparable to the operation phase of the Proposed Action, although the concentration of uranium-bearing solutions would decline. Thus, the potential impacts of aquifer restoration to surface-water quantity and quality would be SMALL.

The potential impacts of aquifer restoration during the Proposed Action to the wetlands on the Ross Project area would be the same as discussed under the Ross Project's construction.

Ground Water

As the GEIS states in Sections 4.3.4.2.3 and 4.4.4.2.3, the potential environmental impacts on ground-water resources during aquifer restoration are related to ground-water consumptive use and waste-management practices, including liquid-effluent discharges to the surface impoundments and deep disposal of brine resulting from the RO process. As noted in the GEIS, potential impacts are affected by the respective aquifer-restoration methodology(ies) chosen, the water quality at the end of operation, and the current and future uses of the ore-zone and surrounding aquifers in the vicinity of an ISR facility. Consequently, the GEIS concluded that the potential impacts of ground-water consumption during aquifer restoration could range from SMALL to MODERATE, depending upon site-specific conditions. In addition, aquifer restoration also directly affects ground-water quality in the vicinity of the wellfield being restored (NRC, 2009b). Rather than negatively impacting the ground-water quality during aquifer restoration, the water quality would improve as restoration continues.

The purpose of aquifer restoration is to return the ground-water quality at a specified point of compliance, generally defined as the boundary of the exempted aquifer, to the ground-water protection standards specified at 10 CFR Part 40, Appendix A. The restoration of an exempted aquifer to meet the standards in Criterion 5B(5)(a) would ensure that a present or potential future USDW outside of the exempted aquifer would be protected (NRC, 2003b). Criterion 5B(5) of Appendix A requires that the concentration of a given hazardous constituent at the point of compliance must not exceed: 1) the NRC-approved concentration of that constituent in ground water (5B(5)(a)); 2) the respective numeric value in the table included in Paragraph 5C of Criterion 5B(6), if the specific constituent is listed in the table and if the level of the constituent is below the value listed (5B(5)(b)); or 3) an ACL the NRC establishes for the constituent (5B(5)(c)). To achieve this requirement, Criterion 5B(6) states, conceptually, that concentrations pose no incremental hazard and the numeric limits in paragraph 5C pose acceptable hazards, but these two options might not be practical at a specific project, in which case the NRC can establish an ACL, if the project's licensee demonstrates that an ACL does not present a significant hazard. Prior to 2009 (i.e., prior to the Regulatory Issue Summary (NRC, 2009c)), the NRC used the "pre-operational class of use" established by a State as a secondary standard for ground-water protection for the evaluation of aquifer-restoration approval requests submitted by licensees. Subsequent to the 2009 Regulatory Issue Summary, the NRC has used the factors listed in Criterion 5B(6) for evaluating proposed ACLs.

Aquifer-restoration success would be assessed when the Applicant monitors the wells, most of which would be installed during the time between Project licensing and wellfield operation and used to determine the post-licensing, pre-operational concentrations required per Criterion

5B(5)(a) as well as the wellfield perimeter wells monitored throughout operation, to detect excursions (NRC, 2003b). The compliance period for which NRC would require this ground-water monitoring program is from the time the ground-water protection standards are established per Criterion 5B(5) of Appendix A, until its Source and Byproduct Materials License is terminated. Therefore ground water would be monitored throughout the operation and aquifer-restoration phases. The NRC could also require that monitoring would be continued through a post-reclamation period (NRC, 2003b).

Recent approvals of aquifer restoration by the NRC provide examples of the improvement in water quality within the exempted aquifer as a result of aquifer-restoration activities. NRC has approved aquifer restoration in Crow Butte Wellfield 1 (NRC, 2003c), Smith Ranch-Highland A-Wellfield (NRC, 2004a), and Irigaray Mine Units 1-9 (NRC, 2006). Cogema Mining Company has also conducted restoration at its Christensen Ranch Mine Units 2 – 6 and improved water quality to the point that it has requested approval of restoration from the NRC. The NRC has requested additional information from Cogema Mining Company before approving the restoration (NRC, 2012a; NRC 2012b).

At the time the NRC approved the restoration of Wellfield 1 at the Crow Butte facility, the wellfield averages for 30 of the 37 water-quality parameters were returned to either post-licensing, pre-operational levels concentrations or Wyoming's Class I Domestic Use standards and the EPA's Drinking Water MCLs. Concentrations of calcium, carbonate, potassium, magnesium, and molybdenum, for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations by 6 – 60 percent. The NRC determined that the radium-226 and uranium concentrations at 31 percent and 18 percent above post-licensing, pre-operational concentrations were protective of human health and the environment (Crow Butte Resources, 2001). The applicable condition in Crow Butte's NRC license was changed to require stability monitoring beyond the six-month period, as necessary to ensure no increasing concentration trends were exhibited.

At the time NRC approved restoration of A-wellfield at the Smith Ranch-Highland facility, 31 of the 35 water-quality parameters were returned to post-licensing, pre-operational concentrations or Wyoming's Class I Domestic Use standards (PRI, 2004). Wellfield average concentrations of iron and selenium were returned to Wyoming's Class II Agriculture Use and Class III Livestock Use standards, respectively. The wellfield average concentration of manganese exceeded the Class II Agriculture Use standard, but Wyoming does not have a Class III Livestock Use standard for manganese. The wellfield's average for radium-226 is within the range of radium-226 measured in the post-licensing, pre-operational monitoring wells.

At the time the NRC approved restoration of Irigaray Mine Units 1 – 9, 27 of the 35 water-quality parameters were returned to post-licensing, pre-operational concentrations or Wyoming's Class I Domestic Use standards (Cogema, 2006a; Cogema, 2006b). Concentrations of calcium, magnesium, sodium, bicarbonate, and alkalinity as well as the measure for conductivity, for which there are no EPA MCLs or Wyoming Class I, II, or III standards, exceeded post-licensing, pre-operational concentrations 48 – 680 percent. Both the post-licensing, pre-operational and the post-restoration average levels of ammonium, TDS, and radium-226 exceeded the Class I Domestic Use standard. The average post-restoration concentration of manganese exceeded the limit for the Wyoming Class II Agriculture Use by 10 percent. The NRC determined that the concentrations in excess of post-licensing, pre-operational levels would not exceed EPA MCLs for ground water outside the aquifer-exemption boundary.

Shallow Aquifers

Potential impacts to the water quantity of the shallow aquifers at the Ross Project area during aquifer-restoration would be reduced, compared to the construction and operation phases of the Proposed Action. The impact to the aquifers' water levels from consumptive use of water from the Oshoto Reservoir and the Little Missouri River would also be moderated, because of the lower-volume withdrawals from the surface-water bodies.

In addition, potential impacts to water quality would again be reduced when compared to the Proposed Action's operation because no lixiviant would be used in the injection stream and the concentration of chemicals in the recovered ground water would be significantly less than during ISR operations. The Applicant's implementation of BMPs during uranium-recovery operation would also reduce the likelihood and magnitude of spills and leaks, and thorough cleanup would be facilitated. The ground-water mitigation measures during aquifer restoration would be the same as those described for the operation of the Proposed Action. Thus, the potential impacts of aquifer restoration to ground-water quantity and quality of the shallow aquifers would be SMALL.

Ore-Zone and Surrounding Aquifers

The potential impacts to water quantity of the ore-zone aquifer (i.e., the exempt aquifer) and the surrounding aquifers during the aquifer-restoration phase of the Proposed Action would be greater than from its operation because of the greater consumptive use of ground water (Strata, 2011a). Ground-water modeling results indicate that the drawdown in the SM aquifer during both Ross Project operation and aquifer restoration would be less than 5 m [15 ft]. The exempted ore-zone aquifer was predicted to experience significant drawdowns in three wells on the Ross Project area, with minor drawdowns in wells within 3 km [2 mi] of the Project. The conservative regional impact analysis conducted by the ground-water modeling predicts a small reduction in the available head in wells used for stock, domestic, and industrial use. Although these effects would be localized and short-lived, the Applicant would commit to provide an alternative source of water of equal or better quantity and quality, subject to Wyoming water-statute requirements, in the event that aquifer-restoration operations prevent the full use of a well under a valid water right (Strata, 2011a; Strata, 2012a). Consequently, the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE.

The potential impacts to water quality of the ore-zone aquifer outside the exempt aquifer as well as the aquifers above and below the exempt aquifer (i.e., SM and DM aquifers) during the aquifer-restoration phase of the Proposed Action would be less than from its operation because no lixiviant would be used during aquifer restoration. The potential for vertical and horizontal excursions during aquifer restoration would be similar to those described for the Proposed Action's operation. However, the magnitude of impacts would be less because the injection and recovery flow rates would be lower during aquifer restoration than during active uranium-recovery operation, the addition of lixiviant would have ceased, and the ore-zone water quality would improve throughout active aquifer-restoration activities. The concentrations of radiological parameters and other chemical constituents in the permeate that would be injected as "clean" water to restore the exempted ore-zone aquifer, would be lower than the pre-licensing, site-characterization ore-zone water quality reported by the Applicant, except for radium-226 (Strata, 2011a). As presented in Table 3.6 of this SEIS, dissolved radium-226 measured in the ore-zone aquifer has ranged from 0.02 Bq/L [0.6 pCi/L] to 0.4444 Bq/L [12.01 pCi/L], and the typical radium-226 concentration anticipated in the permeate is 1 Bq/L [30 pCi/L] (Strata, 2011a).

As described earlier in this section, most of the ground-water-quality parameters in wellfields for which the NRC has approved restoration were either returned to post-licensing, pre-operational concentrations or Class I Domestic Use standards. For the few parameters that exceeded post-licensing, pre-operational concentrations or Class I Domestic Use standards, the concentrations in the ground-water did not change the class of use and did not represent a potential impact to the ground water outside the aquifer-exemption boundary. The potential impacts of aquifer restoration to ground-water quality of the exempted aquifer and the confined aquifers surrounding the exempted aquifer would be SMALL.

Deep Aquifers

The Applicant estimates that less than 14.3 L/s [227 gal/min] of brine and other byproduct wastes would be disposed in the Class I injection wells during aquifer restoration concurrent with operation at the Proposed Action (see Table 4.10 for specific production rates of brine for disposal). Although the volume of waste injected would be greater during the aquifer-restoration phase than during the first 2.5 years of Ross Project's operation before aquifer restoration of the first wellfield begins, the potential impacts would be similar because the injection pressures would not increase beyond the limit established by WDEQ's UIC Class I Permit. These pressure limits would ensure that the capacity of the Class I receiving aquifer is not exceeded. The potential impacts of aquifer restoration to ground-water quantity and quality of the deep aquifers would, therefore, be SMALL.

4.5.1.4 Ross Project Decommissioning

The decommissioning activities of the Proposed Action that might impact surface water and/or ground water include the Applicant dismantling the CPP, auxiliary structures, and the surface impoundments; removing buried pipelines; excavating and removing any contaminated soil; plugging and abandoning wells using accepted practices; breaching the CBW; and restoring and revegetating all disturbed areas. Figure 4.1 indicates the components of the Proposed Action that would be in place by the end of its decommissioning.

Surface Water

As described in GEIS Sections 4.2.4.1.4 and 4.4.4.1.4, during the decommissioning phase, temporary impacts to water quality would be anticipated due to sediment loading during the excavation and removal of pipelines, drainage crossings, and other infrastructure (NRC, 2009b). As the GEIS noted, an Applicant's compliance with permit conditions, its use of BMPs, and its observance of required mitigation measures would reduce decommissioning impacts to SMALL to MODERATE, depending upon site-specific conditions.

For the Proposed Action, the Applicant intends to use surface water from either the Oshoto Reservoir or the Little Missouri River for dust control and any demolition activities during the Project's decommissioning. As shown in Table 4.3, the Applicant estimates that approximately 0.69 L/s [11 gal/min] of surface water would be used during facility and wellfield decommissioning. This withdrawal rate is between the quantities of anticipated water use during the Proposed Action's construction and operation phases.

The primary impacts to surface water during the decommissioning of the Ross Project would be from activities associated with the removal of constructed Project components, reclamation and restoration of the land impacted during the Proposed Action, and the cleanup of any contaminated soils. These impacts would be similar to those that result from the construction of the Proposed Action. Removal of buried pipelines and the roads near stream channels during the decommissioning phase would result in temporary disturbances that could impact surface-water quality. Potential surface-water contamination could occur from spilled or leaked fuel or lubricants from construction equipment and passenger vehicles that would be operated during decommissioning activities, although the equipment would generally be located away from surface-water bodies. These potential impacts to surface-water quality would be mitigated using the same measures as implemented during the Proposed Action's construction (e.g., BMPs and spill-response protocols). The potential impacts to surface-water quantity and quality from the Ross Project's decommissioning would be SMALL.

The potential impacts to wetlands from the Proposed Action's decommissioning would be SMALL, as they would be the same as discussed under the Proposed Action's construction.

Ground Water

As described in GEIS Sections 4.2.4.2.4 and 4.4.4.2.4, the impacts to ground water during the decommissioning of an ISR facility are primarily associated with consumptive use of ground water, potential spills of fuels and lubricants, and well abandonment (NRC, 2009b). Ground-water consumptive use during decommissioning activities would be less than during operation and aquifer-restoration activities. BMPs would reduce the likelihood of spills and leaks. After ISR operations are completed and a facility is decommissioned, improperly abandoned wells could impact aquifers above the OZ aquifer by providing hydrological connections between aquifers (NRC, 2009b). To ensure that this consequence does not happen at the Ross Project, all injection, recovery, and monitoring wells would be plugged and abandoned in accordance with WDEQ/LQD requirements. The GEIS determined that implementation of BMPs and compliance with permit requirements would ensure that the potential impacts to ground water would be SMALL during decommissioning; the Proposed Action's decommissioning would include observance of these procedures and requirements.

Shallow Aquifers

During decommissioning, finger drains (see SEIS Section 2.1.1.4) would be created through the CBW and backfilled with permeable material (gravel). These gravel-filled breaches in the CBW would create a highly permeable flow path through the CBW that would allow the natural flow of the shallow aquifer ground water beneath the CPP and in the immediate vicinity outside the CBW to be restored. Water levels would be monitored by the Applicant to verify that the CBW reclamation and ground-water restoration is complete. The Applicant's implementation of BMPs and SOPs for the plugging and abandonment of its own wells during decommissioning of the Proposed Action would reduce the likelihood of shallow-aquifer contamination. In addition, other BMPs employed by the Applicant would reduce the likelihood and magnitude of spills and leaks during equipment and vehicular operation and would facilitate any soil or other cleanup required. Thus, the impacts to shallow aquifers during the Proposed Action's decommissioning would be SMALL.

Ore-Zone and Surrounding Aquifers

As part of the decommissioning of the Proposed Action and the concomitant land reclamation and restoration activities, all monitoring, injection, and production wells would be plugged and abandoned in accordance with Strata's UIC Class I Permit. The wells would be filled with cement and/or bentonite slurry, and then cut off below plow depth to ensure that ground water does not flow through the abandoned wells and to ensure that the safety of people, livestock, wildlife, and any machinery used in the area are not harmed (Stout and Stover, 1997). Proper implementation of these procedures would isolate the wells from ground-water flow. Thus, the impacts to the ore-zone and vertically adjacent aquifers would be SMALL.

Deep Aquifers

The Applicant estimates that less than 0.6 L/s [10 gal/min] of brine and other liquid byproduct wastes would be disposed in the Class I injection wells during the decommissioning of the Proposed Action. The potential impacts to ground-water quantity and quality during decommissioning would be SMALL and less than the other phases of the Ross Project.

4.5.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Mud pits at each well site to manage drilling fluids and muds would have little potential of impacting surface waters and no potential of impacting ground water. The current roads within the Ross Project area would continue to be maintained in the same manner as they are currently, also leaving little potential for impacts to surface water due to increasing sediment loading in runoff.

Similarly, although no license would be issued and no Ross Project would be constructed or operated in the No-Action Alternative, preconstruction activities would cause potential impacts. The respective impacts to ground water depend upon the density of plugged and abandoned wells and drillholes. As of August 2011, the Applicant had drilled and plugged approximately 612 holes it installed during site and geotechnical characterization; an additional 51 were drilled and are now used as site-characterization ground-water monitoring wells. The Applicant has also located and properly abandoned 55 Nubeth drillholes. Thus, the drillhole density is approximately 1 hole per 1 ha [2.5 ac]. Under the No-Action Alternative, the 51 monitoring wells would be plugged and abandoned in accordance with WDEQ/LQD requirements. The low density of these properly plugged and abandoned wells and drillholes would not affect the ground-water flow or quality.

Thus, the potential impacts from the No-Action Alternative to surface and ground waters, relative to the existing Ross Site area and including the preconstruction activities that have already occurred, would be SMALL

4.5.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. Most of the potential impacts to surface and ground water and mitigation measures for Alternative 3 would be the same as for the Proposed Action. Only the differences in impacts between the Proposed Action and the North Ross Project are described below. Operation of the wellfields during the North Ross Project would be the same as during the Proposed Action and, therefore, the potential impacts and mitigation measures associated with the wellfields would be the same.

4.5.3.1 North Ross Project Construction

Impacts to surface and ground waters during construction are expected to be generally the same as the Proposed Action, although the steeper slopes at the north site would require more engineering and construction activity. As a result, there would be a slight increase in the potential for impacts to surface and ground waters in the shallow aquifer. However, the impacts to shallow ground water in the Proposed Action, which result from the construction of the CBW and, in particular, the alteration of the surficial ground-water flow regime, would not be a consequence of this Alternative. At the north site, shallow ground-water levels are estimated to be at a depth of greater than 15 m [50 ft], within the Lance Formation (as discussed in SEIS Section 3.4); however, during high-precipitation events or after significant snowmelt, perched ground water could be present above the regional water table. If the CBW is not needed and not constructed by the Applicant, then the need for dewatering the shallow aquifer would be eliminated and thereby would reduce the consumption of ground water by a small amount.

Construction of the storm-water-control system and implementation of BMPs during construction of the Alternative 3 facility would be more involved, in order to protect the two ephemeral drainages from impacts of erosion and increased sediment loads. If the Alternative 3 design required the CPP and the surface impoundments to be separated by a drainage (as shown in Figure 2.11 in SEIS Section 2.1.3), the construction of the pipeline network would also require additional construction and engineering activity. However, the BMPs during construction would minimize potential impacts to surface and ground waters from construction of Alternative 3; thus, the impact would still be SMALL.

4.5.3.2 North Ross Project Operation

Alternative 3 would result in many of the same potential impacts to surface water during its operation as the Proposed Action’s. The proximity of the facility to two ephemeral drainages would increase the risk of surface-water impacts from spills and leaks, where the released material could make its way into surface water. The potential for impact to surface water would be mitigated by the distance of approximately 0.8 km [0.5 mi] to the Little Missouri River. Operation of the wellfields during the North Ross Project would be the same as during the Proposed Action and, therefore, the potential impacts and mitigation measures associated with the wellfields would be the same. Thus, the potential impacts to surface water of Alternative 3’s operation would be SMALL.

The greater thickness of the vadose (i.e., unsaturated) zone under the north site would also provide additional natural protection to the shallow ground water in the event of a release of process chemicals, recovery solutions, or liquid wastes within the CPP and surface-impoundment areas. If contaminants reached the ground water, remediation by pump-and-treat methods would be required. By comparison, the Proposed Action, ground-water levels within the CBW would be maintained lower than surrounding and underlying ground-water levels, and would thus prevent any migration of contaminants away from the CPP and surface impoundments. Because there would be no difference between the location and operation of the wellfields under Alternative 3 as compared with the Proposed Action, the potential SMALL to MODERATE short-term impacts from lixiviant excursions discussed in SEIS Section 4.5.1.2 could also occur under Alternative 3. Therefore, the potential short-term impacts to ground water of the operation of Alternative 3 would be SMALL to MODERATE due to the potential for lixiviant excursions.

4.5.3.3 North Ross Project Aquifer Restoration

Because the wellfields would be in the same locations in Alternative 3, this Alternative does not include any modifications to the wellfields from what was described for the Proposed Action (because they follow the subsurface uranium mineralization), the wellfields would result in the same potential impacts to ground water during Alternative 3's aquifer restoration phase as in the Proposed Action. These potential short-term impacts would be SMALL to MODERATE, due to potential drawdowns during aquifer restoration.

4.5.3.4 North Ross Project Decommissioning

Alternative 3 would result in generally the same potential impacts to surface and ground waters during its decommissioning as would the Proposed Action, with the following exceptions: The surface-impoundment area requiring recontouring and revegetation would be larger and more extensive; thus, the potential for surface-water impacts associated with these activities would be marginally greater. Unlike with the Proposed Action, it would not be necessary to cut gravel-filled channels through a CBW, thereby eliminating the potential for the associated surface-water impacts. The potential impacts during Alternative 3's decommissioning to the surface drainages through the north site would be the same as described above for Alternative 3's operation. The potential impacts to surface and ground waters from decommissioning of Alternative 3 would be SMALL.

4.6 Ecology

The Proposed Action could impact the ecology of the Ross Project area, including both flora and fauna, during all phases of the Project's lifecycle. These impacts would include removal of vegetation from the Ross Project area; reduction in wildlife habitat and forage productivity as well as an increased risk of soil erosion and weed invasion; the modification of existing vegetation communities; the loss of sensitive plants and habitats; and the potential spread of invasive species and noxious weed populations. Impacts to wildlife could include loss, alteration, or incremental fragmentation of habitat; displacement of and stresses on wildlife; and direct and/or indirect mortalities. Aquatic species could be affected by disturbance of stream channels, increases in suspended sediments, pollution from fuel spills, and habitat reduction. The potential environmental impacts to and related mitigation measures for the Ross Project area's ecology during the construction, operation, aquifer restoration, and decommissioning of the Proposed Action and the two Alternatives are discussed in the following sections.

4.6.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of the Ross Project's uranium-recovery facility and wellfields.

4.6.1.1 Ross Project Construction

As discussed in GEIS Section 4.4.5, the potential impacts to terrestrial vegetation during the construction of ISR facilities could include removal of vegetation from ISR facilities' sites (and the resulting reduction in wildlife habitat and forage productivity as well as the increased risk of soil erosion and weed invasion), the modification of existing vegetation communities, the loss of sensitive plants and habitats as a result of site clearing and grading, and the potential spread of invasive species and noxious weed populations (NRC, 2009b).

The construction phase of the Proposed Action could potentially impact the local ecology during the Applicant's clearing vegetation and leveling the site; constructing the CPP, auxiliary structures, and surface impoundments; developing the wellfields, including drilling wells, laying pipelines, constructing module buildings and other wellfield components; constructing access roads; clearing storage, parking, and laydown areas; and installing associated infrastructures such as utility and lighting systems. The impacts of these construction activities on the ecology of the Ross Project area are evaluated below for vegetation, wildlife, and protected species.

<u>Terrestrial Species</u>

Vegetation

The construction of the Ross Project facility (i.e., the CPP and surface impoundments) as well as the installation of wellfields would take place within the nine vegetation communities the Applicant indicated in its license application as being present at the Project area—upland grassland, sagebrush shrubland, pastureland, hayland, reservoir/stock pond, wetland, disturbed land, cropland, and wooded draw—(see SEIS Section 3.2) (Strata, 2011a). Direct impacts of such construction would include the short-term loss of vegetation (structure modification, species composition, and areal extent of cover types). According to the Applicant, an estimated 114 ha [282 ac] of land disturbance would occur; one-half of this disturbance would occur within the upland-grassland vegetation community, primarily because of wellfield-module and access-road construction (Strata, 2011a).

Only 7 percent of the Ross Project area is currently hayland; however, 20 – 30 percent of the impacts would be to this vegetation community because of construction of the CPP and surface impoundments. Indirect impacts include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition or changes in vegetation density; reduction of wildlife habitat; and reduction in livestock foraging opportunities.

Sagebrush shrubland, the second largest vegetation type on the Ross Project area, can be difficult and time-consuming to re-establish. Consequently, preconstruction vegetation communities and sub-communities (i.e., shrub-steppe) may be different than post-construction communities (i.e., grass-dominated) for several years, or possibly decades, which could alter the composition and abundance of both plant and wildlife species in the area. Site reclamation and/or regeneration of native shrub species could be further hindered by yearlong grazing pressure. Large ungulates (i.e., wild and domestic animals with hooves) are attracted to the more succulent, younger plants, and they often concentrate in newly seeded locations during the critical early-growth stage. Impacts to the sagebrush-shrubland vegetation type would be minimized by the Applicant's reducing surface disturbance where possible, distributing a temporary seed mixture to prevent invasion of non-native species in disturbed areas, restoring sagebrush and other shrubs on reclaimed lands, and conducting all revegetation activities in accordance with an approved WDEQ/LQD reclamation plan (Strata, 2011b).

Construction activities, including the increased soil disturbance and increased traffic during construction, could stimulate the introduction and spread of undesirable and invasive, non-native species at the Ross Project area. Several species of designated and prohibited noxious weeds listed in the Wyoming *Weed and Pest Control Act* were identified on the Ross Project area. These species included field bindweed, perennial sow thistle, quackgrass, Canada thistle, hounds tongue, leafy spurge, common burdock, Scotch thistle, Russian olive, and skeletonleaf bursage (Strata, 2011a). These species could be locally abundant in small areas, especially around the Oshoto Reservoir and along the Little Missouri River and Deadman Creek, but they were not common over the entire Ross Project area.

The impact from vegetation removal and surface disturbance would affect approximately 114 ha [282 ac] of land, or about 16 percent of the Proposed Action's area. Construction would be phased over time, reducing the amount of surface area disturbed at any one time. Noxious weeds would be controlled with appropriate spraying techniques. As a result of the combination of these measures, in addition to the other mitigation measures discussed above, the impacts to terrestrial vegetation would be SMALL.

In addition, the potential impacts to vegetation during the Proposed Action's construction would be mitigated by the Applicant's ensuring that disturbed areas would be both temporarily and permanently revegetated in accordance with WDEQ/LQD regulations and its WDEQ Permit to Mine. The Applicant would seed disturbed areas to establish a vegetative cover to minimize wind and water erosion and the invasion of undesirable plant species. Impacts would be further mitigated by a phased approach to construction, and therefore surface disturbance would be phased. A temporary seed mixture would be used in wellfields and other areas where the vegetation would be disturbed again prior to final decommissioning and final revegetation. The temporary seed mixture typically would consist of one or more of the native wheatgrasses (e.g., western wheatgrass and thick-spike wheatgrass). Permanent seeding would be accomplished with a seed mixture approved by the WDEQ/LQD and the local landowners. Two permanent land-reclamation seed mixtures (i.e., upland and pastureland/hayland) would be used to reseed disturbed areas. Wellfield areas would be fenced as necessary to prevent livestock access, which would also enhance the establishment of temporary vegetation (Strata, 2011a). The Applicant would conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed-land areas (Strata, 2011a).

Wildlife

As discussed in GEIS Section 4.4.5, in general, wildlife species would disperse from an area undergoing construction, although smaller, less-mobile species could perish during clearing and grading. Habitat fragmentation, temporary displacement, and direct or indirect mortalities are possible, and thus the GEIS concluded that construction impacts on wildlife could range from SMALL to MODERATE (NRC, 2009b). These types of impacts would be mitigated as discussed in this section. Moreover, impacts on raptor species from power-distribution lines could be mitigated by the Applicant's following the Avian Power-Line Interaction Committee's (APLIC's) guidance and avoiding disturbance of areas near active nests and prior to the fledging of young (APLIC, 2006).

Mammals

The Ross Project area provides yearlong range to pronghorn antelope, and winter/yearlong range for mule deer, but it is considered outside of the normal range for white-tailed deer and elk (see SEIS Section 3.6.1). White-tailed deer, however, were observed during the Applicant's wildlife surveys as were pronghorn antelope. No crucial big-game habitats or migration corridors are recognized by the Wyoming Game and Fish Department (WGFD) at the Ross Project area or the surrounding 1.6-km [1-mi] perimeter. (A crucial range or habitat is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level.) Therefore, there would be no direct impact on big-game's crucial habitat, critical or key winter or summer ranges, or migration corridors. Direct impacts on white-tailed deer and elk could include direct loss and modification of habitat, increased mortality from increased traffic collisions on local and regional roads, increased competition for and reduction of available forage, increased conflicts with vehicles because of changes in wildlife movement patterns, and increased disturbance due to the presence of humans. White-tailed deer and elk could be indirectly affected during construction by displacing portions of these populations from the Ross Project area into offsite suitable regional habitat. Because the Project area provides only nonessential habitat for white-tailed deer and elk, impacts to these species would be SMALL.

The direct impacts on pronghorn antelope and mule deer would be the same as those described previously for white-tailed deer and elk. The construction phase of the Proposed Action has been estimated by the Applicant to be 12 months. Adequate habitat for pronghorn antelope and mule deer exists in the surrounding area, and these species could return to the areas affected by Ross Project construction when it is complete. The staged restoration of disturbed areas that the Applicant proposes would provide grass and forage within a few years of habitat disturbance. The movement of big game through the Ross Project would not be significantly impacted by the Proposed Action. The Applicant has committed to implementing mitigation measures, such as reduced speed limits to reduce the risk of vehicular collision, fences designed to permit big-game passage, and use of existing roads where possible to avoid altering wildlife-movement patterns. Because pronghorn antelope and mule deer are highly mobile species, the potential impact to these species would be SMALL.

A variety of small- and medium-sized mammals are also potentially located on the Ross Project area (see SEIS Section 3.6.1) (Strata, 2011a). These include a variety of predators and furbearers, such as coyote, red fox, raccoon, bobcat, badger, beaver, and muskrat. Prey species observed during the Applicant's field surveys included rodents (e.g., mice, rats, voles, gophers, ground squirrels, and chipmunks), jackrabbits, and cottontails. These species are cyclically common and widespread throughout the region and are important food sources for raptors and other predators.

Medium-sized mammals (e.g., coyotes, foxes) could be temporarily displaced to other habitats during construction activities. Direct losses of limited-mobility, small-mammal species (e.g., voles, ground squirrels, mice) could be higher than for other wildlife because of the likelihood they would retreat into burrows if disturbed, and thus potentially be killed by topsoil scraping or staging activities. However, given the limited, noncontiguous area that would be disturbed (approximately 114 ha [282 ac]), no major changes or reductions in small- or medium-sized mammal populations would be expected. Because only a few individuals would be affected, and most mammal species would likely travel to suitable habitat near the Ross Project area during its construction, the Proposed Action would have a SMALL impact on these mammals.

Birds

Potential impacts to upland game birds at the Ross Project area include nest destruction or nest desertions, reproductive failure as a result of proposed construction activities and increased presence of humans, or increased mortalities associated with traffic. Four upland game-bird species occur within or near the Ross Project area (i.e., wild turkey, sage-grouse, sharp-tailed grouse, and mourning doves) (Strata, 2011a). Suitable habitat (for nesting, brood-rearing, and foraging) for these four species exists in the Ross Project area; however, as previously discussed, there are no sage-grouse core areas or connectivity corridors within the Project area. Because of the type of disturbance (the relatively small areas of disturbance and the sequential nature of the disturbance), impacts to upland game birds as a result of the Proposed Action would be SMALL.

Potential impacts to raptors within the Ross Project area also include nest desertions or reproductive failure as a result of construction activities and increased presence of humans; temporary reductions in prey populations; and mortality associated with traffic. Six raptor species on the USFWS's "Birds of Conservation Concern" (BCC) list (i.e., bald eagle, ferruginous hawk, golden eagle, prairie falcon, short-eared owl, and Swainson's hawk,) have been observed within or near the Project area (Strata, 2011a). Swainson's and ferruginous hawks are the only species known to nest in the area. One intact raptor nest (a Swainson's hawk nest, No. SH1) was located at the Ross Project area during the Applicant's field surveys. Seven intact nests and one nest no longer intact were located within 1.6 km [1 mi] of the Project area. The nest within the Ross Project area would not be directly disturbed during the Proposed Action's construction, so nesting raptors would not be directly impacted. Foraging raptors are expected to be able to avoid any areas of disturbance. Because of the type of disturbance (again, the relatively small areas of disturbance and the sequential nature of the disturbance) and the fact that no raptor nests would be directly affected, impacts to raptors during the Proposed Action would be SMALL.

Potential impacts to nongame or migratory birds, including waterfowl, within the Ross Project area include nest destruction or desertions, or reproductive failure as a result of construction activities during the Proposed Action. In addition, disruption of water features, loss of wetlands, construction of surface impoundments for waste management, and installation of aboveground power lines near the Oshoto Reservoir and the Little Missouri River could all impact waterfowl in the area. Increased mortality associated with the increased traffic during the construction phase would also occur. The field surveys completed by the Applicant identified 27 nongame or migratory avian species within the Ross Project area (Strata, 2011a). Because of the type and sequence of land disturbance, and other mitigation measures, the Proposed Action's construction impacts to nongame or migratory birds would be SMALL.

Thus, all impacts to terrestrial wildlife would be SMALL.

Reptiles, Amphibians, and Aquatic Species

Potential impacts to reptiles, amphibians, and fish during construction of the Proposed Action would primarily be the result of the mortality of individuals and destruction of habitat. Sediment loads in surface waters and wetlands from surface-disturbing activities could also potentially impact aquatic habitat, although potential impacts would be greatly reduced through sediment-control BMPs. Up to 0.8 ha [2 ac] of wetland habitat could be disturbed as a result of construction; however, all wetland disturbance would be mitigated in accordance with USACE requirements found in the USACE permit under the CWA.

Because of the type of disturbance, which would be relatively small, and the sequential nature of the disturbance as well as the fact that aquatic habitats would be avoided if at all possible during construction, impacts to reptiles, amphibians, and fish during the Proposed Action would be SMALL.

Protected Species

As discussed in SEIS Section 3.6.1.4, a protected species of bird, the Greater sage-grouse could occur on the Ross Project area, although the Project area is not located in a designated sage-grouse core area. The nearest occupied sage-grouse lek, the Oshoto Lek, a mating-strutting area for male sage-grouse, is located approximately 1.6 km [1 mi] southeast of the Ross Project area. A second occupied sage-grouse lek (the Cap'n Bob Lek) is located approximately 3.5 km [2.2 mi] outside of the Project's boundaries. Wyoming recommends the application of seasonal stipulations (March 14 – June 30) at identified nesting and early brood-rearing habitat within approximately 3 km [2 mi] of an occupied lek in noncore areas. Thus, only the Oshoto Lek has been observed by the Applicant within 3 km [2 mi] of the Ross Project area; however, this Lek is not located in proximity to any proposed construction or operation activities at the Project. If a Greater-sage-grouse lek were to be identified in or near the Ross Project area at any time during the Ross Project, including during construction, the Applicant would follow WGFD policy regarding construction-activity restrictions (see Section 3.6.1.4 regarding current regulations that address this species and additional site-specific information). The Applicant would continue to consult with the WGFD and the WDEQ/LQD to determine if a sage-grouse monitoring, protection, and habitat-enhancement plan would be necessary for the Ross Project, and a plan would be developed and implemented, if warranted.

During the Applicant's field surveys, the northern leopard frog was the only BLM-listed reptile, amphibian, or fish sensitive species actually observed in the Ross Project area; three amphibian and five reptile "Species of Greatest Conservation Need" (SGCN) were observed (Strata, 2011a). Impacts to protected avian, amphibian, and reptile species would be no different than those for other similar species because the Applicant would observe appropriate activity restrictions, attempt to avoid aquatic habitats during road construction, and implement the mitigation measures below.

The potential impacts to ecological resources associated with construction activities during the Proposed Action would be limited due to the relatively small area of surface disturbance and the Applicant's phased approach. Nevertheless, mitigation measures to prevent or further reduce impacts to wildlife would include one or more of the following, as addressed by the various regulatory and permit-issuing agencies:

- Design of fencing to permit big-game passage as recommended by the WGFD.
- Use of existing roads when possible and location of newly constructed roads to access more than one well location according to BLM requirements.
- Implementation of speed limits to minimize collisions with wildlife according to the MOU between the Applicant and Crook County regarding roads near the Ross Project (Strata, 2011d).
- Adherence to temporal and spatial restrictions within specified distances of active sage-grouse leks as determined through consultation with the WGFD and the WDEQ/LQD.
- If direct impacts to raptors or migratory-bird BCC result from construction, a materials management plan (MMP) for those species would be prepared and approved by the USFWS, and would include one or more of the following provisions:
    - Relocation of active and inactive raptor nests that would be impacted by well drilling and other construction activities in accordance with the approved raptor MMP.
    - Institution of buffer zones to protect raptor nests where necessary and restriction of uranium-recovery-related disturbances from encroaching within buffers around active raptor nests (from egg-laying until fledging) to prevent nest abandonment or injury to eggs or young.
    - Restoration of the ground cover necessary to attract and sustain a suitable raptor-prey base after drilling, construction, and future uranium-recovery activities.
    - Requirement for the use of raptor-safe construction for overhead power lines according to current guidelines and recommendations by the APLIC and/or the USFWS, including the use of markers to increase visibility and to limit strikes.
- Restoration of sagebrush and other shrubs on reclaimed land, in accordance with a reclamation plan approved by WDEQ/LQD, and the grading of reclaimed areas to create swales and depressions for sagebrush obligates (sagebrush obligates are those species that need sagebrush to survive, e.g., sage-grouse) and their young per WDEQ/LQD requirements.
- Restoration of preconstruction, native habitats for species that nest and forage in those vegetation communities according to WDEQ/LQD and WGFD requirements.
- Restoration of diverse landforms, replacement of topsoil, and the construction of brush piles, snags, and/or rock piles to enhance habitat for wildlife per WDEQ/LQD requirements.

- Restoration of habitat provided by jurisdictional wetlands as required by both the WDEQ/LQD and the USACE.

Thus, with the measures listed above, the environmental impacts to terrestrial, aquatic, and protected species during Ross Project construction would be SMALL

4.6.1.2 Ross Project Operation

As discussed in GEIS Section 4.4.5, alteration of wildlife habitats could result from uranium-recovery activities (e.g., fencing, traffic, and noise), and conflicts between species habitat and uranium-recovery activities could occur (NRC, 2009b). The GEIS further noted the occurrence of temporary contamination of soils from spills and leaks during ISR operation. However, rapid discovery and response to spills, leaks, and other releases (i.e., spill containment and cleanup of potentially impacted soil), and the eventual survey for radiation during decommissioning, would limit the magnitude of overall impacts to terrestrial ecology during the Proposed Action's operation. Leak-detection systems and spill-response plans would reduce the potential impacts to aquatic species from spills around wellheads and leaks from pipelines by preventing contamination of soils, surface waters, or wetlands. Additional mitigation measures such as perimeter fencing, surface-impoundment netting or other avian deterrents, and periodic wildlife surveys, which would present an opportunity for the Applicant to identify any necessary changes in its mitigation measures, would also limit impacts during the Proposed Action's operation.

Terrestrial Species

Vegetation

During the operation phase of the Proposed Action, the wellfields and CPP would be frequently accessed by use of the existing roads. The installation and operation of the wellfields would involve the excavation of trenches for trunk lines and utilities; this surface disturbance would increase the susceptibility of the disturbed area to invasive and noxious weeds. However, surface disturbance would continue to be minimized during operation as new, additional wellfields are installed, and vehicular access would be restricted to specific roads. The potential for these impacts to occur during operations is less than that during construction, due to fewer hectares or acres of land being disturbed. There is a potential for impacts to vegetation from spills around wellheads and leaks from pipelines during the Ross Project's operation. Based upon the small amount of land that would be disturbed during operation, and the lower number of vehicles accessing the Ross Project, the impacts would be SMALL during the operation phase of the Proposed Action.

Wildlife

Wildlife use of areas adjacent to and near the Proposed Action would likely initially decline because of human presence during the Project's operation and steadily increase to near-normal levels once animals become habituated to the uranium-recovery activities. Because wildlife could be in fairly close proximity to the CPP, surface impoundments, wellfields, and roads, some impacts to wildlife would be expected from direct conflict with vehicular traffic and the presence of Strata's onsite personnel. In addition, wildlife could be exposed to contaminated soil resulting from spills and leaks. All of these impacts would be SMALL, however, because only a few individual animals would be affected, the potential for spills, leaks, or other releases is low, and the continued existence of any particular species at the Ross Project area would not be affected. Potential impacts to terrestrial wildlife during the Ross Project's operation phase from waste process solutions and sediment in the facility's lined surface impoundments would be reduced by the fencing that would be installed around the entire facility (i.e., around the CPP and the surface impoundments) (see Figure 3.1 in SEIS Section 3.2). Moreover, wildlife escape ramps would be installed in each surface impoundment. Therefore, during the operation of the Proposed Action, the potential impacts to wildlife would be SMALL.

Mammals

The potential impact to big game during the Proposed Action's operation phase would either be similar to or less than that described earlier for the construction phase, because limited earth-moving activities would occur. Therefore, there would be only SMALL impacts to big game species during the operation phase of the Proposed Action. The potential impacts to other mammals during operation of the Ross Project would also be similar to or less than that described earlier for the construction phase. Because only a few individual mammals would be affected, and most mammal species would likely travel to suitable habitat outside of the operating facility and wellfields, the Proposed Action would have SMALL impacts on these mammals during its operation.

Birds

The potential impacts to upland game birds, waterfowl, shorebirds, and raptors during the Proposed Action's operation would either be the same or less than that described earlier for the construction phase because earth-moving activities would be more limited during its operation phase.

For avian control at the surface impoundments, the Applicant is considering three options, including netting, “bird balls” (hollow or water-filled balls), or a radar-hazing system (Strata, 2012a). Following an extensive literature review and contact with knowledgeable individuals regarding avian deterrents for impoundments, a radar-hazing system has been identified by the Applicant as the most likely solution for deterring avian species from Project surface impoundments. This system uses radar to detect incoming waterfowl and then uses hazing techniques (primarily noise) to scare the birds away. The avian-deterrent system would require setup and routine maintenance, including calibration of the radar to site-specific conditions to avoid false activations. The potential for other wildlife to access the surface impoundments would be minimized by the installation of fencing around the CPP and surface impoundments. Additionally, BMPs would be the same as those used by the Applicant during construction; therefore, the potential impacts of the Proposed Action's operation would be SMALL for these birds.

Reptiles, Amphibians, and Aquatic Species

The potential impact to reptiles and amphibians from the Proposed Action's operation would be comparable to that described earlier for its construction. Because the potential habitat for reptiles and amphibians is limited within the Ross Project area, the potential impacts would be limited and SMALL. Because of the limited occurrence of surface water and, thus, of aquatic species at the Project area, the potential impact to aquatic species would be SMALL.

Protected Species

No impacts to Federally listed threatened and endangered species would occur during the operation phase because these species have not been identified at the Ross Project area. Potential impacts to the protected species during the Project's operation would be the same or less than those discussed above for the construction of the Ross Project because there would be fewer humans present outdoors on the site itself and fewer vehicles being used. In general, outdoor activities would be limited. Thus, the impacts would be SMALL to all protected species. In addition, mitigation measures implemented during the Project's construction would continue to be employed to ensure that potential impacts to protected species remain SMALL.

As noted in SEIS Section 4.6.1.1, specific mitigation measures for all ecological resources would be required by several Federal and State agencies; these measures would be implemented during the Proposed Action's operation. These include the Applicant reseeding disturbed-land areas with WDEQ- and Crook County-approved seed mixtures to prevent the establishment of competitive weeds and monitoring of invasive and noxious weeds. If these weeds become an issue, then the Applicant would employ other control alternatives, such as the application of herbicides, to minimize their impacts. In addition, impacts to vegetation and wildlife resulting from spills and leaks would be mitigated by the Applicant's use of BMPs. BMPs would include several leak-detection systems and spill-response plans, where released solutions would be contained and affected soils would be removed, thereby reducing the impacts of such releases.

All impacts of the Proposed Action's operation would be SMALL to the ecology of the Ross Project area.

4.6.1.3 Ross Project Aquifer Restoration

In GEIS Section 4.4.5, the potential impacts to ecological resources during the aquifer-restoration phase of an ISR facility are described (NRC, 2009b). These impacts were noted to include habitat disruption. As noted above, however, in the case of the Ross Project, the already in-place infrastructure from the construction and operation phases (i.e., roads) would continue to be used, and little additional ground disturbance would occur.

Contamination of soils and surface waters could result from spills and leaks, which could impact the ecology of the Ross Project. The leak-detection systems and spill-response protocols described earlier, and the eventual radiation survey of all potentially impacted soils and sediments, would limit the magnitude of overall impacts to terrestrial and aquatic ecology during the aquifer restoration at the Proposed Action. In addition, continued implementation of mitigation measures, such as perimeter fencing and the avian-deterrent system would ensure that impacts to vegetation and terrestrial species would be minimized during aquifer restoration at the Ross Project. Also, because the existing infrastructure would be in place, the potential impacts to the Project area's ecology from aquifer-restoration activities would be similar or less than that experienced during the Proposed Action's operation phase—wildlife would have already retreated or learned to tolerate the presence of humans or noise. Therefore, the potential impacts to vegetation and wildlife during aquifer restoration would be SMALL.

There would be no expected impacts to protected species during aquifer restoration beyond those which occurred during the construction and operation phases of the Proposed Action, because the existing infrastructure would be in place and no further excavation of habitat would be necessary. Additionally, to date, no threatened or endangered species have been observed at the Ross Project area. Therefore, the overall impact to threatened, endangered, or protected species during aquifer restoration would be SMALL.

4.6.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.1, temporary land disturbance during the decommissioning of ISR facilities would be a result of excavation and disturbance of soils; excavation and removal of buried pipelines; and the decontamination, dismantling, demolition, and removal of buildings and structures (NRC, 2009b). However, any recontouring of land and its revegetation would assist in the restoration of habitats previously altered during an ISR facility's construction and operation. Wildlife would be temporarily displaced during the decommissioning phase, but species could return upon completion of this phase, when the restoration of vegetation and reclamation of habitat have been accomplished. Although facility decommissioning and site reclamation might result in temporary increases in sediment load in local streams, aquatic species would recover quickly as the additional sediment load decreased. For all of these reasons, the GEIS concluded the overall potential impact during the decommissioning of an ISR facility would be SMALL.

The Proposed Action's decommissioning would be phased over approximately the last five years of the Ross Project. The Applicant estimates a 12-month duration for the decommissioning of the CPP, surface impoundments, pipelines, roads, and other infrastructure (if the CPP does not continue to operate for satellite and/or other offsite uranium-loaded IX-resin processing). Stockpiled topsoil would be used to regrade the land to the contours that existed during the Applicant's pre-licensing, site-characterization efforts, as required, and be reseeded with native vegetation when the buildings and structures are removed as described earlier (see SEIS Section 2.1.1). No loss of vegetation communities beyond those disturbed during the construction phase would occur. Pipeline removal would impact vegetation that could have re-established itself, although this, too, would be temporary as the disturbed areas are reseeded. Thus, the impacts of the Proposed Action's decommissioning would not be expected to be greater than those experienced during its construction, and mitigation measures would continue to be employed. Consequently, the decommissioning impacts to vegetation would be SMALL.

The decommissioning of the Proposed Action would create increased noise and traffic as buildings and structures are decontaminated, dismantled, demolished, and transported offsite to an appropriate waste-disposal facility. During this time, wildlife could either come in conflict with heavy equipment or be disrupted by the higher-than-normal noise. As a result of these impacts, wildlife would move elsewhere either on the Ross Project area or onto other lands. Temporarily displaced wildlife could return to the Ross Project area after the Proposed Action's decommissioning and site restoration and reclamation are complete. Further, as required by NRC regulations, the Applicant would be required to submit a DP as well as its RAP for Commission review and approval (see Appendix 6.1-A to the TR); these documents will address ecological impacts such as these. Consequently, the decommissioning impacts of the Ross Project on area ecology would not be more than those experienced during the Proposed Action's construction. Thus, the impacts to terrestrial wildlife, aquatic, and protected species during decommissioning would be SMALL.

4.6.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, activities such as the plugging and proper abandonment of existing drillholes could continue to occur as could continued environmental monitoring, data collection, and field surveying. These activities, however, would be temporary in nature and the surface area affected would be very limited.

The Ross Project area would continue to support vegetation communities and wildlife habitat typical of the region (as described in SEIS Section 3.2). Land use by wildlife, including the pasturelands and rangelands, would continue. Grazing of existing vegetation, particularly in grassland communities, would continue under the existing grazing leases. Existing wildlife on the Ross Project area would be affected only if continued cattle grazing were to destroy wildlife habitat or if species were to be displaced by cattle populations because of lack of forage and cover. However, in this Alternative, only a few individual species would be affected, and they would relocate to suitable nearby habitats. Therefore, vegetation and wildlife impacts would be SMALL under Alternative 2.

4.6.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The Applicant's construction of the CPP at this location would produce a very slight increase in the travel distance for vehicles accessing the Ross Project's facility and wellfields. This could very slightly raise the potential for vehicular collisions with wildlife. However, the potential impacts during construction of Alternative 3 would be similar to those described for the Proposed Action. In addition, the surface impoundments would be located farther away from the Oshoto Reservoir, which would reduce the likelihood of waterfowl and other wildlife entering the surface impoundments. This would reduce the impacts to wildlife during the operation and aquifer-restoration phases of Alternative 3. All other impacts would be the same as for the Proposed Action, and the same mitigation measures would be implemented. The impacts of the North Ross Project would be of the same magnitude as during the Proposed Action, and they would be SMALL.

4.7 Air Quality

The Proposed Action could impact air quality during all phases of the Project's lifecycle. As discussed in GEIS Section 3.4.6 and in SEIS Section 3.7.1, Wyoming is generally a very windy state and ranks first in the U.S. with an annual average wind speed of 5.8 m/s [13 mi/hr]. During winter, wind speeds in Wyoming can reach 13 – 18 m/s [30 – 40 mi/hr] with gusts to 22 – 27 m/s [50 – 60 mi/hr] (NRC, 2009b). During the 12 months of pre-licensing, site-characterization monitoring at the Ross Project area, the onsite meteorology station recorded average annual wind speeds of 19 km/hr [12 mi/hr], with a maximum wind speed of 74 km/hr [46 mi/hr]. Southerly winds were predominantly recorded at the Ross Project area. Despite the southerly winds, the highest wind speeds tend to occur from the north-northwest. These data suggest that combustion-engine and fugitive-dust emissions from the Ross Project would be moved by the predominant winds to the south. During high wind-speed events, dispersal of gaseous (e.g., combustion-engine) and particulate (e.g., fugitive-dust) emissions would likely be moved to the south-southeast.

In addition to the winds, the Ross Project area and the surrounding region receive relatively little rainfall, with average annual precipitation ranging from 25 – 38 cm [10 – 15 in]. The region receives an average annual snowfall of 130 – 150 cm [50 – 60 in]; approximately one-half of the precipitation is associated with spring snows and thunderstorms. At the Ross Project meteorological station, the total precipitation measured in 2010 was 24.8 cm [9.8 in] (Strata, 2011a).

Because the Ross Project area is very dry and very windy, fugitive dust is readily generated and is a significant air pollutant. These high winds could also more rapidly disperse air pollutants, lowering their concentrations. But the arid conditions in the Ross Project area are not as conducive to removal of suspended dust as areas receiving more rainfall. Therefore, in general, other mechanisms besides precipitation would need to be implemented within the Ross Project area to minimize fugitive dusts and other air emissions.

Air pollutants can also be affected by the regional landscape of an area. The Ross Project's topographical setting—an area consisting of rolling hills and intermittent drainages—provides some topographic breaks (see SEIS Section 2.1.1) (Strata, 2011a). In addition, the nearest mountain range is the Black Hills, whose westernmost edge is approximately 30 km [20 mi] from the eastern boundary of the Ross Project area. It has been suggested that this range may shield easterly winds and channel predominant winds into a north-south pattern (Strata, 2011a).

Finally, atmospheric-stability classification and mixing height are environmental variables that also influence the ability of the atmosphere to disperse air pollutants. The "stability class" is a measure of atmospheric turbulence and "mixing height" characterizes the vertical extent of contaminant mixing in the atmosphere. Stability-class information was collected at the Ross Project meteorological station (Strata, 2011a) and indicated that the class distributions were predominantly neutral (approximately 62 percent of the time).

This information indicates that potential impacts to air quality could occur during all phases of the Ross Project, and the impacts could be related to both the particulate emissions (or effluents) as well as gaseous emissions that would be released during the Ross Project. Consistent with the GEIS, the air-quality impacts analyzed in Section 4.7 only address nonradiological emissions. Emissions of radioactive particulates or gases and dose information are addressed in the public and occupational health and safety impacts analysis in SEIS Section 4.13.

The phases of the Ross Project are anticipated to overlap, resulting in cumulative impacts from multiple phases occurring concurrently. Relevant sources and methods used to summarize emissions were updated from the preliminary emissions inventory found in Addendum 4.6-A to the ER (Strata, 2011a). In the Applicant's Air Quality Permit application, categories of air emissions were summed over the construction, operations, aquifer restoration and decommissioning time periods to produce the summary found as Table 5-2 (Strata, 2011c), as follows in Table 4.4.

Table 4.4
Regional Emissions Summary

Units and Type of Emissions	Year After License Issuance (t/yr [T/yr])									
	1	2	3	4	5	6	7	8	9	10
Tons PM_{10}	167.3 [184.4]	183.8 [202.6]	183.8 [202.6]	183.8 [202.6]	32.6 [35.9]	35.6 [39.3]	35.6 [39.3]	90.7 [100.0]	90.7 100.0]	79.3 [87.4]
Tons $PM_{2.5}$	25.1 [27.7]	27.6 [30.4]	27.6 [30.4]	27.6 30.4]	4.9 [5.4]	5.4 [5.9]	5.4 [5.9]	13.6 [15.0]	13.6 [15.0]	11.9 [13.1]
Tons NO_x	166.3 [183.4]	202.3 [223.0]	202.3 [223.0]	222.8 [245.7]	58.1 [63.9]	116.3 [128.2]	116.3 [128.2]	80.4 [88.6]	80.4 [88.6]	59.8 [65.9]
Tons CO	36.7 [40.5]	44.6 [49.2]	44.6 [49.2]	49.1 [54.1]	13.2 [14.6]	25.8 [28.4]	25.8 [28.4]	17.9 [19.7]	17.9 [19.7]	13.4 [14.8]
Tons SO_2	9.9 [10.9]	12.2 [13.4]	12.2 [13.4]	13.5 [14.9]	3.7 [4.1]	7.6 [8.4]	7.6 [8.4]	5.3 [5.8]	5.3 [5.8]	3.9 [4.3]
Tons TOC	12.2 [13.4]	15.1 [16.6]	15.1 [16.6]	16.6 [18.4]	4.6 [5.1]	9.3 [10.3]	9.3 [10.3]	6.4 [7.1]	6.4 [7.1]	4.8 [5.3]
Tons VOC	0.65 [0.71]	0.69 [0.76]	0.69 [0.76]	0.69 [0.76]	0.69 [0.76]	0.69 [0.76]	0.69 [0.76]	0.65 [0.71]	0.65 [0.71]	0.65 [0.71]
Tons HAP	3.27 [3.61]	3.84 [4.24]	3.84 [4.24]	4.1 [4.57]	1.68 [1.85]	2.20 [2.43]	2.20 [2.43]	1.58 [1.74]	1.58 [1.74]	1.27 [1.40]
Tons CO_2	6467 [7130]	11106 [12245]	11106 12245]	11870 [13087]	5507 [6072]	7670 [8457]	7670 [8457]	3032 [3343]	3032 [3343]	2268 [2500]
Tons HCL	0.02 [0.02]	0.02 [0.02]	0.02 [0.02]	0.02 [0.02]	0.02 [0.02]	0.02 [0.02]	0.02 [0.02]	0.00 [0.00]	0.00 [0.00]	0.00 [0.00]
Tons H_2O2	0.000 [0.000]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.001 [0.001]	0.000 [0.000]	0.000 [0.000]	0.000 [0.000]
Curies Rn-222	0.0 [0.0]	286.7 [316.2]	286.7 [316.2]	572.7 [631.4]	572.7 [631.4]	572.7 [631.4]	572.7 [631.4]	572.7 [631.4]	572.7 [631.4]	0.0 [0.0]

Source: Strata, 2011c.
t = tonnes, metric tons (equal to 1,000 kilograms, or approximately 2,205 lbs).
T = short tons, U.S. tons (equal to 2,000 lbs).
Metric tonne (t) = U.S. ton (T) ÷ 1.1023.

4.7.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. GEIS Section 4.2.6 determined that uranium-recovery facilities are not, in general, major air-emission sources (NRC, 2009b). Given the low levels of particulate and gaseous emissions predicted in GEIS Section 4.2.6, the GEIS determined that the overall potential air-quality impacts of an ISR facility are SMALL, if the following three conditions are true for a specific facility: 1) particulate and gaseous emissions are within regulatory limits and requirements; 2) air quality in the [region] is in compliance with the National Ambient Air Quality Standards (NAAQS); and, 3) the facility would not be classified as a major source under the New Source Review or operating (Title V) air-quality permit programs which were described in the GEIS (NRC, 2009b). As noted in GEIS Section 4.4.6, the entire NSDWUMR is an attainment area for NAAQS (see SEIS Section 3.7.3).

These three conditions do describe the proposed Ross Project area. The Ross Project would be designed to ensure that its emissions are within regulatory limits and requirements; it would be located in the NSDWUMR which, as described in SEIS Section 3.7.3, is an attainment area for all NAAQS primary pollutants (i.e., is in compliance with NAAQS) (see Table 3.17 in SEIS Section 3.7.3); and, the Ross Project would not be classified as a major air-emissions source under New Source Review or Title V of the CAA. The Ross Project also would not impact the nearest prevention of significant deterioration (PSD) Class I areas. These conditions would apply to all phases of the Ross Project.

4.7.1.1 Ross Project Construction

Generation of fugitive dust during land-disturbing activities conducted during ISR facility construction would be the same as discussed in GEIS Section 4.3.6.1, and would be short-term. Other air-quality impacts from fugitive dust would result from road dust being suspended by moving vehicles over nearby and Ross Project roads as well as from construction equipment while it is used to clear and grade portions of the Project area where construction would occur. During the Proposed Action's construction phase, the Applicant estimated a disturbance area of 114 ha [282 ac] during construction of Ross Project buildings and auxiliary structures, surface impoundments, access roads, and other infrastructure. Traffic associated with the Ross Project would use the primary access routes described in detail in SEIS Section 3.3. D Road is a two-lane asphalt and gravel road to 5 km [3 mi] north of Bertha Road, where D Road changes to a reclaimed-asphalt pavement for another 11.7 km [7.3 mi], after which D Road changes to a gravel-only surface. New Haven Road is a two-lane, crushed-shale road approximately 7.6 – 9.1 m [25 – 30 ft] wide, with a posted speed limit of 72 km/hr [45 mi/hr]. The Oshoto Connection road is also a crushed-shale roads. Speed limits on the crushed-shale roads are posted at 72 km/hr [45 mi/hr]. Fugitive-dust generation would be greatest on the gravel- and shale-based roads. Fugitive-dust settling estimates and mitigation strategies are discussed later.

Fugitive dust and other particulate emissions are regulated under the *Wyoming Air Quality Standards and Regulations* (WAQSR), Chapter 3, Section 2(f), "Fugitive Dust." The WAQSR quantifies opacity and emission-specific constituent concentrations that apply exclusively to any point sources at the Ross Project (e.g., combustion engines) (WDEQ/AQD, 2011). In contrast to point sources, WDEQ/Air Quality Division (AQD) also regulates generalized fugitive-dust emissions by imposing BMPs rather than numerical limits.

In a study of air-quality impacts of road construction, Roberts (2010) found that near-road pollutant concentrations decline substantially within 100 – 150 m [330 – 490 ft] of the road, and they can reach routine air conditions at approximately 300 – 500 m [980 – 1,600 ft] from the road. Similarly, a study by Countess et al. (2001), undertaken to improve the modeling of windblown and mechanically re-suspended fugitive-dust emissions, found that not all particulates that could be suspended are in fact transported long distances; this is due to deposition rates, vertical mixing, and transport times. Countess et al. found that PM_{10} (less than 10 μm in diameter) particulates (i.e., dusts) deposit relatively quickly at a rate of 0.5 – 5 cm/s [0.2 – 2 in/s]; $PM_{2.5}$ particulates deposit more slowly at 0.05 – 0.2 cm/s [0.02 – 0.1 in/s], with a continuum of values between these two extremes for cropland, prairie, and paved surfaces. In general, the fraction of the mechanically generated fugitive dust from roads and bare surfaces that is removed from the atmosphere by gravitational settling and by impacting nearby obstacles (such as vegetation) is much larger than that associated with fugitive windblown dust. This is because of the fact that the mechanically generated particulates tend to remain closer to the ground for longer periods after suspension in the air than windblown dusts, such that there is a higher probability that these mechanically generated particulates, such as those generated by vehicles, are removed from the atmosphere close to their sources.

Windblown fugitive-dust emissions can be lofted vertically to great heights above the ground by the sustained energy provided by the vertical component of the wind, especially for strong winds and, consequently, can be transported over much longer distances from their sources than mechanically generated fugitive-dust emissions. A typical wind speed of 2.5 m/s [8 ft/s] results in the transport of particulates to 100 m [330 ft] in 40 seconds, 1,000 m [3,300 ft] in 400 seconds (or approximately 7 min), and 10,000 m [33,000 ft] in 4,000 seconds [or approximately 1.1 hr]. In general, PM_{10} particulates are deposited at a rate that is about an order of magnitude greater than $PM_{2.5}$ because of the greater gravitational settling velocity (Countess et al., 2001). These data indicate that the majority of fugitive-dust impacts would not extend beyond the 80-km [50-mi] radius around the Ross Project area, although winds with large vertical components can transport dust over longer distances when they occur. This physical phenomenon is a *de facto* mitigation measure.

The greatest combustion-engine gaseous emissions from diesel- and gas-powered equipment operation would occur primarily during the construction and decommissioning phases of the Ross Project because of the equipment used during those phases. To determine the potential air-quality impacts from the passenger vehicles of the commuting workforce as well as delivery and shipment trucks to and from the Ross Project area, the Applicant provided the anticipated number of passenger-vehicle trips to and from the Ross Project during each of the Ross Project's phases (see Table 4.2) (Strata, 2011a; Strata, 2012a). The Applicant also estimated the number of each type of supply, material, product, and waste shipment during each phase. Finally, the Applicant estimated the annual operating time of these vehicles and other construction equipment (Strata, 2011a).

All of this information is important when modeling air-quality impacts, as the Applicant did for each phase of the Proposed Action. In its air-quality modeling results, the Applicant provides (primarily diesel) combustion-engine emission and fugitive-dust estimates. These modeled emissions are provided in Table 4.5 for each phase of the Ross Project (Strata, 2011c; Strata, 2011a). In the NRC's evaluation, the assumptions used by the Applicant in its air-quality modeling efforts were conservative (e.g., each worker was assumed to commute to and from the Ross Project area alone). All modeled emission levels were estimated to be below the major-source threshold for NAAQS attainment areas.

In order to determine impacts to air quality from diesel combustion emissions, the GEIS reported emissions for an in situ uranium-recovery facility in Crownpoint, New Mexico, as described in the NRC's *Environmental Impact Statement* (EIS) for that facility (NRC, 2009b; NRC, 1997). Therefore, emissions from the Crownpoint facility were examined for their pertinence to the Ross Project. Estimated maximum uranium production of the Ross Project and Crownpoint are each 1.4 million kg/yr [3 million lb/yr]. The estimated particulate and gaseous emissions were presented in the Crownpoint EIS and in Table 2.7-2 of the GEIS. The results of the Crownpoint preliminary emissions inventory were similar to the Applicant's for the Ross Project, with the exception of particulate matter (PM). PM emissions associated with the Crownpoint facility were approximately 9 t/yr [10 T/yr], while PM emissions for the Ross Project were estimated at 161 t/yr [177 T/yr]. In addition, estimated combustion emissions for the Ross Project were significantly higher than those presented in the Crownpoint EIS. The differences the two can be attributed to the source of emissions factors (e.g., “AP-42” was used in the Ross Project, which are significantly more conservative than the assumptions used for the Crownpoint analysis) as well as the estimated operating hours associated with each piece of equipment. The depth to ore deposits is also greater at the Ross Project site than at Crownpoint, which would require that the drilling equipment would be operated for longer time periods to reach the ore at the Ross Project and, thus, emit more emissions.

The annual average particulate concentration at Crownpoint was estimated to be less than 2 percent of the Federal $PM_{2.5}$ ambient-air standard; less than 1 percent of the previous Federal and current Wyoming PM_{10} ambient-air standards; and less than 2 percent of the Class II PSD allowable increment. However, the estimate for annual average particulate concentration did not categorize the particulates as PM_{10} or $PM_{2.5}$. The annual average SO_2 concentration was estimated in the Crownpoint analysis to be less than 1 percent of both the Federal and the Wyoming ambient-air standards and less than 1 percent of the Class II PSD allowable increment. Finally, the annual average NO_2 concentration at Crownpoint was estimated to be slightly over 2 percent of the Federal and Wyoming ambient-air standards, but less than 9 percent of the Class II PSD allowable increment. Therefore, although PM emissions at the Ross Project could exceed those at Crownpoint, the low percentages of the ambient-air-quality standards estimated for the Crownpoint facility’s emissions indicate that the Ross Project emissions would also be below NAAQS and PSD standards.

In addition, the meteorology used in the Crownpoint EIS to estimate average annual air concentrations of emitted pollutants is more stable than at the proposed Ross Project area, based upon review of wind-stability classes. At Crownpoint, winds that fall into stability classes E and F occur over twice as frequently as winds in stability classes E and F at the Ross Project area. Good dispersion conditions (stability classes A through D) occur approximately 80 percent of the time at the Ross Project area versus approximately 55 percent of the time at the Crownpoint facility. Based upon the information reviewed, the dispersion conditions at the Ross Project area are more favorable than at the Crownpoint facility and would therefore assist in reducing the impacts due to PM emissions at the Proposed Action.

The Applicant has proposed several onsite best available control technology (BACT) mitigation measures as well as many BMPs to control fugitive dust (e.g., fugitive dust would be minimized by the Applicant’s wetting soils down during earth-disturbing activities). The Applicant’s mitigation of fugitive dust from roads would also include setting appropriate speed limits for vehicular traffic, strategically placing water load-out facilities near access roads, using chemical dust suppressants (e.g., magnesium chloride), encouraging employee carpooling, and selecting road surfaces that would minimize fugitive dust. The placement of soil stockpiles on the leeward side of hills and the Applicant’s prompt revegetation of disturbed areas would also reduce the potential for fugitive dust.

For example, the Applicant has committed to treating portions of D Road in accordance with its MOU with Crook County. In this MOU, the Applicant has agreed to implement dust-control mitigation measures (e.g., dust suppressants) over 0.4 km [0.25 mi] stretches of all CRs that front the residential properties along D Road as well as any CR designated by Crook County as an access route to the Ross Project. The MOU also obligates the Applicant to assist Crook County with CR assessment, maintenance, and improvement (Strata and Crook County, 2011d).

Table 4.5
Non-Radioactive Emissions Summary

Construction-Equipment and Truck-Tailpipe Emissions (t/yr [T/yr])						
Phase	**TOC**	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**CO_2**
Construction	12.04 [13.27]	164.90 [181.77]	35.83 [39.50]	10.78 [11.89]	9.82 [10.83]	6363.81 [7014.9]
Operation	2.80 [3.09]	35.18 [38.78]	7.53 [8.36]	2.49 [2.75]	2.32 [2.56]	1303.3 [1438.6]
Aquifer Restoration	1.63 [1.8]	20.6 [22.7]	4.5 [4.9]	1.46 [1.61]	1.36 [1.50]	764.4 [842.6]
Decommissioning	4.63 [5.1]	58.3 [64.3]	12.6 [13.9]	4.14 [4.56]	3.86 [4.25]	2163.6 [2385.0]
Transportation-Related Combustion Emissions (t/yr [T/yr])						
Phase	**TOC**	**NO_X**	**CO**	**PM_{10}**	**SO_2**	**CO_2**
Construction	3.6 [4.0]	7.0 [7.7]	4.2 [4.7]	0.7 [0.8]]	0.6 [0.7]	675 [744]
Operation	1.3 [1.4]	4.3 [4.7]	1.7 [1.9]	0.3 [0.4]	0.3 [0.4]	282 [311]
Aquifer Restoration	0.5 [0.6]	3.0 [3.3]	0.9 [1.0]	0.3 [0.3]	0.2 [0.2]	154 [170]
Decommissioning	1.6 [1.8]	2.6 [2.9]	1.8 [2.0]	0.3 [0.3]	0.3 [0.3]	285 [314]

Fugitive-Dust PM_{10} Emissions (t/yr and T/yr)			
Phase	**Activity**	**PM_{10} (t/yr)**	**PM_{10} (T/yr)**
Construction Equipment	CPP (facility) site preparation	10.60	11.69
Construction Equipment	Wellfield and road preparation	15.86	17.48
Construction	Vehicle use on unpaved roads	129.40	142.64
Construction	Wind erosion from exposed areas	11.25	12.40

Table 4.5
Non-Radioactive Emissions Summary
(*Continued*)

Fugitive-Dust PM_{10} Emissions (t/yr and T/yr) (*Continued*)			
Phase	**Activity**	**PM_{10} (t/yr)**	**PM_{10} (T/yr)**
Operation	Vehicle use on unpaved roads	13.23	14.29
Operation	Wind erosion from exposed areas	1.03	1.14
Operation	Wind erosion from exposed areas in Year Five of uranium-recovery operation	5.69	6.27
Aquifer Restoration	Vehicle us on unpaved roads	8.89	9.80
Aquifer Restoration	Wind erosion from exposed areas	1.03	1.14
Decommissioning	CPP (facility) area reclamation	2.01	2.21
Decommissioning	Wellfield and road reclamation	4.64	5.12
Decommissioning	Vehicle use on unpaved roads	70.52	77.73
Decommissioning	Wind erosion from exposed areas	5.79	6.38

Storage-Tank Emissions (kg/yr and lb/yr)		
Hydrochloric Acid	42.92	47.31
Hydrogen Peroxide	0.98	1.08
Diesel	10.80	11.90
Gasoline	1,176.99	1,297.41

Source: Strata, 2011a; Strata, 2011c.

Note: t = Tonnes, or Metric tons.
T = Short tons, or U.S. tons.

In addition, mitigation of all types of impacts to air quality (i.e., the actual particulate- and gaseous-emission concentrations from the Ross Project area) would be required to be monitored and to comply with the conditions of the WDEQ-issued Construction Air Quality Permit No. CT-12198 (WDEQ/AQD, 2011). The gaseous-emission controls that the Applicant must employ during the Ross Project are outlined in its Air Quality Permit Application, which becomes part of the Air Quality Permit itself (Strata, 2011c). As specified, gaseous emissions would be controlled by the BACT for critical air-emission sources, such as acid-fume scrubbers and acid-storage tanks (Strata, 2011c). Other BACTs are listed in the regulations implementing the CAA (40 CFR Chapter I, Subchapter C).

The Applicant also has indicated that it would use visual observation on at least an hourly basis to monitor air quality in the Ross Project area and on a twice-daily basis at locations along the primary access route leading to the Ross Project. Further, to ensure compliance, the WDEQ/AQD would conduct regular inspections as well as unannounced inspections of permitted facilities (Strata, 2012a). Finally, the Applicant would respond aggressively to any dust-related concerns expressed by its employees, contractors, or members of the public (Strata, 2012a).

Because of the predominant winds (in terms of both speed and direction) in the region, the remote location of the Ross Project area, and the BACT controls and BMPs that the Applicant is required by its Air Quality Permit to implement, many of the air-quality impacts from the Proposed Action would be fully mitigated (WDEQ/AQD, 2011). Because construction at the Ross Project would be typical of ISR facilities considered in the GEIS, anticipated gaseous-emission and fugitive-dust impacts would be limited in duration during the construction phase, and they would be mitigated. Therefore, the impacts of the Proposed Action on air quality during the construction phase would be short-term and SMALL.

4.7.1.2 Ross Project Operation

Air-quality impacts during the Ross Project's operation phase could include the same as those identified earlier for the construction phase of the Proposed Action (i.e., particulate fugitive-dust and gaseous combustion-engine emissions), and they would be generated by many of the same sources. Estimates for these sources are provided by Project phase in the Applicant's Air Quality Permit Application and are summarized in Table 4.5 (Strata, 2011c).

Impacts from fugitive-dust and combustion-engine emissions during the operation phase would be less than construction-phase impacts, however, because fewer vehicles would be in use on or near the Ross Project area. Worker commutes would be approximately 60 workers during the operation phase (less than the 200 during construction). Construction-equipment operation (where most portions of the Ross Project area would have been cleared and graded during construction, so little earth movement would occur during operation—only the drilling and installation of new wellfields would continue to generate fugitive dust and combustion-engine emissions) would diminish substantially, thus generating less particulate and gaseous emissions.

Several point sources could release emissions while the Ross Project is in its operation phase. These point sources of gaseous emissions would be located at the CPP. These would include process-pipeline, process-vessel, and storage-tank vents; emergency generators and space heaters; and other sources such as storage vessels and tanks containing acids and bases (Strata, 2011a). Gaseous emissions from the yellowcake dryer are not expected because of the design of the proposed Ross Project's yellowcake circuit, which would include the BACT design of an indirect heat source as well as an integrated filter and condenser.

Gaseous emissions could also be released during the venting of excess vapor pressure from pipelines within the CPP, with small amounts of chemical vapor released. According to GEIS

Section 4.4.6, excess vapor pressure in pipelines could be vented at various relief valves throughout the system. These emissions would be rapidly dispersed into the atmosphere, resulting in SMALL impacts (NRC, 2009b). In addition, there could also be gaseous emissions during uranium-loaded-resin transfers or during resin elution (e.g., liquefied oxygen or carbon dioxide that come out of solution). The GEIS determined that a low volume of gaseous emissions would be released during resin transfer and elution at an ISR facility.

The Applicant's refilling of acid, sodium carbonate, or bicarbonate tanks would produce only small quantities of emissions; nonetheless, during the process of refilling the acid-storage tanks, the BACT standard of a closed-loop system, which routes displaced vapors back to the tank truck during transfer, would be used (Strata, 2011c). The tanks would be located away from other chemical-storage tanks and away from the process vessels at the chemical-storage area (Strata, 2011b). Any emissions would be scrubbed for acid vapors prior to release to the atmosphere. Sodium carbonate and sodium bicarbonate would be delivered dry by truck and be blown into a storage silo; the vent of this silo would be filtered with a dust-vent bag to capture particulate emissions (Strata, 2011b). The emissions from other storage vessels and tanks are summarized by the Applicant in its license application and additional information it has provided the NRC (Strata, 2011a; Strata, 2011b; Strata, 2012a) as well as in its Air Quality Permit Application (Strata, 2011c).

An emergency generator would be required to supply power to critical process equipment in the event of a power failure. The Applicant's Air Quality Permit restricts the generator's operation to 500 hours per year (WDEQ/AQD, 2011). Strata's Air Quality Permit Application provides a summary of generator emissions. Emissions from the vacuum dryers and space heaters in the CPP (i.e., natural-gas-burning equipment) are also listed in the emissions inventory (Strata, 2011c). Table 4.5 summarizes the Applicant's estimates of particulate and gaseous emissions, including from the point sources described above, as they were modeled for the Air Quality Permit Application (Strata, 2011c).

Other types of air-quality-impact mitigation measures include gaseous-emission control systems that minimize emissions, BMPs that have demonstrated success at controlling emissions, and BACT engineering controls that reduce airborne emissions as well as minimize the potential for accidental releases. For example, powdered-form chemicals that would be necessary for the Ross Project would be delivered in covered trucks and unloaded through sealed pathways into tanks vented through dust-vent bags or fabric filters. The Applicant's earth-moving and excavation activities would be governed by BMPs to minimize fugitive dust being released from disturbed areas, such as its watering dry soils thoroughly during such activities. To ensure that all requirements of the Air Quality Permit are being met, WDEQ/AQD would conduct regular inspections and unannounced visits of the Proposed Action (Strata, 2012a).

During the operation phase, the Applicant would be required to monitor Project effluents and selected environmental media to ensure that environmental impacts are minimized. Thus, the air-quality impacts of the Proposed Action during the operation phase would be SMALL.

4.7.1.3 Ross Project Aquifer Restoration

According to GEIS Section 4.4.6, potential nonradiological air-quality impacts during the aquifer-restoration phase of an ISR facility would include fugitive-dust and combustion-engine emissions from many of the same sources identified above during the construction and operation phases. These impacts were found to be SMALL.

During the aquifer-restoration phase of the Proposed Action, the plugging and abandonment of injection and recovery wells would begin after a wellfield has undergone restoration and has met its ground-water quality goals. The emissions associated with the related equipment would be limited in duration and result in small, short-term effects. Vehicular traffic during the aquifer-restoration phase would be limited to delivery of supplies and commuting personnel; however, the workforce at the Ross Project would decrease to 20 workers during aquifer restoration and, consequently, the vehicular emissions of commuting traffic would substantially decrease. A significant decrease in the frequency of offsite reagent shipments and yellowcake shipments would also occur as aquifer restoration proceeds. Thus, the emission-generating activities during the aquifer-restoration phase would be many fewer than during either the construction or operation phases. Therefore, air-quality impacts of aquifer restoration would be SMALL.

4.7.1.4 Ross Project Decommissioning

According to GEIS Section 4.4.6, potential air-quality impacts during an ISR facility's decommissioning phase include fugitive dust, vehicle emissions, and the combustion-engine emissions from many of the same sources identified for the earlier phases of the facility's lifecycle (NRC, 2009b). In the short term, emissions, especially particulates, could increase because the decommissioning of an ISR facility would generate fugitive dust and the related construction equipment would also generate gaseous emissions. The Applicant's dismantling and demolition of Ross Project process equipment, buildings, structures, and surface impoundments; its excavation and removal of any contaminated soils; its relocation of construction equipment to the different areas where decommissioning activities would take place; and its grading and recontouring of the site during reclamation and restoration would produce particulate matter that would impact air quality. Combustion-engine gaseous emissions would also be generated by not only construction vehicles, but also by worker vehicles traveling to and from the Ross Project (an additional 70 workers would be employed at the Ross Project during its decommissioning phase) (Strata, 2011a). Truck traffic related to the shipment of demolition and other wastes would also increase during the decommissioning phase as the wastes were shipped to various disposal facilities. However, the truck traffic would be only approximately 40 percent of that during the construction phase.

All of the respective mitigation measures identified for the other phases of the Proposed Action would continue to be implemented by the Applicant during decommissioning. Consequently, the overall decommissioning-phase impacts would be similar to or less than construction-phase impacts; therefore, decommissioning-phase air-quality impacts would be SMALL.

4.7.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the Applicant could choose to continue with some preconstruction activities, such as its abandonment of exploration drillholes and its data collection and environmental monitoring of the area. These activities would be similar to or of smaller scale as those activities currently occurring at the Ross Project area. These activities would require some equipment and vehicular access to the Ross Project area, which would result in small particulate and gaseous emissions. Other potential sources of air-quality impacts in the region (including oil-production activities) would continue as well, where emission releases from oil-recovery activities within the area could result from accidental pipe breaks or equipment and infrastructure-system failures. All of these potential emissions would be limited and short term. Thus, the air-quality impacts would be SMALL for the No-Action Alternative.

4.7.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. At the north location, a CBW would not be required. Therefore, the incremental contribution to air-quality impacts that would result from the construction and partial removal of the CBW would not occur under Alternative 3. However, additional construction activities in Alternative 3, such as greater land disturbance due to surface-impoundment construction due to the north site's topography, would be somewhat greater than those in the Proposed Action. The air-quality impacts associated with these activities are not significant relative to the air-quality impacts that would occur due to the activities that the two Alternatives have in common. Therefore, the air-quality impacts of Alternative 3 would be expected to be similar to the air-quality impacts of the Proposed Action. Thus, the air-quality impacts of Alternative 3 would be SMALL.

4.8 Noise

The Proposed Action would generate noise during all phases of the Project's lifecycle. As noted in GEIS Section 3.3.1, most ISR facilities are proposed for undeveloped rural areas at least 16 km [10 mi] from the nearest communities. The nearest community to the Ross Project area is Moorcroft, located 35 km [22 mi] due south. However, as described in SEIS Section 3.2, there are 11 residences within the surrounding 3-km [2-mi] radius of the proposed Ross Project. Four of these residences are located within 300 m [1,000 ft] of the Ross Project's boundary. The GEIS indicates that 300 m [1,000 ft] is the distance outside of which noise from construction activities would return to "normal." The nearest two residences of the four within 300 m [1,000 ft] of the Project are 210 m [690 ft] and 255 m [835 ft] from the Project's boundaries and 800 m [2,500 ft] and 1,700 m [5,600 ft] from the proposed location of the CPP and surface impoundments (i.e., the facility) (see SEIS Figure 3.1). There are no sensitive areas, such as schools, churches, synagogues, mosques, or community centers, located less than 300 m [1,000 ft] from the Ross Project's boundaries (Strata, 2011a). There are no residences within the Project area itself.

As described in SEIS Section 3.3, the primary access routes to or from the Ross Project area would be from I-90 north on either D or New Haven Roads (Strata, 2011a). As noted in SEIS Section 3.8, both of the two nearest residences to the Ross Project are located along New Haven Road. Truck traffic, in particular bentonite hauling from the Oshoto bentonite mine 8 km [5 mi] north of the Ross Project area and, less frequently, livestock hauling, are the main contributors to existing traffic noise on D and New Haven Roads. Two noise studies were conducted by the Applicant to establish the current noise levels in and around the Ross Project area (see SEIS Section 3.8). One study measured current noise with a sound-level meter at two of four nearby residences (i.e., the nearest offsite "receptors"). Noise levels at these residences averaged between 35.4 and 37.4 A-weighted decibels (dBA), depending upon simultaneous factors such as wind speed, traffic volume, vehicular speed, and the type of load being transported (Strata, 2011a). The Applicant's second noise study collected current noise level data at its Field Office in Oshoto, 15 m [50 ft] away from New Haven Road and adjacent to the Ross Project area (see Figure 3.1 in SEIS Section 3.2). The latter study demonstrated that the average, daily duration of noise levels above 55 dBA at the Field Office was 62 minutes per day (Strata, 2011a). This noise was attributed to traffic, because of the Office's close proximity to New Haven Road. The EPA identifies noise at or greater than 55 dBA, with a margin of safety determined to protect hearing, as causing outdoor-activity interference and annoyance (EPA, 1978).

4.8.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. At the Ross Project, impacts from noise would be a result of vehicular traffic, such as those from commuter vehicles; deliveries of supplies, materials, and equipment; and shipments of yellowcake and wastes within and outside of the Ross Project area. In addition, equipment operation, such as trucks and other heavy pieces of construction equipment, as well as smaller equipment, such as pump jacks and compressors, and wellfield and CPP operation could be sources of noise. Both humans and wildlife are defined as potential noise receptors in the vicinity of the Ross Project area.

4.8.1.1 Ross Project Construction

The GEIS (Section 4.4.7.1) stated that because of the use of heavy equipment (e.g., bulldozers, graders, drill rigs, compressors), potential noise impacts would be greatest when an ISR facility is being constructed (NRC, 2009b). The GEIS concluded that the noise impacts during construction would be SMALL to MODERATE, where facility construction and wellfield installation would be expected to have only SMALL and temporary noise impacts for residences or communities that are located more than about 300 m [1,000 ft] from noise-generating activities. The MODERATE rating would be limited to temporary noise impacts to the very nearest residences (NRC, 2009b).

Table 4.6 indicates the noise levels that have been calculated for the different types of construction equipment planned for use at the Proposed Action, at three different distances: 15 m [50 ft], which would represent nearby workers; 210 m [690 ft], which would represent the residence nearest the Project's boundaries; and 762 m [2,500 ft], which would represent the residence nearest the Ross Project's proposed CPP (Strata, 2011a).

Heavy equipment operation within the Ross Project area would peak during the Applicant's construction of the CPP, surface impoundments, wellfields, and associated infrastructure. The majority of construction equipment would only be operated during daylight hours, and these activities would be more than 300 m [1,000 ft] from the nearest residences; thus, associated noise would not exceed the 24-hour average sound-energy guideline of 70 dBA or the daytime average of 55 dBA, the level EPA identifies as protective against interference of receptor activities and receptor annoyance, with a margin of safety determined to protect hearing (EPA, 1978). The noise impacts to nearby residents due to heavy equipment operation would thus be SMALL.

Impacts to workers during the Ross Project's construction would also be SMALL, because the Applicant would comply with Occupational Safety and Health Administration (OSHA) regulations governing occupational noise. Further, a hearing-conservation program would be conducted by the Applicant, which would require assessment of noise exposures, provision of hearing protection when noise levels exceed the daily permissible exposure levels, performance of periodic audiograms, and stipulation of worker training regarding noise and hearing, all consistent with 29 CFR Part 1910.95.

Impulse or impact noises from certain equipment, such as impact wrenches and pneumatic attachments on rock breakers, could be particularly annoying to residents. These types of equipment could be operated during some construction activities of the Proposed Action. However, the primary locations of these noises would be at least 335 m [1,100 ft] from the nearest residence, significantly reducing their perception by residents. The average noise at residences resulting from equipment-related impact or impulse noises would not be expected to reach the 55 dBA nuisance level (Strata, 2012a). Thus, the impacts of impulse noise would be SMALL.

Indoor noise levels due to outside activities typically range from 15 – 25 dBA lower than outdoor levels, depending upon whether windows are open or closed. With windows open during daytime hours, indoor noise levels could have the potential to be greater than the average 55 dBA outdoor level that the EPA defines as preventing receptor activities, interfering with their lives, and annoying them, largely because of truck traffic (EPA, 1978). However, since distances would be greater than 300 m [1,000 ft] from ongoing construction activities, potential indoor noise impacts would be SMALL.

Approximately 85 percent of the overall construction workforce would commute during the daytime (Strata, 2012a), where such commutes could occur to and from the Ross Project in single-occupant cars. Additional traffic would occur due to the relocation of construction equipment to and from the Ross Project area. Noise resulting from vehicle and truck traffic could occasionally be annoying to residents within 300 m [1,000 ft] of noise sources at the Proposed Action, particularly during nighttime hours. However, the Applicant estimates that 90 – 95 percent of all deliveries of supplies, materials, process chemicals, and equipment would occur during daytime hours. Because the roads to and from the Ross Project area currently have very low average daily and annual traffic counts, there would be a large relative increase in vehicular traffic and, thus, noise impacts to nearby residents would be MODERATE; the more distant local communities would experience only SMALL impacts.

Elevated noise levels associated with construction activities could also affect wildlife behavior onsite. The habitat within the Ross Project is not critical for any big-game species or migration corridors (see SEIS Section 4.6.1.1). Impacts to wildlife from noise during construction would be temporary and of relatively short duration. There is adequate habitat adjacent to the Ross Project area, in the surrounding vicinity, so that wildlife would return to the Project area once the temporary noise-producing activities have ceased. Finally, the WGFD's mitigation requirements would be implemented, as necessary, as outlined in SEIS Section 4.6.1.1. In general, however, wildlife would likely avoid the areas where noise-generating activities are ongoing. Thus, noise impacts to wildlife would be SMALL.

Table 4.6
Respective Noise Levels of Construction Equipment

Equipment Type	Noise Level* (@ 15 m [50 ft]) (dBA)	Noise Level** (@ 210 m [690 ft]) (dBA)	Noise Level*** (@ 760 m [2,500 ft]) (dBA)
Heavy Truck	82-96	59-73	24-38
Bulldozer	92-109	69-86	34-51
Grader	79-93	56-70	21-35
Excavator	81-97	58-74	23-39
Crane	74-89	51-66	16-31
Concrete Mixer	75-88	52-65	17-30
Compressor	73-88	50-65	15-30
Backhoe	72-90	49-67	14-32
Front Loader	72-90	49-67	14-32
Generator	71-82	48-59	13-24
Jackhammer/Rock Drill	75-99	52-76	17-41
Pump	68-80	45-57	10-22
Drill Rig****	52-74	29-51	18-40

Source: NRC, 2009b; Strata, 2011a.
Notes:
* = Taken from the GEIS.
** = Minimum distance between the Ross Project's boundary and nearest residence.
*** = Minimum distance between the CPP and nearest residence.
**** = Based upon Strata's 2010 noise study.

To minimize noise impacts to all receptors, the Applicant proposes additional mitigation measures. For example, the USDOT reports that, for heavy trucks, a speed of 80 km/hr [50 mi/hr] results in a noise level of 80 dBA, while a noise level of approximately 63 dBA result when passenger vehicles travel at 88 km/hr [55 mi/hr] (USDOT, 1995). On rough roads, noise levels would be higher. Therefore, the speed limits for onsite and local roads are a component of the Applicant's planned mitigation of noise impacts. Traffic-related noise impacts would be minimized by the Applicant's working with Crook County to implement and enforce lower speed limits on the roads as well as to develop its own speed-limit policy for employees and contractors. Regular maintenance of all road surfaces to avoid ruts, potholes, and uneven wear patterns would also minimize noise impacts from vehicular and truck traffic.

The presence of vegetation and topographic features between the noise-generating activity and the receptor would reduce noise levels even more (Countess et al., 2001). The large topographic features that exist in the Ross Project area (i.e., steep hills and ridges) between the noise-generating construction activities and the nearest receptors would act as barriers to noise propagation. Mitigation measures that would be implemented by the Applicant would include nighttime drilling restrictions within a specified distance of residences, daylight-hour use of construction equipment, "first move forward" driving policies to limit backup alarms from trucks, and speed-limit enforcement on access roads. The Applicant would also limit the use of equipment with loud engines, unrestricted exhaust systems, and compression brakes (Strata, 2011a).

Thus, the noise impacts during the Proposed Action's construction would be SMALL to MODERATE, where only the closest residents to the Ross Project would experience MODERATE, but short term, exposures to noise, particularly vehicular noise.

4.8.1.2 Ross Project Operation

As noted in GEIS Section 4.4.7, the noise impacts of an ISR facility during the operation phase would be SMALL to MODERATE (NRC, 2009b). Truck traffic would be present during the Proposed Action's operation phase and would be associated with yellowcake, vanadium, and waste shipments (16 trucks would be expected during operation versus 24 during construction). Commuter-traffic noise would decrease because of the smaller workforce required during uranium-recovery operations (60 workers would commute per day during operation versus 200 during construction). Thus, vehicular noise impacts produced at the Ross Project during operation would be SMALL for most offsite receptors and MODERATE, but short term, for the nearest receptors (i.e., closest residences).

During the operation phase, most of the Ross Project's uranium-recovery activities would be conducted inside buildings (although some wellfield activities would take place outdoors) and fewer pieces of heavy machinery would be used. Therefore, the potential noise impacts from the use of equipment during the operation phase would be less than those discussed under the construction phase, and they would be SMALL. Noise emanating from the CPP from a variety of mechanical equipment (e.g., generators; pumps; air compressors; and heating, ventilation, and air conditioning systems) would not be expected to exceed the 55-dBA nuisance level because the doors to the CPP would be kept closed as much as possible. Because noise levels decrease significantly with distance and because the CPP would be located approximately 760 m [2,500 ft] from the nearest residence, impacts due to noise emanating from the CPP itself would be SMALL for all offsite receptors.

Similarly, health and safety impacts to the Applicant's personnel at the Ross Project would be SMALL because most of the noise associated with construction would no longer take place. The specific mitigation measures related to noise impacts adopted by the Applicant during Ross Project construction would continue to be observed through its operation. Every plant worker would be periodically retrained to understand the hazards of excess noise and how to decrease noise impacts under the hearing conservation program the Applicant would develop. Thus, noise impacts to workers would be SMALL.

As during the construction phase, noise from the Ross Project's operation would have SMALL impacts to wildlife, which would likely avoid areas where noise-generating activities are ongoing.

4.8.1.3 Ross Project Aquifer Restoration

As noted in GEIS Section 4.4.7.1, the overall noise impacts during aquifer restoration would be SMALL to MODERATE (NRC, 2009b). However, noise impacts during the aquifer-restoration phase at the Ross Project would be SMALL because: truck traffic would subside to only approximately 12 shipments per day, overall density of residences and receptors near the Ross Project area is sparse, and the noise-mitigation measures that the Applicant would undertake would minimize noise. All noise impacts would continue to be temporary and intermittent. In addition, the workforce employed during the aquifer-restoration phase would be smaller (i.e., 20 workers) than that during the construction and operation phases of the Proposed Action and, thus, there would be fewer workers, less traffic, and fewer noise-producing activities. Finally, the Applicant's continued compliance with OSHA noise standards would minimize noise impacts to workers. Wildlife would continue to avoid the areas where noise-generating activities are ongoing (e.g., the wellfields). All of these factors would ensure that the noise impacts during the aquifer-restoration phase of the Proposed Action would be SMALL.

4.8.1.4 Ross Project Decommissioning

The GEIS indicated that noise impacts emanating from an ISR facility undergoing decommissioning would be SMALL to MODERATE. At the Ross Project, noise levels during the decommissioning phase of the Proposed Action would be similar to or less than those identified for the construction phase for both onsite receptors (i.e., workers) and offsite receptors (i.e., nearest residents and those beyond). Most of the potential noise impacts to nearby residences would occur as a result of the increased vehicular noise due to commuter and truck traffic to and from the Ross Project area during decommissioning (i.e., 90 workers and additional waste shipments), and these impacts would be MODERATE for the nearest residences and SMALL for those farther away from the Project area.

Many decommissioning activities would be focused at the ISR facility itself (i.e., the CPP, the surface impoundments, and auxiliary structures), where activities would include decontamination, dismantling, and demolition of these structures, which would be accomplished through the use of heavy equipment. However, because this area is approximately 760 m [2,500 ft] from the nearest residential receptor, noise impacts to the nearest residents would be SMALL. In the wellfields, equipment used during plugging and abandonment of recovery, injection, and monitoring wells, such as cement mixers, compressors, and pumps, would produce significant levels of short-term noise. Impacts to workers during the Proposed Action's decommissioning would be SMALL, due to the same variables indicated earlier for its construction and operation as well as for aquifer restoration (i.e., OSHA noise-standard compliance). The same is true for wildlife noise receptors, which would avoid the locations where decommissioning activities are taking place.

Despite the standard mitigation measures taken during decommissioning—the same as those identified for the other phases of the Proposed Action—the distance from the closest residences to the Ross Project would result in MODERATE noise impacts to those receptors, but short-term, and SMALL to receptors beyond the closest residences.

4.8.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the preconstruction activities the Applicant has undertaken, such as the plugging and abandonment of wells, could continue under the No-Action Alternative. Thus, the noise levels within the Ross Project area, where the current, measured noise levels are 36 – 40 dBA, could continue (Strata, 2011a). This noise would occasionally be elevated by the passing of heavy trucks and passenger vehicles, nearby agricultural activities, and nearby oil-production activities (Strata, 2011a). Thus, the noise impacts of Alternative 2 would be SMALL.

4.8.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. However, because the north site of Alternative 3 is farther away from main roads than the south site of the Proposed Action, the north site's nearest residential receptors are farther away than from the location of the south site. Therefore, the noise generated by construction equipment would be even less likely to exceed the 55-dBA nuisance level at the nearest residences. Within the fenced facility area itself, the noise levels during construction of Alternative 3 would be similar to those in the Proposed Action because the same types of construction activities would take place.

The noise levels associated with vehicle and truck traffic volume under Alternative 3 would be essentially the same as described for the Proposed Action, because the uranium-recovery activities would be identical to those of the Proposed Action, including the vehicular traffic on local roads and CRs. Thus, residents nearest these roads would experience the same noise impacts as described under the Proposed Action. Workers and wildlife would experience the same impacts under this Alternative as in the Proposed Action. Mitigation measures for noise impacts under Alternative 3 would be same as well. Thus, although the impacts from noise associated with Ross Project construction, operation, aquifer restoration, and decommissioning would be slightly lower than those described above for the Proposed Action because of the slightly greater distance to receptors, the noise impacts of the North Ross Project would be SMALL (most receptors) to MODERATE (nearest receptors, but these impacts would be short term).

4.9 Historical, Cultural, and Paleontological Resources

As discussed in GEIS Section 4.4.8, potential environmental impacts to cultural resources, which are defined in the GEIS as historical, cultural, paleontological, and traditional cultural properties (TCPs), could occur during all phases of an ISR facility's lifecycle (i.e., during construction, operation, aquifer restoration, and decommissioning) (NRC, 2009b). SEIS Section 1.7.3.8 decribes the NRC's Ross Project Tribal consultation activities to date, and SEIS Section 3.9 describes the cultural-resource identification efforts and current National Register of Historic Places (NRHP) eligibility determinations. Table 3.18 lists the current NRHP-eligibility determinations for the 42 historic and cultural properties that have been identified within the Ross Project area. The NRC staff and Wyoming State Historic Preservation Office (WYSHPO) have made consensus determinations on two NRHP-eligible and eight non-eligible properties.

Of the remaining 32 properties, 18 are TCP sites. The NRC has recommended that 13 of the TCP sites are NRHP-eligible, 3 are not eligible, and 2 are unevaluated. The remaining archaeological sites are unevaluated. The final determinations of the NRHP eligibility of these 32 sites, as well as the evaluation of potential adverse effects to historic properties and measures to avoid, minimize, or mitigate those effects, will be be completed in accordance with the Ross Project Programmatic Agreement (PA) (see Appendix E for the Draft PA, which has been issued to the PA paricipants for comment).

4.9.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of the Ross Project facility and wellfields. The impacts of the Ross Project would include the potential to disturb, disrupt, or otherwise adversely affect historical, cultural, and paleontological resources, including NRHP-eligible archaeological sites, in the area of potential effect (APE). Two eligible properties and two unevaluated sites are located within the Applicant's currently proposed areas of land disturbance. A preliminary cultural-resource-impact assessment has indicated that direct and indirect (i.e., visual) effects could occur during Ross Project construction at 7 TCP sites (e.g., Site Nos. 48CK2070, 48CK2214, 48CK2215, 48CK2216, 48CK2218, 48CK2219, and 48CK2222) and that indirect effects could occur at 1 site (Site No. 48CK2220). However, these direct and indirect effects cannot be fully determined because key elements of the final Ross Project design, such as well installation, pipeline and utility line burial, and road and building construction, have not been completed. As needed, adverse impacts would be mitigated by specific measures, which could include the Applicant's avoiding, where practical, NRHP-eligible sites through adjustments in the Ross Project's design; the NRC's consulting with the WYSHPO and Ross Project Consulting Tribes in a timely fashion in accordance with the finalized Ross PA; and all of the consulting parties' agreeing to established protocols if unrecorded resources are inadvertently unearthed during ground-disturbing activities. Once NRHP-eligible and potentially eligible sites, including TCPs and any newly discovered cultural material or human remains, have been identified and an evaluation of adverse effects has been completed, mitigation measures to avoid, minimize, or mitigate any adverse impacts would be developed by the consulting parties pursuant to the process defined in the finalized Ross Project PA.

4.9.1.1 Ross Project Construction

Construction of the Proposed Action could disturb up to 114 ha [282 ac], or 16 percent, of the total Ross Project area. As noted in GEIS Section 4.4.8, most of the potential for direct and indirect adverse impacts to NRHP-eligible properties, traditional culturally significant sites, and paleontological material would likely occur during ground-disturbing activities during construction or decommissioning (NRC, 2009b). Land-disturbing activities during construction with the potential to adversely affect the spatial integrity of archaeological sites and to damage artifacts as well as paleontological resources include, but are not limited to, the Applicant's grading or excavating for roads and parking lots; installing pipes, wells, and wellfields; constructing buildings and structures; building domestic-sewage facilities; installing utility transmission lines and poles; and lighting the facility and surface impoundments. Buried archeological and cultural features as well as deposits of paleontological materials that are not visible on the surface during the initial cultural-resource inventories could be exposed during earth-moving activities. Other potential impacts come from compaction of the soil by heavy equipment, causing damage to subsurface site integrity by crushing or scattering artifacts or features.

Certain paleontological specimens have been located at the Ross Project area; however, they are believed not to be in situ (i.e., the specimens had already been disturbed). Ground disturbance in excess of a few feet during construction could have a limited impact on the geologic units themselves, including the Lance Formation, which have the potential to contain a variety of fossils. In addition, increased access to surface-evident archaeological sites during construction could result in vandalism. TCPs could also be affected by temporary visual intrusions.

The mitigation measures related to historical and cultural resources would include the standard industry practices that are described in GEIS Sections 4.4.8 and 7.4, Table 7.4-1. . Consultation by the NRC with the WYSHPO, the Ross Project Consulting Tribes, other consulting parties, and the Applicant will result in the clear delineation of the measures the Applicant would take to avoid, minimize, or mitigate adverse effects to historical, cultural, and paleontological resources. The NRC staff has concluded that the impacts to historical and cultural resources at the Ross Project area during the construction phase of the Ross Project could range from SMALL to LARGE. This assessment reflects the fact that the highest potential for adverse effects to historical and cultural resources would take place during the construction phase as well as the fact that efforts to evaluate historic and cultural properties and to determine adverse effects and mitigation measures are incomplete. Construction impacts beyond MODERATE would not be anticipated because every effort would be made to avoid, minimize, and mitigate adverse effects to historic properties in accordance with the Ross Project PA that is currently being prepared. However, a LARGE impact is not impossible, depending upon the significance and integrity of, and the extent of adverse effects on, previously identified historic properties or those potentially inadvertently discovered.

4.9.1.2 Ross Project Operation

Direct and indirect adverse impacts on archaeological sites, NRHP-eligible and potentially NRHP-eligible historic properties, TCPs, and paleontological resources would be minimal during the operation phase of the Ross Project. Mitigation measures to avoid, minimize, and resolve adverse impacts to historical, cultural, and paleontological resources would be implemented prior to Ross Project construction. The impacts of the Ross Project's operation would be generally limited to previously disturbed areas (except continuing wellfield installation). Visual or audible impacts from uranium-recovery operation at the Ross Project to TCPs located within the Ross Project area and other cultural landscapes, which would be identified before construction, would be expected to continue during operation. Therefore, the impacts to historical, cultural, and paleontological resources during Ross Project operations would be SMALL.

4.9.1.3 Ross Project Aquifer Restoration

Impacts to archaeological sites, NRHP-eligible and potentially NRHP-eligible historical properties, TCPs, and paleontological resources from aquifer restoration would be similar to or less than those during uranium-recovery operation. These impacts would primarily result from the surface disturbance associated with operation, maintenance, and repair of existing wellfields as part of the aquifer-restoration process as well as on-going visual or audible impacts. Therefore, the impacts to historical, cultural, and paleontological resources during aquifer restoration would be SMALL.

4.9.1.4 Ross Project Decommissioning

Ground-disturbing activities would temporarily increase during the Ross Project's decommissioning. As during the construction phase, ground disturbance in excess of a few feet during facility decommissioning would have an impact on the geologic units themselves, including the Lance Formation, which has the potential to contain a variety of fossils. However, most of the decommissioning activities would focus on previously disturbed areas and, therefore, most of the historic, cultural, and paleontological resource materials would already be known as a result of the investigations that would be conducted prior to facility construction and wellfield construction. Unavoidable visual and audible impacts, however, could increase temporarily during the decommissioning of the Proposed Action. Therefore, the impacts to historical, cultural, and paleontological resources during decommissioning would be SMALL.

4.9.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Under the No-Action Alternative, no major disturbance of land and concomitant potential impacts to historic, cultural, and paleontological resources would occur, except for natural processes such as erosion, although some preconstruction activities could potentially disturb historical, cultural, or paleontological resources. Inadvertent discoveries would be less likely to occur under the No-Action Alternative as little ground disturbance would occur. Cultural-resource inventories have already occurred within the Ross Project area and, thus, most historical and cultural resource information has already been captured scientifically. However, because there would be no systematic protocol with which to discover, identify, characterize, and/or record such new knowledge, artifacts, or cultural resources, there would be fewer discoveries recorded and less knowledge gained about ancient cultures under the No-Action Alternative. The impacts to historical, cultural, and paleontological resources under Alternative 2 would be SMALL.

4.9.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. Any impacts to historical, cultural, or paleontological resources from the construction, operation, aquifer restoration, and decommissioning of the Ross Project under Alternative 3 would occur as described above for the Proposed Action. Also, as noted above, cultural-resource inventories have already occurred within the Ross Project area and, thus, most historical and cultural resource information has already been captured scientifically. Yet, unlike Alternative 2, any new knowledge that would be gained by inadvertently discovered historical and cultural resources during Alternative 3 (and Alternative 1 as well) would be reported and recorded, because the two Alternatives entail Federal and State involvement and the framework of the NHPA and the Ross Project PA would provide a framework.

Therefore, the impacts to historical, cultural, and paleontological resources as a result of Alternative 3 also would be SMALL to LARGE during construction and SMALL during operation, aquifer restoration, and decommissioning. However, as with the Proposed Action, avoidance, minimization, or mitigation measures would be developed prior to construction that would eliminate or reduce the construction impacts.

4.10 Visual and Scenic Resources

The Proposed Action could impact visual and scenic resources during all phases of the Project's lifecycle. The visual-resources impacts analysis below is an evaluation of the landscape changes that could occur as a result of the Proposed Action. Most of the visual and scenic impacts would be associated with construction activities, which would be short term, as well as with the new buildings and roads, which would exist until all phases of the Project were completed. The Ross Project would introduce new elements of form, line, color, and texture into the landscape of the Ross Project area. Because of the small footprint of ground disturbance (only 114 ha [282 ac]) and low profile of the uranium-recovery facility and wellfields, no major visual or scenic impacts would occur as discussed below.

4.10.1 Alternative 1: Proposed Action

Alternative 1 consists of four phases: construction, operation, aquifer restoration, and decommissioning of an ISR uranium-recovery facility and wellfields. Potential visual and scenic impacts at the proposed Ross Project could result from earth moving and surface disturbance as well as the construction, operation, and decommissioning of the following: 1) wellfields (including drill rigs, wellhead covers, module buildings, and roads); 2) the CPP; 3) the surface impoundments; 4) the CBW; 5) secondary and tertiary access roads; 6) power and utility lines; and 7) fencing. The Ross Project area is currently categorized by the Applicant as a VRM Class III, according to the BLM scale noted in SEIS Section 3.10. Consequently, the level of change to the characteristic landscape in Class III areas can be moderate (BLM, 2010).

4.10.1.1 Ross Project Construction

GEIS Section 4.4.9 noted that visual-resource impacts could result from heavy equipment use (drill-rig masts and cranes); fugitive-dust and gaseous emissions; and hillside and roadside cuts into the native topography during construction. In addition, construction activities within a rural setting could give the area a more industrial appearance, thereby decreasing the local visual appeal. However, at the Ross Project area, the existing landscape already includes visual alterations as a result of oil extraction, existing roads, and current utility corridors. Construction-phase activities would be short term, and following completion of construction efforts, many of the areas where temporary ground disturbance had occurred would be restored and reclaimed to the visual conditions prior to licensing.

The largest visible features of the Proposed Action that would emerge during the construction phase would include the CPP and surface impoundments, wellhead covers and module buildings; electrical- and other utility-distribution lines, which are mounted on 6-m [20-ft] wooden poles; and more roads. The Applicant had proposed to use both existing and new roads to access each wellfield and the facility itself (i.e., the CPP and surface impoundments) (see SEIS Section 3.10).

Short-term visual contrasts with the characteristic landscape of the Proposed Action would also result from actual activities associated with construction of the Ross Project. Site clearing and grading; facility and surface-impoundment construction and wellfield installation; access road construction; vehicular and pedestrian traffic increases; and underground and overhead pipeline and utilities installation all would result in visual contrasts to the color of the Ross Project area. Irregularity of the natural landscape would occur during the construction phase. Construction activities would typically occur during daylight hours and would be consequently visible, with the exception of some drilling and equipment maintenance that could occur at night (Strata, 2011a).

Wellfield construction would involve the use of drill rigs, water trucks, backhoes, supply trailers, and passenger vehicles. This equipment would be temporarily concentrated at each well or wellfield. A typical truck-mounted drill rig can be approximately 9 – 12 m [30 – 40 ft] tall and would be the most visible piece of equipment used during wellfield installation. Once a well is completed and developed for use, the drill rig would be moved to a new location. Strata anticipates that up to 12 drill rigs could be operated at one time during wellfield construction. As with the construction activities above, drilling would primarily occur during daylight hours; however, it is possible drilling would continue into the night. For nighttime operation, the drill rigs would be lighted, increasing the potential visual impacts.

Additional construction impacts would include visible fugitive dust that would be generated during ground clearing and grading for the module buildings and drilling pads; access roads and parking lots; storage and laydown pads; the CPP, auxiliary structures, and surface impoundments; injection, recovery, and monitoring wells; and pipelines. In addition, the drill rigs, trucks, and other vehicles employed during the construction phase at the Ross Project could potentially emit visible emissions (see SEIS Section 3.7.3). These impacts would be temporary and short-term. In the long term (i.e., greater than one year), as major construction activities are completed, fugitive dust and vehicle emissions would decrease (see SEIS Sections 4.7.1.1 and 4.7.1.2).

The Applicant would mitigate visual and scenic impacts related to fugitive dust by wetting soils when clearing and grading activities are being conducted; by using chemical dust suppressants, as necessary, to control fugitive dust on roads within and adjacent to the Ross Project area; by establishing diminished speed limits for vehicular traffic; by strategically placing water load-out facilities near all access roads; by encouraging personnel to carpool; and by selecting road surfaces that would minimize fugitive dust. In addition, following the Applicant's completion of wellfield installation, disturbed areas would be restored, reclaimed, and reseeded within a single construction season, if at all possible (Strata, 2011a). These mitigation measures are discussed in more detail in SEIS Section 4.7.1.1.

A viewshed analysis that has been performed by the Applicant demonstrated that the Ross Project would not be visible from the base of Devils Tower National Monument (Devils Tower, or Bear Lodge) or from its Visitor's Center. Moreover, it would be unlikely that the Project area would be visible to climbers scaling the Monument due to the distance between the Project area and Devils Tower (see the photographs taken from the top of Devils Tower by the National Park Service in September 2011 [ADAMS Accession No. ML11320A307]). The Ross Project would not be visible from Keyhole State Park, Black Hills National Forest, or Thunder Basin National Grassland during any phase of the Project due to the long distances between these recreational areas and the Ross Project as well as to the screening effects of topography (Strata, 2011a).

During initial construction, fugitive dust, other emissions, and construction traffic could also impact the limited viewshed from the Devils Tower. As major construction activities are completed, however, fugitive dust and other emissions would decrease. In addition, impacts from visible-light pollution on human beings can be in the form of disability glare, circadian-rhythm changes, and sleep disorders (Darksky, 2013). Changes in visual aesthetics, such as an increase in artificial light, could also adversely affect a Devils Tower climber's experience if the climbers do not expect to see artificial lighting in the viewshed while recreating. Due to the distance between Devils Tower and the type of lighting proposed for the Ross Project, however, such changes (e.g., disability glare, circadian-rhythm changes ,and sleep disorders) would not occur. Visitors to Devils Tower who climb at night and who are sensitive to visual aesthetics could experience some SMALL adverse effects to their recreational experience.

The Applicant would mitigate visual impacts during its construction activities by phasing construction activities; limiting the extent of land disturbance at any one time; promptly reclaiming and reseeding disturbed areas; using existing roads wherever possible; following existing topography during access road construction to minimize cut and fill and thus reduce contrast; minimizing secondary and tertiary access road widths; and locating access roads, pipelines, and utilities in common corridors (Strata, 2011a).

Prior to construction of the Ross Project, monitoring for potential light pollution would be conducted at eight sites. Based upon the results of this preconstruction evaluation, a light-pollution monitoring plan would be prepared by the Applicant. This plan would finalize the locations for both continuous and intermittent light sources; in addition, it would provide a schedule for periodic checks on sky brightness during the construction and operation of the Ross Project to ensure worker safety and to measure, and to mitigate if necessary, obtrusive light emanating from the Proposed Action (Strata, 2012a).

The Applicant proposes the following mitigation measures to limit light-pollution impacts at the Ross Project during construction. These mitigation measures would be implemented in all portions of the Ross Project area, including all buildings, the CPP, all wellfields, roads, and other ancillary structures (and they would be implemented during the operation and aquifer-restoration phases of the Project, as appropriate). The Applicant proposes that it would:

- Design lighting plans with an emphasis on the minimum lighting requirements for operation, safety, and security purposes.
- Use light sources of minimum intensity (as measured in lumens) necessary to accomplish the light's purpose.
- Specify lighting fixtures that direct light only where it is needed (i.e., shine down, not out or up) in conjunction with shielding that further directs the light towards the respective work area.
- Turn lights off when not needed at proposed intermittent light locations either manually, with timers, or occupancy sensors.
- Adjust the type of lights used so that the light waves emitted are those that are less likely to cause light-pollution problems such as those attendant with high-pressure sodium lamps.

- Fit building windows with shutters, where appropriate, to block light emissions, including the CPP and other buildings.
- Use natural and/or in situ screens to reduce perceptible light (i.e., locating buildings and other facility components to take advantage of the natural topography and any trees).
- Evaluate the results of the light-pollution monitoring to ensure that, as necessary, the mitigation measures suggested previously have been implemented successfully (Strata, 2012a).

Finally, the Applicant is committed to evaluating the extent of the light pollution to nearby residences following installation of the final lighting system. The Applicant is committed to acting on any concerns of local residents as long as worker safety would not compromised (Strata, 2012a).

Because the management objective of VRM Class III is to partially retain the existing character of the landscape so that the level of change to the characteristic landscape can be moderate, the impacts from the Ross Project's construction are in fact consistent with VRM Class III. Thus, in the short-term (i.e., less than one year), construction activities at the proposed Ross Project would result in MODERATE visual impacts to the nearest four residences, each of which has a view of the Ross Project area. For the remaining 7 of the 11 nearby residences as well as all other members of the public, however, the visual impacts would be SMALL.

4.10.1.2 Ross Project Operation

SEIS Section 2.1.1 describes the Proposed Action's uranium-recovery operation. Most of the wellfield and surface infrastructure would have a low profile, and most piping and cables would be buried. The irregular layout of wellfield surface structures, such as wellhead covers and module buildings, would further reduce visual contrast. Because uranium-recovery operations are generally located in sparsely-populated areas, typically in generally rolling topography, most visual impacts during facility and wellfield operation would not be visible from more than approximately 1 km [0.6 mi] away. As described in GEIS Section 4.4.9.2, the potential visual and scenic impacts of ISR facilities would be SMALL.

At the Ross Project, wellhead covers and module buildings (wellhead covers would be typically low at approximately 1 m [3 ft] high), the CPP and auxiliary buildings, the surface impoundments, access roads, buried utilities, and unburied facility lighting and power lines would be similar to those discussed in the GEIS and, therefore, the potential impacts to the visual resources during Ross Project operation would also be SMALL. All of the pipelines associated with wellfield operation would be buried below the frost line to protect them from freezing; thus, they would not be visible during the Proposed Action's operation. Other potential impacts that are a result of wellfield activities, such as monitoring-well sampling, module-building inspections, and mechanical-integrity testing, could also occur; these impacts would also be SMALL. Because the location of the ore zone underlying the Ross Project is typically irregular, the network of pipes, wells, and power lines (6 m [20 ft] tall) would not be regular in pattern or appearance (i.e., not a grid); this lack of a pattern would reduce visual contrast and associated potential impacts. The overall visual impact of an operating wellfield at the Proposed Action would be SMALL.

Because the uranium-recovery processing and support facilities, such as the CPP, offices, and maintenance buildings, would be located in one area, they would be more noticeable to the casual observer due to their size and density. The CPP would be the largest structure. These components would be prominent in the foreground and middle-ground views, and they would be silhouetted in the view from public access points (i.e., the adjacent county roads). As described in SEIS Section 3.10, however, the Proposed Action would be located in gently rolling topography, where the visibility of aboveground infrastructure would vary and would be relative, depending upon the location and elevation of an observer as well as on nearby topography, total distance, and lighting characteristics.

Lighting from the Ross Project would be visible from five of the residences to the east and from various locations directly to the west, north, and southeast. Figure 3.23 in SEIS Section 3.10.2 shows where lighting emanating from the Proposed Action would be visible within the 3-km [2-mi] vicinity surrounding the Project area. Mitigation measures for local light-pollution impacts would be the same as those described above (in bullet form) for the construction phase of the Ross Project especially those that would mitigate impacts to climbers at Devils Tower.

In addition to the mitigation measures employed during the Proposed Action's construction phase, the Applicant has identified a number of additional mitigation measures to reduce the visual impacts during its operation. The wellhead-cover color would be selected to blend with the environment. Pipelines and electrical lines between the wells and module buildings would be buried as new wellfields come online, and disturbed areas would be immediately reclaimed, reseeded, and restored. The electrical-distribution poles would be wooden so that the natural color would tend to blend with the landscape. Another mitigation measure for screening the CPP and surface impoundments would include the Applicant's planting trees at a density that would limit views into the Project area from public roads and nearby residences. The tree species would be a conifer or another species native to the area. The approximate tree locations are depicted in Figure 2.5. Thus, the impacts to visual and scenic resources during the operation of the Proposed Action would be SMALL.

4.10.1.3 Ross Project Aquifer Restoration

GEIS Section 4.4.9 concluded that the visual impacts during aquifer restoration would be similar to those experienced during uranium-recovery operation, and therefore the impacts would be SMALL (NRC, 2009b). Much of the same equipment and infrastructure used during Ross Project operation would be employed during aquifer restoration at the Project, so that impacts to the visual landscape would be similar to or less than the impacts during the Proposed Action's operation phase. In the wellfields, the greatest source of visual contrast would be from equipment used as injection and production wells are being plugged and abandoned during the natural sequence of the installation of a new wellfield(s) and restoration of the aquifer in a spent wellfield(s). Because there is no active drilling in any wellfield undergoing aquifer restoration, potential visual impacts during this phase would be expected to be less than those during facility construction and wellfield installation, and these impacts would be of short duration.

The mitigation measures presented above for both the Proposed Action's construction and operation phases would continue to be implemented during the aquifer-restoration phase, and these would continue to limit potential visual impacts. Vehicular traffic during the aquifer-restoration phase would be much more limited: worker commutes would diminish significantly (i.e., from a workforce of 200 persons during the construction phase to 60 persons during the operation phase to 20 persons during the aquifer-restoration phase) and there would be fewer deliveries of supplies. There would also be a decreasing-to-zero frequency of yellowcake shipments as aquifer restoration proceeds. Therefore, fewer trips would occur than during the earlier phases, with concomitant lower levels of fugitive dust and combustion-engine emissions as a de facto mitigation measure. Because aquifer-restoration activities at the Ross Project would be very similar to those described in the GEIS (NRC, 2009b), and the impacts would be less than those detailed above for the construction and operation phases, the impacts of the Project during the aquifer-restoration phase would be SMALL.

4.10.1.4 Ross Project Decommissioning

As discussed in GEIS Section 4.4.9.4, the impacts on visual and scenic resources during the decommissioning of an ISR facility would be SMALL (NRC, 2009b). The Proposed Action would not cause any significant impacts to the landscape that would persist after facility decommissioning and site reclamation are completed. Most visual impacts during decommissioning would be temporary and diminish as structures, equipment, and other facility components are removed; the disturbed land surface is reclaimed and restored; and the vegetation is re-established. NRC licensees are required to conduct final decommissioning and site restoration under an NRC-approved DP and RAP, with the goal of returning the landscape to the visual conditions of the area prior to any NRC-licensed activities. While some roadside cuts and hill-slope modifications could persist beyond facility and wellfield decommissioning and site reclamation (depending upon a landowner's wishes), the recontouring, revegetating, and reclaiming of the Ross Project area would consist of the same activities described in the GEIS and, hence, the visual and scenic impacts from the Proposed Action's decommissioning would be SMALL.

When the Ross Project's decommissioning efforts have been accepted by the NRC, all buildings and equipment would have been decontaminated, dismantled, decommissioned, and either disposed of or relocated to another facility. Site reclamation efforts would be designed to return the visual landscape of the Ross Project to its previous contours. Recontouring of disturbed areas on the Ross Project (including access roads) and the reseeding of those areas with native vegetation or an approved seed mixture would both be accomplished during site reclamation. All of these activities would minimize any permanent impacts on visual and scenic resources.

The Applicant would mitigate the fugitive-dust impacts that could result from decommissioning activities by its use of water spray during dismantling and demolition activities and on unimproved roads to reduce dust emissions (Strata, 2011a). All facility-decommissioning and site-restoration activities would be done in accordance with NRC and WDEQ/LQD guidelines. Once these activities are complete, the visual landscape would have been returned to its condition prior to licensing.

4.10.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. Therefore, there would be no change to the existing visual and scenic resources at the Ross Project area. In general, the existing site conditions and current land uses would persist, including oil-production activities. All existing roads, fences, utilities, landscape formations, and vegetation would remain. No additional structures or land uses associated with the Ross Project would be introduced to affect the existing viewscapes, and the existing scenic quality would be unchanged. The visual resource classification would remain BLM Class III, as described in SEIS Section 3.10. Thus, visual and scenic impacts would be SMALL.

4.10.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The Alternative 3 facility would remain within the Ross Project area, albeit in a location that is more shielded by topographical features than where it would be located in the Proposed Action. Thus, some of the Ross Project views from neighboring properties would be diminished, and the nearby residences would be more shielded from light pollution than they would be under the Proposed Action. As a result, the visual- and scenic-resource impacts would, at the least, not differ from those of the Proposed Action and, most likely, they would be somewhat reduced from those of the Proposed Action. Therefore, the visual-resource impacts would be MODERATE for Ross Project neighbors (and short term) and SMALL for all others and over the long term.

4.11 Socioeconomics

The Proposed Action could impact local socioeconomics during all phases of the Project's lifecycle. During socioeconomic-impact analyses, several areas are examined; these include employment, demographics, income, housing, finance, education, and social and health services.

4.11.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields.

4.11.1.1 Ross Project Construction

The Ross Project would employ approximately 200 people during construction (Strata, 2012a). The peak construction workforce of 200 workers is within the range of the construction workforce estimates provided in the GEIS (i.e., also 200 workers) (NRC, 2009b). The GEIS assumed that the majority of the construction personnel positions would be filled by skilled workers from outside the NSDWUMR and that this influx of workers would be expected to result in SMALL to MODERATE socioeconomic impacts, with the greatest impacts for communities with small populations (NRC, 2009b). However, due to the short duration of construction, the GEIS also noted that these workers would have only a limited effect on public services and community infrastructure. Further, construction workers would be less likely to relocate their families to another region, and if the majority of the construction workforce would be filled from within the region of the facility, socioeconomic impacts would be SMALL (NRC, 2009b).

The size of the Ross Project's construction workforce is of similar size to that presented in the GEIS and the Applicant is committed to hiring locally—it projects that 90 percent of the construction workforce would be local hires (Strata, 2012a)—the employment, demographic, income, housing, education, and health and social services impacts during the construction phase of the Ross Project would be SMALL. The employment increases would represent only 1.2 percent of all jobs in the region of socioeconomic influence (ROI) (i.e., Crook and Campbell Counties), and the population increases, and consequent increases in public and private services, would represent only a 0.1 percent increase over those present prior to Project licensing. MODERATE impacts could occur in the finance sector as a result of the additional property-tax revenues generated by the Project (see Table 4.7).

Table 4.7
Estimated Major Tax Revenues

Revenue Source	Tax Revenues	
	Average Per Year	Over 10 Years
Severance Taxes	$855,000	$8,550,000
State Royalties	$243,000	$2,430,000
Gross Production Taxes	$1,337,000	$13,370,000
Property Taxes	$350,000	$3,500,000
TOTAL	$2,785,000	$27,850,000

Source: Strata, 2012a.

The following sections provide impact estimates for each of the specific resource areas within socioeconomics during the construction phase of the Ross Project.

Employment

The 200 construction workers that would be employed at the proposed Ross Project could generate an additional 140 indirect jobs in the ROI for a peak employment impact of 340 workers as a result of the Project's construction phase (NRC, 2009b). With an employment base in the ROI of 30,815 workers (see SEIS Section 3.11.4), impacts on the region's employment would be SMALL, representing approximately 1.2 percent of all jobs in the two Counties.

Demographics

It is estimated that less than 10 percent of the construction workforce would come from outside the immediate Ross Project vicinity, or approximately 20 workers (Strata, 2012a). As workers could potentially travel from anywhere in the U.S., based upon the average household size of 2.58 for the U.S. (USCB, 2012a), this would translate into 52 additional residents in the ROI. It is likely that most new construction workers for the Ross Project would not relocate their families, however for the purposes of this SEIS, it is assumed that they would move their families. This number is less than 0.1 percent of the combined population base of 53,216 persons in Crook and Campbell Counties as of 2010 (see SEIS Section 3.11.1). This would be a SMALL demographic impact.

Income

It is expected that workers would be paid the regional rates typical of Crook and Campbell Counties, where a higher percentage of jobs are in the relatively higher-paying energy industry. Based upon a weighted-average annual earnings per job of $61,400 (see SEIS Section 3.11.2), the 200 workers would generate approximately $12.3 million in annual earnings. With an estimated $2.6 billion in total personal income in both Crook and Campbell Counties, the impacts of the construction of the Ross Project on local income would represent less than 1 percent of total income in the two Counties and would be a SMALL impact.

Housing

According to GEIS Section 4.4.10, the impacts to housing from ISR-facility construction would be expected to be SMALL (and short term), even if the workforce were to be primarily filled from outside the region (NRC, 2009b). It is likely, however, that the majority of workers would use temporary housing such as apartments, hotels, or trailer camps (NRC, 2009b). At the maximum, if the additional 20 new workers to the Ross Project vicinity represent a demand for 20 housing units in the ROI (see above), this additional demand for housing would represent less than 0.1 percent of the total housing stock of 22,550 units in the region (see SEIS Section 3.11.3), and this would be a SMALL impact.

Finance

As noted in GEIS Section 4.4.10, the construction of an ISR facility could have a MODERATE impact on finances within a ROI (NRC, 2009b). Local-government finances would be affected by ISR-facility construction by the additional taxes collected and the purchase of goods and services in support of construction activities. Although Wyoming does not have an income tax, it does have a state sales tax, a lodging tax, and a use tax. Construction workers would contribute to these as they purchase goods and services within the Ross Project ROI, while they work on the construction of the Proposal Action. Based upon a valuation of $50 million for the Ross Project facility and wellfields, as well as the related and real property, multiplied by an 11.5 percent assessment ratio and the Crook County mill levy of 0.062545, local property taxes that would accrue to Crook County would be estimated to be approximately $350,000 per year, reflecting approximately 13 percent of Crook County property-tax collections (Strata, 2012a). These benefits would be offset, however, by the cost of additional public services required by the new residents in the vicinity. This additional demand would be associated with just the estimated 52 additional residents in the ROI, representing less than 0.1 percent of the population in the two Counties; the additional cost for public services also would represent less than a 0.1 percent increase in local-government expenditures. Because the size and scale of the Ross Project is similar to that described in the GEIS, and given the foregoing information, the impacts to local finance would be MODERATE.

Education

As discussed above, it is likely that most new construction workers for the Ross Project would not move their families. However, at a maximum, if all 20 workers were to bring their families, and based upon a school-age population representing 20.4 percent of the population nationwide (USCB, 2012a), the 52 additional residents in the Ross Project vicinity would generate 11 additional elementary and secondary students in the ROI schools. This would represent less than 0.1 percent of the total enrollment in area schools and would represent a SMALL impact on education.

Health and Social Services

Increased demand for health and social services is a function of the additional population in the ROI. As discussed above, the population increase in the ROI due to construction activities would represent less than a 0.1 percent increase in the local population because most workers would already reside within a commuting radius of the Project. Thus, only a 0.1 percent increase in the demand for health and social services would occur, and this increased demand for such services would represent a SMALL impact.

In addition, as noted in the GEIS, accidents resulting from construction of the Proposed Action would not be expected to be different than those from other types of similar industrial facilities (NRC, 2009b). In the case of an industrial accident, the Applicant would commit to maintaining emergency-response personnel on staff and would train local emergency responders in preparing and responding to potential environmental, safety, and health emergencies resulting from Ross Project construction (Strata, 2011a), thereby minimizing any potential decrease in or impact to the availability of local emergency health services.

4.11.1.2 Ross Project Operation

The Ross Project would employ approximately 60 people during its operation (Strata, 2012a). This number is within the range of the operation-workforce estimates provided in the GEIS (50 – 80 workers) (NRC, 2009b). According to the GEIS, if the majority of the operation workforce is filled by personnel from outside the area, potential population and public services impacts would range from SMALL to MODERATE, depending upon the proximity of the ISR facility to population centers (NRC, 2009b). However, because an outside workforce would be more likely to settle in more populated areas, with increased access to housing, schools, services, and other amenities, these impacts could be reduced (NRC, 2009b). If the majority of the workforce during ISR-facility operation is of local origin, the potential impacts to population and public services would be expected to be SMALL (NRC, 2009b).

Because the size of the Ross Project's proposed workforce during the operation of the Ross Project would be within the range evaluated in the GEIS, and because the Applicant would commit to hiring locally—80 percent of the operation workforce would be expected to be local hires (Strata, 2012a)—the employment, demographic, income, housing, education, and health and social services impacts during the Ross Project's operation phase would be SMALL. Employment and population increases, and consequent increases in public and private services, would represent less than 1 percent over pre-licensing, site-characterization levels. MODERATE impacts, however, would be projected for finance as a result of the additional tax revenues that would accrue to Crook County (see Table 4.7).

4.11.1.3 Ross Project Aquifer Restoration

The GEIS assumed that the workforce during aquifer-restoration activities at an ISR facility would be the same as the operation phase (i.e., 50 – 80 workers) and, thus, the impacts would be similar and would be SMALL (NRC, 2009b). The Applicant indicates that at the Ross Project there would be a workforce of 20 – 30 workers during the aquifer-restoration phase , without concurrent operations (Strata, 2012a), a smaller workforce than that projected in the GEIS.

The need for regulatory, management, and health and safety personnel would continue throughout aquifer restoration, but this need would be met by personnel transitioning from operation-phase work to aquifer restoration, and no new personnel would necessarily be required (Strata, 2012a). Thus, the impacts of the Proposed Action's aquifer-restoration phase would likely be at most the same, or, would more likely be less than those noted for the Ross Project's operation phase. Because the aquifer-restoration workforce at the Project would be less than that estimated in the GEIS, and with an employment base in Crook and Campbell Counties of 3 workers (see Section 3.2.10.4), the socioeconomic impacts of the Ross Project on area employment would be SMALL, representing less than 1 percent of all jobs in the two Counties. Severance tax revenues accruing to local jurisdictions would decrease as uranium production ceases during this phase of the Ross Project.

4.11.1.4 Ross Project Decommissioning

In GEIS Section 4.4.10, the workforce examined for an ISR facility's decommissioning was estimated to be similar to that of the construction phase (i.e., up to 200 persons) and, thus, the impacts would be similar and would be SMALL to MODERATE, with MODERATE impacts for areas with small populations (NRC, 2009b). The Applicant indicates, however, that about only 90 workers would be required during decommissioning of the Ross Project (Strata, 2011a). Only 12 of these workers would be non-local hires (Strata, 2012a). These personnel generally represent the regulatory, management, and health and safety personnel that would have been present at the Ross Project during the earlier Project phases. Because the size of the workforce for the Ross Project's decommissioning phase is less than that estimated in the GEIS, and only 12 workers would be expected to be non-local hires, the overall socioeconomic impacts of the Proposed Action's decommissioning phase would be SMALL. Tax revenues accruing to local jurisdictions would decrease to zero as uranium production is concluded during decommissioning of the Ross Project.

4.11.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. There would be no new jobs created; no changes in income levels in the ROI; no changes in population; no increased demand for education, health, or social services; and no changes in local finances. Other forms of energy development in the ROI would continue to impact regional socioeconomic resources. The economic benefits and socioeconomic impacts described for the Proposed Action would not accrue to Crook and Campbell Counties, nor to Wyoming. Thus, the socioeconomic impacts of the No-Action Alternative would be SMALL.

4.11.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The construction of the CPP and surface impoundments at the north site would not change workforce levels, and therefore the impacts would be the same as those described under the Proposed Action. Because changes in employment are the principal driver of socioeconomic impacts, the socioeconomic impacts of Alternative 3 would be the same as for the Proposed Action, SMALL to MODERATE during Alternative 3's construction and operation, and SMALL during aquifer restoration and its decommissioning.

What is the terminology used during an environmental-justice analysis ?

■ ***Low-Income Populations***

These populations are identified by annual statistical poverty thresholds from the U.S. Census Bureau (USCB). In identifying low-income populations, agencies may consider a community as either a group of individuals living in geographic proximity to one another *or* a set of individuals (such a migrant workers or Native Americans), where either type of group experiences common conditions of environmental exposures or impacts.

■ ***Minority Individuals***

Minority individuals are those who identify themselves as members of the following population groups: Hispanic or Latino, American Indian or Alaska Native, Asian, Black or African American, Native Hawaiian, or Other Pacific Islander *or* are two or more races, meaning individuals who identified themselves on a Census form as being a member of two or more races, for example, Hispanic and Asian.

■ ***Minority Populations***

Minority populations must be identified when the minority population of an affected area exceeds 50 percent *or* the minority-population percentage of the affected area is meaningfully greater than the minority-population percentage in the general population or other appropriate unit of geographic analysis.

■ ***Disproportionately High and Adverse Human Health Effects***

Adverse health effects are measured in risks and rates that could result in latent cancer fatalities as well as other fatal or nonfatal adverse impacts on human health. Adverse health effects may include bodily impairment, infirmity, illness, or death. Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant (as determined during NEPA analysis) and appreciably exceeds the risk or exposure rate for the general population or for another appropriate comparison group.

■ ***Disproportionately High and Adverse Environmental Effects***

A disproportionately high environmental impact that is significant (as defined by NEPA) refers to an impact or risk of an impact on the natural or physical environment in a low-income or minority community that appreciably exceeds the environmental impact on the larger community. Such effects may include ecological, cultural, human health, economic, or social impacts. An adverse environmental impact is an impact that is determined to be both harmful and significant (as employed by NEPA). In the assessment of cultural and aesthetic environmental impacts, impacts that uniquely affect geographically dislocated or dispersed minority or low-income populations or American Indian tribes are considered.

4.12 Environmental Justice

On February 11, 1994, President Clinton signed Executive Order (EO) 12898, entitled *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, which directs each Federal agency to "… make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low income populations" (EOP, 1994).

On December 10, 1997, the Council on Environmental Quality (CEQ) issued its *Environmental Justice Guidance Under the National Environmental Policy Act*. The CEQ developed this guidance to "… further assist Federal agencies with their [NEPA] procedures." As an independent agency, the CEQ's guidance is not binding on the NRC. However, the NRC considered the CEQ's guidance on environmental justice in developing its own environmental-justice analytical methodology (NRC, 2003a). The CEQ provided the definitions listed in the text box above in its Guidance for consistent use during environmental-justice analyses (CEQ, 1997).

The NRC has required an environmental-justice analysis be included in its EISs (NRC, 2004b; NRC, 2003a, Appendix C). NRC environmental-justice guidance discusses the procedures to evaluate potential disproportionately high and adverse impacts associated with physical, environmental, socioeconomic, health, and cultural resources to minority and low-income populations (NRC, 2004b).

4.12.1 Minority and Low-Income Population Analysis for the Ross Project

Demographic and socioeconomic data for the Ross Project area and surrounding communities was assembled to identify minority or low-income populations within a 6-km [4-mi] radius of the area and is shown in Tables 4.8 and 4.9.

Table 4.8
Ross Project Area Poverty and Income Characteristics

Area of Comparison[a]	Percent Living Below Poverty[b]	Median Household Income[c]
Wyoming	9.8	$53,802
Crook County	7.8	$49,890
Census Tract 9502	7.2	$52,106
Census Tract 9503	9.0	$46,848

Source: USCB, 2012b.

Notes:

a = Income data is not available at the Census-Block-Group level for 2010.
b = Source: USCB, 2012b (S1701).
c = Source: USCB, 2012b (B19013)

Table 4.9 compares race and ethnicity characteristics by census block group to Crook County and Wyoming. The percentage of the population in Wyoming and Crook County that is nonwhite is 9.3 percent and 2.9 percent, respectively (100 percent minus percent white alone equals percent nonwhite). The percentage of nonwhite population that lives in the block groups within a 6-km [4-mi] radius of the Ross Project area ranges from 0.4 – 2.9 percent. In addition, the percentage of the population in Wyoming and Crook County who are Hispanic or Latino is

Table 4.9
Ross Project Area Race and Ethnicity Characteristics

Area of Comparison	Total	White Alone	% White Alone	Black or African American Alone	% Black or African American	American Indian and Alaska Native Alone	% American Indian and Alaska Native Alone	Asian Alone	% Asian Alone	Hispanic or Latino	% Hispanic or Latino
Wyoming	563,626	511,279	90.7	4,748	0.8	13,336	2.4	4,426	8.2	50,231	8.9
Crook County	7,083	6,884	97.1	14	0.2	48	0.7	11	0.2	141	2.0
Block Group 1 Census Tract 9502	1,211	1,176	97.1	0	0	7	0.6	1	0.1	20	1.6
Block Group 2 Census Tract 9502	1,880	1,843	98	2	0.1	11	0.6	2	0.1	22	1.2
Block Group 3 Census Tract 9502	1,390	1,333	95.9	6	0.4	9	0.6	2	0.1	65	4.7
Block Group 1 Census Tract 9503	1,280	1,171	96.9	4	0.3	8	0.7	5	0.4	16	1.3
Block Group 2 Census Tract 9503	1,394	1,361	97.6	2	0.1	13	0.9	1	0.1	18	1.3

Source: USCB, 2012b (P1 and QT-P4).

8.9 percent and 2.0 percent, respectively. The percentage of Hispanic or Latino populations that lives in the block groups within a 6-km [4-mi] radius of the Ross Project area ranges from 1.3 – 4.7 percent. When these numbers are compared to the State and Crook County proportions, they do not exceed the 20-percent level that is commonly considered of environmental-justice significance.

Table 4.8 compares poverty and income characteristics by census tract to Crook County and Wyoming. The percentage of the population living below poverty for Wyoming and Crook County as well as Census Tracts 9502 and 9503 are 9.8 percent, 7.8 percent, 7.2 percent, and 9.0 percent, respectively. When these numbers are compared to the State and Crook County proportions, they also do not exceed the 20-percent level that is considered of environmental-justice significance.

Because no minority or low-income populations, as defined by EO 12898, have been identified in the Ross Project area, no further environmental-justice analysis (Steps 3 – 5) was conducted.

4.12.2 Alternative 1: Proposed Action

Under the Proposed Action, there are no minority or low-income populations identified that are greater than 20 percent within a 6-km [4-mi] radius of the Proposed Action. Therefore, there are no disproportionately high and adverse impacts to minority and low-income populations under the Proposed Action.

4.12.3 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. The conditions affecting minority and low-income populations in the vicinity of the Ross Project area would remain unchanged. Therefore, there would be no disproportionately high and adverse impacts to minority and low-income populations under the No-Action Alternative.

4.12.4 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. As there are no minority or low-income populations identified that are greater than 20 percent within a 6-km [4-mi] radius of the Ross Project area under this Alternative, there are no disproportionately high and adverse impacts to minority and low-income populations.

4.13 Public and Occupational Health and Safety

All phases of the proposed Ross Project could result in potential radiological and nonradiological impacts to public and occupational health and safety. Public nonradiological impacts are unlikely, except under accident conditions. Radiological impacts to the public could occur during both routine Ross Project activities as well as during accidents. Impacts to occupational health and safety could result from both routine exposures to hazardous chemicals and direct radiation (i.e., gamma) emitted from radionuclides present during Ross Project activities as well as from exposures by way of ingestion or inhalation of radioactive gases or fugitive dust or following an accident. The respective standards related to radiological exposures are found in 10 CFR Part 20, where the public dose standard is 1 mSv/yr [100 mrem/yr] and the 40 CFR Part 190 annual standard is 0.25 mSv [25 mrem]. The corresponding occupational dose limit is 50 mSv [5 rem] for total effective dose equivalent (TEDE) exposure.

4.13.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. During all phases, both radiological and nonradiological impacts could occur.

4.13.1.1 Ross Project Construction

Radiological

Proposed construction activities at the Ross Project are very similar to those described in GEIS Sections 4.4.1 and 4.4.11, where the greatest risk to a worker is the inhalation of gaseous radionuclides (e.g., Rn-222) during well drilling and wellfield installation as well as inhalation of fugitive dust containing uranium or its progeny (e.g., Ra-226) during construction activities. The GEIS indicated that an internal exposure to radiation via ingestion would be unlikely without substantial intake of soil containing radionuclides. Also, radiological impacts to both the public and site workers from inhalation of fugitive dust during construction of an ISR facility would be SMALL because the radionuclide concentrations would be low (NRC, 2009b). The GEIS concluded that the radiological impacts to both the general public as well as construction workers during ISR facility construction would be SMALL.

As described in SEIS Section 2.1.1 and consistent with the GEIS, construction activities associated with the Ross Project would include preparation of the site and the construction of buildings, surface impoundments, access roads, wellfields, and other structures and systems. The important radiation-exposure pathway during the construction phase would be through direct exposure to radiation, inhalation of gaseous radionuclides during well construction, or ingestion of radioactive materials during construction activities that disturb surface soil and/or fugitive dust from vehicular traffic during construction. For direct (i.e., gamma or γ) radiation, the public's potential exposure would be equivalent to approximately 5.3 – 25.3 microRoentgens (μR) per hour (μR/hr), which is much lower than the radiation exposure from naturally occurring radionuclides that

How is radiation measured?

When someone is exposed to direct (gamma or γ) radiation, "radiation exposure" results. Such radiation exposure is measured in Roentgens (R) or microRoentgens (μR) per a unit of time.

"Radiation dose," where dose considers, unlike radiation exposure, the human body's consequences of the radiation (i.e., these units are used in radiation-protection efforts to measure the amount of damage to human tissue from a dose of ionizing radiation). Radiation dose is measured in units of either Sievert or rem and is often referred to in either milliSv/mSv or millirem/mrem where 1,000 mSv = 1 Sv and 1,000 mrem = 1 rem. The conversion for Sieverts to rem is 1 Sv=100 rem.

Total effective dose equivalent, or TEDE, refers to the sum of the deep-dose equivalent (for "external" to the human body exposures that penetrate the body) and the committed effective dose equivalent (CEDE) (for radiation exposures that are internal to a human body, such as when radionuclides are inhaled or ingested).

the public receives each day. The concentrations of the naturally occurring radionuclides (e.g., Ra-226, Rn-222, and uranium radioisotopes) are low; for example, the total concentration of uranium in the native surface soils at the Ross Project area is only 0 – 2.80 mg/kg [2.80 ppm] (on the order of x Bq/g [1 – 2 pCi/g]). Thus, the sparse population near the Ross Project area and its vicinity (see SEIS Section 3.2), the lack of public access to the Ross Project area, the low concentrations of radionuclides in the Project's soils, and the atmospheric dispersion of radionuclides in fugitive dust (see SEIS Section 4.7.1) would be sufficient to minimize impacts from any such routine exposures to the public.

The low concentrations of radionuclides in the Project soils and the relatively rapid atmospheric dispersion of radionuclides in gases and in fugitive dust would minimize routine radiation-exposure impacts to workers as well. During the Applicant's proposed use of mud-rotary drilling techniques during wellfield installation, some drilling fluids and muds (i.e., cuttings), originating from the ore zone into which the wells would be drilled, would be brought to the surface. This type of well-drilling technique involves the use of a drilling fluid that is introduced through the drill's stem, out the drill bit (i.e., end), and then back up to the surface through the drillhole and the drill stem. These fluids and muds would be collected in pre-excavated pits near the well being installed (see Section 2.1.1.5). After drying out, the pits would be covered with native topsoil and then revegetated (Strata, 2011a). But because these fluids have been passed through the uranium-ore-bearing zone, they have the potential to contain higher concentrations of naturally occurring radionuclides than do surficial soils. As the discussion of the existing radiological pre-licensing, site-characterization conditions in SEIS Section 3.12.1 establishes, however, the relative concentration of radionuclides would still be very low. Thus, the radiological impacts to the occupational health and safety of workers, including the well-drillers, would also be SMALL during the construction phase of the Ross Project.

Nonradiological

Construction equipment would likely be diesel powered and would emit diesel exhaust, which includes small particulates (<PM_{10}), during Project construction activities. The impacts and potential human exposures from these emissions would be small because the releases are usually short in duration, and the gases and particulates are readily dispersed into the atmosphere. SEIS Section 4.7.1 describes in greater detail the impacts to air quality from potential diesel emissions, including comparisons with health-based standards. Therefore, the impacts as a result of these emissions would be SMALL, consistent with the GEIS conclusions in Section 4.4.11.1 (NRC, 2009b).

Thus, the potential impacts to public and occupational health and safety during construction of the Proposed Action are SMALL.

4.13.1.2 Ross Project Operation

Radiological

Normal Conditions

As discussed in GEIS Section 4.4.11.2.1, some amount of byproduct material would be released to the environment during normal ISR operations. The potential impact from these releases has been evaluated by the MILDOS-AREA computer code (MILDOS), which Argonne

National Laboratory developed for calculating offsite radiation doses to individuals and populations. MILDOS uses a multi-pathway analysis for determining external dose (from gamma radiation); inhalation dose; and ingestion dose when potentially contaminated soil, plants, meat, milk, aquatic foods, and water are consumed. The primary radionuclide of interest at an ISR facility is Rn-222. MILDOS uses a model that typically assumes no dilution and, thus, provides conservative estimates of downwind air concentrations and doses to human receptors (persons who have a “radiation exposure” in Roentgens [R] or microRoentgens which will produce a “radiation dose”).

GEIS Section 4.4.11.2.1 presented historical data for ISR operations, providing a range of estimated offsite doses associated with six current or former ISR facilities. For these operations, doses to potential offsite exposure (to the public or “human receptors”) locations range between 0.004 mSv [0.4 mrem] per year at the Crow Butte Project’s facility (in Nebraska) discussed earlier in SEIS Section 4.4.1.2 and 0.32 mSv [32 mrem] per year for the Irigaray Project’s facility (in Wyoming). In each case, the estimated dose was well below the 10 CFR Part 20 annual public radiation-dose limit of 1 mSv/yr [100 mrem/yr] (NRC, 2009b).

With respect to estimated maximum doses to members of the public, GEIS Section 4.4.11.1.2 noted that radon gas is emitted from ISR wellfields and processing facilities during operations and is the only radiological airborne effluent during normal operation at facilities using vacuum-dryer technology (NRC, 2009b); the Applicant has proposed to dry yellowcake using a rotary-vacuum dryer (Strata, 2011a). During normal operation, emissions other than Rn-222 are not expected with a uranium-recovery facility.

The Applicant evaluated the potential consequences of radiological emissions at the Proposed Action (Strata, 2011a). Sources of Rn-222 emanation that the Applicant identified and modeled consisted of point sources (i.e., those operations that have their exhaust confined in a stack, duct, or pipe prior to atmospheric release, such as process-tank vents described in SEIS Section 4.7.1.2) and area sources (i.e., wellfields). The Applicant described its implementation of the computer code MILDOS that was used to model radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific data that included radon-release estimates, meteorological and population data, and other parameters. The estimated radiological impacts from routine Project activities during operation were compared to applicable public radiation-dose limits in 10 CFR Part 20 (i.e., 1 mSv/yr [100 mrem/yr]) as well as to the pre-licensing, site-characterization radiological conditions it meansured.

The NRC review of the Applicant’s radiological-impacts modeling independently verified that appropriate exposure pathways were modeled and reasonable input parameters were used. The Applicant also listed the origin of the input parameters and provided justification for their use. The Applicant described the source terms (i.e., a “source term” is the total amount of radioactivity and radionuclides available to be released). The NRC staff concluded that the source terms used by the Applicant represented uranium-recovery operation at full CPP capacity and that the estimated releases during wellfield operation from the CPP and from the UIC deep-disposal wells were appropriate.

The Applicant calculated the TEDE across a projected area set on a grid system, centered about the CPP and extending beyond the Project boundaries, for a total of 287 locations, 14 members of the public including children that could be living at the four nearest residences and the Oshoto Field Office, 5 ranchers, 2 oil-field workers, and 2 vendors or couriers working both within and outside of the Project area. Results of the Applicant's modeling indicated that the maximum TEDE of 0.016 mSv/yr [1.6 mrem/yr] was located near the Ross Project's eastern boundary in the vicinity of the CPP area. The Applicant's calculations also demonstrated that inhalation accounted for 98 percent of the TEDE at this location (i.e., not exposure to direct radiation nor ingestion of radionuclides) (Strata, 2011a). Thus, the 10 CFR Part 20 public radiation-dose limit would likely not be exceeded at any Ross Project boundary. The annual dose to the population within 80 km [50 mi] of the Ross Project was estimated at 10,500 person-rem; this estimation is based upon a naturally occurring and man-made radiation dose of 2.57 mSv/yr [257 mrem/yr] for Wyoming. For comparison, the TEDE from the Ross Project to the that population based upon the Applicant's modeling is estimated to be 0.361 person-rem. This TEDE represents 1.6 percent of 10 CFR Part 20's radiation-dose limit of 1 mSv/yr [100 mrem/yr] for a member of the public.

Because Rn-222 is the only radionuclide emitted during normal operations, the public radiation-dose requirements in 40 CFR Part 190 and the 0.1 mSv/yr [10 mrem/yr] constraint rule in 10 CFR Part 20.1101 do not apply. The Applicant calculated that radon emissions from the wellfields accounted for 75 percent of the total radiological emissions. In its calculations, the Applicant assumed that 100 percent of the radon was contained within the ground water or process solutions that would be released to the atmosphere. The estimated radon release from the facility is listed in Table 7.3-4 of Strata's ER (Strata, 2011a). As shown, the radiation dose to the public is below the 10 CFR Part 20 public radiation-dose limit; thus, radiation-dose impacts to the public from normal operations would be SMALL.

GEIS Section 4.4.11.2.1 also provided a summary of radiation doses to occupationally exposed workers at ISR facilities. As stated in the GEIS, the radiation doses at an ISR facility are not dependent upon a facility's location and are well within the 10 CFR Part 20 annual occupational radiation-dose standard of 0.05 Sv/yr [5 rem/yr]. The largest average annual dose to a worker at a uranium-recovery facility over a 10-year period [1994 – 2006] was 0.007 Sv/yr [0.7 rem/yr]. More recently, the maximum TEDEs reported for 2005 and 2006 were 0.00675 and 0.00713 Sv [0.675 and 0.713 rem]. Similarly, the average and maximum worker exposures to radon (i.e., radon-222 or Rn-222) and radon-progeny ranged from 2.5 – 16 percent of the occupational exposure limit of 4 working-level months (a "working level" is a unit of radon exposure). The NRC concluded in the GEIS that the radiological impacts to workers during normal operations at ISR facilities would be SMALL (NRC, 2009b).

In addition, the Applicant is required to implement an NRC-approved radiation protection program (RPP) to protect occupational workers and ensure that radiological doses are as low as reasonably achievable (ALARA). The Applicant's proposed RPP included commitments for implementing management controls, engineering controls, radiation-safety training, radon sampling and monitoring, and audit programs (Strata, 2011a). Potential radiation doses to occupationally exposed workers and members of the public during normal operations would be SMALL.

Occupational doses at the proposed Ross Project (i.e., radiation doses to workers or "occupational receptors"), given that the Ross Project's design and its operations would be consistent with those analyzed in the GEIS, would be the same or less than those evaluated in the GEIS. Occupational radiological impacts would be SMALL. To mitigate radiological exposures to Project workers, the Applicant would: 1) install ventilation systems designed to limit worker exposures to radon; 2) install gamma-exposure-rate monitors, air-particulate monitors, and radon-progeny monitors, all to verify that estimated radiation levels are met; and 3) conduct work-area radiation surveys to prevent and to limit the spread of radioactive contamination (Strata, 2011a). The Applicant's airborne radiation-monitoring program is further described in SEIS Section 6.2.1.

Accident Conditions

The GEIS identified, described, and assessed the consequences of bounding abnormal and accident conditions that could occur at an ISR facility. The GEIS's information was based upon previous radiological-hazard assessments that considered the various stages of an ISR facility (Mackin et al., 2001). The calculated radiation doses from the releases of byproduct or source material to the environment are small fractions of the limits set forth at 10 CFR Part 20—limits that have been established by the NRC for the protection of public health and safety. The GEIS considered three separate accidents, which represent events resulting in higher-than-usual levels of radioactivity being released (i.e., above those levels discussed above): a thickener failure and spill; pregnant lixiviant and uranium-loaded resin spills (i.e., radon release), and a yellowcake-dryer accident release. The GEIS concluded that potential impacts to workers could be MODERATE based upon the estimated consequences of an unmitigated dryer release, but doses to the general public would be SMALL.

An overview of the three accident scenarios, as evaluated in the GEIS with site-specific information about the Ross Project, is presented in the following sections.

Thickener Failure and Spill

Thickeners are used to concentrate yellowcake slurry before it is transferred to a dryer or packaged for offsite shipment. Radionuclides (or, radioactive materials) could be inadvertently released to the atmosphere during a thickener failure or spill. This accident scenario, as evaluated in the GEIS, assumed a tank or pipe leak, releasing 20 percent of the thickener both inside and outside of a central-processing facility. The analyses described in the GEIS included a variety of wind speeds, stability classes, release durations, and human-receptor distances. A minimum receptor distance of 500 m [approximately 1,600 ft] was selected as a variable in the scenario because it was found to be the shortest distance between a processing facility and an urban development at currently operating uranium-recovery facilities. The model indicated that offsite, unrestricted (i.e., unmitigated) doses from such a spill could result in a dose of 0.25 mSv [25 mrem], or 25 percent of the annual public radiation-dose limit of 1 mSv [100 mrem] per year. External doses were negligible based upon sufficient distance between facility and receptor (NRC, 2009b). The nearest two residences to the Ross Project's CPP are located at a distance of 860 m [2,500 ft] and 1,700 m [5,600 ft], each of which are farther than the shortest distance analyzed in the GEIS. Therefore, the potential public dose from a thickener spill at the Ross Project would be less than the radiation dose estimated in the GEIS, and could be even less given the secondary-containment structures (e.g., concrete berms) included in the Applicant's facility design.

As discussed in the GEIS, doses to unprotected, occupational receptors inside the CPP have the potential to exceed the annual dose limit of 0.05 Sv [5 rem] if timely corrective measures are not taken to control and remediate the spill. Typical personnel-protection measures, such as air monitoring, respiratory protection, and material control, which would be a part of the Applicant's RPP, would reduce worker exposures and resulting doses to a small fraction of those evaluated

(NRC, 2009b). The Applicant has proposed a RPP and spill-response protocols that include commitments similar to those described in the GEIS, such as requiring the use of personal protective equipment (PPE) (Strata, 2011a). Therefore, the potential dose to workers at the Ross Project from a thickener spill is expected to be consistent with the dose estimate provided in the GEIS but this dose would be reduced significantly, as described in the GEIS, by the Applicant's implementation of radiation protection and spill-response programs.

Pregnant Lixiviant and Uranium-Loaded Resin Releases

Process equipment (e.g., IX columns) at the Ross Project would be located on curbed concrete pads to prevent any fluids from spills or leaks from exiting the CPP and contaminating the outside environment. In the event of a process-tank failure, released fluids would be captured in concrete berms in the CPP, which would be designed to contain a volume of 110 percent of the largest tank in that building (Strata, 2011b). Personnel would follow precise spill-response protocols, which are discussed in the Applicant's ER, including the requirement for the use of PPE (Strata, 2011a). Collected fluids would the be pumped from a sump in the bermed area to other process vessels, a lined surface impoundment, or a deep-disposal well. The contaminated area would then be washed down, and the wash water disposed of by deep-well injection as well. Therefore, except for wellfield leaks or spills, the NRC staff does not consider the accidental release of liquids in the facility portion of the Ross Project as a pathway to radiation exposure to be realistic. The primary source of radiation exposure for liquid releases within the Ross Project facility would be the resulting airborne radon gas released from a liquid or resin-tank spill.

In the case of a wellfield leak at the Ross Project, pregnant lixiviant could be released from the pipes containing the fluid onto the soil below. The Applicant would be able to identify such a leak by monitoring the pipelines to detect changes in pressure or flow. If a significant change in pressure or flow is detected, an alarm would sound at the CPP, which would prompt the Applicant's personnel to investigate the cause and identify any leaks. If the pressure or flow change is outside of acceptable operating parameters, the pumping system would automatically shut-down. Additionally, wellfield operators would visually inspect all pipelines and equipment within the module buildings, wellheads, and valve vaults at least weekly (Strata, 2011a). Potentially contaminated soil would be sampled and contaminated soil would be removed and disposed of in accordance with NRC and State requirements. In the event of a spill that meets NRC criteria for reporting, the Applicant would notify the NRC within 24 hours and submit a report within 30 days that describes the conditions leading to the spill, the corrective actions taken, and the results achieved.

The GEIS did model a radon-release accident scenario in which a pipe or valve of the IX system, containing pregnant lixiviant, were to develop a leak, almost instantaneously all of the the radon at a high-radioactivity level (2.96 x 10^7 Bq/m^3 [8 x 10^5 pCi/L]) were to be released. The radiation dose to a worker located inside a processing facility who is performing light activities without respiratory protection, was estimated to be 10 mSv [1,300 mrem] as a result of a 30-minute exposure. This dose is below the 10 CFR Part 20 occupational-dose limits of 0.05 Sv [5 rem] (NRC, 2009b). The Ross Project would include a pipeline system for pregnant lixiviant consistent with the system evaluated in the GEIS and, thus, the potential radiation dose estimated in the GEIS is consistent with the dose expected during this type of accident scenario at the Ross Project. Ventilation systems and alarms at the Ross Project that would alert workers to immediately evacuate the CPP, which would further reduce the potential exposure to radiation and the resulting dose to workers. Atmospheric transport of radionuclides offsite would further reduce airborne levels of radioactivity by several orders of magnitude and would reduce the respective radiation dose to a member of the public to less than the 1-mSv [100-mrem] public radiation-dose limit of 10 CFR Part 20.

Yellowcake Dryer Accident Release

In GEIS Section 4.4.11.2.2, the consequences of an explosion involving a yellowcake dryer with multiple hearths at an ISR facility were evaluated. The analysis assumed that approximately 4,300 kg [9,500 lb] of yellowcake uranium would be released within the facility housing the dryer and that, due to the mass and physical characteristics of yellowcake, most of it would rapidly fall out of airborne suspension. Therefore, only 1 kg [2.2 lb] of the yellowcake was assumed to be subsequently released as an air effluent to the outside atmosphere as a 100-percent respirable powder. The GEIS's calculated maximum dose to workers in this scenario was 0.088 Sv [8.8 rem], which exceeds the annual occupational radiation-dose limit of 0.05 Sv [5 rem] established in 10 CFR Part 20. The atmospheric dispersion of the fraction of yellowcake that was assumed to be released as an air effluent would significantly reduce the exposure to members of the public to approximately 6.5×10^{-4} Sv [65 mrem], which is less than the 10 CFR Part 20 public radiation-dose limit of 1 mSv [100 mrem] (NRC, 1980).

The Applicant proposes to use a vacuum dryer for both yellowcake and vanadium, which is the current industry standard for ISR facilities. In a vacuum dryer, the heater's combustion source is separated from the dryer itself. This configuration eliminates the possibility of an explosion for the most part, which was assumed to be the initiating event for the accident scenario considered in the GEIS and discussed above. Therefore, the vacuum-dryer accidental release that could occur at the Ross Project would be expected to have less significant consequences than the multiple-hearth yellowcake-dryer accidental-release scenario considered in the GEIS.

The Applicant analyzed the potential for a release of yellowcake due to a seal rupture in a vacuum dryer into the dryer room in the CPP. SOPs proposed by the Applicant, such as its conducting regular inspections of the seals, monitoring for pressure changes, and other indicators of seal problems during dryer operations, would reduce the likelihood of an unnoticed seal rupture. However, in the event of a yellowcake release due to a seal rupture, radiation doses to CPP personnel would be minimized because each worker would be required to wear respiratory protection when the dryer is in operation and would immediately evacuate the area. Public exposure would be significantly reduced, as described in the GEIS, due to atmospheric dispersion of any fraction of the yellowcake that is released from the dryer.

Accident-Analysis Conclusions

The NRC staff reviewed and evaluated site-specific and Project-specific information related to potential accidents at the Ross Project and determined that the types of accidents analyzed in the GEIS and their potential consequences bound those that could occur for the proposed Ross Project. There would be no significant radiological impacts as a result of the potential accidents to the public or to occupationally exposed workers beyond those described in the GEIS. Based upon this finding, the potential doses could result as a MODERATE impact to occupational health and safety, in the case of an unmitigated accident, and a SMALL impact to public health and safety. Occupational health and safety impacts from accidents would be reduced by the Applicant's implementing protective SOPs such as routine monitoring, spill response, spill-cleanup, and respiratory protection. Thus, the overall radiological impacts to public and to occupational health and safety from accidents during the operation phase of the Ross Project would be SMALL.

Nonradiological

Normal Conditions

GEIS Section 4.4.11.2.4 identified the various chemicals, hazardous and nonhazardous, that are typically used at ISR facilities. The GEIS also identified the typical quantities of these chemicals that are used. The following hazardous chemicals would be used in the largest quantities at the CPP during the Ross Project's operation phase:

- Anhydrous ammonia
- Sodium hydroxide
- Sulfuric acid and/or hydrochloric acid
- Oxygen
- Hydrogen peroxide
- Carbon dioxide
- Sodium carbonate
- Sodium chloride
- Ammonium sulfate

Each of these chemicals would be purchased in bulk, would be transported to the Project area by motorized vehicles, and would be stored within the controlled area of the Ross Project (i.e., in the fenced facility itself). Typical onsite quantities for some of these chemicals exceed the regulated, minimum-reporting quantities and trigger an increased level of regulatory oversight regarding possession (type and quantities), storage, use, and disposal practices. The use of hazardous chemicals at ISR facilities is controlled by several regulations that are designed to provide adequate protection to workers and the public. The primary regulations applicable to use and storage include the following:

- **40 CFR Part 68:** ***Chemical Accident Prevention Provisions***. This regulation lists regulated toxic substances and threshold quantities for accidental-release prevention.
- **29 CFR Part 1910.119:** ***Occupational Safety and Health Administration Standards/Process Safety Management of Highly Hazardous Chemicals***. This regulation lists highly hazardous chemicals as well as toxic and reactive substances (i.e., chemicals that can potentially cause a catastrophic event at or above the threshold quantity).
- **29 CFR Part 1910.120:** ***Hazardous Waste Operations and Emergency Response***. This regulation instructs employers to develop and implement a written health and safety program for their employees involved in hazardous-waste operations. The program should

be designed to identify, evaluate, and control health and safety hazards and provide for emergency response during hazardous-waste operations.

- **40 CFR Part 355:** ***Emergency Planning and Notification***. This regulation lists extremely hazardous substances and their threshold planning quantities so that emergency response plans can be developed and implemented. There are approximately 360 extremely hazardous substances listed. Over a third of these are defined by the *Comprehensive Environmental Response, Compensation, and Liability Act* (CERCLA), the "Superfund" law. The regulations associated with this statute also list so-called "reportable quantity" values for these substances.
- **40 CFR Part 302.4:** ***Designation, Reportable Quantities, and Notification/Designation of Hazardous Substances***. This regulation identifies the reportable quantities for the CERCLA hazardous substances on the promulgated list. There are approximately 800 of these substances, and they are compiled from the 1) CWA, Sections 311 and 307(a); 2) CAA, Section 112; 3) *Resource Conservation and Recovery Act* [RCRA], Section 3001; and 4) *Toxic Substance Control Act*, Section 7.

The Applicant's compliance with applicable regulations would reduce the likelihood of continuing or significant releases, which may result in injury or illness to an exposed worker. The risk of offsite impacts to the public due to a chemical spill is not significant because chemicals would be stored and used in or near the facility and wellfields. Therefore, impacts to the public would be SMALL.

To promote occupational health and safety, the Applicant would issue a formal Safety Policy Statement to define its overall health- and safety-protection policy and the requirements that must be met by all employees and contractors at all times while at the Ross Project (Strata, 2012a). In addition, the Applicant proposes the development of several plans, SOPs, and other management tools to further decrease and mitigate occupational health and safety impacts (Strata, 2011a). All workers and contractors would receive required health and safety training. This training would include indoctrination to plans such as the Project's health and safety plan (HASP) as well as all pertinent SOPs and BMPs. The Ross Project would operate under a comprehensive Ross Project HASP, which would include specific industrial-hygiene SOPs and other HASPs. These SOPs would govern a worker's entering a confined space, trenching and excavation of utility and pipeline corridors, referring to appropriate Material Safety Data Sheets (MSDSs), decanting a hazardous chemical, and donning appropriate levels of PPE. Other HASPs would include a respiratory protection plan, a hearing conservation plan, and a health and safety training plan. These latter plans would be developed and instituted by the Applicant only when it is not practical to use process or other engineering controls (Strata, 2012a). The Applicant's HASP would also include specific training requirements as well as hazard identification and mitigation policies and SOPs. The HASP would define the protocols, methods, and procedures the Applicant would use to ensure compliance with the OSHA requirements found at 29 CFR Part 1910.

The types and quantities of chemicals (both hazardous and nonhazardous) identified for use at the proposed Ross Project are consistent with those evaluated in the GEIS. In addition, the Applicant proposed to implement the occupational health and safety protection plans evaluated for typical ISR facilities in the GEIS and to comply with the requirements of regulations governing the use and storage of chemicals. Therefore, the NRC staff has concluded that the nonradiological impacts to public and occupational health and safety during normal operations of the Proposed Action would be SMALL.

Accident Conditions

Potential nonradiological accidents are consistent with the typical accidents at other industrial facilities, including high consequence chemical release events. In GEIS Section 4.4.11.2.2, the likelihood of such a release is determined to be low based upon historical operating experience at ISR facilities, primarily due to operators' following commonly applied chemical safety and handling SOPs. Past history at current and former ISR facilities demonstrates that these facilities can be designed and operated with measures that adequately reduce the risks to worker and public health and safety. The GEIS concluded that the nonradiological impacts due to accidents at an ISR facility would be SMALL offsite and potentially MODERATE for workers involved in accident response and cleanup if no mitigation measures are observed.

If a large quantity of one or more of the chemicals that would be present in significant quantities at the Ross Project were to be released during the Ross Project's operations, the nonradiological impacts to public health and safety would depend on the proximity of potentially exposed populations. Potential receptors are sparse in the area around the Ross Project (the nearest residents to the Ross Project are identified in Figure 3.1 in SEIS Section 3.2). In addition, the Ross Project area is large and affords a great distance that would allow released hazardous chemicals to be either deposited or dispersed before reaching the Project boundaries, thereby diminishing individual impacts. Workers involved in a response and cleanup of an accident could experience MODERATE impacts, but training requirements and the establishment of and adherence to applicable procedures would reduce the impacts to SMALL. Thus, consistent with the GEIS, impacts to public and occupational health and safety due to an onsite accident during Ross Project operations would be SMALL.

4.13.1.3 Ross Project Aquifer Restoration

GEIS Section 4.4.11 indicated that the activities that would take place during aquifer restoration are similar to ISR facility operation (i.e., wellfield operation, uranium extraction, waste-water treatment, and waste disposal), except that each would begin to diminish as less and less uranium is recovered from the ore-zone aquifer. The gradual cessation of many of these processes as the Ross Project, such as uranium-loaded IX-resin elution, yellowcake drying and packaging, and vanadium recovery and packaging, further limits the relative magnitude of potential public and occupational health and safety hazards. There would be fewer opportunities for accidents with the decreasing number of operations and the decreasing workforce as well as fewer chemicals used onsite and smaller volumes of chemicals stored onsite. The same mitigation measures and management controls, such as an RPP and the Project's HASP, as discussed earlier for the Ross Project's construction and operation, would be observed during its aquifer-restoration phase as well. Thus, the nonradiological and radiological impacts to public and occupational health and safety during aquifer restoration would be SMALL.

4.13.1.4 Ross Project Decommissioning

The GEIS found in Section 4.4.11 that the radiological impacts to the public and occupational health and safety from the decommissioning of an ISR project would be SMALL (NRC, 2009b).

Consistent with the description in the GEIS, the magnitudes of potential impacts from the decommissioning of the Ross Project facility and its wellfields would be less significant than impacts during operations because the hazards would be reduced and eliminated and the soils, structures, and equipment would be decontaminated.

In addition to the mitigation measures described in SEIS Sections 4.13.1.1 and 4.13.1.2, the NRC will require that the Applicant submit a DP and a RAP for the Ross Project for its review and approval (see Appendix 6.1-A to the TR for the proposed RAP) (Strata, 2011b). Protection of workers and the public would be ensured through the NRC's approval of the DP and RAP, verification that doses from exposures during the decommissioning phase would comply with 10 CFR Part 20's radiation-dose limits and would be ALARA. Following decontamination, demolishing, and decommissioning, the Ross Project area will only be released for unrestricted use when the area is in conformance with the conditions of the Source and Byproduct Materials License and the radiation-dose criteria for release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A limit the dose from radiological contamination, a small amount of which could exist at the Project area after decommissioning is complete, to levels that are sufficiently low to protect public's health and safety. Any area, item, or surface that cannot be economically decontaminated, where "economically decontaminated" would be defined by the Applicant, would be shipped to a properly licensed radioactive-waste disposal facility. Therefore, the impacts to public and occupational health and safety from the decommissioning of the Ross Project would be SMALL.

4.13.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, until the NRC has made its decision regarding the licensing of the Project, the Applicant could continue with some of preconstruction activities (e.g., monitoring-well installation). If a license is not issued, there would need to be some additional work to properly abandon these wells that would have been installed by the Applicant. However, the public and occupational impacts to health and safety of this No-Action Alternative would be less than those impacts associated with the construction of the Proposed Action (i.e., Alternative 1). Thus, the public and occupational impacts of the No-Action Alternative would be SMALL.

4.13.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action and the construction of a CBW would not be necessary, as described in SEIS Section 2.1.3.

Under Alternative 3, the length of the wellfield pipelines could be increased and, thus, there would be more pipeline subject to failure. However, the Applicant would implement the same methods and SOPs described under the Proposed Action to reduce the risk and severity of pipeline failures (e.g., monitoring the pipelines to detect changes in pressure or flow, allowing for automatic shut-down of the pumping system, visually inspecting pipelines at least weekly, and removing contaminated soil).

Alternative 3 would be located, constructed, and operated farther away from the primary roads to the Ross Project area, which would require the construction of additional road extensions. This road construction would generate additional fugitive dust. However, the nearest residential receptors would be farther away from the CPP under the North Ross Project than they would be from the location of the CPP under the Proposed Action; thus, they would be less affected overall by fugitive dust, which could contain very low levels of uranium, and/or the impacts of accidents. Construction activities and chemical use would be similar to the Proposed Action because the construction footprint of the facility's structures would be consistent with the Proposed Action. Activities associated with Strata's constructing and decommissioning the CBW with the Proposed Action and the associated incremental contribution to public and occupational health and safety would not occur under Alternative 3. All other potential public and occupational health and safety impacts would be the same as described for the Ross Project in this SEIS Section 4.13.1. Consequently, as with the Proposed Action, workers involved in a response and cleanup of an accidental release could experience MODERATE impacts, but training requirements and the establishment of and adherence to applicable SOPs would reduce the impacts to SMALL. Thus, the impacts to public and occupational health and safety of Alternative 3 would be SMALL.

4.14 Waste Management

The Proposed Action could have potential waste-management impacts during all phases of its lifecycle. Waste volumes, disposal practices, and associated mitigation measures for the four phases of the Proposed Action were evaluated and compared to the impacts identified in GEIS Sections 4.3.12 and 4.4.12 (NRC, 2009b). The waste-management practices, waste types, and estimated waste volumes that the Applicant has proposed are generally consistent with the typical ISR facility's described in the GEIS. The impacts of the Applicant's management of liquid and solid waste streams for each phase of the Proposed Action as well as the two Alternatives are evaluated in this section. Impacts as a result of the transportation of solid wastes offsite for disposal are evaluated in SEIS Section 4.3.1; impacts to the geology, soils, and water resources as a result of spills, leaks, and other accidental releases of liquid wastes as well as onsite disposal of liquid wastes are evaluated in SEIS Sections 4.4.1 and 4.5.1, respectively.

4.14.1 Alternative 1: Proposed Action

Alternative 1, the Proposed Action, consists of four phases: construction, operation, aquifer restoration, and decommissioning of a uranium-recovery facility and wellfields. The volumes of each type of waste the Applicant would generate at the Ross Project and the Applicant's proposed management approach and disposal activities are fully described in SEIS Section 2.1.1; respective types and quantities are reviewed in Table 4.10. The conditions stipulated in the UIC Class I Permit already obtained by the Applicant for its UIC Class I deep-disposal wells would mitigate many of the impacts of liquid-waste disposal at the Project (WDEQ/WQD, 2011b).

The Applicant will be required to have formal agreements with solid-waste and byproduct-material disposal facilities in place prior to uranium-recovery operation, which would mitigate impacts from solid-waste management (NRC, 2014b, License Condition Nos. 9.9 and 12.5). As part of these agreements, the Applicant would need to ensure that sufficient capacity for solid

Table 4.10
Ross Project Waste Streams

Waste Stream	Source	Disposal Method	Estimated Typical Quantity
NRC-Regulated Wastes			
Excess Permeate (*Defined as the volume of permeate produced minus that which is re-injected into wellfields and/or is used as plant make-up water in the CPP.*)	Uranium Production Aquifer Restoration RO Circuits	Reinjection into Wellfield Deep-Well Injection	**C:** 0 m^3/min [0 gal/min] **O w/o RI:** 0.2 m^3/min [57 gal/min] (See notes.) **O w/ RI:** 0 m^3/min [0 gal/min] **R w/o RI:** 0.6 m^3/min [160 gal/min] (See notes.) **R w/ RI:** 0 m^3/min [0 gal/min] **D:** 0 m^3/min [0 gal/min]
Brine and Other Liquid Byproduct Wastes	Uranium Production Aquifer Restoration RO Circuits Spent Eluate Process Drains Contaminated Reagents Filter Backwash Wash-Down Water Decontamination Showers	Deep-Well Injection Evaporation from Surface Impoundments	**C:** 0 m^3/min [0 gal/min] **O w/o RI:** 0.2 m^3/min [62 gal/min] (See Notes.) **O w/ RI:** 0.9 m^3/min [227 gal/min] (See notes.) **R:** 0.7 m^3/min 190 gal/min] (See notes.) **D:** 0.04 m^3/min [<10 gal/min]
Solid Byproduct Wastes	Filtrate and Spent Filters Scale and Sludges from Equipment Maintenance Contaminated Soils Damaged IX Resin Contaminated Solids from Wells Contaminated PPE Contaminated Materials and Equipment	Shipment to NRC- or Agreement State-Licensed Disposal Facility	**C:** 0 m^3/yr [0 yd^3/yr] **O:** 76 m^3/yr [100 yd^3/yr] **R:** 76 m^3/yr [100 yd^3/yr] **D:** 3,058 m^3 yr [4,000 yd^3/yr]

Table 4.10
Ross Project Waste Streams
(*Continued*)

Waste Stream	Source	Disposal Method	Estimated Typical Quantity
Non-NRC-Regulated Wastes			
TENORM	Drilling Fluids and Muds	Mud Pits	**C:** Per Well = Drilling Fluids 23 m^3 [6,000 gal] Drilling Muds 0.1 m^3 [15 yd^3] **O:** 0 m^3 [0 gal] **R:** 0 m^3 [0 gal] **D:** 0 m^3 [0 gal]
Industrial or Municipal Solid Waste	General Office Trash	Shipment to Municipal Landfill	**C:** 11 m^3/wk [15 yd^3/wk] **O:** 11 m^3/wk [15 yd^3/wk] **R:** 11 m^3/wk [15 yd^3/wk] **D:** 11 m^3/wk [15 yd^3/wk]
Recyclable Solid Waste	Plastic, Glass, Paper, Aluminum, and Cardboard	Shipment to Municipal Recycling Facility Recyclable Waste-Collection Facility	**C:** 4 m^3/wk [5 yd^3/wk] **O:** 4 m^3/wk [5 yd^3/wk] **R:** 4 m^3/wk [5 yd^3/wk] **D:** 4 m^3/wk [5 yd^3/wk]
Construction and Demolition Debris	Construction Debris Decontaminated Materials and Equipment	Shipment to Demolition-Debris Landfill	**C:** 4 m^3/wk [5 yd^3/wk] **O:** 4 m^3/wk [5 yd^3/wk] **R:** 4 m^3/wk [5 yd^3/wk] **D:** 1,529 m^3 [2,000 yd^3]
Petroleum-Contaminated Soil	Equipment Spills and Leaks	Shipment to WDEQ/SHWD-Permitted Disposal Facility	**C:** < 0.8 m^3/wk [< 1 yd^3/wk] **O:** < 0.8 m^3/wk [< 1 yd^3/wk] **R:** < 0.8 m^3/wk [< 1 yd^3/wk] **D:** < 0.8 m^3/wk [< 1 yd^3/wk]
Hazardous Waste	Used Batteries Expired Laboratory Reagents Fluorescent Bulbs Solvents, Cleaners, and Degreasers	Shipment to WDEQ/SHWD-Permitted Recycling or Disposal Facility	**C, O, R, D:** < 100 kg/mo [< 220 lb/mo]

Table 4.10
Ross Project Waste Streams
(*Continued*)

Waste Stream	Source	Disposal Method	Estimated Typical Quantity
Non-NRC-Regulated Wastes (*Continued*)			
Used Oil	Vehicle Maintenance	Shipment to Used-Oil Recycling Facility	**C:** 0.02 kg/mo [5 gal/mo] **O:** 0.02 kg/mo [5 gal/mo] **R:** 0.02 kg/mo [5 gal/mo] **D:** 0.02 kg/mo [5 gal/mo]
Used Oil Filters and Oily Rags	Vehicle and Equipment Maintenance	Shipment to Used-Oil Recycling Facility	**C:** < 9 kg/mo [< 20 lb/mo] **O:** < 9 kg/mo [< 20 lb/mo] **R:** < 9 kg/mo [< 20 lb/mo] **D:** < 9 kg/mo [< 20 lb/mo]
Domestic Sewage	Restrooms	Onsite Waste-Water Disposal or Treatment System Holding Tanks/Portable Toilets during Construction and Decommissioning	**C:** 9.8 m^3/d [2,600 gal/d] **O:** 3 m^3/d [800 gal/d] **R:** 1.1 m^3/d [300 gal/d] **D:** 4.5 m^3/d [1,200 gal/d]

Sources: Strata, 2011b; Strata, 2012a; Strata, 2013.

C = Construction O = Operation R = Aquifer Restoration D = Decommissioning RI = Re-Injection

Notes:

Excess permeate produced during the operation phase without concurrent aquifer restoration (2.5 years) is 0.22 m^3/min [57 gal/min] excess permeate minus 0.095 m^3/min [25 gal/min] used for plant make-up water equals 0.12 m^3/min [32 gal/min] for disposal with brine into a UIC Class I well (where evaporation from surface impoundments is not considered). The actual volume of excess permeate would likely be less than reported in the license application (Strata, 2013).

Excess permeate produced during aquifer-restoration sweep without re-injection (2 months) is 0.698 m^3/min [184.5 gal/min] excess permeate minus 0.095 m^3/min [25 gal/min] plant make-up water equals 0.603 m^3/min [159.5 gal/min] for disposal with brine into a UIC Class I well (evaporation from surface impoundments is not considered). The actual volume of excess permeate would likely be less than reported in the license application (Strata, 2013).

Brine produced during operation without concurrent aquifer restoration (2.5 years) is 0.23 m^3/min [62 gal/min] brine minus 0.04 m^3/min [10.4 gal/min] evaporation equals 0.195 m^3/min [51.6 gal/min] to UIC Class I disposal well.

Brine produced during operation with concurrent restoration is 0.859 m^3/min [227 gal/min] brine minus 0.033 m^3/min [8.8 gal/min] evaporation equals 0.826 m^3/min [218.2 gal/min] to UIC Class I disposal well.

Brine during aquifer restoration-only produces 0.72 m^3/min [190 gal/min] brine minus 0.035 m^3/min [9.3 gal/min] evaporation equals 0.684 m^3/min [180.7 gal/min] to UIC Class I disposal well.

radiologically and/or chemically contaminated wastes as well as solid byproduct material (liquid byproduct wastes would be disposed of onsite in the UIC Class I deep-injection wells) would be available throughout the lifecycle of the Ross Project. Condition No. 10.4 of the Draft License and the corresponding inspections would ensure that proper practices are used by the Applicant to comply with the safety requirements that will protect workers and the public during waste management (NRC, 2014b). The Applicant would implement waste-minimization and volume-reduction BMPs, as possible, to further mitigate the impacts of waste management (Strata, 2011a).

Each of the disposal facilities noted in Table 4.10 has indicated to the Applicant that it has sufficient disposal capacity to accept the volumes of wastes shown in Table 4.10 (see Table ER RAI Waste-1-1 in Strata, 2012a).

4.14.1.1 Ross Project Construction

As described in GEIS Section 4.4.12, construction activities would be expected to generate small quantities of wastes. No byproduct or source material that is regulated by the NRC would be generated during the Proposed Action's construction phase. The GEIS found that the waste-management impacts from the construction of an ISR facility would be SMALL due to the limited volumes of wastes (NRC, 2009b).

Liquid Waste

Liquid wastes not containing byproduct material would be generated during construction of the Ross Project from the Applicant's drilling and development of injection, recovery, and monitoring wells. The Applicant estimated that a volume of 22,000 L [6,000 gal] of water and 12 m^3 [15 yd^3] of drilling muds would be produced per well (Strata, 2012a). Construction of the UIC Class I deep-injection wells would also produce drilling fluids and muds. These fluids would be stored onsite in mud pits, which would be constructed adjacent to the respective drilling pad(s) and evaporated. GEIS Section 4.4.12.1 found that the liquid-waste-management impacts from the construction of an ISR facility would be SMALL due to the limited volumes of wastes (NRC, 2009b).

Construction releases from the mud pits would be mitigated by the implementation of sediment-control BMPs (Strata, 2011a). The dried pits would be backfilled, graded, covered with topsoil, and reseeded, to achieve the reclamation standards required by WDEQ/LQD (Strata, 2011a). The Applicant would attempt to complete reclamation of the mud pits within one construction season to minimize wind and water erosion. The reclaimed mud pits would be included in final radiation surveys that would be accomplished during the Proposed Action's decommissioning phase so that no potential long-term impacts from radioactivity would be present (Strata, 2011a).

Waste water not containing byproduct material would be produced during aquifer-pumping tests and during the Applicant's sampling of wells to develop the data necessary for the hydrologic-test data packages. These data packages would be required by the Source and Byproduct Materials License, and they will be required to be reviewed and approved by the NRC prior to the Applicant's injection of lixiviant into a new wellfield (NRC, 2014b, License Condition No. 10.13). This ground water, which would potentially contain technologically enhanced naturally occurring radioactive material (TENORM) would be discharged per a temporary WYPDES

Permit (No. #WYG720229) issued by WDEQ/WQD, as described in SEIS Section 2.1.1.5. This Permit would require the Applicant to mitigate the potential for erosion and to meet discharge limitations for TDS, total suspended solids (TSS), pH, radium, and uranium. Because of the Permit requirements, the potential impacts of this discharge would be SMALL.

The Applicant estimates that 20 L/mo [5 gal/mo] of used oil would be generated and shipped to a local commercial recycler (Strata, 2012a). Strata also estimates that 9,800 L/d [2,600 gal/d] of domestic sewage would be generated during construction; this waste would be managed in portable toilets which would later be removed from the Project area (Strata, 2012a).

The potential impacts of the management of liquid wastes during construction, therefore, would be SMALL.

Solid Waste

Solid wastes generated during the construction of the Proposed Action would be of limited quantity and volume. The estimated volume of each type of waste and the respective disposal practices that would be used by the Applicant to manage the wastes are described in SEIS Section 2.1.1 and are summarized as follows:

- Less than 9 kg/mo [20 lb/mo] of used oil filters and oily rags would be produced and shipped to a local commercial recycler.
- 19 m^3/wk [25 yd^3/wk] of solid waste not regulated by the NRC nor the EPA would be generated and disposed or recycled at an offsite local landfill.
- Less than 1 m^3/wk [1 yd^3/wk] of petroleum-contaminated soil would be transported by a waste-disposal contractor to a permitted facility in northeast Wyoming, such as the Campbell County Landfill.
- Less than 100 kg/mo [220 lb/mo] of hazardous waste would be securely and appropriately accumulated at the Ross Project and transported by a hazardous-waste contractor to an appropriately permitted, commercial treatment, storage and disposal (TSD) facility outside of Wyoming (Strata, 2012a).

The Applicant has proposed to minimize the volume of used oil and hazardous waste by servicing its vehicles and equipment offsite and by limiting its chemical-reagent orders to quantities that can be consumed within the reagents' shelf lives (Strata, 2011a).

The Applicant's estimated waste volumes are similar to those described in GEIS Section 4.4.12. Thus, the potential impacts of the management of solid wastes during the construction of the Proposed Action would be SMALL.

4.14.1.2 Ross Project Operation

As described in GEIS Section 4.4.12.2, waste-management impacts during the operation of an ISR facility would be SMALL, based upon the required pre-operational disposal agreement(s) for solid byproduct material in addition to regulatory controls such as the applicable permit and license conditions with which an Applicant must comply as well as the inspections the NRC and other regulatory agencies would perform (NRC, 2009b). At the Ross Project, the UIC Permit for the Class I injection wells that has already been obtained by Strata for deep-well injection of liquid byproduct material specifies operating conditions and reporting requirements with which the Applicant must comply (WDEQ/WQD, 2011b). Design specifications related to byproduct material that would need to be approved by the NRC include waste-treatment and volume-reduction techniques, surface-impoundment leak-detection systems, and other routine monitoring activities that would further minimize the potential for impacts to the environment (NRC, 2009b).

Liquid Waste

As described in SEIS Section 2.1.1, liquids containing byproduct material which would be generated during ISR operations include process bleed (an average of 1.25 percent of injection volume) and other process solutions and waste waters. The process bleed would be treated by a two-stage RO circuit during the Proposed Action, producing a minimized volume of brine. Permeate from the RO process would be re-used as plant make-up water or lixiviant. Excess permeate requiring disposal would be only generated during the first two and one-half years of uranium-recovery operation before aquifer restoration begins (Strata, 2011a). The Applicant proposes that excess permeate, up to with 0.2 m^3/min [57 gal/min] would be discharged to the surface impoundments. The double-liner, leak-detection system the Applicant proposes for its surface impoundments, in addition to the monitoring and reserve-capacity requirements mandated by NRC regulations, would allow detection of any surface-impoundment spills or leaks before any significant release of material occurs (NRC, 2009b; NRC, 2014b, License Condition Nos. 10.8, 10.20, and 12.12). These requirements were also anticipated by GEIS Section 4.4.12.1, when it concluded that similar waste-management techniques would result in SMALL impacts. Thus, the potential impacts of the Proposed Action’s use of surface impoundments for the management of liquid byproduct waste would be SMALL.

The Applicant estimates that, during uranium-recovery operation with concurrent aquifer restoration, less than 0.9 m^3/min [200 gal/min] of brine and other process waste waters would be disposed of into the UIC Class I deep-injection wells (see Table 4.10). The lined surface impoundments and a storage tank with secondary containment would be used to manage the brine before its disposal in the deep-disposal wells (Strata, 2012b). The use of the surface impoundments for waste management and the disposal by UIC Class I deep-well injection that the Applicant proposes are consistent with the waste-management practices described in the GEIS. As described in SEIS Section 2.1.1.5, the Applicant expects the capacity of each of the five UIC Class I wells would range between 2.2 – 5 L/s [35 – 80 gal/min]. The Applicant has also proposed storage tanks at the location of the Class I deep-disposal wells which, in addition to the lined surface impoundments at the CPP, would provide surge capacity for the management of all brine (Strata, 2012b). The UIC Class I Permit from the WDEQ sets a maximum limit on the injection pressure (2,570 psi) and sets a range for the annulus pressure (200 – 800 psi). Injection at pressures less than the injection limit ensures that the capacities of the target aquifers (Deadwood and Flathead Formations) are not exceeded.

The Applicant expects that ground water generated during the construction and development of recovery and injection wells would be disposed of in mud pits similarly to the disposal of drilling fluids generated during the construction phase. However, drilling fluids generated during development of wells completed in an aquifer affected by uranium recovery would be disposed of in the lined surface impoundments or via the UIC Class I deep-injection wells (Strata, 2012b).

The volume of used oil that would be produced during the Proposed Action's operation and its management would be the same as during its construction (Strata, 2012a). The volume of domestic sewage, which would be managed in an onsite system, would be approximately 3,000 L/d [800 gal/d] (Strata, 2012a).

The potential impacts of the management of liquid wastes during operation would therefore be SMALL.

Solid Waste

As described in SEIS Section 2.1.1, the Applicant estimates that approximately 80 m^3/yr [100 yd^3/yr] of solid byproduct waste would be generated during the operation phase of the Proposed Action (Strata, 2012a). The Applicant proposes to minimize the quantity of solid byproduct-material waste by selecting high-efficiency filter media for the uranium-recovery and aquifer-restoration circuits (Strata, 2011a). Getting more use out of filter media would minimize the quantity used as well as the waste generated during operations. This byproduct material would be accumulated inside 210-L [55-gal], lined drums and stored in a restricted area of the CPP (Strata, 2011a). Full drums would later be sealed and moved into a 15-m^3 [20-yd^3] roll-off container. Roll-off containers would be stored in a restricted area outside of the CPP where access is secured and restricted. Sealed roll-off containers would be transported to a disposal facility licensed by the NRC or an Agreement State. This disposal would only be allowed by the NRC after pre-operational agreements between the Applicant and the licensed facility(ies) have been executed. The Applicant has identified four facilities currently licensed to receive such waste byproduct material and that can ensure adequate capacity for the solid byproduct material generated by the Ross Project (Strata, 2012a). The NRC will require in the Source and Byproduct Materials License that a formal agreement with each facility to be used for disposal by the Applicant be formally executed before any uranium-recovery activities would begin at the Ross Project area.

Solid non-byproduct waste and hazardous-waste volumes generated during the Proposed Action's operation would be similar to or less than that generated during its construction (Strata, 2011a). Therefore, the potential impacts of the management of all solid wastes during Ross Project operation would be SMALL.

4.14.1.3 Ross Project Aquifer Restoration

In GEIS Section 4.4.12.3, the impacts associated with waste management during an ISR facility's aquifer-restoration phase were evaluated. These were determined to be generally the same as those during its operation. Thus, the GEIS found that waste-management impacts would be SMALL.

Liquid Waste

The liquids containing byproduct material generated during the Proposed Action's aquifer-restoration, which concurrent with operation, would be less than 14.3 L/s [227 gal/min] of brine (see Table 4.10). During the few years at the end of the Project when no wellfields are in operation, the liquid byproduct material would be 12 L/s [190 gal/min]. The Applicant has proposed to minimize the volume of liquid byproduct material that would be generated while the Ross Project is in the aquifer-restoration phase by its limiting the ground-water sweep to the perimeter of a wellfield module, rather than throughout the entire module. As during operation, the two-stage RO circuit would reduce the volume of brine requiring disposal. Evaporation from the surface impoundments, where brine would be stored, would further reduce the volume of brine requiring disposal (see Table 4.10). All permeate after RO would be used for aquifer restoration and for process water.

The volume of used oil that would be produced during the Proposed Action's aquifer-restoration phase would be the same as or less than that produced during its construction and operation (Strata, 2012a). The volume of domestic sewage managed with the Ross Project's onsite treatment system would decrease to approximately 1,100 L/d [300 gal/d] (Strata, 2012a) due to the smaller number of workers at the Ross Project during aquifer restoration. Thus, the potential impacts of the management of all types of liquid wastes during aquifer restoration at the Proposed Action would be SMALL.

Solid Waste

The management of solid wastes, including byproduct material and hazardous wastes, generated during the aquifer-restoration phase of the Proposed Action would be similar to its construction and operation phases (Strata, 2011a). The volume of office and municipal solid wastes would decrease due to the smaller workforce during aquifer restoration (i.e., 200 to 60 tod 20 workers, respectively), while the volume of byproduct material and other wastes would also diminish, producing less and less byproduct material, as the aquifer is restored. Thus, the potential impacts of the management of solid wastes during aquifer restoration would be SMALL.

4.14.1.4 Ross Project Decommissioning

As described in GEIS Section 4.4.12.4, the impacts associated with liquid-waste management during decommissioning at an ISR facility would be SMALL and would be similar to the respective construction and operational impacts. However, the volume of solid byproduct waste and all other types of solid wastes generated during decommissioning would be substantially greater than during the other phases due to the decontamination, dismantling, demolishing, and disposal of the Ross Project components (Strata, 2012a).

Liquid Waste

The Applicant estimates that less than 0.6 L/s [10 gal/min] of brine would be generated and disposed of by deep-well injection during the Proposed Action's decommissioning (Strata, 2012a). This volume would be a significant reduction from that generated during the other phases of the Proposed Action. The volume of used oil that would be generated during decommissioning and its management would be the same as that generated during operation (Strata, 2012a). As during the construction phase, the estimated 4,500 L/d [1,200 gal/d] of domestic sewage would be managed by the Applicant's use of portable toilets during the decommissioning phase, and the toilets would be removed when decommissioning is complete. (Strata, 2012a). Thus, the potential impacts of the management of liquid wastes during the decommissioning phase of the Proposed Action would be SMALL.

Solid Waste

The Applicant estimates that decommissioning would generate 3,000 m^3 [4,000 yd^3] of solid waste byproduct material (Strata, 2012a). The nature of this material is described in SEIS Section 2.1.1. A typical ISR project generates approximately 4,500 m^3 [6,000 yd^3] of waste byproduct material, and Strata would generate less; thus, the analysis in the GEIS is bounding and the potential impacts are SMALL (NRC, 2009b).

The onsite collection, minimization, and storage of the solid byproduct material would follow the same techniques and SOPs as those described for the Proposed Action's operations. The pre-operational agreements with one or more appropriately licensed waste-disposal facilities would govern the disposal of this material the same as during the Ross Project's operation phase. The Applicant proposes to reduce the quantity of solid byproduct material by decontaminating as many surfaces as technically possible, using decontamination techniques such as high-pressure washing, sand blasting, and acid rinsing that allow waste volumes to be volume reduced (Strata, 2011a). Where possible, the Applicant has indicated that it intends to decontaminate equipment and building surfaces, such as mobile equipment, dismantled process equipment, and demolished building components. By doing so, the Applicant could demonstrate that the respective radioactivity levels are below regulatory concern and could be reclassified for unrestricted use.

The Applicant has estimated that decommissioning would generate 1,500 m^3 [2,000 yd^3] of solid non-byproduct-containing waste. Such waste would consist of construction debris and decontaminated equipment and materials (Strata, 2012a). As described in SEIS Section 2.1.1, the Applicant has proposed that this waste would be disposed of in local solid-waste landfills. The estimated volume of solid waste would be about twice the amount generated by the typical ISR facility as described in the GEIS (NRC, 2009b); however the capacity of the local landfills were shown in the Applicant's responses to the NRC's Requests for Additional Information and the Applicant's corresponding table indicated there would be sufficient local capacity for disposal of this volume (Strata, 2012a).

The volumes of other typical solid and hazardous wastes including industrial or municipal wastes, recyclable materials, demolition wastes, and petroleum-contaminated soil generated during the Proposed Action's decommissioning would be similar to those generated during construction and operation (Strata, 2012a). Thus, the potential impacts of the management of solid wastes during the decommissioning phase, therefore, would be SMALL.

4.14.2 Alternative 2: No Action

Under the No-Action Alternative, the Ross Project would not be licensed and the land would continue to be available for other uses. However, the Applicant could continue preconstruction activities until that decision is made. Thus, drilling fluids and muds from drillholes and wells installed by the Applicant to delineate the ore zone as well as to characterize the ground water and the geotechnical, subsurface conditions at the Ross Project area would continue to be generated under the No-Action Alternative. These wastes would continue to be contained in mud pits constructed at each well pad (as described in SEIS Section 2.1.1), and then they would be evaporated to dryness. The dried pits would be backfilled, graded, covered with topsoil, and reseeded to achieve reclamation standards required by WDEQ/LQD (Strata, 2011a). No additional, distinct waste-management impacts would result from the No-Action

Alternative; thus, the potential impacts of waste management in the No-Action Alternative would be SMALL.

4.14.3 Alternative 3: North Ross Project

Under Alternative 3, the North Ross Project would generally be the same as the Proposed Action, except that the facility (i.e., the CPP, associated buildings, and auxiliary structures as well as the surface impoundments) would be located to the north of where it would be located in the Proposed Action, as described in SEIS Section 2.1.3. The wastes generated during this Alternative would be essentially the same as those generated during the Proposed Action during each of its phases: Alternative 3 would be constructed and operated the same as the Proposed Action, and its aquifer restoration and decommissioning would also be the same. Thus, the waste-management techniques and waste-disposal strategies employed for the Proposed Action would also be employed for Alternative 3.

However, as described in SEIS Section 2.1.3, the construction of the CBW would not be required at the north site (i.e., it would be necessary only at the south site because of that site's higher water table). Consequently, the volume of liquid wastes generated at north site would be reduced by the volume of any leaks and/or ground water that would need to be dewatered from inside the CBW during facility operation, aquifer restoration, and decommissioning of Alternative 1. In addition, the volume of solid waste ultimately requiring disposal would be reduced by the small amount of material generated during the breach of the CBW during decommissioning. Therefore, potential impacts of waste management for Alternative 3 would be SMALL.

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5 CUMULATIVE IMPACTS

5.1 Introduction

The Council on Environmental Quality's (CEQ's) *National Environmental Policy Act of 1969* (NEPA) regulations, as amended (Title 40 *Code of Federal Regulations* [CFR] Parts 1500 – 1508), define cumulative impacts as "the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions" (40 CFR 1500 – 1508). Cumulative impacts can result from individually minor, but collectively significant, actions that take place over a period of time. (For the purposes of this *FinalSupplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]) analysis, the phrase "cumulative impacts" is synonymous with the phrase "cumulative effects.") A proposed project could contribute to incremental cumulative impacts when its environmental impacts overlap with those of other past, present, or reasonably foreseeable future actions (RFFAs) in a given area. For this SEIS, other past, present, and future actions near the Ross Project include (but are not limited to) cattle and sheep grazing, agricultural production, other uranium-recovery activities, coal mining, oil and gas production, and wind-farm operation.

This analysis of the cumulative impacts of the Proposed Action is based upon publicly available information on existing and proposed projects, information in the *Generic Environmental Impact Statement* (GEIS), NUREG–1910 (NRC, 2009b), and general knowledge of the conditions in Wyoming and in the nearby communities. The current primary activities taking place in the area of the Ross Project are mineral recovery and mining as well as oil and gas development. The Power River Basin contains the largest deposits of coal in the United States (U.S.) as well as significant reserves of other natural resources including uranium, oil, and gas (NRC, 2010). There has been a resurgence in interest in these mining and recovery activities.

This section evaluates the potential for cumulative impacts associated with the Ross Project and other RFFAs as described below in Section 5.2. The GEIS provides an example methodology for conducting a cumulative-impacts assessment (NRC, 2009b). This methodology, which has been used by U.S. Nuclear Regulatory Commission (NRC) staff in its cumulative-impact analysis in this SEIS, is discussed in Section 5.3.

5.2 Other Past, Present, and Reasonably Foreseeable Future Actions

The Ross Project area, where the Proposed Action would be sited, is located just within the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR) as defined in the GEIS (NRC, 2009b). The Ross Project encompasses approximately 696 ha [1,721 ac] of land, all of which is located in Crook County, Wyoming. It is located within the Lance District (see Figure 2.1), so-called due to its location above the uranium-rich Late Cretaceous Lance Formation as discussed earlier in Section 3.4. The surface landowners of the Ross Project area include private parties (553 ha [1,367 ac]), the State of Wyoming (Wyoming) (127 ha [314 ac]), and the U.S. Bureau of Land Management (BLM) (16 ha [40 ac]). The subsurface-mineral owners include the same parties, except that of 553 ha [1,367 ac] of privately owned land, 65 ha [160 ac] of subsurface mineral rights are administered by BLM. The surface water at the Ross Project predominantly flows in a northeasterly direction to the Little Missouri River, while the ground water, which is part of the Powder River Basin regime, flows mostly westerly. This bifurcation is important to note as cumulative impacts are identified and evaluated. The Ross Project area, at approximately 7 km^2 [somewhat less than 3 mi^2] in size, represents approximately 0.03 percent of the 25,900 km^2 [10,000 mi^2] of the entire Powder River Basin.

5.2.1 Actions

The historical and current actions (i.e., historical and current land uses) on and near the Ross Project area include livestock grazing, crop cultivation and agriculture, wildlife habitats, oil production, and, to the northeast, bentonite mining (Strata, 2011a). The historical Nubeth Joint Venture (Nubeth) was also operated on some of the land which comprises the proposed Ross Project area. SEIS Section 3.2 discusses these historical and present land uses in more detail; these land uses are expected to continue into the future, albeit to a lesser extent, while the Ross Project is operating in the area. It should be noted that no long-term, permanent changes to the environment are anticipated as a result of the Ross Project within about 8 km [5 mi] of the Ross Project area, except for the potential installation of additional roads. The extensive aquifer-restoration and site-reclamation activities that Strata Energy, Inc. (Strata) (herein also referred to as the “Applicant”) would perform during the Ross Project’s aquifer-restoration and decommissioning phases would ensure that no permanent land-use changes occur on the Ross Project area itself.

Several industries presently conduct activities in and near Crook County, activities which could have environmental impacts that, when combined with those of the Ross Project, could be greater than the individual impacts of the Ross Project. In addition, some of these activities, such as uranium recovery as well as oil and gas production, could be actively expanded within Crook County and into its neighboring counties. These activities are described below.

5.2.1.1 Uranium Recovery

Uranium was discovered in 1918, near Lusk, Wyoming, and then first mined in 1920. Greater uranium reserves were discovered in both the Powder River Basin and the Wind River Basin during the 1950s, and continued exploration for uranium resulted in the delineation of additional sedimentary uranium deposits in the major basins of central and south Wyoming, including the Powder River Basin. Uranium production in Wyoming declined in the mid-1960s, but increased again in the late 1960s and 1970s. Conventional uranium-mine production peaked in 1980 and then decreased in the early 1980s through the early 1990s when in situ uranium-recovery (ISR) facilities were established. The total uranium-mine production in the U.S. in 2007 was 2.1 million kg [4.5 million lb], almost half of which was produced in the southernmost Powder River Basin. ISR replaced conventional uranium mining and milling as the preferred means for extracting uranium in the U.S. Currently, only ISR facilities are extracting uranium in Wyoming.

Interest in uranium-recovery has translated into several ISR projects in Wyoming (see Table 5.1). The Ross Project is one. In addition, the Applicant indicates that it might develop at least four additional satellite uranium-recovery areas within the larger Lance District over the next few years (each of which would be subject to its own license-amendment actions by the NRC). Several other ISR projects are currently licensed in Wyoming as well, with two facilities operating and two ready for construction in the Powder River Basin (see Figure 5.1).

None of these operating and/or licensed ISR projects is located in Crook County (i.e., the location of the proposed Ross Project) nor have any other Crook County ISR facilities been officially proposed to the NRC. However, four ISR projects are reportedly in the very early stages of development in Crook County (Strata, 2012a). In addition, two licensed ISR facilities

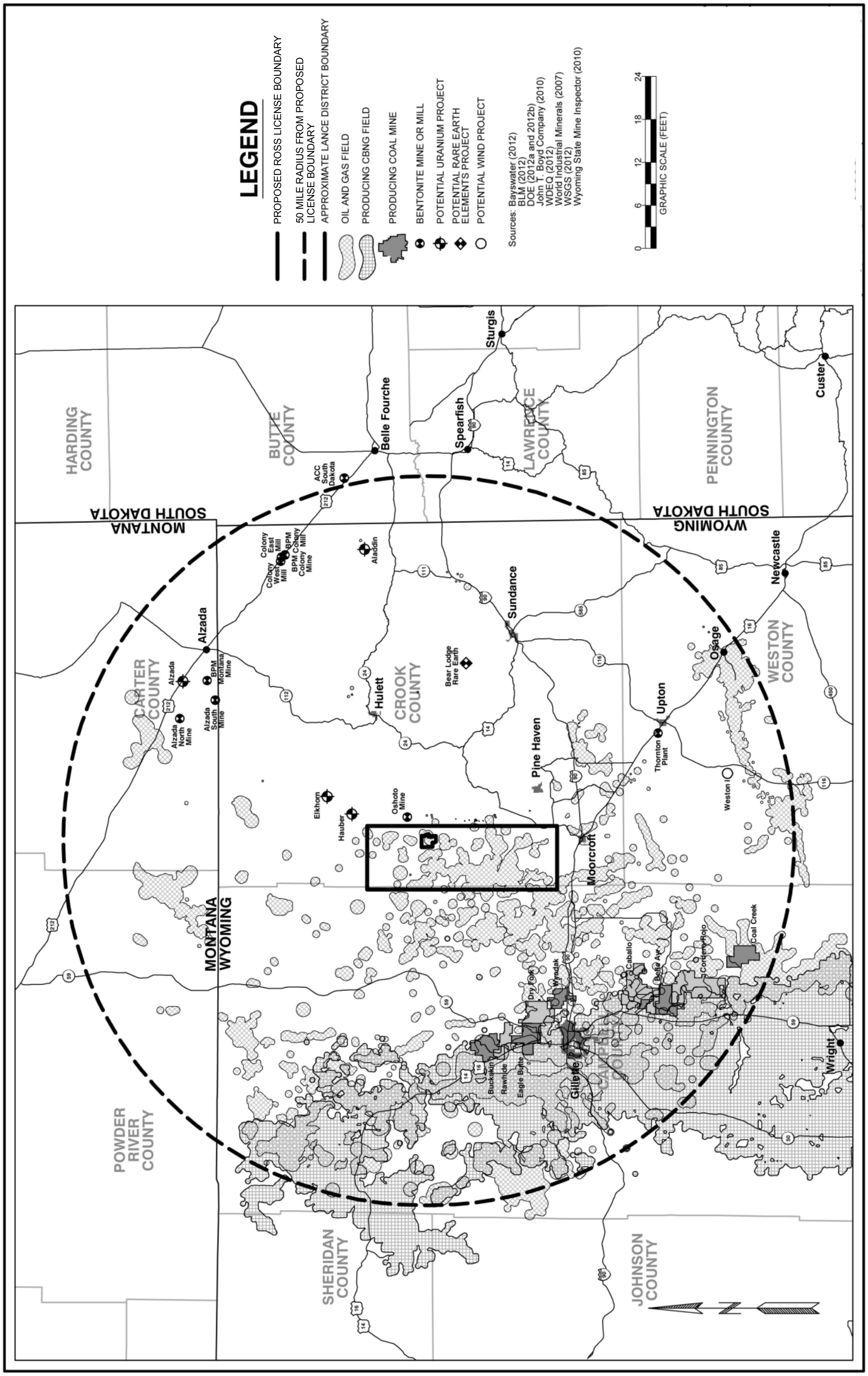
Table 5.1
Uranium-Recovery Projects
within Eighty Kilometers [Fifty Miles] of Ross Project Area

Project	Owner	County	Direction and Distance[a] (km [mi])	Status
Smith Ranch License SUA-1548 North Butte Ruby Ranch	Cameco Resources Inc./ Power Resources Inc.	Converse Campbell Campbell	SSW 180 km [110 mi]	Operating. Renewal and expansion (additional satellite areas) license application in technical review. Construction activities are occurring at the North Butte site. Ruby Ranch expansion license application not yet submitted.
Willow Creek (Formerly Irigaray/ Christensen Ranch) License SUA-1341 Ludeman Allemand-Ross	Uranium One	Johnson and Campbell Converse Converse	WSW 120 km [75 mi]	Operating. Renewal license issued March 2013. Amendments to include Ludeman (license application has been submitted) and, later, Allemand-Ross (license application has not been submitted) satellite areas.
Nichols Ranch License SUA-1597	Uranerz Energy Corporation	Johnson and Campbell	SW 120 km [75 mi]	Licensed and under construction.
Moore Ranch License SUA-1596	Energy Metals Corporation/ Uranium One	Campbell	SW 150 km [90 mi]	Licensed, but not yet under construction.
Reno Creek	AUC LLC	Campbell	SW 105 km [65 mi]	License application submitted.

Sources: Strata, 2012a; NRC, 2013a.

Note:

[a] Approximate distance from the Ross Project area to the respective ISR project in “as the crow flies” (i.e., a straight line) in kilometers [miles].



Source: Strata, 2012a.

Figure 5.1
Circular Area of an Eighty-Kilometer [Fifty-Mile] Radius around Ross Project Area

are located in adjacent Campbell County (satellite areas of the Smith Ranch ISR Project, which is currently operating, and the Moore Ranch, which is still to be constructed). Two other ISR facilities overlap both Campbell and Johnson Counties (Willow Creek, which is currently operating, and Nichols Ranch, which is licensed and under construction).

The Applicant describes in its license application the types and sequence of its planned development of the Lance District. The Applicant has identified significant uranium resources within the District, and it intends for the Ross Project to be the first of several "satellite" areas. These potential satellite areas could consist of those shown in Figure 2.2 in SEIS Section 2.1.1, including, within the northern portion of the Lance District, Ross Amendment Area 1 and, to the south within the Lance District, the potential Kendrick, Richards, and Barber satellite areas (Strata, 2012a). If additional wellfields were to be developed by the Applicant and licensed by the NRC, the Ross Project's Central Processing Plant (CPP) would be used to process pregnant solutions from these satellite areas into yellowcake. In addition, the Applicant also proposes that ion-exchange (IX) resin loaded with uranium ("uranium-bearing" or "pregnant") would be accepted at the Ross Project's CPP from other offsite ISR facilities (this activity is referred to as "toll milling") or companies and/or from water-treatment plants (Strata, 2011a). This additional potential use of the CPP at the Ross Project is the reason that the Plant is designed for four times the capacity needed for only the Ross Project.

Lance District

The four satellite areas within the Lance District that the NRC staff has identified as reasonably foreseeable are as follows:

Ross Amendment Area 1

This area would be an extension of the proposed Ross Project to the north and west. This area would not increase the overall production rate of yellowcake, but rather it would increase the operating life of the Ross Project. As uranium production from the early wellfields within the Ross Project area begins to diminish and the wellfields begin to enter the aquifer-restoration phase of the proposed Project, additional wellfields in the Ross Amendment Area 1 could be begin uranium recovery. The Ross Amendment Area 1 could extend the lifetime of the Ross Project by several years as shown in Figure 2.6 (Strata, 2012a).

Kendrick Satellite Area

The Kendrick satellite area would be contiguous to the Ross Project area as shown in Figure 2.2 in SEIS Section 2.1.1. However, unlike the Ross Amendment Area 1, the Kendrick satellite area would allow the Applicant to increase its production of yellowcake to approximately 680,000 kg/yr [1.5 million lb/yr] (Strata, 2012a).

Richards Satellite Area

The Richards satellite area would be contiguous to the Kendrick satellite area. The uranium-rich solutions extracted from this satellite area would be piped to the Ross Project's CPP for uranium recovery or, potentially, piped to the Barber satellite area as described below (Strata, 2012a). The relative schedule for this satellite would be identified by the Applicant in the future.

Barber Satellite Area

Although the Applicant's plans for development of the Lance District are not yet complete, Strata anticipates that a remote IX-only plant would be constructed at the Barber satellite area. This would mean that the pregnant, uranium-rich solutions brought to the surface at the Barber satellite area would be treated by IX to yield uranium-loaded resin, which would then be trucked to the Ross Project's CPP for further processing (e.g., resin elution) (Strata, 2012a). This additional uranium would increase the CPP's output to approximately 993,000 kg/yr [2.19 million lb/yr]. In addition, the Applicant would investigate the possibility of transferring pregnant solutions from wellfields in the Richards satellite area to the remote IX facility at the Barber satellite area before transfer to the CPP at the Ross Project area.

Other Potential ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project

There are no other uranium-recovery or nuclear-fuel-cycle projects currently located within 80 km [50 mi] of the Ross Project area nor have any Letters of Intent or license applications been submitted to the NRC for any ISR projects within 80 km [50 mi] (see Figure 5.1) (Strata, 2011a). There are, however, four other uranium-recovery operations in various very early planning stages located within 80 km [50 mi] of the Ross Project, including the following:

Potential Aladdin Project

The potential Aladdin ISR Project would be located in Crook County, approximately 66 km [41 mi] east-northeast of the Ross Project, although the driving distance to this Project would be approximately 113 km [70 mi]. The Aladdin Project is being considered by Powertech Inc. and comprises approximately 7,099.8 ha [17,554 ac].

Potential Elkhorn Project

The potential Elkhorn ISR Project is currently being evaluated by NCA Nuclear, Inc. (a wholly owned subsidiary of Bayswater Uranium Corporation). This Project would also be located in Crook County, approximately 26 km [16 mi] from the Ross Project (driving distance would be approximately 30 km [20 mi]). It is currently estimated that this Project's area of 2,110 ha [5,215 ac] may ultimately yield approximately 544,000 kg [1.2 million lb] of uranium. The Project is located near the former, and decommissioned, Homestake Hauber Uranium Mine (see below).

Potential Hauber Project

The potential Hauber ISR Project would also be owned by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. This Project would be located approximately 23 km [14 mi] from the Ross Project area, or 30 km [20 mi] if driven, and would comprise approximately 2,090 ha [5,160 ac]. The total uranium production from this Project is estimated at 680,000 kg [1.5 million lb] (Strata, 2012a). This Project would be located near the now-closed Hauber Uranium Mine, which was operated between 1958 and 1966 and which is discussed below (Strata, 2011a).

Potential Alzada Project

The potential Alzada ISR Project would be owned and operated by NCA Nuclear, Inc. and would comprise approximately 10,000 ha [25,000 ac]. It would be located approximately 62 km

[39 mi] north-northeast of the Ross Project area (driving distance would be approximately 129 km [80 mi]) (Strata, 2012a).

Other ISR Facilities within the Powder River Basin

There are four other ISR Projects in various stages of the NRC's licensing process and/or currently operating or being constructed within the Powder River Basin, all of which are located in Wyoming, although none of these Projects are within a 80-km [50-mi] radius of the Ross Project. However, the 80-km [50-mi] cumulative-impacts area does not include the entire Powder River Basin; thus, none of these four Projects is located within that cumulative-impacts area. Two of these facilities are currently operating; two have been licensed, one of which has begun construction. The owner of a fifth ISR Project has submitted a license application to the NRC in October 2012. These ISR projects include the following:

Smith Ranch ISR Project

The Smith Ranch ISR Project conducts uranium recovery and is currently being operated by Power Resources Inc. (dba Cameco Resources Inc. [Cameco]). The Smith Ranch Project is primarily located in Converse County, Wyoming, but this Project also includes several remote satellite areas in other Wyoming counties—one of which is not located in the Powder River Basin (i.e., in the Wind River Basin). A license application to renew and to expand Source Materials License SUA-1548 for the Smith Ranch Project was received by the NRC in February 2012 (see Docket No. 40-8964). If the NRC grants a license amended and renewed as proposed, the Smith Ranch License would allow Cameco to continue conducting ISR activities at its Smith Ranch Project as well as to initiate and/or expand ISR activities at its associated and remote ISR satellite areas: 1) the Highlands and the Reynolds Ranch satellite areas, both also located in Converse County, Wyoming; 2) the Gas Hills remote satellite area in Fremont and Natrona Counties, Wyoming; 3) the North Butte remote satellite area in Campbell County, Wyoming; and 4) the Ruth remote satellite area in Johnson County, Wyoming (NRC, 2013a).

Willow Creek ISR Project

The Willow Creek ISR Project is located in Johnson and Campbell Counties, Wyoming; the Project is owned by Uranium One (see Docket No. 40-8502). The NRC license was renewed for this Project in March 2013. A license application for the Ludeman ISR Project was originally submitted to the NRC in January 2010, but it was subsequently withdrawn in May 2010. A license application was resubmitted by the owner of the Project, Uranium One, in December 2011, where three specific subdivisions of the Ludeman area, which is located in Converse County, would be satellites of the Willow Creek ISR Project (NRC, 2013a). Both of these Projects are situated in the Powder River Basin. The Ludeman Project consists of approximately 8,000 ha [20,000 ac]; the Willow Creek Project is approximately 5,500 ha [13,600 ac].

Nichols Ranch ISR Project

The Nichols Ranch ISR Project is located in Johnson and Campbell Counties of Wyoming. It is owned by the Uranerz Corporation (Uranerz) and is comprised of 1,251 ha [3,091 ac]. Its NRC license has been granted, and the facility is currently under construction (see Docket No. 40-9067) (NRC, 2013a). Uranerz has received an Underground Injection Control (UIC) Permit from the Wyoming Department of Environmental Quality (WDEQ). The company has also signed a toll-milling agreement with the owner of the Smith Ranch Project, Cameco, to transfer uranium-loaded IX resin from the Nichols Ranch ISR Project to the Smith Ranch Project for final processing to yellowcake.

Moore Ranch ISR Project

The Moore Ranch ISR Project is located in Campbell County, Wyoming; it is owned by Energy Metals Corporation, a wholly owned subsidiary of Uranium One. It is comprised of approximately 2,879 ha [7,110 ac]. It is currently licensed by the NRC to operate through September 2020 (see Docket No. 40-9073) (NRC, 2013a); construction on this ISR facility has not yet begun.

Reno Creek ISR Project

AUC LLC, submitted a license application in October 2012 to site, design, license, construct, and operate an ISR facility in Campbell County, Wyoming (NRC, 2012c).

Past ISR Facilities within 80 Kilometers [50 Miles] of the Ross Project

In addition to the present and reasonably foreseeable uranium-recovery facilities described above, it should be noted that, historically, two uranium-recovery facilities were located in the 80-km [50-mi] area surrounding the Ross Project area. The first was a historic uranium mine near Hulett, and the second, Nubeth, is identified above; Nubeth has been included in this SEIS's analysis of pre-licensing, site-characterization data as well as cumulative impacts in this section.

The historic Homestake Hauber Uranium Mine was operated by the Homestake Mining Company between 1958 – 1966; the mine closed in 1966. It is also located in Crook County, approximately 19 km [12 mi] to the northeast of the Ross Project. This mine is no longer a contributor to cumulative impacts in the area because it is not operating and, thus, no longer producing impacts related to traffic, water resources, ecology, air quality, noise, and so forth. However, it is now a part of the area currently being explored for additional potential uranium recovery by NCA Nuclear, Inc., in a joint venture with Ur-Energy Inc. The potential Hauber ISR Project is described above; the Project is currently in the planning stages. This Project would be the nearest uranium-recovery project to the proposed Ross Project.

Nubeth was described more extensively in SEIS Sections 2.1.1 and 3.5.3. This research and development ISR operation operated between 1978 – 1979. Nubeth was decommissioned according to NRC and WDEQ requirements, and final approval for its decommissioning was issued between 1983 – 1986. Additional information regarding potential impacts from this historical operation is included in this SEIS Section's assessment of cumulative impacts.

5.2.1.2 Mining

Coal as well as other natural resources are mined in and around Crook, Weston, and Campbell Counties. Indeed, Powder River Basin coal mines supply almost 97 percent of the coal produced in Wyoming each year (BLM, 2005a; BLM, 2005b; BLM, 2005c), and Wyoming produces the greatest quantity of coal in the U.S. Thus, substantial mining activities occur throughout the Basin, and coal mining continues to be the most prolific mining activity in the region.

Coal Mining

Coal mining in the Powder River Basin began in 1883, and underground coal mines began operation during 1894. The Powder River Basin emerged as a major coal-production area during the 1970s and early 1980s. The largest area, the Gillette coalfield, is approximately 24 km [15 mi] wide and extends from approximately 35 km [22 mi] north of Gillette, Wyoming, to approximately 40 km [25 mi] south of Wright, Wyoming. A second coal area is approximately 30 km [20 mi] wide, extending from Sheridan, Wyoming, north to the Wyoming-Montana state line. In 2007, this region accounted for approximately 97 percent of Wyoming's production and hosted the 10 largest coal mines in the U.S. Coal production in the Wyoming portion of the Powder River Basin is expected to grow at an annual rate of 2 – 3 percent per year. Additional coal leases and associated lands may be required to keep up with the world’s demand (BLM, 2009e).

The Powder River Federal Coal Region was decertified as a Federal coal-production region by the Powder River Regional Coal Team in 1990, which allowed leasing to occur in the region on an application basis. Because of decertification, U.S. coal production increased 11 percent, from 900,000 t [1 million T] in 1990 to 1.1 million t [1.2 million T] in 2007 (BLM, 2009a). From 1990 – 2008, the BLM’s Wyoming State Office held 25 competitive lease sales and issued 19 new Federal coal leases representing more than 5.7 billion tons of coal using the “lease by application” process (BLM, 2005a; BLM, 2005b; BLM, 2005c). In 2003, the cumulative disturbed-land area attributable to coal mines within the Powder River Basin totaled nearly 28,000 ha [70,000 ac]. Reasonably foreseeable future development projects contributing to the estimate of the cumulative acreage disturbed range from 47,400 – 50,600 ha [117,000 – 125,000 ac] in 2015. Other developments related to coal include railroads, coal-fired power plants, major 230 kV-transmission lines, and coal-technology projects. The total land area of other coal-related disturbance in the Powder River Basin in 2003 was nearly 2,000 ha [5,000 ac].

Within 80 km [50 mi] of the Ross Project there are 9 active coal mines (Strata, 2012a). Table 5.2 lists surface coal mines within 80 km [50 mi]; the respective locations are shown in Figure 5.1.

Table 5.2
Active Coal Mines within Eighty Kilometers [Fifty Miles] of Ross Project Area

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
Belle Ayr Mine	Alpha Coal West, Inc.	64 [40]	103 [64]
Buckskin Mine	Buckskin Mining Company	47 [29]	108 [67]
Caballo Mine	Peabody Caballo Coal L.L.C.	63 [39]	109 [68]

Table 5.2
Active Coal Mines within Eighty Kilometers [Fifty Miles] of Ross Project Area
(*Continued*)

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
Coal Creek Mine	Thunder Basin Coal Co. L.L.C.	72 [45]	137 [85]
Cordero Rojo Mine	Cloud Peak Energy/ Cordero Rojo Mine	68 [42]	119 [74]
Dry Fork Mine	Western Fuels Wyoming Inc.	45 [28]	85 [53]
Eagle Butte Mine	Alpha Coal West Inc.	48 [30]	93 [58]
Rawhide Mine	Peabody Energy Rawhide Mine	47 [29]	100 [62]
Wyodak Mine	Wyodak Resources Development	45 [28]	71 [44]

Source: Wyoming State Mine Inspector, 2010; BLM, 2012 as cited in Strata, 21012a.

Bentonite Mining

Bentonite is weathered volcanic ash that is used in a variety of products such as drilling muds and cat litters because of its absorbent properties. There are 10 bentonite-producing mines in in the 80-km [50-mi] area surrounding the proposed Ross Project area (see Figure 5.1 and Table 5.3). One, the Oshoto Mine, is 8 km [5 mi] (driving distance) from the Ross Project area. The two next closest bentonite mines are approximately 56 – 69 km [35 – 43 mi] from the Ross Project area. Table 5.3 presents the relative distances to the Ross Project area from these bentonite mines.

Table 5.3
Active Bentonite Mines within Eighty Kilometers [Fify Miles] of Ross Project Area

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
ACC South Dakota	American Colloid Company	74 – 80 [46 – 55]	129 [80]
Alzada North	American Colloid Company	56 – 65 [35 – 40]	89 [55]
Alzada South	American Colloid Company	56 – 65 [35 – 40]	72 [45]

Table 5.3
Active Bentonite Mines within Eighty Kilometers [Fifty Miles] of Ross Project Area
(*Continued*)

Mine Name	Owner	Straight-Line Distance km [mi]	Driving Distance km [mi]
BPM Colony Mill	Bentonite Performance Minerals L.L.C.	71 [44]	151 [94]
BPM Colony Mine	Bentonite Performance Minerals L.L.C.	71 [44]	151 [94]
BPM Montana	Bentonite Performance Minerals L.L.C.	56 – 64 [35 – 40]	72 [45]
Colony East Mill	American Colloid Company	71 [44]	151 [94]
Colony West Mill	American Colloid Company	69 [43]	151 [94]
Oshoto Mine	Black Hills Bentonite	5 [3]	8 [5]
Thornton Plant	Black Hills Bentonite	56 [35]	69 [43]

Source: Wyoming State Mine Inspector, 2010; WDEQ, 2012; BLM, 2008; BLM, 2011 as cited in Strata, 2012a.

Other Mining

Sand, gravel, and clinker (or "scoria") have been and continue to be mined in the Powder River Basin. Aggregate, which is sand, gravel, and stone, is used for construction purposes. The largest aggregate operation is located in the Powder River Basin in northern Converse County, and it has an associated total area of land disturbance of approximately 27 ha [67 ac], of which 1.62 ha [4 ac] have been reclaimed. Scoria is used as aggregate where alluvial-terrace gravel or in-palace granite or other igneous rock is not available. Scoria generally is mined in Converse and Campbell Counties, in the western portion of the Powder River Basin (BLM, 2005a; BLM, 2005b; BLM, 2005c). None of these are within 80 km [50 mi] of the Ross Project area (see Figure 5.1).

Oil and Gas Production

Regional oil- and gas-related activities (i.e., exploration, extraction, and pipeline development) could have the potential to generate cumulative impacts (BLM, 2005b) when evaluated in conjunction with the Ross Project as well. There are approximately 472 oil- and gas-production units evenly dispersed throughout the Powder River Basin in various stages of production. The Wyoming Oil and Gas Conservation Commission reported that, in 2003, oil and gas wells in the

Powder River Basin produced approximately 113 million barrels of oil and 1.1 billion m^3 [40 billion ft^3] of conventional gas (BLM, 2005a; BLM, 2005b; BLM, 2005c).

From 1992 – 2002, oil extraction from conventional oil and gas wells in Campbell and Converse Counties within the Powder River Basin decreased approximately 60 percent. Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to identify new fields has been low (BLM, 2005a). Data posted by the Wyoming Oil and Gas Conservation Commission (WOGCC) show that the production of oil and gas in Crook County has declined from their respective peaks in 1985 and 1990 – 2007, from which time the production has remained approximately constant (WOGCC, 2013). In Campbell County, gas extraction has declined steadily since its peak in 2001 – 2005, and oil extraction has declined since approximately 1992, except for slight increases since 2010. The BLM's Wyoming State Office's Whitepaper entitled "Hydraulic Fracturing," dated July 2013, includes shallow coal-bed-methane (CBM) wells and the Niobrara Shale as likely targets for hydraulic fracturing technology, although according to the WOGCC, Crook County does not produce CBM nor has it seen any development of the Niobrara Shale characteristic of southeastern Wyoming (BLM, 2013). Of all of the BLM districts in Wyoming, projected water use for hydraulic fracking is the lowest in the Newcastle District, which includes Crook Country.

Oil- and gas-related development includes major transportation pipelines and refineries as well. In 2003, the cumulative disturbed-land area in the Powder River Basin from oil and gas activities, CBM expansion, and related developments was nearly 76,100 ha [188,000 ac]. The corresponding projection for the year 2015 is approximately 123,000 ha [305,000 ac] (BLM, 2005a; BLM, 2005b; BLM, 2005c). The depth to producing gas- and oil-bearing units generally ranges from 1,219 – 4,115 m [4,000 – 13,500 ft], but some wells are as shallow as 76 m [250 ft] (BLM, 2005a; BLM, 2005b; BLM, 2005c).

There are three oil-producing wells on the Ross Project area itself in addition to three oil-field water-supply (i.e., industrial) wells and two injection wells (Strata, 2011a). These wells are mostly used for enhanced oil recovery (EOR) and are discussed in SEIS Section 4.5.1. Figure 3.2 indicates the locations of all oil- and gas-producing wells in a 3-km [2-mi] radius of the Ross Project area.

Coal-Bed Methane Development

Natural-gas production has been increasing in Wyoming. CBM is located where there are abundant coal resources. For this reason, the majority of CBM production in Wyoming occurs in the Powder River Basin, within the Wasatch and Fort Union Formations. Annual CBM production in the Powder River Basin increased rapidly between 1999 – 2003, with nearly 15,000 producing CBM wells in the Powder River Basin in 2003 and a total CBM-production volume of 10.3 billion m^3 [364 billion ft^3] (BLM, 2005a; BLM, 2005b; BLM, 2005c). However, there are no CBM-producing wells in the Lance and Fox Hills aquifers within the 80-km [50-mi] radius vicinity of the Ross Project area. This is because the stratigraphic layers targeted at the Ross Project lie below the Wasatch and Fort Union Formations where CBM production occurs (Strata, 2012a).

Wind-Power Development

While there is potential in the Powder River Basin for wind-power generation to contribute to region's meeting forecasted electric-power demands, it depends upon 1) the location of sage-grouse core breeding areas and 2) the available transmission capacity to send power to users. Both the location of Greater sage-grouse core breeding areas and transmission capability may be constraining factors (BLM, 2008).

There are currently no wind-power projects within the 80-km [50-mi] vicinity of the Ross Project area, and only one has been proposed (see Figure 5.1) (Strata, 2012a). This wind-power project, as proposed, would have a 250-MW capacity with 166 turbines generating approximately 600 million kWh annually (Strata, 2012a). It would be constructed and operated by Wind Energy America. The turbines would be located approximately 42 miles south-southeast of the Ross Project area, although it would be approximately 97 km [60 mi] to drive between the two operations. The project would be south of Interstate (I)-90, where the Ross Project area would be north of I-90.

5.3 Cumulative-Impacts Analysis

5.3.1 EISs as Indicators of Past, Present, and Reasonably Foreseeable Future Actions

One indicator of RFFAs in a particular region of interest is the number of recent draft and final environmental impact statements (EISs) and environmental assessments (EAs) that have been prepared by Federal agencies. The NRC used information presented in GEIS Section 5.1.1 as well as publicly available information, several site-specific EISs and Supplemental EISs (SEISs) for projects in the Powder River Basin, and draft and final programmatic EISs for large-scale actions related to several states, including Wyoming, to accomplish its cumulative-impacts analyses (NRC, 2009b).

5.3.2 Methodology

For the determination of potential cumulative impacts, the NRC staff reviewed Appendix F of the GEIS and determined that a Level 2 cumulative-impacts analysis was appropriate for this Ross Project SEIS due to the fact that concerns were identified during the site-specific analysis (SEIS Section 4) with respect to the sustainability or quality of some of the resource areas within the uranium-milling region (NRC, 2009b). Therefore, the following methodology was developed, based upon CEQ guidance for a Level 2 cumulative-impacts analysis as described in the GEIS (CEQ, 1997; NRC, 2009b):

- Identify for each resource area potential environmental impacts that would be of concern from a cumulative-impacts perspective. The impacts of the Proposed Action and the two Alternatives are described and analyzed by resource area in SEIS Section 4, "Environmental Impacts and Mitigation Measures."
- Identify the geographic scope for the analysis of each resource area. This scope would be expected to vary from resource area to resource area, depending upon the geographic extent of the potential impacts.
- Identify the timeframe over which cumulative impacts would be assessed. The cumulative-impacts analysis timeframe selected for the proposed Ross Project was

selected as 2013 in 2011, the estimated earliest year in which the when the Applicant could receive its Source and Byproduct Materials License from the NRC and could begin major construction. While there have been some preconstruction activities conducted by the Applicant since 2009, those activities have been determined to be minor with respect to cumulative impacts, because most of the actions have been simply ground-water monitoring-well installation, surface-water- and meteorological-station installation, data collection (i.e., ground-water and surface-water monitoring in addition to meteorological monitoring and a variety of pre-licensing, site-characterization field surveys); minor road construction; and renovation of a ranch house into Strata's Field Office).

After the NRC approves the Applicant's development of its post-licensing, pre-operational ground-water constituent-concentration values (i.e., after the first wellfield is fully installed and all required wellfield data have been collected and reported) that would be used for lixiviant-excursion detection and aquifer-restoration success, the Applicant could begin uranium recovery. In general, the cumulative-impacts analysis timeframes terminate in 2027, which represents the projected license-termination date at the end of the decommissioning period (see Figure 2.6 in SEIS Section 2.1.1). In some resource areas, however, the NRC's analysis considers impacts beyond 2027 to the extent that some resources, such as ground-water resources, could require additional time to equilibrate after the complete decommissioning of the Ross Project.

- Identify past, existing, and anticipated future projects and activities in and surrounding the Project area. These projects and activities are identified in this section.
- Assess the cumulative impacts for each resource area as a result of the Proposed Action and the reasonable Alternatives and other past, present, and reasonably foreseeable future actions. This analysis should take into account the environmental impacts of concern identified in Step 1 and the resource area-specific geographic scope identified in Step 2.

The following terminology was used to define the level of cumulative impact:

SMALL: The environmental impacts are not detectable or are so minor that they would neither destabilize nor noticeably alter any important attribute of the resource considered.

MODERATE: The environmental impacts are sufficient to alter noticeably, but not destabilize important attributes of the resource considered.

LARGE: The environmental impacts are clearly noticeable and are sufficient to destabilize important attributes of the resource considered.

In conducting this assessment, the NRC staff recognized that for many aspects of the activities associated with the proposed Ross Project, there would be SMALL impacts on affected resources. It is possible, however, that an impact that may be SMALL by itself, but could result in a MODERATE or LARGE cumulative impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a small individual impact could be important if it contributes to or accelerates the overall resource decline. The NRC staff determined an appropriate level of analysis that was merited for each resource area potentially affected by the Proposed Action and alternatives. The level of detailed analysis was determined by considering the impact level to that resource, as described in SEIS Section 4, as well as the likelihood that the quality, quantity, or stability of the given resource could be affected.

The subsequent sections document the NRC's cumulative-impact analysis in the following areas:

- Land Use
- Transportation
- Geology and Soils
- Water Resources
- Ecology
- Air Quality
- Global Climate Change and Greenhouse-Gas (GHG) Emissions
- Noise
- Historical, Cultural, and Paleontological Resources
- Visual and Scenic Resources
- Socioeconomics
- Environmental Justice
- Public and Occupational Health and Safety
- Waste Management

5.4 Land Use

The geographic area within which cumulative impacts to land use were evaluated were Crook and Weston Counties, which are within the BLM's Newcastle Field Office planning area, and Campbell County, which is within the planning area administered by the BLM's Buffalo Field Office (see Figure 2.1 in SEIS Section 2.1). These three counties include over 26,000 km^2 [10,000 mi^2] and incorporate the approximately 96 km^2 [56 mi^2] of the Lance District area. These three Counties serve as the geographic area where socioeconomic factors that could relate to land use (i.e., reasonable commuting, shopping, and/or lodging or new-home distances) would occur. This area is referred to in this section as the "land-use cumulative-impacts study area." Given the size of the three Counties and the size of the Ross Project, the Project would be approximately 0.03 percent of the entire land-use cumulative-impacts study area. The timeframe for this cumulative-impacts analysis is from 2013, when it was estimated the Applicant could be issued a Source and Byproduct Materials License by the NRC, through 2027, when the Ross Project and the satellites in the Lance District would be completely decommissioned and the aquifers would have been restored.

Land use within the Powder River Basin is diversified and cooperative, with CBM as well as oil- and gas-extraction activities sharing the land with livestock. Although Federal grasslands and forests cover approximately 21 percent of the Powder River Basin area, most rangeland is privately owned (68 percent) and is used primarily for grazing cattle and sheep. In Crook County, land ownership is also primarily private. Within Campbell County, however, land ownership is primarily Federal and is allocated by the BLM for use as pastureland (see Figure 3.1 in SEIS Section 3.2).

As noted in SEIS Section 4.2, the land-use impacts of the Ross Project would result primarily in the interruption, reduction, or impedance of livestock grazing and wildlife habitat; there is not public access to the Project area generally (e.g., for hunting or fishing) nor is there significant agriculture occurring currently at the Ross Project area (see Table 3.1 in SEIS Section 3.2). There are no longer any impacts from historical operations at the Ross Project area (i.e., Nubeth). In addition, the area that would be disturbed by the Ross Project encompasses a total of 114 ha [282 ac] of land, which represents 16 percent of the Ross Project area. The permanent impacts of the Ross Project would be limited, because the Applicant would be required to return the land to the pre-licensing conditions described in SEIS Sections 2.1.1.2 and 3.2, unless the respective landowners wish to have certain roads, for example, remain. Thus, the potential land-use impacts from the Ross Project would be temporary and SMALL through all of its phases, as discussed in SEIS Section 4.2.

Mining in the form of coal, mineral, oil, and gas extraction are all important land uses of the cumulative-impacts study area. As noted Section 5.2, both conventional and CBM oil and gas production are expected to continue in upcoming years. As of 2010, there were over 2,600 conventional oil- and gas-well permits in the land-use cumulative-impacts study area (USGS, 2011), with 889 producing wells (or less than 1 producing well per 26 km^2 [10 mi^2]). A typical drilling location, including a well pad and any access roads, disturbs approximately 1.11 ha [2.75 ac] of land (BLM, 2009e); at a density of 1 well per 26 km^2 [10 mi^2], this would represent up to 0.04 percent of the land affected by these wells. In addition, over 1,570 of the permitted wells have been abandoned and are no longer being used. Through 2008, 547 CBM wells had been drilled within the three-County study area (or approximately one producing well per 52 km^2 [20 mi^2], affecting approximately 0.02 percent of the total land area) (USGS, 2011). Because of the small area of impact for each well and the moderate number of wells currently being operated, the cumulative impacts by the use of land for oil and gas production is SMALL.

As noted in Section 5.2, coal production in the Wyoming portion of the Powder River Basin is expected to grow at an annual rate of 2 – 3 percent per year. It is predicted that from 2010 – 2020, the land area impacted by coal development in the Powder River Basin will increase from 39,927 ha – 55,621 ha [98,662 ac – 137,443 ac]. By 2020, these impacts would represent 1.3 percent of the land in the Powder River Basin. However, most of this coal-mining growth would be in the central area of Campbell County and in an area where the nearest coal mine is over 45 km [28 mi] from the Ross Project area. In the 80-km [50-mi] area shown in Figure 5.1, there are 9 operating coal mines (Strata, 2012a). This land use dedicated to coal mining has and would continue to have a MODERATE impact in the land-use cumulative-impacts study area.

There are no operating nor licensed ISR uranium-recovery facilities within 80 km [50 mi] of the Ross Project area, although there are four uranium-recovery projects in the very early stages of development as described in SEIS Section 5.2 (i.e., Aladdin, Elkhorn, Hauber and Altzada). There is also a potential for development of other uranium facilities to the north, east, and south of the Ross Project as part of the entire Lance District as described earlier. Thus, some land-use changes as a result of these reasonably foreseeable future developments could occur. To assess the projected land area that would be affected by the development of these present and foreseeable future actions, the NRC staff assumed that approximately the same area affected by the Ross Project and its disturbance of 114 ha [282 ac] would also be approximately the same as by these other ISR projects. Using this assumption, the NRC staff estimated that the four other non-Strata projects and the four other Strata Lance-District projects would impact an additional 904 ha [2,240 ac], for a total area disturbed by potential ISR projects in the land-use cumulative-impacts study area of 1,017 ha [2,520 ac]. This acreage accounts for only approximately 0.04 percent of the total study area. Therefore, these ISR projects would have a SMALL impact on land use.

The NRC staff has concluded that the cumulative impacts on land use in the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE. The

Ross Project would have a SMALL incremental effect on land use when added to the MODERATE cumulative land-use impacts.

5.5 Transportation

An area with an 80-km [50-mi] radius was used as the geographic boundary in the evaluation of the cumulative impacts of transportation for this SEIS (referred to in this section as the "transportation cumulative-impacts study area"). This study area was selected because it incorporates the area that would likely be travelled by the majority of the workers at the Ross Project and includes the distance to the nearest Interstate highway (i.e., I-90). The analysis of transportation-related cumulative impacts uses the timeframe of 2013 – 2027, which would be the entire lifecycle of Ross Project from licensing to final decommissioning. The analysis assumes that, within this timeframe, the four potential satellite areas within the Lance District would be developed sufficiently by the Applicant to construct and begin operation.

The environmental impacts identified in SEIS Section 4.3.1 for the Ross Project would result from the transport of chemical supplies, building materials, yellowcake product, vanadium product, solid byproduct wastes, other hazardous and nonhazardous wastes, and the commuting workforce, all of which increase traffic volumes to and from the Ross Project area. During the phases of the Ross Project examined in SEIS Section 4.3, traffic volume was estimated to increase up to 400 percent. This traffic would predominantly be present on the local Crook County roads. As a result, the wear and tear of the county roads would be significantly increased, and the potential for wildlife mortality and vehicular accidents would increase as well. Therefore, the transportation impacts were found to be SMALL to MODERATE to LARGE on local and county roads, depending upon the Project phase, and SMALL to the Interstate-highway system, as discussed in Section 4.3. With the mitigation measures discussed in Section 4.3, the overall transportation impacts would be reduced to SMALL to MODERATE. Once the Ross Project is decommissioned, most wellfield roads constructed as part of the Ross Project would be removed, and the traffic volume would subside to possibly a little more than the 2010 volume.

Direct impacts to the roads and highways within the transportation cumulative-impacts study area include increased vehicular-traffic volumes and increased risk of vehicular accidents during daily commutes by workers and the trips their families take, especially on roads such as New Haven and D Roads. Ross Project workers would use these local and county roads as would workers from the Lance District satellite areas and two of the five potential ISR projects currently being planned. If the same workforce is assumed for the two other potential ISR projects; if they are assumed to be under construction at the same time; and if it is assumed that the workers at both the Elkhorn and Hauber Projects were to use D or New Haven Roads to commute to and from work, these assumptions would increase the traffic on D and New Haven Roads to approximately and conservatively 920 additional automobiles on these roads alone per day (it was assumed here that the Ross Project would be already in its operation phase and its workforce would have been reduced to 60 workers). In addition, all of the supply and materials deliveries during their respective construction phases and uranium-product shipments would need to be added to this traffic volume. The volume that results, if the same number of deliveries and shipments by the other potential ISR projects is assumed, would increase to almost 1,000 vehicles per day. (Also, D Road is already being used by the Oshoto bentonite mine northeast of the Ross Project area, although there are only a reported eight workers currently commuting to that facility; consequently, this traffic was already considered under the

Ross Project's transportation impacts in SEIS Section 4.3.) This would be a LARGE cumulative impact for both D and New Haven Roads. Traffic on I-90 would be similarly increased during this period. However, the Interstate highway has been designed to provide sufficient capacity to accomodate this increase (as discussed in SEIS Section 4.3). Thus, the transportation impacts on the Interstate-highway system of the U.S. would be SMALL.

All of the indirect impacts identified for the proposed Ross Project, including increased wear and tear on existing roads, additional air emissions and fugitive dusts, greater noise, and an increased risk of vehicle collisions with livestock, wildlife, and other vehicles, would occur as a result of this increased traffic volume on the local county roads. This increased local traffic would yield MODERATE to LARGE impacts for the local roads, depending upon the sequencing of project development.

The NRC staff has concluded that the cumulative impacts within the overall transportation study area resulting from past, present, and reasonably foreseeable future actions, such as energy-related projects (e.g., CBM, oil, and gas projects as well as uranium recovery and coal mining) would be MODERATE. The proposed Ross Project would have a SMALL to MODERATE incremental effect on transportation when added to the MODERATE cumulative transportation impacts due primarily to significantly increased traffic.

5.6 Geology and Soils

The geographic area for the evaluation of geology and soils cumulative impacts ("geology and soils cumulative-impacts study area") is defined as the approximately 9,000-ha [22,200-ac] Lance District shown on Figure 2.2 in SEIS Section 2.1.1. This limitation of the cumulative-impacts assessment for soils to this area is appropriate since geology and soil impacts are constrained to the area in which they occur (i.e., they don't spread). The Ross Project itself would result in the disturbance of 114 ha [282 ac] of surface soil, a very small fraction of the total study area (i.e., approximately 0.013 percent).

Previous ISR activities at the Ross Project site include research and development activities conducted by Nubeth in the late 1970s. These activities included construction and operation of a small 5-spot wellfield for one year that likely resulted in some soil disturbance to a small area of land (Strata, 2011a). Regulatory approval of Nubeth's decommissioning was granted by 1986. The Nubeth area was approved as restored and reclaimed; thus, this past action is consequently no longer relevant for the geology and soils cumulative-impacts analysis.

As noted in SEIS Section 5.3.2, the proposed schedule for the construction, operation, and decommissioning phases as well as the restoration of the aquifer(s) at the Ross Project has these activities taking place over an approximate nine-year period from the time the Project would be licensed by the NRC (Strata, 2012a). Other Lance District wellfield-development activities (i.e., satellite areas) could extend the processing of uranium-bearing IX resin at the Ross Project's CPP by another five years or more, to 2027 (see Figure 2.6 in Section 2.1.1) (Strata, 2012a). However, the geology and soils impacts within the Ross Project area, where the soils would have been disturbed, would need time after the cessation of uranium recovery to recover. These impacts would dissipate once site restoration is complete, within five years or less according to the professional judgment of soils scientists; therefore, the time period for this geology and soils cumulative-impacts evaluation is a conservative 19 years from the licensing of the Ross Project, or the year 2032.

During the lifecycle of the Ross Project, as discussed in SEIS Section 4.4, potential impacts to Ross Project area geology would be predominantly associated with drillholes, wells, and wellfields. At the conclusion of the Ross Project, an average density of approximately 4.3 wells/ha [1.7 wells/ac], each properly plugged and abandoned, would remain. The Applicant's proper plugging and abandoning of these holes would mitigate their impact to the local geology. Also, the records required by the Applicant's permits for well plugging and abandonment would allow a final assessment of any impacts on the geology after the Ross Project has been decommissioned, if necessary.

The most significant impacts for soils would be soil loss and compaction, soil-productivity loss, and potential soil contamination. There would also be soil disturbance associated with the construction of the CPP, surface impoundments, and access roads as well as pipeline and wellfield installation. Accidental spills or other releases of drilling fluids and muds, process solutions, and other liquids could cause soil contamination throughout the Project's lifecycle. As noted in SEIS Section 4.4, facility- and wellfield-design features, best management practices (BMPs), and permit requirements, such as the requirements of the Applicant's Permit to Mine, UIC Permit, and Wyoming Pollutant Discharge Elimination System (WYPDES) Permit would minimize these potential impacts during the Ross Project's construction, operation, aquifer restoration, and decommissioning. The Project's decommissioning would include reclamation of soils and the restoration of the area to current conditions. Current conditions have been documented by soils and vegetation pre-licensing, site-characterization surveys of the Ross Project area as described in SEIS Section 3.4.. These surveys have established the conditions against which soils impacts at the Ross Project could be measured (see Figure 3.10). Thus, the geology and soil impacts of the Ross Project would be SMALL in the geology and soils cumulative-impact study area.

To assess cumulative impacts to soils, the area of soil disturbances needs to be quantified. The Applicant has identified four potential satellite areas within the Lance District (see Figure 2.2 in SEIS Section 2.1.1) (Strata, 2012a). The NRC assumed that each of these satellite areas would require the same area of soil disturbance as the Ross Project; consequently, their development would result in 450 ha [1,120 ac] of soil disturbance. The density of wells at the satellite facilities is also assumed to be similar to the well density at the Ross Project area. In addition, the impacts to geology and soils would be mitigated as those at the Ross Project would, including complete site reclamation at the end of the Project's lifecycle. If the density of drillholes and wells at these areas would be the same as the Ross Project, and the requirements for the plugging and abandonment of the drillholes and wells would be the same, then the potential impacts to geology and soils at each satellite facility would be generally equivalent to those of the Ross Project; thus, they would be SMALL.

As shown on Figure 5.1, there are numerous oil and gas fields that are located within the area of the Lance District, as noted earlier in this section. However, there are no publicly announced plans for further oil and gas development in the Lance District itself. The impacts to local geology would then be the depletion of the oil and gas mineral resources and the remaining, plugged wells after gas and oil extraction. For soils, the current wells and any future wells would cause soil impacts due to the drilling of the wells, the construction of new access roads, and the conduct of other operating activities. These soil impacts would also be required to be mitigated with site-specific BMPs as well as site-restoration and site-reclamation permit requirements.

The NRC staff has determined that the cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area would be SMALL. The soil disturbance associated with the Ross Project area and the other satellite projects in the Lance District would be limited to approximately 5 percent of the approximately 9,000-ha [22,200-ac] Lance District with 95 percent of the area remaining undisturbed. This disturbance to geology and soils would be dispersed throughout the Lance District and site restoration and reclamation would be required of the Applicant. The proposed Ross Project would have a SMALL incremental impact on the SMALL cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area.

5.7 Water Resources

The analysis of the cumulative impacts to both surface and ground waters are described below.

5.7.1 Surface Water

The geographic area for the evaluation of surface-water cumulative impacts has been defined by the NRC staff as Little Missouri River Basin, from the Ross Project downstream to the Wyoming/Montana border (see Figure 3.10 in SEIS Section 3.4.2). Within this stretch of the Little Missouri River, which begins in the Ross Project area, the mean flow increases from an average of less than 0.05 m^3/s [1.7 ft^3/s] at SW-1, near the downstream Ross Project boundary, to an average of 2 m^3/s [77 ft^3/s] just downstream of the Wyoming/Montana border. The 45-fold increase in flow within 80 km [50 mi] indicates that cumulative impacts associated with the Ross Project could only be measured in the upper reaches of the Little Missouri River Basin, which is why this geographic area was selected for cumulative-impacts analysis. As the River's flow substantially increases downstream of the Ross Project, any cumulative impacts would be greatly diminished by the additional volume of water.

As discussed in SEIS Section 5.3.2, the timeframe defined for the cumulative-impact analysis is 14 years after license issuance. The schedule shown in Figure 2.6 in SEIS Section 2.1.1 indicates that the construction, operation, aquifer restoration, and decommissioning of the Ross Project facility and wellfields as well as other potential Lance District satellite areas would take place during this time period. Since the impacts of the Ross Project on surface-water flows and surface-water quality would dissipate quickly upon completion of the decommissioning phase, this cumulative-impact analysis for surface water ends at 2027 after final Ross Project decommissioning is complete.

As described in the SEIS Section 3.5, the Ross Project would use surface water from the Oshoto Reservoir for dust control and construction-related activities at rates far less than the permitted water right. The Applicant has already obtained a WYPDES Permit (No. WYR104738) to manage storm-water runoff into the Little Missouri River (see SEIS Section 1.7). In addition, a temporary WYPDES Permit would continue to be required for the Applicant's discharge to the ground surface of all waters pumped from each new well during Strata's development of all injection, recovery, and montitoring wells (currently WYPDES Permit No. WYG720229). Water from the development of UIC Class I wells would also discharged according to a WYPDES permit. As described in SEIS Section 4.5.1, the impacts to surface-water quantity would be minimal, and the potential water-quality impacts would be mitigated by standard operating procedures (SOPs), BMPs, and permit requirements. The potential impacts of erosion in the small area of temporary land disturbance as well as from accidental process-solution and other liquid spills, leaks, and other releases would be localized and short-term because of the SOPs and BMPs the Applicant would adopt. The potential impacts to the surface-water quantity and quality from the Ross Project would be SMALL.

With respect to wetlands, the Ross Project's construction would have the potential to impact up to 0.8 ha [2 ac] of wetlands. A USACE-required permit would oblige the Applicant to provide a site-specific mitigation plan for all Project-related disturbance of jurisdictional wetlands. This plan would ensure that appropriate mitigation measures would be in place so that there is no net loss of wetlands. As described in SEIS Section 4.5.1, the Ross Project's potential impacts to wetlands would be SMALL.

Measurements of pre-licensing, site-characterization surface-water flows and water-quality parameters provide the basis for an assessment of the cumulative impacts to surface-water quantity and quality (Strata, 2011a). The monitoring program that the Applicant would implement during all phases of the Ross Project would ensure that the Applicant meets all Conditions of its Source and Byproduct Materials License as well as WDEQ/Land Quality Division's (LQD's) Permit to Mine requirements (NRC, 2014b; WDEQ/LQD, 2011). This monitoring program is discussed in SEIS Section 6.

The cumulative impacts for surface water would be related to water quantity and water quality. All streams within the upper reaches of the Little Missouri River and for 67 km [40 mi] downstream of the Ross Project are classified by WDEQ/Water Quality Division (WQD) as 3B streams (i.e., intermittent or ephemeral streams incapable of supporting fish populations or providing drinking water). At the confluence with Government Canyon Creek (approximately 67 km [40 mi] downstream of the Ross Project area), the River's flow increases to the point that the stream classification changes to 2ABWW (i.e., it is protected as a drinking-water source and can support warm-water fisheries). Surface-water quality in the upper reaches of the Little Missouri River currently meet Wyoming's surface-water criteria for a Class 3B stream (Strata, 2011a). Current surface-water flows would define the conditions against which impacts to Project surface-water can be measured over time. Data on surface-water flows are available from three monitoring stations within the Ross Project area for 2010 and 2011 (see SEIS Figure 3.12) (Strata, 2012a). These data, combined with flow data from the Wyoming/Montana border, would provide a data set against which changes in surface-water flow could be evaluated.

Surface-Water Quantity

Strata's potential uranium-recovery satellite areas in the Lance District, as described in SEIS Section 5.2, could impact the Little Missouri River (Strata, 2012a). Of the four identified potential satellite areas, only the Ross Amendment Area 1 lies within the Little Missouri River Basin, however. The others are located within the drainage basin of the Belle Fourche River. Because process-solution blending would continue to occur at the Ross Project's CPP as well as yellowcake production, all of these areas were considered in the NRC staff's evaluation of surface-water-quality cumulative impacts.

Crop irrigation and stock watering are the primary uses of surface water in the Wyoming portion of the Little Missouri River Basin (WWDC, 2002a). Irrigation use is estimated to range from

1,200 ha-m [9,700 ac-ft] to 1,400 ha-m/yr [11,600 ac-ft/yr] and evaporative loss from stock reservoirs is less than approximately 120 ha-m/yr [1,000 ac-ft/yr] (WWDC, 2002a). There are no other significant uses of surface water in the Wyoming portion of the Little Missouri River. The high estimate of current surface-water use is approximately 22 percent of the mean annual flow in the Little Missouri River at the Wyoming/Montana border (6,900 ha-m/yr [55,800 ac-ft/yr]). Agricultural uses of surface water in the northeastern portion of Wyoming are estimated to grow between 0 – 9 percent, or an increase up to 140 ha-m/yr [1,130 ac-ft/yr], over the next 30 years (WWDC, 2002a). The predicted future increase to 140 ha-m/yr [1,130 ac-ft/yr] would represent approximately 24 percent of the mean annual flow in the Little Missouri River at the Wyoming/Montana border.

During the lifecycle of the Ross Project, the annual surface-water use for construction and dust control is estimated to range from 0.71 – 4.6 ha-m/yr [5.8 – 37 ac-ft/yr]. If the Ross Amendment Area 1 were to be permitted and developed concurrently with the Ross Project, and if it were to use a similar quantity of water for construction and dust control, surface-water use would double. However, the potential for increasing water-quantity impacts would continue to be mitigated by SOPs, BMPs, and permit requirements. The remaining Lance District potential satelllite areas are expected to rely upon surface water from outside the Little Missouri River Basin.

Other projects that could potentially affect surface-water use within the surface-water cumulative-impacts study area (i.e., the Little Missouri Basin within Wyoming) are described as follows.

- ***Oshoto Mine*:** Bentonite mining typically does not use surface water. Water quality could be impacted by increased sediment due to erosion and runoff (see Surface-Water Quality below) (BLM, 2011).

The two uranium-recovery projects that have been identified for potential development within the Little Missouri River Basin are the Hauber and Elkhorn Projects. Because there are no concrete plans available for these Projects, the amount of surface-water use is unknown. However, the quantity of uranium targeted by each Project has been used to scale and calculate the approximate water use by each, based upon the quantity of uranium reported to occur at each site.

- ***Hauber Uranium Project*:** This Project targets approximately 1.5 million pounds of U_3O_8, approximately 12 – 25 percent of the 3 – 6 million pounds targeted by the Ross Project. Thus, this Project could use between 12 – 25 percent of the surface water that the Ross Project would use.
- ***Elkhorn Uranium Project*:** This Project targets approximately 1.2 million pounds of U_3O_8, approximately 10 – 20 percent of the 3 – 6 million pounds targeted by the Ross Project. Thus, this Project could use between 10 – 20 percent of the surface water that the Ross Project would use.

The numerous oil- and gas-extraction operations identified in Figure 5.1 have been assumed to rely upon ground water for water supply and are not expected to impact surface-water quantity. As discussed in SEIS Section 4.5.1, if water from the Oshoto Resorvoir were to be used to replace ground water pumped by the Merit Oil Company (Merit) from wells within the Project area and used for EOR, the requirement for surface water would be far less than the permitted water right from the Oshoto Reservoir. In addition, the projected changes in agricultural and industrial uses of surface water over the next 14 years are predicted to increase surface-water use of the Little Missouri River from 22 – 24 percent of the total flow in the Little Missouri River.

Agriculture would account for about 1.8 percentage-point increase. The two areas that the Applicant could develop (i.e., the Ross Project and the Ross Amendment Area 1) and the two other planned uranium-recovery projects, the Hauber and Elkhorn Projects, all in the Little Missouri Basin, would account for a 0.2 percentage-point increase over the current use. Thus, the cumulative impact, a two-percent decline in the flow of the Little Missouri at the Wyoming/Montana border, due primarily to an increase of agricultural withdrawals over the next 14 years, is SMALL. In addition, the reduction in flow due to uranium-recovery projects would be short-term and minor compared to agricultural use. Thus, surface-water cumulative-impacts related to water quantity would be SMALL.

Surface-Water Quality

Water-quality impacts at the Ross Amendment Area 1 and the Hauber and Elkhorn Projects described above would also be mitigated by SOPs, BMPs, and permit requirements. Increases in sediment and other water-quality parameters from uranium-recovery projects and other mining (e.g., bentonite) activities would be mitigated by the owner's/operator's implementing SOPs and BMPs as well as complying with respective WYPDES permits, WDEQ/LQD permits to mine, and the NRC's conditions in amended or new licenses. Increases in the impacts to water quality from agriculture would be mitigated through compliance with Wyoming's Watershed Protection Program. Thus, the cumulative impacts to surface-water quality in the Little Missouri River Basin would be SMALL. Also, the proposed Ross Project would contribute SMALL incremental impacts to the SMALL cumulative impacts.

5.7.2 Ground Water

The geographic area for the cumulative-impact analysis of ground-water impacts was based upon the hydrogeology of the Lance and Fox Hills Formations within the Powder River Basin, the practical maximum depth for water-supply wells, and the availability of ground-water sources as alternatives to the Lance and Fox Hills Formations. As described in SEIS Section 3.5.3, the ore zone at the Ross Project area is within the lower interval of the Lance Formation and upper interval of the Fox Hills Formation, which are separated from the aquifers above and below by confining units. The NRC's evaluation of cumulative impacts is therefore limited to only the stratigraphic horizon targeted by the Ross Project, because the ore-zone aquifer is not in contact with aquifers above and below it.

The Black Hills Monocline east of the Ross Project area brings the Lance and Fox Hills Formations to outcrop. Recharge occurs primarily in the area of outcrop and where the Formations are directly below alluvium-filled drainages. The geographic extent for the "ground-water cumulative-impacts analysis study area" is therefore delimited by the outside edge of the outcrop of the Fox Hills Formation, which is less than 300 m [1,000 ft] east of the Ross Project area, and by the 0 m [0 ft] elevation contour of the top of the Fox Hills Formation, which is located approximately 60 km [40 mi] west of the Project area. At this point, the Fox Hills aquifer is approximately 1,200 – 1,500 m [4,000 – 5,000 ft] deep. Along the other Ross Project boundaries, the geographic extent is defined by the 80-km [50-mi] radius of a circle whose center is the Ross Project boundaries.

As described in SEIS Section 3.5, the ground-water flow within the Ross Project area is to the west northwest, into the Powder River Basin. The top of the Fox Hills Formation is at an elevation of approximately 1,100 m [3,600 ft] in the area of the Ross Project. A review of ground-water resources in the Powder River Basin indicated that ground-water quality and drilling economics generally limit the maximum depth of drinking-water wells to less than 300 m [1,000 ft] (WWDC, 2002b). However, wells operated by the City of Gillette are approximately 1,050 – 1,350 m [3,500 – 4,500 ft] deep; these tap the Fox Hills Formation, where the top of the Fox Hills Formation is at an elevation of 150 m [500 feet]. The quality of the ground water taken from these wells is poor (WSGS, 2012). The high total dissolved solids (TDS) found in this ground water requires it to be mixed with waters from other, deeper wells, which are located near Moorcroft; these wells are drilled into the Madison Formation, where lower TDS concentrations are present. Because both the depth to the Fox Hills Formation and the fact that TDS concentrations increase as one travels farther into the Powder River Basin, the municipal water-supply wells for Gillette mark the practical westernmost limit for extraction of potable water from the Ross Project's ore-zone aquifer. Therefore, the western edge of the ground-water area defined for cumulative-impact analysis is the 0 m [0 ft] structural contour, on the top of the Fox Hills Formation.

The schedule for construction, operation, aquifer restoration, and decommissioning at the Ross Project indicates a period of 14 years, from the licensing of the Ross Project to its complete decommissioning if Strata's potential satellite areas within the Lance District are developed (see Figure 2.6 in SEIS Section 2.1.1) (Strata, 2012a). Site-specific ground-water modeling demonstrates that ten years after aquifer restoration is complete, ground-water levels would have nearly recovered to a pre-uranium-recovery state (Strata, 2011b). Thus, the time period of 24 years from the start of the Ross Project was defined for this cumulative-impacts evaluation of ground water (i.e., the year 2037).

Data on ground-water levels and water-quality data are available for a number of wells within the Ross Project area from early 2010 (Strata, 2011a; Strata, 2011b; Strata, 2012a). These data, together with individual wellfield post-licensing, pre-operational hydrologic and water-quality data that would be required by the Source and Byproduct Materials License, would provide a data set against which changes in ground-water quality and quantity could be evaluated. Long-term observations of ground-water levels and ground-water monitoring within the hydrostratigraphic ore-zone unit would provide a metric for the assessment of the cumulative ground-water impacts. The aquifer-monitoring program proposed by the Applicant to meet NRC requirements as well as those requirements in its WDEQ/LQD Permit to Mine are discussed in SEIS Section 6.3.2.

Cumulative impacts to ground-water resources could be related to both water quantity and water quality, and these are evaluated below.

Ground-Water Quantity

During uranium-recovery operations at the Ross Project, there would be a net withdrawal of water from the ore-zone aquifer. This withdrawal would produce decreases in ground-water levels in Ross Project wellfields. Other ground-water users that operate wells completed in the same hydrostratigraphic unit would also affect water levels in the vicinity of their wells. Extraction of ground water in excess of the rate of recharge to the aquifer in the same hydrostratigraphic unit would result in the decline in ground-water levels with time. Upon termination of ground-water extraction, however, recharge of the ore-zone aquifer would then begin to increase ground-water levels. The Applicant estimates that recharge to the Lance Formation would be between 0.03 – 0.09 cm/yr [0.07 – 0.22 in/yr] (Strata, 2011b). Because of the limited Lance and Fox Hills Formations' recharge areas and the low recharge rates, small residual drawdowns in the vicinity of the Lance District would likely be present for tens of years after cessation of uranium-recovery activities. However, this small residual drawdown would not affect the water available for use in the aquifer because the projected drawdown would be a minor reduction of the total thickness of water in the ore-zone aquifer. As described in SEIS Section 4.5.1, the potential impacts to the ground-water quantity outside the Ross Project would be SMALL and mitigated by alternative water supplies as necessary.

The schedule for the potential development of the Ross Project and the Lance District, which is shown in Figure 2.6 of SEIS Section 2.1.1, suggests that other uranium-recovery satellite areas in the Lance District could overlap temporally with the Ross Project. Extrapolation of the ground-water model constructed for the Ross Project indicates the potential for overlap of ground-water drawdowns from wellfield development (Strata, 2011b).

During the operation and aquifer-restoration phases of the Ross Project, the weighted average ground-water consumption has been estimated to be 7.7 L/s [122 gal/min] over a period of 6 years (Strata, 2011a). The Ross Project area has a predicted U_3O_8 production of 340,000 kg/yr [750,000 lb/yr] over 4 – 8 years, and the Ross Amendment Area 1 would extend this rate of production for several years (Strata, 2012a). Production would rise to 993,000 kg/yr [2.2 million lb/yr] U_3O_8 (i.e., yellowcake) with the Kendrick, Richards, and Barber satellite areas. If consumptive water use is assumed to be proportional to U_3O_8 production, then ground-water consumption would increase to an average of 22.5 L/s [356 gal/min] spread across the Lance District for the period of maximum yellowcake production within the Lance District.

The NRC recognizes that it would be in the Applicant's operating interest to minimize overlap of ground-water drawdowns produced by future potential satellite operations. Thus, Strata would minimize the overlap to prevent interference between wellfields during operations as well as wellfields undergoing aquifer restoration in order to effectively recover uranium and to restore ground-water resources.

As noted earlier, the Wyoming State Engineer's Office (SEO) maintains a database of ground-water rights, including water use, well yield, well location, and well depth; however, the geologic interval from which the ground water is extracted is not recorded. Furthermore, data on the yield might not be representative of the actual volumes pumped. Thus, the current rate of ground-water withdrawal from the Lance and Fox Hills Formations, and in particular the ore-zone aquifer, cannot be estimated. The Applicant reviewed the Wyoming SEO's database and concluded that most of the permitted stock and domestic wells within the region of the Ross Project were completed within the Lance Formation's sandstones—above the ore zone—and are not in hydrologic communication with the ore-zone aquifer (see SEIS Section 3.5 3). The depth of the ore zone, typically greater than 120 m [400 feet], and the fact that there are other aquifers above the ore-zone aquifer, would make the ore-zone aquifer unattractive as a ground-water source (Strata, 2011b). In addition, any future ground-water development of the Lance and Fox Hills aquifers would be localized and limited, due to poor water quality (WWDC, 2002a).

In addition to the potential for future ISR development in the Lance District, there are a number of existing or potential resource-extraction projects within the ground-water cumulative-impacts study area that have water demands. These are:

- ***Uranium Recovery*:** Other existing or planned uranium-recovery projects are outside the specific geographic area selected for ground-water-related cumulative-impact analysis, and would utilize a different stratigraphic horizon than the Ross Project would (Strata, 2012a). The planned uranium-recovery Aladdin, Elkhorn, Hauber, and Alzada Projects, if they come to fruition, would target uranium in the Fall River and Lakota Formations. These Formations are of Lower Cretaceous age, located several thousand feet below the Lance and Fox Hills Formations, and are separated by the thick Pierre Shale. Thus, uranium-recovery activities in those Formations would not impact the same ground water at the Ross Project.

- ***Oil Extraction:*** In the mature oil fields of northeast Wyoming, water is used for EOR and is described as "water flooding" (De Bruin, 2007). A planning report prepared for the Wyoming Water Development Commission (WWDC) concluded that traditional oil and gas production in northeast Wyoming is in decline. Ground-water use by the oil-and-gas industry might cause localized aquifer depression, but it would be generally spread over a large geographic area and would not typically impact other ground-water resources (WWDC, 2002a). At the Ross Project area, the Lance and Fox Hills aquifers show approximately 46 m [150 ft] of drawdown due to withdrawals from the three industrial water-supply wells that have been used since 1980 for oil extraction (see SEIS Section 4.5.1) (Strata, 2011b). The Applicant could not develop wellfields south of the Little Missouri River until the three water-supply wells cease operation or the water volume removed through the three wells diminishes to an acceptable level (NRC, 2014b, License Condition 10.19). Only a portion of the water requirements for EOR is provided by the Lance and Fox Hills Formations, as stratigraphically higher aquifers are available in the western portion of the Project area.

- ***Coal Mining and CBM Extraction:*** The mining of coal and extraction of CBM occur within the western portion of the ground-water cumulative-impacts geographic study area (see Figure 5.1). The principal coal seams are in Tongue River Member of the Fort Union Formation, which is above the Lance and Fox Hills Formations and which is separated by several thousand feet of the Upper Hell Creek (Upper Lance Formation) and Lebo (Lower Fort Union Formation) confining units (Hinaman, 2005). Ground-water pumping associated with CBM production, coal mining and processing, and mine-mouth power generation would therefore not impact ground water within the Lance and Fox Hills Formations.

- ***Bentonite Mining:*** Bentonite-mining operations take place in the shale horizons stratigraphically below the Lance and Fox Hills Formations and are, therefore, outside the geographic area for the analysis of ground-water cumulative impacts.

- ***Other Mining:*** Other potential mining projects, for example, the Bear Lodge Rare Earth Project, are also outside the geographic area defined for ground-water cumulative impacts.

- ***Domestic Use:*** Ground water extracted for domestic use within northwest Wyoming, which includes the ground-water cumulative-impacts study area, is expected to increase approximately 24 percent between 2002 – 2030 which includes the underlying assumption that population growth will be moderate (WWDC, 2002a). The water satisfying this increased need will be meet by pumping the Wasatch and Fort Union aquifers, Lance and Fox Hills aquifers, and other, deeper aquifers, all of which possess better water quality.

The NRC staff has determined that the cumulative impacts to ground-water quantity in the ground-water cumulative-impacts study area would be SMALL. There would be no expected increases in water consumption as a result of continued oil and gas extraction and/or agriculture, although the possibility of small increases from the Lance and Fox Hills Formations as a result of domestic-use requirements exists. The impacts on ground-water quantity from uranium recovery in the Lance District would be essentially recovered within 24 years after the issuance of the Source and Byproduct Materials License to the Applicant. As described in Section 4.5.1.2, the impacts from drawdown during the operation and aquifer-restoration phases, and the time it takes for the aquifer to recover to pre-licensing, site-characerization conditions, would be SMALL because the drawdown would be only be a small portion of the total water in wells. Similar levels and durations of drawdowns would be expected in localized areas around wellfields throughout the Lance District if the potential satellite areas were to be developed by the Applicant. Therefore, cumulative impacts to ground-water quantity in the Lance and Fox Hills Formations would be SMALL.

Ground-Water Quality

Impacts from previous uranium-recovery activities at Nubeth are part of the cumulative impacts to the Ross Project area. Past impacts can be evaluated by comparing Nubeth's pre-operational water-quality data to Nubeth's post-aquifer-restoration data, as summarized in Table 5.4 (Nuclear Dynamics, 1980; ND Resources, 1982) and to Strata's pre-licensing, site-characterization data as described in SEIS Section 3.5.1.2. The data in Table 5.4 show that aquifer-restoration efforts by Nubeth returned TDS to levels below pre-operational conditions, except for the Injection Well 20X, which also contained levels of radiological parameters above pre-operational values obtained at the completion of Nubeth's aquifer-restoration efforts. Of the six buffer and monitoring wells in the ore zone, pre-operational mean values for gross alpha, radium-226 (Ra-226), and total uranium were achieved by aquifer restoration in three, four, and two wells, respectively. In the other wells, concentrations of radiological constituents exceeded the average pre-operational levels by 5 – 243 percent at the close of aquifer restoration; the concentrations of radiological constituents in the Recovery Well 19X and Injection Well 20X exceeded the average pre-operational levels at the close of aquifer restoration. The monitoring well in the shallow-monitoring (SM) zone (Well 7X) did not show excursions of TDS and

Table 5.4
Comparison of Pre-Operational† and Post-Restoration††
Water Quality at Nubeth Joint Venture

Well in Zone	Well Use	Sample Date	TDS (mg/L)	Gross Alpha (pCi/L)	Ra-226 (pCi/L)	Uranium (mg/L)
3X in OZ	Buffer	Mean Baseline 1978	1674	209	76	0.07
		Restoration 10/1981	1500	130	22	0.24
4X in OZ	Buffer	Mean Baseline 1978	1660	145	16	0.09
		Restoration 10/1981	1510	180	26	0.22
5X in OZ	Monitoring	Mean Baseline 1978	1562	88	0.3	0.08
		Restoration 4/1980	1550	37	0.5	0.04
6X in OZ	Monitoring	Mean Baseline 1978	1746	98	0.4	0.09
		Restoration 4/1980	1650	66	0.1	0.095
7X in SM	Observation	Mean Baseline 1978	1498	1.4	0.3	0.004
		Restoration 4/1980	1400	180	0.6	< 0.001
11X in OZ	Monitoring	Mean Baseline 1978	1764	78	1.3	0.08
		Restoration 4/1980	1730	116	1	0.08
12X in OZ	Monitoring	Mean Baseline 1978	1596	67	2.2	0.06
		Restoration 4/1980	1520	111	1.6	0.08
19X in OZ	Recovery	Mean Baseline 1978	1672	178	85	0.12
		Restoration 10/1981	1510	300	31	0.48
	Industrial Supply	2009 – 2011†††	1703	234	39	0.08
20X in OZ	Injection	Mean Baseline 1978	1284	4.4	1.5	0.003
		Restoration 10/1981	1520	85	20	0.07

Sources: Nuclear Dynamics, 1980; ND Resources, 1982.

Notes:

† "Pre-operational" values calculated as the average of five samples collected from April – June 1978 before Nubeth operations began (Nuclear Dynamics, 1978). These values were identified as "baseline," though that term is not used in this document.

†† Restoration data from Nuclear Dynamics, 1980, and ND Resources, 1982.

††† The reported values for Well 19XX18 during 2009 – 2011 are average concentrations from Strata's pre-licensing, site-characterization environmental monitoring (Strata, 2011a; Strata, 2012a). Well 19XX18 is Nubeth's Recovery Well 19X that was converted to a water-supply for oil- and gas-extraction operations in the 1980s.

*"<" = "Less than," where the value following the "<" is the detection limit.

uranium. The measurements of Ra-226 in Well 7X before and after Nubeth activities were equivalent (i.e., within the analytical error of the measurement). The gross-alpha measurement of 180 pCi/L [6.7 Bq/L] in Well 7X in April 1980 indicated an excursion of radioactivity into the aquifer above the ore zone (see Table 5.4). However, gross-alpha measurements in Well 7X during the 1979 aquifer-restoration period were much lower than 180 pCi/L [6.7 Bq/L], ranging from 1.4 – 4.7 pCi/L [0.1 – 0.2 Bq/L] which suggests that the measurement in April 1980 may be an outlier (Nuclear Dynamics, 1980).

Evaluation of the restoration conditions in Nubeth's wells provides a short-term assessment of past impacts. The longer-term impacts from Nubeth can be determined by a comparison of Nubeth's pre-operational water-quality data with Strata's pre-licensing, site-characterization water-quality data, as described in SEIS Section 3.5.3. The data presented in Tables 3.6 and 3.7 in SEIS Section 3.5.3 suggest that the current water quality in the ore zone and the SM aquifers are the same as each were at the time of Nubeth's pre-operational sampling.

For example, the maximum values of TDS, total uranium, Ra-226, and gross alpha determined by Strata (see Table 3.6) are less than the maximum values of those parameters measured in 1978 (see Table 3.7). Specifically, Strata's pre-licensing, site-characterization water quality in Well19X (Strata's sample location = 19XX18) can be compared with Nubeth's pre-operational data to evaluate longer-term impacts from that past action. The average values as a result of the monitoring efforts in 2009, 2010, and 2011 (0.08 mg/L uranium and 1.4 Bq/L [39 pCi/L] Ra-226) are less than the values measured in Well 19X in 1978. The current TDS concentrations range from 1,650 – 1,790 mg/L, which includes the average concentration of 1,672 mg/L measured in 1978. The current gross-alpha measurements range from 6.2 – 12 Bq/L [168 – 324 pCi/L]; this range encompasses the average concentration of 6.6 Bq/L [180 pCi/L] measured in 1978. Thus, these two aquifers (i.e., ore zone and SM zone) are not currently impacted by the past uranium-recovery activities by Nubeth.

As described in SEIS Section 4.5.1, water quality at the Ross Project could be impacted during operations by excursions of lixiviant (i.e., process solutions) from the ore-zone aquifer into surrounding aquifers. The lixiviant injected into the ore zone causes metals such as uranium, vanadium, arsenic, selenium, and molybdenum, as well as other constituents such as radium, to dissolve into the ground water. Despite the design of the wellfields and the pumping methods, which would contain the uranium-recovery process within the exempted aquifer (see SEIS Section 2.1.1), short-term impacts from excursions do occur. As described in SEIS Sections 2.1.1 and 4.5.1, a network of monitoring wells around the perimeter of each wellfield would provide the capability for early detection, control, and reversal of such excursions. As Draft Source and Byproduct Materials License Condition No. 11.5 indicates, the Applicant would recover any excursions into aquifers surrounding the ore-zone aquifer (NRC, 2014b). Ground-water restoration would return the exempted aquifer to the ground-water protection standards that would be established in accordance with the License. As described in SEIS Section 4.5.1, therefore, the potential impacts to the ground-water quality from the Ross Project would be SMALL. The same set of potential impacts to short-term ground-water quality, mitigating actions, and license requirements would be incorporated into any license that the Applicant would be required to obtain for the potential Lance District satellite areas; these would ensure that the potential impacts of each satellite area would be SMALL.

Because the water quality of the exempted aquifer for each potential uranium-recovery project would be returned to the ground-water protection standards of 10 CFR Part 40, Appendix A, and every NRC license would require all excursions to be recovered, the cumulative impacts of the all potential uranium-recovery projects would also be SMALL. In the unlikely event that increased concentrations of metals mobilized by the lixiviant at the Ross Project or other satellite areas in the Lance District migrate downgradient, outside the area affected by lixiviant, the geochemical conditions of the ore-zone aquifer in that area would promote lower dissolved metal concentrations (i.e., would cause the dissolved metals to precipitate) (NRC, 2007). That is, as the dissolved metals enter portions of the aquifer that had not been subjected to the oxidizing lixiviant, the naturally occurring, oxygen-deficient conditions would cause chemical reactions that would precipitate the dissolved metals into minerals on the rock of the impacted aquifer. Thus, cumulative impacts to ground-water quality would be SMALL. Therefore, the incremental impacts of the proposed Ross Project in terms of both ground-water quantity and quality would be SMALL when added to the SMALL ground-water quantity and quality cumulative impacts in the ground-water cumulative-impacts study area.

5.8 Ecology

The geographic area employed by the NRC staff in the analysis of cumulative impacts to ecological resources is the entire Powder River Basin (i.e., the “ecology cumulative-impacts study area”) because grassland and sagebrush-shrubland habitats are important features of the Basin’s entire landscape, and these habitats occur on the Ross Project area as well. The Powder River Basin includes approximately 1,801,401 ha [4,451,360 ac] of land (BLM, 2009e). Approximately 222,568 acres, or 5 percent, of the Powder River Basin land area has been disturbed by past development activities. Of this amount, approximately one-half of the disturbed area has been reclaimed (BLM, 2009e).

The timeframe for the ecology cumulative-impacts analysis is 2013 – 2032. This timeframe was chosen to allow impacts to the ecology of the Ross Project area and its vicinity to mature. It would take some time for the flora and fauna to fully recover after site restoration; the NRC has assumed five years in this cumulative-impacts analysis.

5.8.1 Terrestrial Ecology

Activities occurring in the vicinity of the Ross Project include livestock and wildlife grazing, agricultural production, and mineral extraction. These activities take place over a larger area of the Powder River Basin as well. As discussed in SEIS Section 4.6, potential impacts to ecological resources, both flora and fauna, include reduction in wildlife habitat and forage productivity, modification of existing vegetative communities, and potential spread of invasive-species and noxious-weed populations. Impacts to wildlife could involve loss, alteration, and incremental habitat fragmentation; displacement of and stresses on wildlife; and direct and indirect mortalities.

5.8.1.1 Vegetation

Vegetation at the Ross Project area is primarily sagebrush shrubland and upland grasslands, which are typical of the Powder River Basin. As discussed in Section 4.6, the Ross Project’s impacts to vegetation at Project area would be SMALL.

There are no licensed or operating uranium-recovery projects within 80 km [50 mi] of the Ross Project area, although there is a potential for development of satellite areas as part of the

Applicant's development of the entire Lance District. There are also four potential uranium-recovery projects in the very early stages of development as described earlier (i.e., Aladdin, Elkhorn, Hauber and Alzada) (see SEIS Section 5.3). To assess the extent of impacted vegetation as a result of the development of these areas and projects, the NRC staff assumed that approximately the same area affected by the Ross Project (114 ha [282 ac]) would also be affected by these other uranium-recovery activities. With this assumption, the four Lance District satellite areas and the four other potential uranium-recovery projects would impact approximately 904 ha [2,240 ac], for a total area of vegetation impacts in the study area of 1,017 ha [2,520 ac]. This area would be approximately 0.05 percent of the total ecology cumulative-impacts study area. Therefore, these ISR projects would have a SMALL impact on vegetation.

Other mineral-development activities described in Section 5.2, including coal-, oil-, and gas-extraction developments, occur within the Powder River Basin. Currently, 53,680 ha [132,645 ac] of land is disturbed by these activities (BLM, 2009e). Land restoration and reclamation would be required for these operations within the Powder River Basin in their respective permits. It has been estimated that all but approximately 0.8 percent of the disturbed vegetation would be reclaimed (BLM, 2009e). The remaining areas would be associated with permanent infrastructure components. Therefore, the impact to vegetation within the Powder River Basin due to past and present actions as well as RFFAs would be SMALL to MODERATE, and the Ross Project's incremental contribution to vegetation impacts would be SMALL.

5.8.1.2 Wildlife

Loss and degradation of native sagebrush-shrubland habitats has affected much of this ecosystem type as well as sagebrush-obligate species including the Greater sage-grouse. Most of the sagebrush shrublands in the Powder River Basin have already been significantly impacted by land uses such as livestock grazing, crop agriculture, or resource extraction. These uses can influence habitats either directly or indirectly; for example, an indirect effect would be the alteration of the natural regime, which could change the frequency of land-clearing fires (Naugle et al., 2009). As another example of a direct impact, the long-term viability of the Greater sage-grouse continues to be at risk because of population declines related to habitat loss and degradation. Because of its spatial extent, oil and gas production are regarded as playing a major role in the decline of this species in the eastern portion of its range (Becker, et al. 2009). Therefore, there are currently MODERATE cumulative impacts to the Greater sage-grouse. As of the time the NRC's cumulative-impacts analysis was conducted, the U.S. Fish and Wildlife Service (USFWS) had designated the Greater sage-grouse as a "candidate species" under the *Endangered Species Act of 1973* (ESA) and will continue to consider the bird on an annual basis for listing as a threatened or endangered species.

However, the impact to sagebrush-shrubland communities at the proposed Ross Project would be SMALL because only 114 ha [282 ac] , 16 percent of the total Project area, would be disturbed. Additionally, only 21 percent of the Ross Project area consists of sagebrush-shrubland habitat. Most of the habitat disturbance at the Project would be a result of scattered drilling sites for uranium-recovery and monitoring wells; these would not result in large expanses of habitat being dramatically transformed from its original character, as do other surface-mining operations; no substantial long-term impact would be expected. No leks or wintering areas have been identified on the Ross Project area, and the area is not located within a designated core area for the Greater sage-grouse.

Potential impacts (e.g., habitat loss, habitat fragmentation, and noise disturbance) would also likely occur at mines as well as oil- and gas-extraction sites throughout the ecology geographic cumulative-impacts study area, and these impacts would potentially affect localized wildlife populations in the same manner as the Ross Project. These impacts to other species would be similar; therefore, impacts as a result of the other Lance-District satellites and uranium-recovery projects would be SMALL. Other past, present, and RFFAs discussed in the Powder River Basin could result in the disturbance of tens of thousands of acres. However, site-reclamation requirements of required permits as well as SOPs and BMPs would mitigate these impacts. Thus, the cumulative impacts on terrestrial ecology would be SMALL within the Powder River Basin. Cumulative impacts to the Greater sage-grouse would continue to be MODERATE, however. The Ross Project's incremental impacts to cumulative impacts on ecology in the Powder River Basin would also be SMALL.

5.8.2 Aquatic Ecology

Three amphibians and five reptiles designated as Wyoming Species of Greatest Conservation Need (SGCN) have been observed on the Ross Project area. However, because the Applicant has committed to avoiding aquatic areas during Project construction and operation as much as possible (Strata, 2011a), the proposed Ross Project would have a SMALL impact on aquatic resources. Similarly, due to the amount of surface disturbance in the Powder River Basin (i.e., 5 percent), and the mitigation requirements associated with the required regulatory permits and licenses, the cumulative impacts on aquatic ecology anticipated from the other past or present actions as well as RFFAs within the Powder River Basin would be SMALL (BLM, 2009e).

5.8.3 Protected Species

No Federal- or State-listed protected plant species or designated critical habitats occur within the proposed Ross Project area. With regard to Federal or State protected species, the Ross Project has the potential to impact 18 avian species known to be present on the Ross Project area (see SEIS Section 4.6). The limited footprint of the actual buildings and other structures across the entire Ross Project area would serve to reduce the impacts to protected species. In addition, the Applicant's proposed mitigation measures described in SEIS Section 4.6 would further diminish the respective impacts. These Impacts would be SMALL.

There are Federally listed protected plant and wildlife species within the Powder River Basin, however, including the Ute ladies'-tresses orchid, the Preble's meadow jumping mouse, the boreal toad, and the mountain plover (BLM, 2003). In addition, the range of bald eagles is throughout the Powder River Basin. On the lists of sensitive species maintained by the BLM, Wyoming Game and Fish Department (WGFD), and the U.S. Forest Service, there are 3 plants, 3 amphibians, 1 snake, 10 fish, 25 birds, and 8 mammals that are known to occur within the Powder River Basin. For the majority of these species, the BLM has determined that there could be impacts on these species due to development within the Basin (BLM, 2003); however, given the location of development activities as compared with the geographical occurrence of many of these species, and with mitigating permit requirements in place, the cumulative impacts to all but one species would be SMALL. Potential impacts to the Greater sage-grouse were identified by the BLM to be of particular concern.

The USFWS had designated the Greater sage-grouse as a "candidate species" under the ESA. However, after implementation of Wyoming EO 2011-5, the USFWS has endorsed the State's conservation strategy that, if fully supported and implemented, would be a means to prevent a listing decision. Within the Power River Basin, potential impacts to the sage-grouse were identified due to loss of habitat and connectivity, construction of disposal impoundments for produced waters generated during oil and gas production, and disturbance related to increased vehicular traffic (BLM, 2003). Because of these factors, the BLM concluded that the cumulative impacts would likely result in a downward trend for the sage-grouse population, and they may lead to its federal listing.

The USFWS has completed a 90-day finding for the eastern population of the boreal toad, and it determined that there is substantial information that the eastern population might qualify as a distinct population segment and that listing may be warranted under 50 CFR Part 167. The USFWS is moving forward with a 12-month finding, but at this time the boreal toad is not Federally listed (USFWS, 2013).

Therefore, the NRC staff determined that the cumulative impacts on protected species within the ecology study area resulting from all past and present actions and RFFAs is SMALL to MODERATE. Thus, the proposed Ross Project would have a SMALL incremental impact when added to the SMALL to MODERATE cumulative impacts on the ecology of the Powder River Basin.

5.9 Air Quality

The geographic area for the air-quality cumulative-impacts analysis was based upon the NRC staff's consideration of other regional air-pollutant-modeling studies that address larger-scale emissions sources applicable to oil and gas production as well as a general understanding of the effect of source-emission strength on the spatial extent and magnitude of downwind air impacts (i.e., larger plumes transport air emissions farther distances downwind before diminishing to insignificant levels). The "air-quality cumulative impacts study area" was therefore defined for air emissions as the circular area formed by an 80-km [50-mi] radius around the Ross Project area. However, significant air-pollution contributors and prevention of significant deterioration (PSD) sensitive areas up to approximately160 km [100 mi] were included, as appropriate, in this analysis. As shown on Figure 5.1, an 80-km [50-mile] radius area encompasses the northeast corner of Wyoming, including the city of Gillette and numerous small towns, and extends into South Dakota and Montana.

Any immediate air-quality impacts of the Ross Project would dissipate quickly once wellfield closure and facility decommissioning is complete and as vegetation is re-established in the areas where there was soil disturbance. The generally windy conditions present at the Ross Project readily disperse airborne pollutants, and the suspended particulates under the influence of gravity, fall out of suspension. As described in Section 5.3.2, the timeframe considered in this assessment of air-quality cumulative impacts begins in 2013, when it was estimated the Applicant could be issued a Source and Byproduct Materials License by the NRC, and ends in 2027 when the Source and Byproduct Materials License would be projected to be terminated (see Figure 2.6). After license termination, there would be no impacts on air quality by the Ross Project as all sources of air pollution would be no longer operative.

As noted in SEIS Section 4.7, the potential impacts to air quality from the Ross Project would be SMALL during each phase of the Project. Air-quality impacts primarily involve combustion-engine emissions from both the equipment that would be used predominantly during the construction and decommissioning phases of the Ross Project as well as the combustion-engine emissions associated with the commute of Project workers and Project deliveries and shipments during all phases. In addition, there would be measurable fugitive-dust emissions from roads traveled by vehicles used for commuting, deliveries, and shipments to and from the Ross Project facility as well as from the land-disturbing activities during, especially, the construction and decommissioning phases.

Very small emissions are also possible from processes at the CPP and/or the storage of waste liquids in the surface impoundments at the Ross Project facility. These could include minor chemical-vapor emissions during tank and vessel refilling, chemical delivery, or waste shipments. Windblown emissions from the surface impoundments are also possible. However, SOPs, BMPs, and other air-quality-related management actions such as the monitoring plans that the Applicant would adhere to, would help mitigate air emissions and air-quality impacts. Other facility-design attributes, such as exhaust-point filters, would help to reduce these potential air-quality impacts to even lesser proportions.

The Ross Project could contribute to air-quality cumulative impacts when its environmental impacts overlap with those of other present actions or RFFAs. As described in SEIS Section 5.2, other present and future actions in the air-quality cumulative-impacts study area could include additional in situ uranium-recovery activities, both those by the Applicant in the Lance District and the four other potential ISR projects in the study area; coal, bentonite, and rare-earth element mining; oil and gas production; electricity generation by a wind farm; and the current uses of cattle and sheep grazing. The Ross Project would ultimately disturb 114 ha [282 ac] of ground surface; there are, however, no other existing, present ISR projects within the air-quality cumulative-impacts study area to generate impacts to air quality. In addition, air-quality impacts from past operations in the study area have been resolved and are no longer relevant as noted above and as discussed in SEIS Section 3.7.

Three of the most important metrics in the estimate of the cumulative impacts of combustion-engine and fugitive-dust emissions are the amount of soil that is disturbed during a project's construction, road installation, and wellfield drilling as well as the types of roads used to access a given project (e.g., gravel or dirt roads), their maintenance, and the number of vehicles on the roads (see SEIS Section 4.7). In general, undisturbed surfaces produce much less dust than disturbed surfaces, because the undisturbed surfaces usually require considerably higher wind speeds to pick up and suspend particulates that then could become an emission source (Countess et al., 2001). Further, in general, fugitive dusts are usually generated by ground-level activities.

Studies have been performed to better understand the characteristics of the windblown fugitive dust and mechanically re-suspended road dust that contribute to regional haze (i.e., visible air pollutants such as fugitive dust). These studies are summarized in SEIS Section 4.7.1.1 and indicate that the majority of fugitive-dust-related air-quality impacts caused by the Ross Project would not be expected to extend beyond the 80-km [50-mi] radius around the proposed Ross Project area during its entire lifecycle.

However, as described in SEIS Section 5.2, four satellite areas within the Lance District could be developed for uranium recovery by the Applicant (Strata, 2012a). The NRC staff has made the assumption that each of these satellite areas would involve the same amount of soil disturbance as the Ross Project. (This is a conservative approach, as the satellite areas would not include a CPP and surface impoundments and, thus, such construction would not occur.) Thus, the satellite areas could result in approximately 450 ha [1,120 ac] of soil disturbance. It was further assumed that any air-quality impacts of these satellite areas would be mitigated with the same measures identified in SEIS Section 4.7 for the Ross Project itself. These dust-control measures would include the Applicant's minimizing the area of soil that would be disturbed at any one time, spraying water to suppress dust, and promptly revegetating disturbed areas. Further, the Applicant's enforcement of speed limits, treatment of roads to minimize dust, and restriction of equipment-operation hours would further mitigate fugitive-dust impacts.

Although no other nuclear-fuel-cycle or ISR projects are currently operated within 80 km [50 mi] of the Ross Project, within that area there are four other, potential uranium-recovery projects in the early planning stages as noted in Section 5.2. These include the Aladdin Project (7,100 ha [17,550 ac]), the Elkhorn Project (2,110 ha [5,215 ac]), the Hauber Project (2,090 ha [5,160 ac]), and the Alzada Project (10,000 ha [25,000 ac]) (Strata, 2012a).

It has been assumed that these projects would be developed similarly to the Ross Project and that 16 percent of the total area of each would be disturbed during these Projects' lifecycles. This would result in approximately 3,150 ha (7,840 ac) of soil disturbance. Because ISR uranium-recovery commonly employs a phased approach to well drilling and wellfield construction, and because the four Projects would not begin construction simultaneously (as each must go through an average two-year licensing process), the degree of overlap for activities associated with these four Projects would likely occur predominantly during the wellfield-installation phase, not during the construction phases. Thus, the surface disturbances likely would not occur simultaneously and would not be additive. Once fugitive dust was suspended in the air, the dust would settle out within the distances described earlier (not exceeding 80 km [50 mi]. In this assessment of air-quality cumulative impacts, it has been further assumed that combustion-engine and fugitive-dust emissions as well as any processing-plant emissions would be managed and mitigated in a manner similar to the Ross Project. Therefore, the relative contribution of reasonably foreseeable future uranium-recovery projects to any regional air-quality impacts would be SMALL.

Ten current bentonite-mining operations are within 80 km [50 mi] of the Ross Project area (see Figure 5.1). The straight-line distances to the ten active bentonite mines from the Ross Project range from 5 – 88 km [3 – 55 mi]. The Oshoto bentonite mine is approximately 5 km [3 mi] from the Ross Project area; the next closest bentonite mine is approximately 56 km [35 mi] distant (Strata, 2012a). Surface mining of bentonite can result in significant removal and disturbance of soils during operation, resulting in both combustion-engine and fugitive-dust emissions. However, bentonite mines must apply the same types of SOPs, BMPs, and other air-quality-management tools as would the Ross Project, including spraying exposed soils to ensure that fugitive particulates are not generated. Consequently, bentonite mining has a SMALL impact on air quality.

Numerous oil fields are located within 80 km [50 mi] of the Ross Project area. In general, future development of these resources would include well-installation and operation activities which would cause combustion-engine emissions and some soil disturbance, generating fugitive dust. However, it has been assumed that combustion-engine and fugitive-dust emissions would be managed and mitigated in a manner similar to the Ross Project. Both the potential rare-earth minerals extraction and wind-power projects have also been assumed to be required to manage and minimize each project's respective soil disturbance and combustion emissions during construction and operation. Thus, the air-quality impacts of local oil and gas production would be SMALL. As shown on Figure 5.1, 9 coal mines are located within 80 km [50 mi] of the Ross Project area, southwest of the Project (Strata, 2012a). The straight-line distances to the nine active coal mines within 80 km [50 mi] range from 45 – 72 km [28 – 45 mi]. Five surface coal mines are within approximately 48 km [30 mi] of the proposed Ross Project. This distance is sufficient to ensure that any fugitive dusts that would be generated at the coal mines would not be additive and that the particulates, whether mechanically suspended or windblown, would settle out prior to traveling great distances.

At least six power plants are currently operating within the 80-km (50-mile) radius of the circular air-quality cumulative-impacts study area. Of these, the coal-fired Wyodak plant near Gillette, Wyoming, is a significant emitter of CO_2 (greater than 3 million t/yr [3.3 million T/yr]) and other hazardous air pollutants. Wyodak is one of the four coal-fired power plants in Wyoming that are the subject of recent EPA actions to compel upgrades to their pollution-control systems (to the “best available control technology [BACT]) in order to reduce CO_2 and other emissions. The other coal-fired power plants within the air-quality cumulative-impacts study area emit much less pollution due to advanced BACT controls.

The newest power plant, Dry Fork Station, seven miles north of Gillette, is a natural-gas fired plant with advanced pollution controls. Two other plants, Neil Simpson near Gillette, Wyoming, and Ben French near Rapid City, South Dakota, generate power by burning both natural gas and coal. In addition, the Black Hills Corporation has announced its closure of the 22-megawatt Neil Simpson 1 unit in March 2014 (Wyoming Star Tribune, 8/8/2012). Two Elk, a waste-coal power plant proposed in the mid-1990s for northeast Wyoming has yet to be financed or built. The future development of coal-fired power plants in the air-quality study area would be subject to stringent pollution controls, if any were to be built. Ms. Marion Loomis, the Executive Director of the Wyoming Mining Association, has predicted that many older power plants will be shut down in the next ten years in the U.S. and that some might be converted to natural gas (Wyoming Star Tribune, 8/8/2012). Therefore, it is unlikely that any new power plants without BACT would be developed within the air-quality cumulative-impacts study area. Given the large area that encompasses the emissions from these plants, as well as the moves toward BACT performance, the regional air-quality impacts would be SMALL.

These conclusions are consistent with a previous evaluation by BLM of potential air-quality impacts from future coal and CBM mining as well as oil and gas production in the Powder River Basin (BLM, 2003; BLM, 2006; BLM, 2009b; BLM, 2009e; BLM, 2010; ENSR, 2006; BLM, 2009e). This recent BLM cumulative-impacts analysis of air quality in the Powder River Basin was conducted to support the development of increased coal production (BLM, 2009e). Emissions data were acquired for the base year of 2004 for nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter less than 2.5 microns ($PM_{2.5}$) , and particular matter less than 10 microns (PM_{10}); these were then modeled to 2020. The estimated impacts of the modeled emissions indicated that air-pollutant concentrations were compliant with (i.e., below) the National Ambient Air Quality Standards (NAAQS), except for the 2020 estimates when short-term and annual $PM_{2.5}$ and PM_{10} standards were exceeded in localized areas. Therefore, although future coal-mine expansion and development of other projects could result in some increase in emissions in the Powder River Basin and downwind areas during the cumulative-impacts study’s timeframe, such impacts would be SMALL.

Further, as noted in SEIS Section 3.7.3, no violations of the ozone standard have occurred in the area. The levels reported by the nearby air-quality monitoring stations described earlier, however, are close to the respective ozone standard (see Table 3.17 in SEIS Section 4.7.1). Reasonably foreseeable future actions, if conducted concurrently with the Ross Project, could result in occasional exceedances of the ozone standard because of the cumulative number of vehicles associated with all of the activities. However, because of the distance to these mines and the pollutant mixing afforded by the winds in Wyoming, air-quality impacts related to ozone would also be SMALL.

Thus, all contributors to air-quality cumulative impacts related to these actions would be SMALL. Because the impacts of gaseous and particulate emissions associated with uranium recovery would be SMALL, as described in SEIS Section 4.7.1, the NRC staff has concluded that the incremental air-quality impacts of the Ross Project would be a SMALL contribution to the SMALL cumulative impacts to air quality resulting from past, present, and future actions.

5.10 Global Climate Change and Greenhouse-Gas Emissions

5.10.1 Global Climate Change

While there is general agreement in the scientific community that some change in climate is occurring, considerable uncertainty remains in the magnitude and direction of some of these changes, especially during the prediction of trends in a specific geographic location. To predict the effect on climate change of the proposed Ross Project (and vice-versa), temperature and precipitation data for Wyoming were evaluated. Data have been collected over the period of 1895 – 2010. On average, the temperature in Wyoming has increased approximately 0.09 °C [0.16 °F] per decade during this time period (NCDC, 2011a). In its report, the U.S. Global Change Research Team (USGCRT) indicated that the temperatures in the past 15 years have risen faster (i.e., 0.83 °C [1.5 °F] for the Great Plains), most of which is attributed to warmer winters (GCRP, 2009). The projected change in temperature over the period from 2000 – 2020, which encompasses the period that the Ross Project would be licensed and operated, ranges from a decrease of approximately 0.28 °C [0.5 °F] to an increase of approximately 1.1 °C [2 °F] (GCRP, 2009).

For the same period (i.e., 1895 – 2010), a slight downward trend in precipitation (0.30 cm [0.12 in] per decade) has been measured (NCDC, 2011b). Nevertheless, the USGCRT has predicted that the Great Plains region would receive increased precipitation in future decades. Most of the precipitation is expected to fall in the colder months (i.e., winter and spring), and the summer and fall are predicted to become drier. In addition, with the colder months expected to warm over the next several decades, more precipitation would fall in liquid form, resulting in less snow pack in the higher elevations (GCRP, 2009).

The small predicted increases in temperatures and precipitation over the next decade would have no effect on any of the phases of the Ross Project. Because the most significant activities at the Ross Project would be belowground, the effects of the surficial and atmospheric environments are not expected to impact significantly uranium recovery. There could be an increase in recharge to aquifers underlying the Ross Project area in future years, which would result from the predicted increased precipitation (i.e., higher precipitation would consequently increase infiltration into the ground-water regime). This could affect the Ross Project by increasing the volume of ground water in the ore-zone and improving the effectiveness of the aquifer-restoration process. Similarly, while potential changes to the Ross Project area's environment and resources, such as ecology, are plausible, the small magnitude of the predicted climate change during the period when the uranium recovery would be conducted would not be sufficient to alter the environmental conditions at the Ross Project area in a manner that would significantly change the environmental impacts from those that have been evaluated in this SEIS. Based upon the above analysis, the proposed Ross Project would have a SMALL incremental impact to predicted climate change.

5.10.2 Greenhouse-Gas Emissions

The evaluation of cumulative impacts of greenhouse-gas (GHG) emissions requires the use of a global-climate model. A comparison of annual carbon dioxide emissions by source is provided below as Table 5.5. A U.S. Global Change Research Program (GCRP) report provided a synthesis of the results of numerous climate-modeling studies (GCRP, 2009). The NRC staff has concluded that the cumulative impacts of GHG emissions around the world, as presented in the GCRP report, are an appropriate basis for its evaluation of cumulative impacts.

Table 5.5
Comparison of Annual Mass of Carbon-Dioxide Emissions by Source

Source	Annual CO_2 Emissions (tonnes [T])	Percent of World Emissions	Percent of U.S. Emissions
Global Emissions (EPA, 2009)	28,000,000,000 [30,884,000,000]	100%	500%
United States (EPA, 2009)	6,000,000,000 [6,618,000,000]	21%	100%
Current/Proposed ISR Facilities (NRC, 2011b)	7,380 [8,140]	0.000026%	0.00012%
Average U.S. Passenger Vehicles (FHWA, 2006)	4.5 [5]	Negligible	Negligible
Estimated Proposed Ross Project (Strata, 2011c)	11,872 [13,087]	0.000042%	0.0002%

Notes: t = Tonnes, or Metric tons.
T = Short tons, or U.S. tons.

Based upon the impacts identified in the GCRP report, the national and worldwide cumulative impacts of GHG emissions are noticeable, but they are not destabilizing (refer to SEIS Section 5.3 which defines the impact magnitudes that the NRC uses). Consequently, a meaningful approach to address the cumulative impacts of GHG emissions, including carbon dioxide, is to recognize that such emissions contribute to climate change and that the carbon footprint is a relevant factor in the evaluation of potential impacts of alternatives.

The Center for Climate Strategies (CCS) prepared a report for the WDEQ that provides an inventory and forecast of Wyoming's GHG emissions (CCS, 2007). These emissions data were based upon projections from electricity generation, fuel use, and other GHG-emitting activities. Emissions are reported as carbon-dioxide equivalents (CO_2e); this conversion renders all of the various gases emitted (i.e., methane or nitrogen oxides) during an operation or activity into an equivalent-GHG effect compared to carbon dioxide. Gross CO_2e emissions in 2005 for Wyoming were 56 million t [62 million T]; these account for less than 1 percent (i.e., 0.8 percent) of the total U.S. gross GHG emissions. This total is reduced to 36 million t [40 million T] CO_2e as a result of annual sequestration (i.e., removal) due to forestry and other land uses (CCS, 2007).

Wyoming has a higher per-capita emission rate than the national average (i.e., greater than 4 times the national average), due primarily to the State's fossil-fuel-extraction industry, industries that consume great amounts of fossil fuels, a large agricultural industry, great distances between Wyoming cities, and a small population (EPA, 2008). The report shows that the Wyoming GHG emissions would continue to grow as demand for electricity is projected to increase, followed by emissions associated with transportation. It is estimated that Wyoming gross GHG emissions will be 69 million t [76 million T] by 2020 (EPA, 2008).

According to the WOGCC, Wyoming contains over 33,000 active gas and oil wells, 45 operational gas-processing plants, 5 oil refineries, and over 14,484 km [9,000 mi] of gas pipelines (CCS, 2007). Because there is no regulatory requirement to track carbon dioxide or methane emissions, there is a high degree of uncertainty associated with the estimated Wyoming GHG emissions from oil- and gas-production operations . However, the CCS estimated that approximately 13.5 million t [14.9 million T] of CO_2e was emitted by fossil-fuel industries (CCS, 2007). Of this amount, 80 percent was due to the natural-gas industry. This amount is expected to grow an additional 8 – 10 percent in the next decade (CCS, 2007). No data currently exists for the non-fossil-fuel industries, including the uranium-recovery industry.

In response to current concerns related to GHG emissions, the Applicant evaluated carbon-dioxide emissions for the lifecycle of the Ross Project and then compared them with other forms of resource extraction. Annual and cumulative carbon-dioxide emissions from the Ross Project during the construction and decommissioning phases were estimated by the Applicant during the air-permitting process for the WDEQ (Strata, 2011c). Combustion-engine exhaust calculations performed for the Ross Project were based upon a combination of Project-specific and representative information appropriate to support a conservative emissions-screening analysis. The primary source of carbon-dioxide emissions at the Ross Project would result from combustion-engine emissions from construction equipment, including drill rigs (see Table 5.6). The GHG inventory was calculated for the maximum yellowcake production rate of 1,360 t/yr [1,500 T/yr]. Construction equipment is used most frequently during initial facility construction and wellfield installation, but also later during the decommissioning phase to demolish buildings, dismantle equipment, and reclaim the land.

The Applicant found that minor amounts of methane and nitrogen oxides, both of which are considered GHG, would be emitted during natural-gas combustion. The GHG potential or CO_2e of these emissions is a fraction of one percent of the carbon-dioxide emissions, and they were therefore omitted from the calculations. The maximum GHG emissions per year coincide with the year where some wellfield installation, facility and wellfield operation, and aquifer restoration would occur concurrently (i.e., Year 4).

Table 5.6
Maximum Annual Greenhouse-Gas Emissions
(CO_2 in t [T])

Activity	Carbon Dioxide (t [T])
Uranyl Tricarbonate Breakdown	640 [705]
Sodium Bicarbonate in Eluate	776 [855]
Product Drying	871 [960]
Space Heaters	1,049 [1,156]
Diesel Powered Equipment	8,433 [9,296]
Diesel Generators	104 [115]
TOTAL	11,872 [13,087]

Source: Strata, 2011c.

As described above, the total gross amount of GHGs produced in Wyoming in 2005 was 56 million t [61.7 million T], without the reducing effects of sequestration (EPA, 2008). If the 36 million t [39.7 million T] of GHGs sequestration is taken into account (EPA, 2008), the net total of GHGs produced annually in Wyoming is 20 million t [22 million T]. The Ross Project would conservatively produce a maximum annual GHG total of 11,872 t [13,087 T] (as carbon dioxide). This figure equates to approximately 0.06 percent of the net total GHGs produced in Wyoming in 2005. If there has been an increase in GHG emissions, or a decrease in sequestration since 2005, the effect of the Ross Project would be even less.

The Applicant's use of BMPs and other mitigation measures could minimize the emission of GHGs at the Ross Project. These mitigation measures could include, but are not limited to, the Applicant's performing the following:

- Using fossil-fuel vehicles that meet latest emission standards.
- Ensuring that diesel-powered construction equipment and drill rigs are properly tuned and maintained.
- Using low-sulfur diesel fuel.
- Using newer, cleaner-running equipment.
- Avoiding equipment idling or equipment running unnecessarily.
- Minimizing the number of trips to drilling pads and wells.

Therefore, the potential impact of GHGs from the Ross Project would be SMALL and the cumulative impacts of GHG within the cumulative-impacts study area would be SMALL.

5.11 Noise

Cumulative noise impacts were assessed within a rectangular area, a 300-m [1,000-ft] distance from all points on the sides of the Lance District, so as to include the potential development by the Applicant of satellite areas within the Lance District (the “noise cumulative-impacts study area”) (see SEIS Section 5.2). Although some noises would be detectable beyond the Lance District, this distance was considered appropriate because noise dissipates a short distance from the source.

As described in SEIS Section 5.3.2, the timeframe considered in the assessment of potential noise cumulative impacts begins in 2013, when it was estimated the Applicant could be issued a Source and Byproduct Materials License by the NRC, and it ends in 2027, when all facility decommissioning and other disturbed-areas reclamation has been completed (see Figure 2.6 in Section 2.1.1). All Ross Project-related noise of any type would cease at the end of the decommissioning phase. There would be no more activities taking place at the Project area that would generate noise, nor would there be any workers commutes to and from the Project area, supply deliveries to the area, and yellowcake shipments from the area.

As discussed in SEIS Section 4.8, the potential impacts as a result of noise at the Ross Project result from both activities taking place at the Project itself as well as automobiles and trucks coming and going from the Project area. The noise generated at the Ross Project area would be the greatest during its construction phase and second greatest during the decommissioning phase. Vehicular noise would be generated during all phases, however, as workers commute; as supplies, materials, and uranium-loaded resin are delivered to the Project; and as yellowcake and wastes are taken away from the Project. All of these sources of noise would generate SMALL to MODERATE noise impacts during the lifecycle of the Ross Project.

As shown in Figure 2.6 in SEIS Section 2.1.1, the potential development of the Lance District would occur in significantly overlapping phases. Each of the phases (i.e., construction, operation, aquifer restoration, and decommissioning) at each of the satellite areas would produce the same noise as discussed in SEIS Section 4.8.1 for each phase of the Ross Project. At the Ross Project itself, the sources of noise are primarily associated with the operation of construction and drilling equipment during facility construction and wellfield installation as well as vehicular noise. In general, the noise generated during the Project would occur during only Ross Project facility construction, not at any of the satellite areas because the satellite areas would be predominantly only additional wellfields. However, the Applicant has indicated it could construct an IX facility at the Barber satellite area to treat pregnant lixiviant by IX. Thus, some construction noise can be expected there while that smaller facility is built.

As Figure 2.6 depicts, wellfield installation at the Ross Project would begin within a few months of the Project’s start (after licensing). Other wellfields in the Lance District would begin approximately one year following that time. Over the following years, other wellfields would begin to enter the aquifer-restoration phase and even decommissioning. This noise cumulative-impacts analysis has assumed that the noise generated within the Lance District would be the same as that generated during the four phases of the Project’s lifecycle. Thus, this noise—the maximum of which would occur during the CPP’s and surface impoundments’ construction during the same time the first wellfields are being installed—would be SMALL.

The phases when the Ross Project is being operated—60 operations workers—overlap with the installation of wells in two new satellite areas—70 well-installation workers—and continuing uranium recovery at one satellite area—20 wellfield operators—would result in 440 passenger vehicles and approximately 24 heavy truck trips per day, which would be the highest traffic volume anticipated for the Ross Project. During the initial construction phase of the Ross Project, when the CPP would be constructed, there would be approximately 400 passenger vehicles and 24 heavy truck trips per day. Thus, the maximum estimated impacts of vehicular noise during any point in time would not differ much from the noise evaluated in SEIS Section 4.8, and, therefore, these impacts would be short-term and SMALL to MODERATE (for the nearest residences). The transportation of process chemicals and supplies to the Ross Project, and yellowcake and waste shipments from the Ross Project, were predicated on the maximum yellowcake production rate of 1.4 million kg/yr [3 million lb/yr], which would include the truck delivery of uranium-loaded IX resin from the Barber satellite area to the Ross Project's CPP. Consequently, vehicular noise would not appreciably increase with the additional Lance District satellite areas, even during overlapping phases, because the approximate number of vehicles—400—has already been considered in SEIS Section 4.8.

There are no past or present actions nor additional RFFAs within the noise cumulative-impacts study area than those in the Lance District itself; all of the ISR facilities in the preplanning stage near the Ross Project are over ten miles away from the Project area. Similarly, all other present and future actions are greater than 300 m [1,000 ft] away, and no cumulative noise impacts would occur. (And, all noise ceases when an action is completed, so no past actions are relevant to this analysis.) This cumulative-impacts analysis included a search for any planned oil- and gas-extraction projects that would take place in the Lance District; however, none were identified. Because the Applicant is also unaware of any such plans, this analysis did not include any noise related to future oil and gas wells in the Lance District. Thus, construction-noise cumulative impacts would be SMALL.

Some of the present and future actions that could be constructed near the Ross Project area as described in SEIS Section 5.2, however, could produce noise cumulative impacts related to vehicular traffic. For example, the primary access route to and from the Ross Project and the Lance District would be along D Road (County Road [CR] 68) for 18.3 miles, then the New Haven Road (CR 164) for 3.0 miles to the appropriate access roads onto the Ross Project area itself (see Figure 2.1 in SEIS Section 2.1) (Strata, 2011a). Virtually all traffic associated with the Ross Project would use this access route (Strata, 2012a). Of the present and potential projects identified during the noise cumulative-impacts analysis, the only potential projects that would share the route on D and New Haven Roads would be the Elkhorn and Hauber ISR Projects. Because of the uncertainty of uranium-recovery and processing methods that would be used, no estimate of the number of employees or truck traffic is possible at this time (Strata, 2012). However, if it is assumed that the same workforce would be required for those two developments (as was assumed in the transportation cumulative-impact analysis in SEIS Section 5.5), then there would be SMALL to MODERATE cumulative impacts with regard to vehicular noise along D and New Haven Roads.

In addition, the existing bentonite mine northeast of the Ross Project area would contribute to noise along some of the routes potentially taken by the Applicant's personnel at the Ross Project (see Figure 5.1). Highway-legal trucks (as opposed to heavy mine-haul trucks) transport bentonite from the Oshoto Mine to a processing and packaging plant in Upton (see Figure 5.1). The transportation route between the Oshoto Mine and Upton includes portions of D and New

Haven Roads, which are adjacent to the Ross Project area and the Lance District. The bentonite-truck routes also include roads north and east of the Ross Project that would not be used by Ross Project-related traffic. The degree to which the increased traffic would contribute to potential cumulative noise impacts would depend on hiring and production at Oshoto. The daily Oshoto Mine traffic is estimated at eight commuter trips and ten truck trips. This traffic was already included in the analysis of both transportation and noise impacts in SEIS Sections 4.3 and 4.8 (see also Table 3.2 in SEIS Section 3.8). Thus, the noise associated with the present operation of the nearby bentonite mine has already been considered in the noise impacts found to be SMALL to MODERATE during the Ross Project's lifecycle.

All of the sources of noise described above would be short-term and dissipate quickly with distance. For noise levels typical of drilling and construction, including multiple simultaneous noise sources in close proximity, calculations show that at the residences nearest to the Ross Project, the average noise from equipment would be significantly less than 55 dBA based upon the noise data collected by the Applicant (EPA, 1978; Strata, 2011a). Given the distance between potential and existing projects, the Ross Project and Lance District areas would only contribute SMALL incremental impacts. However, given the potential noise from increased traffic on local roads as a result of present and reasonably foreseeable future projects, there would be MODERATE noise cumulative impacts to the residents living nearest the roads traversed by traffic associated with these projects. These MODERATE impacts would continue insofar as the two potential Projects (i.e., the Elkhorn and Hauber Projects) would also use the CRs utilized for Ross Project access, such as D or New Haven Roads.

5.12 Historical, Cultural, and Paleontological Resources

The assessment of cumulative impacts on historical, cultural, and paleontological resources has been geographically defined as the area of potential effect (APE) that has been established through the Section 106 process. The Ross Project's APE is discussed in SEIS Section 3.9. The APE is defined as the Ross Project site and its immediate environs, which may be impacted by activities associated with the construction and operation of the proposed facility. These activities would include construction, operation, aquifer restoration, and decommissioning activities. The direct APE is comprised of the areas within the Ross Project boundary that may be directly affected by physical ground disturbance and construction of the Ross Project, and the indirect APE is comprised of the area within three miles of the Ross Project boundary wherein potential visual and audible effects to historic properties may occur. In relationship to other proposed undertakings with the potential to affect these resources, the regional cultural sub-area constituted by the headwaters of the Little Missouri River and the Cretaceous-era Lance Formation provide vectors for analysis of cumulative effects to the archaeological and paleontological record.

The cumulative-impacts analysis timeframe begins in 2013, the earliest estimated year in which the Applicant could have received a Source and Byproduct Materials License from the NRC and could have begun major construction, and concludes in 2027, the estimated year the license would be terminated after the decommissioning and site restoration of the Ross Project and all satellites in Lance District.

The description of the affected environment in Section 3.9 serves as the basis for this cumulative-impacts assessment. Table 3.18 lists the current National Register of Historic Places (NRHP) eligibility status of the 42 historic and cultural properties identified within the

Ross Project area. As indicated in Table 3.18, two sites, 48CK1603 and 48CK2083, are NRHP-eligible per consensus determinations between the NRC and the Wyoming State Historic Preservation Office (WYSHPO), and eight sites have consensus determinations of non-eligible. Of the remaining 32 properties, 18 are Traditional Cultural Property (TCP) sites. The NRC has determined that 13 of the TCP sites are NRHP-eligible, three are not eligible, and two are unevaluated. The remaining archaeological sites are unevaluated. The final determinations of the NRHP eligibility of these 32 sites, as well as the evaluation of potential adverse effects to historic properties and measures to avoid, minimize, or mitigate those effects, will be be completed in accordance with the Ross Project Programmatic Agreement (PA) (see Appendix E for the draft PA, which has been issued to the PA participants for comment). As described in Section 4.9, the NRC staff concluded that construction impacts from the Ross Project would be SMALL to LARGE, while impacts from project operation, aquifer restoration, and decommissioning would each be SMALL.

At present, there is already some disturbance at all site types as a result of past livestock grazing and agricultural activities as well as some encroachment due to road construction and oil production, but other impacts of human activities are minimal. Erosion is currently causing some site damage as archeological and paleontological materials erode out of cut banks. In some portions of the APE where alluvium is present, some sites as yet unidentified likely remain protected by intact terraces, and they may be deeply buried.

Archaeological investigations for the Ross Project and other undertakings in the vicinity show that humans have occupied the area for at least 12,000 years (Ferguson, 2010). The Ross Project area is situated in a known culturally-sensitive area at the headwaters of the Little Missouri River, where there is potential for deeply buried archaeological material that could provide information on earlier periods of regional culture. Ground disturbance during construction activities would be the greatest threat to archaeological sites. This includes the impacts of excavation as well as from construction of access roads. There is a risk of damaging Native American archaeological sites that may be eligible for the NRHP, depending upon the depth and location of such ground disturbances.

Ground disturbances could also have an adverse impact on TCPs by damaging landforms or other organic relationships that create or enhance a TCP's setting. A TCP could also be damaged by compromising of the very qualities that make it significant to a community and help it to maintain and perpetuate cultural identity and values. Significant qualities could include integrity of visual setting, a sense of privacy, silence, and other factors that support the general ambiance of a natural setting.

The Project could also damage paleontological resources, as the APE is situated within the Late Cretaceous Lance Formation, which is known for its potential to contain a variety of fossil types. Paleontological remains in two of the prehistoric sites recorded during the Class I survey were brought to the site from elsewhere, but, as in the case of the potential for buried sites, paleontological material of varying ages could be encountered wherever the Lance Formation is penetrated or otherwise disturbed.

To determine cumulative effects, other proposed projects in the nearby Powder River Basin were reviewed for activities that have the potential to impact historical, cultural, and paleontological resources. Other ongoing developments include activities related to energy development, including other potential ISR uranium-recovery projects, coal mines, and oil- and gas-recovery operations. The potential projects related to changing population demographics and public-service needs throughout the general vicinity include wind-power facilities; utility transmission and distribution lines; transportation infrastructure; reservoir development; agricultural activities; livestock grazing; and other economic endeavors. Activities related to all of these pursuits—in addition to natural effects, particularly erosion—have the potential to amplify the impacts of the Ross Project. These impacts taken cumulatively can lead to incremental damage to the archaeological, TCP, and paleontological record by the elimination of potential data points from the cumulative record of the entire vicinity, which potentially encompasses the Powder River Basin, Black Hills, and Big Horn Mountains.

The Applicant expects to develop subsequent areas of the Lance District for uranium-recovery satellite operations (see Figure 2.2 in SEIS Section 2.1.1). Similarities in landscape and existing conditions as well as potential construction activities make it likely that the impacts to historical, cultural, and paleontological resources would be similar to those resulting from Ross Project.

Cumulative-impacts analysis for the Moore Ranch Project indicated that the potential impacts of its construction and operation would be small, because the Moore Ranch Project is not expected to directly impact eligible archaeological sites when added to the moderate cumulative impacts to the resources from other past, present, and reasonably foreseeable future actions (NRC, 2010). The Nichols Ranch ISR facility, approximately the same distance from the Ross Project area as the Moore Ranch Project, identified numerous “pre-contact” sites (i.e., the period of time prior to the arrival of Euro-Americans) and deemed the impacts from that Project to be small to moderate, and cumulative effects to be moderate.

The BLM has identified proposed coal-mining operations in the Powder Basin as well as continuing development trends. Impacts arising from development of mines, access roads, and related transportation infrastructure, such as extensions of railways, could have a varying effect on historical, cultural, and paleontological resources, depending upon where they are sited, but such development is projected to increase at least over the next few years in the Powder River Basin. The same is true of quarries for sand, gravel, and scoria, all of which are used in road construction and maintenance.

CBM and oil and gas exploration and delivery are also expected to continue increasing with population growth and its attendant energy demands. These increases, however, are tempered by economic and regulatory factors. Development of these projects would also be similar to uranium-recovery projects, potentially involving the construction of access roads, pipelines, utility transmission lines, and support facilities of various types as well as ground-water-well installation and facility decommissioning activities.

Mitigation measures can reduce or minimize some impacts to historical, cultural, and paleontological resources. Sites could be deliberately avoided during construction, by flagging them or protecting them with a barrier. Careful monitoring during construction and the implementation of an inadvertent discovery plan can also provide a measure of avoidance or minimize impacts to sites as well as to paleontological discoveries. When impacts are unavoidable, data recovery is often proposed as mitigation measure. A Memorandum of Agreement (MOA), a Programmatic Agreement (PA), or another type of formal agreement between the cognizant Federal agency(ies), the WYSHPO, the Applicant, project proponent, and/or the respective Tribes could stipulate the management and treatment of identified sites.

The agreement could also support ongoing consultation with Tribes designed to avoid, minimize, or mitigate adverse impacts to archaeological sites, TCPs, and other cultural resources. Activities which are on Federally-managed lands, or that would be subject to Federal licenses and permits, would be expected to generate fewer impacts, as the Federal agency would be required to identify historic properties and assess and avoid or resolve potential adverse effects on them in accordance with Section 106 of the *National Historic Preservation Act of 1966* (NHPA).

Some impacts, however, can be greater on lands, including private or even State, that are not Federally administered. These would include impacts to physical remains as well as the integrity of their settings. The NHPA provides regulatory thresholds for the assessment of impacts to historic properties, which would include the identification of the loss of characteristics that make the properties eligible for the NRHP as well as loss of integrity. For archaeological sites, these impacts could entail an incremental loss of data. For TCPs, these impacts could entail a gradual decline of the very qualities that make a property a functioning element, important for its role in maintaining a living culture.

While data recovery is a mitigation option that is often included in a treatment plan, archaeological sites are nonrenewable resources, and loss of any data contributes to the net loss of information on local and regional cultural history. Whether sites are removed by inadvertent destruction or intended data collection, this loss of these properties precludes any additional investigation in the future, when advances in the field could change interpretations or allow new methodologies to be applied. Paleontological resources are also non-renewable, and they are subject to the same cumulative risks.

Due to urbanization, population growth, and its attendant development, Tribal peoples are experiencing an ongoing loss of TCPs, places that play a vital role in maintaining and perpetuating cultural identity and values. Along with other threats to their life ways, the loss of any culturally empowering resource has a cumulative impact on a group's ability to maintain its cultural identity.

The NRC staff has concluded that the cumulative impacts on historical, cultural, and paleontological resources in the study area resulting from past, present, and reasonably foreseeable future actions is MODERATE to LARGE. The Ross Project would have a SMALL to LARGE incremental effect on historical, cultural, and paleontological resources when added to the MODERATE to LARGE cumulative impacts of the facilities and operations described above.

5.13 Visual and Scenic Resources

The geographic area used in this analysis of visual and scenic cumulative impacts (the "visual-resources cumulative-impacts study area") is a circular area with a 30-km [20-mi] radius around the Ross Project area. This area was established as the geographic boundary because it includes the recreational destinations in the immediate vicinity of the Ross Project (described in SEIS Section 3.10), and it addresses the highest (i.e., most sensitive) visual-classification areas in the vicinity of the Ross Project as well. Devils Tower National Monument, Thunder Basin National Grassland, Keyhole Reservoir State Park, and the Black Hills National Forest all fall within this visual-resources cumulative-impacts study area. As discussed in SEIS Section 5.3.2, the timeframe evaluated for the cumulative-impacts analysis is 14 years, to the year 2027.

As described in SEIS Section 4.10, the potential impacts on visual and scenic resources from the Ross Project include the contrast of surface infrastructure (e.g., drill rigs, the CPP, access roads, and utility lines) with the existing visual inventory. These types of visual impacts are consistent with the management objectives of the VRM Class III area in which the Ross Project area is located. Thus, the potential impacts to visual and scenic resources from the surface structures and equipment of the Ross Project would be SMALL during all phases, except during construction phase. The short-term impacts to visual and scenic resources from construction activities would be MODERATE.

Many of the construction and operation activities (e.g., drilling, pipeline and wellfield installation, and surface infrastructure, such as access-road, utility-corridor, and lighting-system construction) at present actions and RFFAs identified in SEIS Section 5.2, both uranium recovery as well as oil production, are very similar to those described in SEIS Section 4.10. In addition, the bentonite mine has already become a fixture of the landscape in the cumulative-impacts area. There are no coal mines within the 30-km [20-mi] radius of the visual-resources cumulative-impacts study area. Thus, the same types of impacts to visual resources described in SEIS Section 4.10 would be associated with these other mineral-extraction and energy-production activities that occur or could occur within the 30-km [20-mi] radius of the Ross Project.

All of these developments, however, would take place in the existing classifications of VRM Class III or IV, where change to an environment can be moderate or even undergo significant modification. In addition, many of the mitigation measures that would be used to reduce the contrast of the Ross Project structures with the existing visual inventory would also be required of new areas and projects. The lower profile and smaller footprint associated with the Ross Project, and presumably with the other satellite areas and the potential ISR Projects, would diminish visual impacts as well.

Thus, the NRC staff has concluded that the cumulative impacts to the viewshed within the 30-km [20-mi] visual-resources cumulative-impacts study area as a result past or present actions and RFFAs would be MODERATE. The Ross Project would contribute a SMALL incremental impact and a MODERATE short-term incremental impact to the MODERATE potential cumulative impacts to the viewshed within the 30 km [20 mi] visual-resources cumulative-impacts study area.

5.14 Socioeconomics

The geographic study area for this analysis of socioeconomic cumulative impacts is the six counties of Crook, Campbell, Weston, Sheridan, Johnson, and Converse, consistent with the geographic scope of the BLM's *Report for the Powder River Basin Coal Review Cumulative Social and Economic Effects* (BLM, 2005b). Thus, the "socioeconomics cumulative-impacts study area" is this six-County region, also known as the "region of interest" (ROI). The timeframe for this analysis is 2013 through 2027, as the socioeconomic effects of the Ross Project end when the Project is finally decommissioned and the site reclaimed.

The potential socioeconomic impacts of the Ross Project range from SMALL to MODERATE, with the MODERATE impacts associated with the benefits of the additional tax revenues projected to accrue to Crook County. Because the size and scope of the Ross Project relative to existing employment levels in the six-County study area are small (see SEIS Section 4.11), and the Applicant would be committed to hiring locally, the population impacts and the change in demand for public and private services would be SMALL.

There have been, however, a number of energy-related developments recently completed in the socioeconomic study area as well as those proposed future projects in the vicinity of the Ross Project discussed earlier in SEIS Section 5.2. These projects all have the potential to cause additional impacts to local socioeconomics. The projects considered in the BLM report cited above include two additional coal mines over the 2003 – 2010 period; 9,519 additional conventional oil and gas wells, with over one-half of these in place over the 2003 – 2010 period; 62,868 additional CBM wells, with about 40 percent of these in place over the 2003 – 2010 period; and 3 – 4 new coal-fired power plants, with three in place over the 2003 – 2010 period and 1 additional plant planned in the 2016 – 2020 period.

Socioeconomic impacts have been projected over both a low-production scenario and a high-production scenario. Under the low-production scenario, the 2020 population in the six-County cumulative-impacts study area is projected to increase by 24,100 persons over 2003 levels, reflecting an increase of 25.1 percent, with 55.8 percent of the increase attributed to projects already in place by 2010 (BLM, 2005b). Under the high-production scenario, the 2020 population in the six-County area is projected to increase by 28,625 persons over 2003 levels, reflecting an increase of 29.8 percent, with 54.0 percent of the increase attributed to projects already in place by 2010. Under both scenarios the large majority (over 70 percent) of the increase is projected in Campbell County, the regional commercial and services center for the area.

The population increases through 2010 are already evident in the U.S. Census Bureau's data for 2010. Population over the 2000 – 2010 period in Campbell County increased 36.9 percent and increased 20.3 percent in Crook County (see Section 3.11). In contrast, population growth in Wyoming was 14.1 percent per year over the same period.

Population increases associated with the four potential four ISR Projects in the study area would be in addition to those discussed above. Other additional potential uranium-recovery areas could also be operated by the Applicant at Lance-District satellite areas. However, in this cumulative-impacts analysis, the NRC staff assumed that the other planned ISR Projects in the 80-km [50-mi] vicinity have the same construction and operating characteristics as the Ross Project, meaning that, at peak construction employment, including the employment associated with the Ross Project, all ISR areas and projects within 80 km [50 mi] would create approximately 2,080 jobs. If these additional projects were online and operating through 2027, operation-phase employment levels would total approximately 540 jobs. If these other projects follow the Applicant's local hiring and purchasing patterns, peak construction-population increases would amount to an additional 436 residents in two Counties (i.e., Crook and Campbell Counties), while the operation-phase population increases by 2027 would total an additional 248 residents. The additional operation-phase population would increase the projected six-County population in 2027 to 24,348 residents, or a 25.4 percent increase over 2003 levels under the low-production scenario, and to 28,873 residents under the high-production scenario, or a 30.1 percent increase over 2003 levels.

Campbell County and local jurisdictions throughout the Powder River Basin have shown their ability to respond to these periods of rapid growth. As an example, in response to Campbell County population increases of 36.9 percent over the 2000 – 2010 period, new housing construction increased 42.5 percent over the same period (USCB, 2002; USCB, 2012a). Similarly, new housing construction in Crook County increased 22.5 percent compared to population growth of 20.3 percent over the same period.

Periods of rapid growth can stress other public and private service delivery systems. Over the 2010 – 2027 period, population in the six-County area, including the additional residents associated with operation-phase activities of the four potential ISR Projects, is projected to increase by another 10,900 persons, a 10.0 percent increase, under the low-production scenario, and another 13,419 persons, a 12.2 percent increase, under the high-production scenario. Under the low-production scenario, BLM (2005b) also projected enrollment in Campbell County School District No. 1 to increase by 1,587 additional students by 2020, reflecting a 22 percent increase over recent levels; this could cause short-term capacity shortfall. Under the high-production scenario, enrollments could increase another 10 percent. Water and waste-water systems in all communities in the six-County study area would have the capacity to accommodate the projected increases in demand through 2020. However, if ongoing and planned improvements are not completed (BLM, 2005b), short-term peak demands might result in the need for some conservation. Because the potential short-term peak demands would be temporary, this would be a MODERATE impact.

While county jurisdictions would benefit from the increased tax revenues from these various projects, some directly from increased property taxes and others indirectly from worker spending and local purchases of goods and services by the projects' proponents, this benefit would be offset by additional demands for public services. Additional street and highway improvements would likely be required in response to the increasing population as well (see SEIS Section 5.5) (BLM, 2009a). Increased traffic levels would also result in increased demand for law-enforcement and emergency-response services, and similar increases in the demand for health services would be expected.

Although the incremental socioeconomic impacts of the Ross Project would be SMALL (with impacts to finance—tax revenues—MODERATE), as the cumulative population increases and their consequent impact on the demand for other public and private community services rises as well, there would be MODERATE socioeconomic cumulative impacts in the study area and during the respective timeframe.

5.15 Environmental Justice

Because no minority or low-income populations, as defined by Federal EO 12898 have been identified in the Ross Project area, no disproportionate human-health and environmental impacts were determined. Therefore, there are no cumulative impacts expected in minority and low income populations near the Ross Project.

5.16 Public and Occupational Health and Safety

Cumulative impacts to public and occupational health and safety were assessed along the roads of the circular area defined by an 80-km [50-mi] radius around the Ross Project area (the "public and occupational health and safety cumulative-impacts study area"). This area includes the potential development of satellite areas within the Lance District by the Applicant, the four other potential ISR Projects identified in Section 5.2, and the other past, present, and other reasonably foreseeable future projects described in SEIS Section 5.2. As described in SEIS

Section 5.3, the timeframe for this cumulative-impacts analysis is 2013 – 2027, the expected lifecycle of the Ross Project, including potential uranium-recovery activities in the Lance District. There would be no potential impacts on public or occupational health and safety from the Ross Project following its license termination.

The public and occupational health and safety impacts from the proposed Ross Project would be SMALL and are discussed in detail in Section 4.13 of this SEIS. During normal activities associated with all phases of the Project lifecycle, radiological and nonradiological worker and public health and safety impacts would be SMALL. Annual radiological doses to the population within 80 km [50 mi] of the proposed Project (i.e., in the "public health and safety cumulative-impacts study area") would be far below the applicable regulations. For accidents, radiological and nonradiological impacts to workers could be MODERATE if the appropriate mitigation measures and other procedures to ensure worker safety are not followed. Typical protection measures, such as radiation and occupational monitoring, respiratory protection, standard operating procedures for spill response and cleanup, and worker training in radiological health and emergency response, would be required as part of the Applicant's NRC-approved radiation protection program (RPP) (Strata, 2011a). These procedures and plans would reduce the overall radiological and nonradiological impacts to workers from accidents to SMALL.

As shown in Figure 5.1 and discussed in SEIS Section 5.2, in addition to the Ross Project, four satellite areas could be developed by the Applicant and four other ISR projects could be brought to construction and operation during the timeframe of this cumulative-impacts analysis. If constructed and operated, all of these facilities would have similar radiological and nonradiological impacts on the public and occupational health and safety to those at the Ross Project site. Potential radiological cumulative impacts from these facilities would result from incremental increases in annual radiological doses to the population when combined with the impacts of the proposed Ross Project. As stated in Section 4.13, for normal operations, Rn-222 and its progeny would be the most prevalent radionuclides, by dose contribution, anticipated to be released during normal operations at the proposed Ross Project. As further described in SEIS Section 4.13, the maximum expected exposure to a member of the public is estimated to be 0.008 mSv/yr [0.799 mrem/yr] and is consistent with estimates of exposure levels at other operating ISR facilities in the United States (NRC, 2009b). This exposure, combined with exposures from other potential ISR facilities in the study area, would remain below the 10 CFR Part 20 public dose limit of 1.0 mSv/yr [100 mrem/yr] and have a negligible contribution to the 6.2 mSv [620 mrem] average yearly dose received by a member of the public from all sources.

As described in SEIS section 4.13, both worker and public radiological exposures are addressed in NRC regulations at 10 CFR Part 20. Licensees are required to implement an NRC-approved RPP to protect workers and ensure that radiological doses are "as low as reasonably achievable" (ALARA). The Applicant's RPP includes commitments for implementing management controls, engineering controls, radiation safety training, radon monitoring and sampling, and audit programs (Strata, 2011a). Measured and calculated doses for workers and the public are often only a fraction of regulatory limits. Analyses of various radiological accident scenarios, described in SEIS Section 4.13, also estimate that the dose to the public would be a fraction of the applicable regulatory limits.

Other developments in the 80-km [50-mi] area include existing and potential coal, oil, gas, and bentonite projects. The concomitant major nonradiological occupational hazards of all of these existing or future facilities would be similar to those at the Ross Project; that is, they would include slips, trips, and falls, which could then result in musculoskeletal injuries; potential exposures to excessive noise; potential inhalation of particulates, gasses, or vapors; and skin contact with corrosive materials. These impacts would only be present at the actual facilities where occupational risks are located; the distance between the facilities and operations in the public and occupational health and safety cumulative-impacts analysis study area suggests that, if an occupational hazard were to be experienced, such as a chemical release into the air, the distance itself would mitigate the resulting impacts and would limit impacts to the onsite workers.

All of the facilities and operations identified above would be required to implement the same or similar mitigation measures as at the Ross Project. For example, all such facilities would be required to have spill-response plans, Occupational Safety and Health Administration (OSHA)-compliant SOPs, and health and safety plans as a matter of course because all such facilities are subject to State and Federal occupational health and safety requirements. Thus, nonradiological cumulative impacts to occupational workers would be SMALL, since there would be no cumulative-effects between facilities or projects. However, in the unlikely event that an accident or spill is not mitigated, the impacts to workers could be MODERATE.

The cumulative impacts to the public from nonradiological normal operations would be SMALL, because the public would not have access to the facilities included in this cumulative-impacts analysis. Concurrent generation of fugitive dusts at various operations could occur, if they were closely located to each other, but these facilities would implement the same or similar BMPs for fugitive-dust and combustion-emissions control as described in SEIS Section 4.7. (See also SEIS Section 5.9 regarding air-quality cumulative impacts.) The very distance from the Ross Project to the other potential ISR, coal, gas, oil, and bentonite facilities preclude fugitive-dust cumulative impacts due to not only similar BMPs, SOPs, and other mitigation measures, but also due the significant winds in the study area which would disperse the fugitive dust rapidly.

Potential accidents and chemical releases could affect the public, depending upon the location of the release and the nearest receptors, the closest of which is 0.21 km [690 ft] from the Ross Project's boundary. Accidents could include bulk chemical spills during transport, during operations or maintenance, or during product or waste shipment. Spill prevention and response mitigation measures would include training of all personnel as well as standard spill-response plans. Coordination between both present and future ISR projects, especially the two that would use the same county roads as are adjacent to the Ross Project area (the Hauber and Elkhorn uranium-recovery projects), could optimize emergency-response activities and efficient response. Thus public impacts could range from SMALL to MODERATE, if accidents are not appropriately managed.

Because Strata would implement preventative and mitigation measures, the incremental impacts on public and occupational health and safety of the proposed Ross Project would be SMALL when added to the SMALL cumulative impacts of other past, present, and reasonably foreseeable future actions.

5.17 Waste Management

The cumulative impacts of waste management at the Ross Site were evaluated for both liquid and solid waste streams.

5.17.1 Liquid Wastes

There are two types of potential liquid-waste-disposal techniques that would be used at the Ross Project. One type employs the injection of liquid wastes into deep, UIC Class I wells, which is discussed below. Then, liquid wastes that are disposed of by other methods are described next.

The Applicant estimates the completion of Ross Project's (i.e., CPP's) decommissioning and that of the Lance District satellite areas to be approximately 14 years after the Source and Byproduct Materials License would be issued. Since the UIC Class I Permit issued by WDEQ/WQD for the injection wells requires that the wells are plugged and abandoned within six months after waste injection ceases, the timeframe for evaluation of impacts from deep-well injection is the period from 2013 through final decommissioning of the Ross Project (2027). Except for domestic sewage and used oil, which would be managed only for the lifecycle of the Lance District satellite areas, the generation of other liquid wastes, such as excess permeate as well as ground water taken from monitoring wells, would cease during Ross Project operation and aquifer restoration, respectively.

5.17.1.1 Disposal by Deep-Well Injection

As described in SEIS Section 2.1.1.1, the liquid wastes generated by the Ross Project would include byproduct material, predominantly brine from the RO process and other process waters. These wastes would be stored in lined surface impoundments and then disposed of into the UIC Class I deep-injection wells, into the Deadwood and Flathead Formations (WDEQ/WQD, 2011). As noted earlier in SEIS Section 4.14, impacts of the management and disposal of liquid byproduct wastes into the UIC-permitted deep-injection wells at the Ross Project would be mitigated by the Applicant's adherence to permit requirements and would be SMALL. Since the CPP at the Ross Project would process uranium for the satellite areas that could be developed by the Applicant within the Lance District, there would be no need for additional UIC Class I deep-disposal wells, except in the event that a remote IX-only plant were to be constructed at the Barber satellite area. A remote IX-only plant could possibly require nearby, additional deep-well injection capacity.

The geographic area selected for cumulative-impacts analysis for the management of byproduct material into the UIC Class I deep-injection wells is similar to the area defined as the ground-water cumulative-impacts study area in SEIS Section 5.7. This area extends westward into the Powder River Basin, approximately 60 km [37 mi] west of the Ross Project. At this location, the Cambrian aquifers (i.e., the Deadwood and Flathead Formations) that are the target for liquid-waste injection at the Ross Project are over 3,700 m [12,000 ft] below the ground surface. This depth to the Cambrian aquifers makes it impractical to drill UIC Class I wells into these aquifers; thus, the aquifers accessed at the Ross Project would not likely be used for Class I disposal wells at that western location. At this western edge of the cumulative-impacts study area, the existing UIC Class I injection wells make use of the Upper-Cretaceous aquifers at depths of 1,200 – 2,900 m [4,000 – 9,500 ft] which are about 750 m [2,500 ft] above the Cambrian aquifers. Similarly, the Upper-Cretaceous aquifers are used for UIC Class I injection wells at existing uranium-recovery operations in Campbell, Johnson, and Converse Counties (NRC, 2010; NRC, 2011; WDEQ/WQD, 1999; WDEQ/WQD, 2010). These Upper-Cretaceous aquifers are: Tecla, Teapot, and Parkman members of the sandy units within the Lewis and Mesaverde

Shale Formations; the Lance and Fox Hills Formations; and the Tullock member of the Fort Union Formation above the Lance Formation.

The other boundaries of the “waste-management cumulative-impacts study area” for deep-well liquid-waste injection would be the 80-m [50-mi] radius to the north, east and south that is shown in Figure 5.1. Four potential uranium-recovery projects outside of the Lance District, but within 80 km [50 mi] of the Ross Project have been identified and were described earlier, in SEIS Section 5.2. These projects are located east and northeast of the Ross Project and would recover uranium from the Lower Cretaceous Fall River and Lakota sandstones. They range from 23 – 66 km [14 – 41 mi] from the Ross Project. The projected estimated amounts of uranium production at each of these potential ISR uranium-recovery projects, as reported by the Applicant, are expected to be less than the Ross Project (Strata, 2012a). The area encompassing the Ross Project and future potential projects is approximately 0.5 million ha [1.3 million ac].

The operators’ use of UIC Class I deep-injection wells for the disposal of liquid byproduct material has been assumed by the NRC staff at the potential uranium-recovery projects. It appears likely, given the stratigraphy, that the same aquifers targeted by the Class I deep-injection wells at the Ross Project would be used for disposal at these future projects. For example, the Dewey-Burdock uranium-recovery project in the eastern portion of the NSDWUMR, is stratigraphically similar to the future projects near the Ross Project. The Dewey-Burdock Project, located in the Edgemont uranium district in South Dakota, would recover uranium from the Fall River and Lakota sandstones and has proposed Class V deep-injection wells in the Deadwood and Flathead Formations, the same Formations that would be used for the Ross Project (NRC, 2009; Powertech, 2010).

The deep-well injection of liquid wastes within the geographic area selected for this cumulative-impacts analysis would not impact development of mineral resources due to the fact that the oil, gas, CBM, and coal resources are located in rock units *above* the Deadwood and Flathead Formations, which are targeted for deep-well liquid-waste injection. For example, conventional oil-and gas-extraction efforts generally target the Minnelusa Formation, a unit which is greater than 300 m [1,000 ft] *above* the depth of the permitted Class I deep-injection wells (in the Deadwood and Flathead Formations). Similarly, coal and CMB resources are located in rock units many thousands of meters (feet) above the permitted depth of the Class I deep-injection wells.

The EPA has defined an “area of review” for a Class I well as the zone of endangering influence around the well, or the radius at which pressure due to injection may cause the migration of the injected wastes and/or poor-quality water in the target formation into an underground source of drinking water (EPA, 2001). The EPA allows the area of review to be determined by either a fixed radius or mathematical computation. When a fixed radius is used in an analysis, the area of review for Class I nonhazardous wells must be, at a minimum, 0.4 km [0.25 mi] unless specified as greater by State regulations. Although the Applicant used 0.4 km [0.25 mi] as the area of its review, the estimated area of influence calculated by Strata in its application to the WDEQ for a UIC Class I Permit was less than 0.4 km [0.25 mi] (Strata, 2011b).

In addition, earthquakes induced by underground waste disposal have been rare, because typically large, porous aquifers are targeted and injection pressures are sufficiently low so that seismic activity is avoided (Nicholson and Wesson, 1990). Nicholson and Wesson documented only two instances in which waste disposal triggered significant adjacent seismicity. If earthquakes were to be induced by fluid-injection activities, they would be located within a few miles from the point of injection.

The WDEQ/WQD's UIC Class I Permit prescribes well design, injection rates, permitted wastes, and injection pressures. Careful monitoring is required to characterize post-licensing, pre-operational water quality of the targeted aquifer and pressures of the lowermost drinking-water aquifer for a new well. Operational monitoring is required to record continuously the rate, volume, and pressure of injection. Every two years, the deep-injection wells must be tested to determine the radius of influence and to compare the results with historical and expected future responses. These required data would provide the information necessary for an assessment of cumulative impacts.

During this analysis, the NRC assumed that all five UIC Class I wells that are already permitted for the Ross Project would be installed and that an average of three UIC Class I wells would be installed at each of the four potential future projects outside the Lance District but within the study area; thus, there would be 17 deep-injection wells within the approximately 0.5 million-ha [1.3 million-ac] area. The overall density of deep-injection wells would consequently be very low and the potential impacts from deep-well liquid-waste injection would be localized, within the minimum area of review of 0.4-km [0.25-mi] radius around each well. Also, because the UIC Class I deep wells would have no impact on mineral development in the area, the cumulative impacts of disposal of liquid byproduct material and other appropriate liquid wastes would be SMALL, to which the Ross Project would contribute only a SMALL incremental impact.

5.17.1.2 Disposal by Other Methods

The geographic area for cumulative impacts from disposal of liquid wastes by methods other than deep-well injection is the circular area with an 80-km- [50-mi]-radius around the Ross Project area as shown in Figure 5.1. Liquid non-byproduct wastes would include drilling fluids and muds from the installation of injection, recovery, and monitoring wells; small amounts of used oil; and domestic sewage. In addition, lined surface impoundments may be used for the management of fluids and the evaporation of liquid wastes. BMPs, management plans, and WDEQ permit requirements would be implemented to mitigate impacts from such waste-management and disposal techniques.

For drilling fluids and muds, the respective management technique would be their evaporation and disposal in mud pits near each drillhole. As noted in Section 2.1.1.1, the proposed wellfields would consist of 1,400 – 2,200 recovery and injection wells in addition to 34 to 140 – 250 monitoring wells. A mud pit would be constructed for the drilling of each well. This would represent a maximum average density of approximately 3.6 mud pits/ha [1.4 mud pits/ac]. The density of these mud pits at potential, future ISR projects within the 80-km [50-mi] radius around the Ross Project are estimated to be similar to the density of the mud pits in the Ross wellfields.

Impacts to soils during construction of the mud pits at the drilling pads and the lined surface impoundments would be mitigated by the Applicant's removing and then stockpiling topsoil before construction, followed by grading and spreading topsoil as soon as the mud pits and impoundments are dry, and reseeding disturbed areas as quickly as possible to achieve the reclamation standards required by WDEQ/LQD. The reclaimed mud pits and surface impoundments would be included in the final radiation surveys that would be accomplished during the Proposed Action's decommissioning, so that no potential long-term impacts from radioactivity are present (Strata, 2011a)

All non-byproduct used oils would be taken offsite to a properly permitted oil recycler. Finally, the domestic-sewage system installed onsite would follow the required industry standards and practices as well as all permitting requirements.

Thus, as described in SEIS Section 4.14, the impacts of the management and disposal of liquid non-byproduct wastes at the Ross Project would be SMALL. Given that the potential impacts from mud pits and surface impoundments are short-term and localized, the cumulative impacts of disposal of liquid non-byproduct material would be SMALL, to which the Ross Project would contribute only a SMALL incremental impact.

5.17.2 Solid Wastes

The geographic area selected for solid waste-management cumulative-impacts analysis is the Ross Project area itself and, though disconnected, the areas that would be impacted by the actual disposal of each type of solid-phase waste that would be generated at the Ross Project (the "solid-waste-management cumulative-impacts study area"). Because most of the waste-disposal facilities that would accept the Ross Project's wastes would be open through 2027, the NRC's waste-management cumulative-impacts analysis assumed that the cumulative impacts of waste management would occur through 2027.

The waste-management impacts of the Ross Project were determined to be SMALL in SEIS Section 4.14 through all of the Project phases. This impact magnitude is primarily a result of the relatively small solid-waste volumes that would be generated at the Ross Project. Even during the decommissioning of the Ross Project, the volumes of the different types of solid wastes, would be relatively small due to the decontamination efforts anticipated by the Applicant as well as the fact that the Ross Project would not generate substantial quantities of waste when dismantled and/or demolished (uncontaminated equipment would be re-used).

For the waste-management cumulative-impacts analysis, the NRC assumed that all of the waste-disposal facilities that would accept and dispose of Ross Project wastes would have been properly licensed or permitted. (And that all Ross Project waste shipments would be managed as required in the pre-operational agreements the Applicant must set up with the respective waste-disposal facilities prior to uranium-recovery.) Every waste-disposal facility must undergo significant pre-operational planning and design. This is especially true for the disposal facilities that could accept the Ross Project's byproduct material. These facilities would have been licensed by the NRC or by an Agreement State; the other, non-radioactive facilities would have been permitted on the county- or State-level. Also, licensed or permitted facilities that generate solid byproduct material would be required to demonstrate that they have a valid agreement with a solid byproduct material disposal facility in order to continue to operate. This requirement would help to ensure that the byproduct disposal facilities have sufficient capacity to accept incoming material.

Consequently, the incremental impact of the Ross Project's waste management would be SMALL when considered with the SMALL cumulative impacts of waste management over the solid waste management cumulative-impacts study area.

5.18 References

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6 ENVIRONMENTAL MEASUREMENTS AND MONITORING

6.1 Introduction

As described in the *Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (GEIS), NUREG–1910, monitoring programs are developed for in situ uranium-recovery (ISR) facilities to verify compliance with the applicable standards and requirements for the protection of worker health and safety in active uranium-recovery areas (i.e., both the facility and the wellfields) and for the protection of the public and the environment beyond the licensed facility's boundary (NRC, 2009b). Monitoring programs provide data on operating and environmental conditions so that prompt corrective actions can be implemented when adverse conditions are detected. It is important to note that the management of spills and leaks is not considered part of a routine environmental monitoring program (NRC, 2009b). Potential spills and leaks are described Section 2.1.1 in this *Final Supplemental Environmental Impact Statement* (SEIS, or FSEIS if the respective section, figure, or table did not appear in the Draft SEIS [DSEIS]), including the design components and management techniques that are intended to detect and to minimize the impacts of spills and leaks.

This section of the SEIS discusses the types of environmental-monitoring activities that the Applicant would undertake throughout the Ross Project. These include radiological, physiochemical, meteorological, and ecological monitoring activities.

6.2 Radiological Monitoring

Radiological-effluent and environmental-monitoring programs are required in United States (U.S.) Nuclear Regulatory Commission's (NRC's) source and byproduct materials licenses. The purpose of the monitoring programs is to: 1) characterize existing levels of radioactive materials in environmental media; 2) provide data on measurable levels of radiation and radioactivity in effluents and environmental media during the operational life of a facility; and 3) evaluate the principal pathways of radiation exposure to the public. This section describes Strata Energy Inc.'s (Strata's) (also referred to herein as the "Applicant") proposed radiological-monitoring programs for the Ross Project as described in its license application as well as in supporting documents and its subsequent Responses to the NRC staff's Requests for Additional Information (RAIs).

In accordance with Title 10 *Code of Federal Regulations* (CFR) Part 40, Appendix A, Criterion 7, a license applicant is required to submit pre-licensing, site-characterization data as well as, in some cases (i.e., uranium-recovery wellfields), post-licensing, pre-operational ground-water data to provide site conditions prior to licensing and prior to operation, respectively (see Section 2.1.1). The results of Strata's pre-licensing radiological-monitoring program are presented in SEIS Section 3.12.1. After establishing initial conditions, a uranium-recovery facility operator must conduct a monitoring program during all uranium-recovery operation to evaluate both the facility's compliance with applicable standards and the performance of its control systems as well as to measure the environmental impacts of the uranium-recovery facility under operating conditions and to detect potential long-term effects. In accordance with 10 CFR Part 40.65, a licensee must also submit to the NRC a semi-annual effluent- and environmental-monitoring report, as would be required by its license. In addition, the facility operator could employ NRC's Regulatory Guide 4.14, Revision 1 (NRC, 1980); this Guide suggests the appropriate values for the quantity of each of principal radionuclides released in effluents from radiological facilities and/or the respective levels within various environmental media in all unrestricted areas during the previous six months of operation. The report required of an operator would also provide other NRC-required information so that the potential maximum annual radiation doses to the public as a result of a facility's effluents could be estimated.

The following sections briefly describe the Applicant's proposed operational monitoring program. The NRC's Regulatory Guide 4.14, Revision 1 provides guidance for establishing radioactive-effluent and environmental-monitoring programs for uranium mills, which includes ISR facilities (NRC, 1980). A summary of the operational radiological-effluent and environmental-monitoring program is presented in Table 6.1.

6.2.1 Airborne Radiation Monitoring

The Applicant has proposed to conduct continuous air-particulate sampling at six locations identified in Figure 6.1. The filters from air samplers would be analyzed on a weekly basis, or more frequently if required due to dust loading, for lead-210 (Pb-210), natural uranium, radium-226 (Ra-226), and thorium-230 (Th-230) in accordance with the NRC's Regulatory Guide 4.14, Revision 1 (Strata, 2011a; NRC, 1980). The air samplers would be calibrated per manufacturer recommendations or at least semiannually with a mass-flow meter or other primary calibration standard (Strata, 2011a).

In addition to the air-particulate sampling, passive track-etch detectors and thermo-luminescent dosimeters (TLDs) would be deployed at each air-particulate monitoring station (Strata, 2011a). The passive track-etch detectors would provide continuous monitoring of radon-222 (Rn-222), and the detectors would be exchanged and analyzed on a monthly basis. The TLDs would be used to assess gamma-exposure rates continuously at each air-particulate monitoring station. The TLDs would be exchanged and analyzed on a quarterly basis.

In addition, during uranium-recovery operation, Strata would passively monitor radon gas and gamma radiation by Trak-etch detectors and environmental low-level TLDs, respectively, at locations shown in Figure 6.1. In total, radon would be monitored at 18 sampling locations, of which 6 locations are co-located with the air-particulate samplers, as recommended in Regulatory Guide 4.14, Revision 1 (NRC, 1980).

6.2.2 Soils and Sediment Monitoring

The Applicant has proposed to collect representative soil samples annually at each of the five air-particulate monitoring stations shown in Figure 6.1. The soil samples would be collected similar to the pre-licensing, site-characterization sample-collection procedure (i.e., two surficial samples to a depth of 15 cm [6 in] and two subsurface samples to a depth of 150 cm [60 in]). The samples would be analyzed for gross alpha, natural uranium, Pb-210, and Ra-226 (Strata, 2011a).

The Applicant has also proposed to collect sediment samples annually at the three surface-water gaging stations on Little Missouri River and Deadman Creek as well as from the Oshoto Reservoir (see Figure 3.12 in SEIS Section 3.5.1). The sediment sampling at the stream gaging stations would occur during a runoff event between April and October each year. The sediment samples would be analyzed for gross alpha, natural uranium, Pb-210, Ra-226, and Th-230 (Strata, 2011a).

Table 6.1
Summary of the Major Elements of Ross Project Operational Environmental-Monitoring Program

Program Element	Location	Radionuclides Analyzed	Sampling Frequency	Number of Sampling Locations
Ground Water Monitoring Wells	▪ Upgradient and downgradient from CPP	Dissolved uranium, Ra-226, Th-230, Pb-210, Po-210, gross alpha, gross beta	Monthly first year and quarterly thereafter	Three or more downgradient and at least upgradient control sample
Ground Water Water-Supply Wells	▪ Private wells within 3 km [2 mi] of Ross Project area and similar to pre-licensing, site-characterization monitoring	Dissolved and suspended uranium, Ra-226, Th-230, Pb-210, Po-210, gross alpha, gross beta	Quarterly	29
Surface Water	▪ Surface water passing through Project area and reservoirs subject to runoff similar to pre-licensing, site-characterization monitoring	Dissolved and suspended uranium, Ra-226, Th-230, Pb-210, Po-210, gross alpha, gross beta	Quarterly (as available)	3 surface-water monitoring stations and 11 reservoirs within project area
Air Particulates	▪ Locations with the highest predicted concentrations, nearest residences, and a control location similar to pre-licensing, site-characterization monitoring	Total uranium, Th-230, Ra-226, Pb-210	Continuous with composites of weekly filters analyzed quarterly	Five or more

Table 6.1
Summary of the Major Elements of the Ross Operational Environmental Monitoring Program (*Continued*)

Program Element	Location	Radionuclides Analyzed	Sampling Frequency	Number of Sampling Locations
Radon in Air	▪ Particulate in air locations and other areas of interest similar to pre-licensing, site-characterization monitoring	Rn-222	Continuous via Track-Etch units Quarterly exchange and analysis of units	Five or more
Soils	▪ Particulate in air locations and other locations with the highest predicted concentrations similar to pre-licensing, site-characterization monitoring	Total uranium, Ra-226, Pb -210, gross alpha	Annually	Five or more
Sediment	▪ Surface water passing through Project area and reservoirs subject to runoff—similar to pre-licensing, site-characterization monitoring	Total uranium, Ra-226, Pb -210, gross alpha	Annually (as available)	3 surface water monitoring stations and 11 reservoirs within Project area
Direct Radiation	▪ Particulate in air locations and other areas of interest—similar to pre-licensing, site-characterization monitoring	Continuous via TLD	Quarterly	Five or more

Table 6.1
Summary of the Major Elements of the Ross Operational Environmental Monitoring Program
(*Continued*)

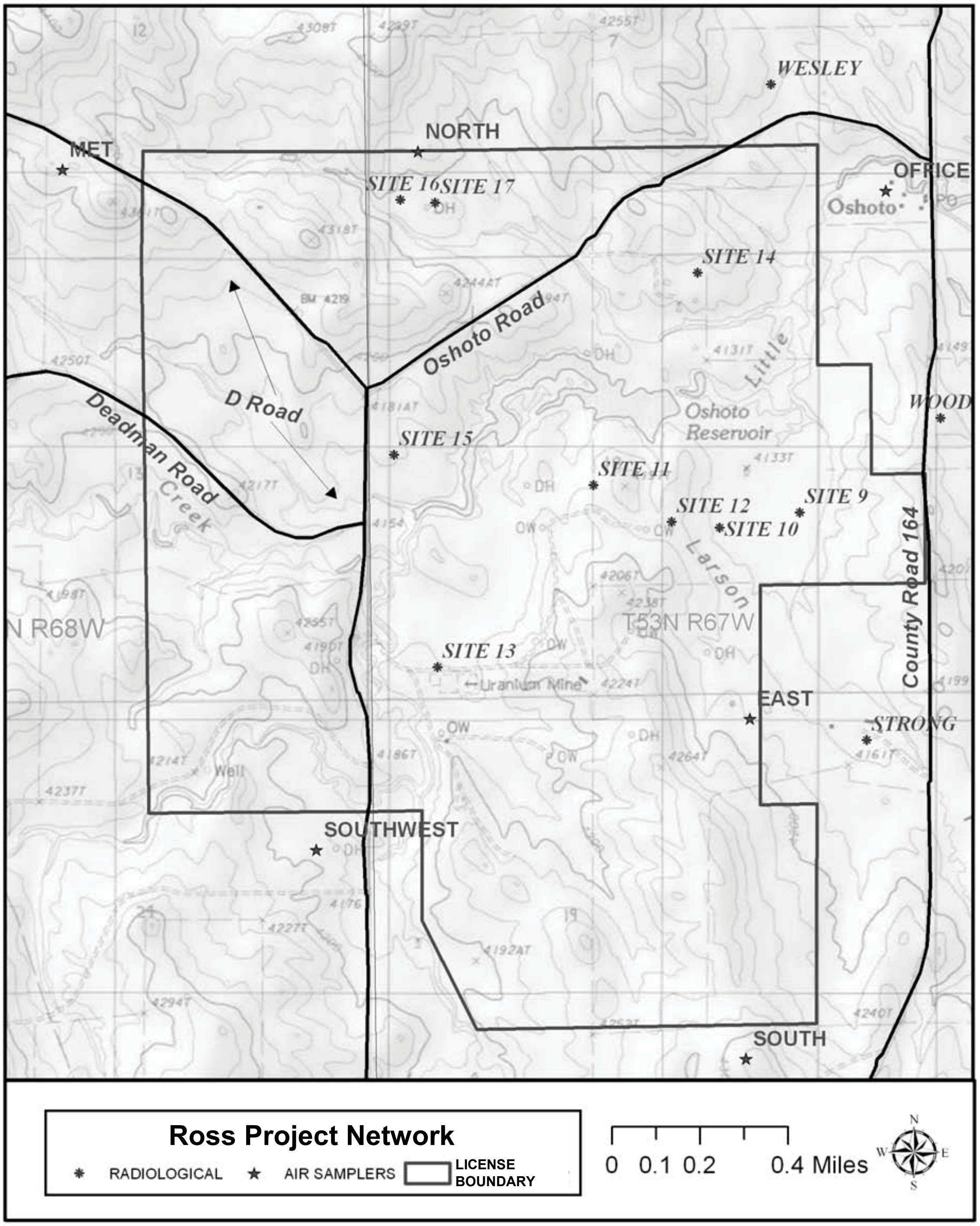
Program Element	Location	Radionuclides Analyzed	Sampling Frequency	Number of Sampling Locations
Vegetation (2)	▪ Animal grazing areas and other locations with the highest predicted concentrations similar to pre-licensing, site-characterization monitoring	Ra-226, Pb-210	Three times during grazing season	Grazing vegetation representing three different sectors that have the highest predicted concentrations of radionuclides
Animal Tissue	▪ Livestock (cattle) raised within 3 km [2 mi] of the site and fish from Oshoto Reservoir similar to pre-licensing, site-characterization monitoring	Ra-226, Pb-210	Once during Project decommissioning and prior to license termination	Three beef samples and one fish sample (composite to meet laboratory MDL)

Source: Table 5.7-1 (Strata, 2011a).

Notes:

1) Location of particulate samplers used during the pre-licensing, site-characterization air monitoring will be re-evaluated for monitoring during uranium-recovery operations based upon results of the pre-licensing environment-monitoring program and the results of the MILDOS-AREA analysis to ensure at least three locations are selected which are representative of three different sectors that have the highest predicted concentrations of radionuclides.

2) In accordance with the provisions of NRC's Regulatory Guide 4.14, Footnote (o) to Table 2: "*vegetation and forage sampling need be carried out only if dose calculations indicate that the ingestion pathway from grazing animals...*" is defined as a pathway which would expose an individual to a radiation dose in excess of 5 percent of the applicable radiation-protection standard. This pathway was evaluated by MILDOS-AREA.



Source: Figure 3 of Addendum 3.6-A (Strata, 2011a).

Figure 6.1
Ross Project Air-Sampling and Radiation-Monitoring Locations

The proposed sampling and analysis protocols are consistent with the recommendations of Regulatory Guide 4.14, Revision 1 (NRC, 1980). Similarly, the analytical limits of detection for the soil and sediment sampling program are consistent with the recommendations of Regulatory Guide 4.14 as well, unless matrix interferences prohibit attainment of the low detection-limit goals (NRC, 1980).

6.2.3 Vegetation, Food, and Fish Monitoring

Where a significant pathway to humans is identified, the NRC's Regulatory Guide 4.14, Revision 1, suggests analyzing three of each type of crop as well as livestock raised within 3 km [2 mi] of a uranium-recovery facility (NRC, 1980). The Regulatory Guide also suggests that vegetation samples be collected three times during a grazing season, and food and fish samples be collected at the time of harvest or slaughter. Further, the Guide suggests that all samples be analyzed for Pb-210 and Ra-226. Note (o) in Regulatory Guide 4.14's Table 2 clarifies that an exposure pathway would be considered important if the predicted dose to an individual would exceed 5 percent of the applicable radiation-protection standard (NRC, 1980). Individual members of the public would be subject to the dose limits at 10 CFR Part 20.1301, which is 100 mrem/yr total effective dose equivalent (TEDE).

The Applicant has collected pre-licensing, site-characterization data by conducting those sampling and analysis efforts as suggested by Regulatory Guide 4.14 as well (Strata, 2012a; NRC, 1980). Based upon modeling (i.e., MILDOS-Area), the Applicant has calculated that the maximum impacts to the public through all pathways would be less than 1 percent of the applicable radiation-protection standard (Strata, 2011a). Therefore, because the Applicant has determined that a significant pathway to humans does not exist from these sources, the Applicant did not propose to perform any vegetation, food, or fish sampling during uranium-recovery operation (Strata, 2011a). However, the Applicant stated that in the event that such monitoring is required, it would propose to follow the protocol used in the pre-licensing, site-characterization sampling for three vegetation samples during the grazing season at three locations at which the model-predicted concentrations were the highest. The Applicant proposed to collect samples of animal and fish tissues from the Oshoto Reservoir during the Ross Project's decommissioning phase.

The NRC staff will include a Condition in the Source and Byproduct Materials License that will require the Applicant to establish a plan for verifying the input values used in the MILDOS-Area calculations by monitoring liquid-effluent discharges. Should the effluent discharges invalidate the model's calculations, the Applicant would be required to recalculate the model and/or determine the radiological impacts to local vegetation and food sources through routine sampling.

6.2.4 Surface-Water Monitoring

During the construction phase, the Applicant proposed to conduct an operational surface-water monitoring program consisting of its sampling at the Oshoto Reservoir and the three gaging stations on the Little Missouri River and Deadman Creek (SW-1 and SW -2 on the River, and SW-3 on the Creek, as shown in Figure 3.12 in SEIS Section 3.5.1) (Strata, 2011a). The Applicant indicated that, based upon pre-licensing, site-characterization monitoring efforts, flows in the Creek could be ephemeral primarily during April to October (Strata, 2011a). Surface water is found year-around in the Oshoto Reservoir. To avoid frozen conditions, all surface-water stations would only be operated April through October.

During uranium-recovery operation, the Applicant has proposed to conduct surface-water monitoring as was conducted during pre-licensing, site-characterization monitoring efforts. These efforts included quarterly sampling at the 3 onsite surface-water gaging stations (see Figure 3.12) and also sampling 11 onsite or nearby reservoirs. The analytical parameters to be analyzed in the operational surface-water monitoring program are dissolved and suspended uranium, gross alpha and beta, Pb-210, polonium-210 (Po-210), Ra-226, and Th-230, unless sufficient cause can be demonstrated to measure a parameter less frequently.

The Applicant also committed to monitoring surface water should monitoring be required for a Wyoming storm-water discharge permit through the Wyoming Pollutant Discharge Elimination System (WYPDES) program (Strata, 2011a).

6.2.5 Ground-Water Monitoring

The Applicant has proposed to monitor ground-water quality at the domestic, livestock, and industrial water-supply wells located within a 3 km [2 mi] radius of the Ross Project boundaries during both the construction and operation phases. The Applicant has indicated that its monitoring of nearby water-supply wells would be conducted quarterly, and the results would be provided to the NRC on an annual basis. The monitoring at a specific water-supply well, however, would be contingent upon the landowner's (well owner's) consent and, for a variety of reasons (e.g., abandoned, non-functioning pump, not winterized), may not be available every quarter (Strata, 2011a). The parameters that would be analyzed for are dissolved and suspended total uranium, gross alpha and beta, Pb-210, Po-210, Ra-226, and Th-230.

The Applicant estimates that 29 wells exist within 3 km [2 mi] of the Ross Project (Strata, 2011a). Based upon information in the license application, the water-supply wells consist of 3 industrial water-supply wells, 15 livestock water-supply wells, and 12 domestic water-supply wells. Four of the livestock water-supply wells and three of the industrial wells are located within the Ross Project area itself. (Only two of the three industrial wells, Wells 19XX18 and 22X-19, were able to be sampled as part of the water-supply well pre-licensing, site-characterization ground-water monitoring. A third industrial well (Well 789V) could not be accessed.) The proposed ground-water monitoring program would be a continuation of the pre-licensing, site-characterization monitoring accomplished earlier by the Applicant, although the parameters that would be analyzed during operation would be reduced from those analyzed for in the pre-licensing, site-characterization effort.

The Source and Byproduct Materials License would require that nearby water-supply wells within 2 km [1 mi] of an active wellfield be sampled in lieu of 2 km [1 mi] of the Project area (NRC, 2014b). In addition, the Source and Byproduct Materials License would require an annual update on nearby ground-water use (i.e., quantity) as well as monitoring of the onsite industrial water-supply wells on a monthly basis as a part of the Applicant's effluent-monitoring program, if operations at the industrial wells have not been terminated.

6.3 Physiochemical Monitoring

This section describes the operational monitoring program proposed by the Applicant that would be conducted in compliance with applicable environmental regulations and with the Conditions in the Source and Byproduct Materials License. This monitoring program would allow for an evaluation of changes in the chemical and physical environment as a result of the proposed Ross Project. The physiochemical monitoring program would include surface water and ground water as well as flow and pressure monitoring of wellfields and pipelines as described in this section.

Pre-licensing, site-characterization monitoring of surface water and ground water was completed by the Applicant in 2009, 2010, and 2011. The Applicant also provided supplemental environmental-monitoring data in 2012 (Strata, 2012a). The acquired data were then used to characterize the Ross Project area according to the requirements in 10 CFR Part 40, Appendix A, Criterion 7 (Strata, 2011a). The Applicant collected samples and contracted laboratory analyses for its license application according to the recommendations found in the NRC's Regulatory Guide 4.14, Revision 1 as noted above (Strata, 2011a; NRC, 1980). In addition, the Applicant adhered to the specifications in ASTM D449-85a (now superseded by ASTM D4448-01), *Standard Guide for Sampling Groundwater Monitoring Wells*.

The Applicant's monitoring of the surface-water stations within the Project area (as shown in Figure 3.12) would continue throughout the operation of the Ross Project (Strata, 2011a). In addition, the private water-supply wells from within 2 km [1 mi] that were sampled during the Applicant's pre-licensing, site-characterization monitoring would also continue to be sampled by the Applicant. The ground-water monitoring wells within the Project area that were sampled for the Applicant's site-characterization efforts might also be used to satisfy the requirement of the post-licensing, pre-operational ground-water sampling and analysis, depending upon the proximity of the existing wells to the wellfields (Strata, 2011a).

6.3.1 Monitoring of Surface-Water Quality

The Applicant proposes to continue quarterly sampling of the surface-water stations that were established for pre-licensing, site-characterization water-quality data during uranium-recovery operation (Strata, 2011b). The existing surface-water monitoring stations include one station at the Oshoto Reservoir and three stations on the Little Missouri River (SW-1 and SW-2) and Deadman Creek (SW-3) (see Figure 3.12 in Section 3.5.1). The Applicant has committed to installing any additional stations as necessary to meet any additional conditions in its License (see Draft Condition No. 10.9) (NRC, 2014b). Each station is already equipped with a pressure transducer, a data-logging system, and a runoff-event-activated sampling mechanism. The surface-water sampling stations would be only operated April through October to avoid those months when the Project surface waters tend to freeze.

6.3.2 Monitoring of Ground-Water Quality

The Applicant has proposed a ground-water monitoring program to acquire post-licensing, pre-operational data in order to establish the constituents and their concentrations that would form the basis to detect excursions outside the ore zone during active uranium-recovery operation and to observe aquifer-restoration performance as restoration proceeds (Strata, 2011b). The post-licensing, pre-operational data would be collected from each individual wellfield as it is completed and installed, but prior to the Applicant's initiating uranium recovery in the respective wellfield. Each wellfield's ground-water monitoring data would be used to establish NRC-approved upper control limits (UCLs) in accordance with 10 CFR Part 40, Appendix A, Criterion 5B(5) (i.e., constituent concentration-based values for excursion detection and for aquifer-restoration performance assessment). (See SEIS Section 2.1.1 for a further explanation of this type of monitoring.) Thus, excursion-parameter values and aquifer-restoration target values would be wellfield specific.

Wells with intended uses for injection, recovery, or monitoring would be completed in the ore zone to establish post-licensing, pre-operational water quality for each “mine unit” (“mine units” is a phrase found in Strata’s Permit to Mine from the Wyoming Department of Environmental Quality [WDEQ]). (See also Figure 2.4 in SEIS Section 2.1.1.) In addition, monitoring wells would be installed around the perimeter of each wellfield within the exempted aquifer at a minimum density of 1 well per 1 ha [2 ac]. Monitoring wells installed in the overlying and underlying aquifers would be spaced at a minimum density of 1 well per 2 ha [4 ac] of wellfield. Wells that have been used to collect pre-licensing, site-characterization data could also be used to measure aquifer-restoration success and water-quality stabilization within the wellfields depending upon their relative proximity. Excursions to adjacent geologic units would be detected, and progress toward meeting aquifer-restoration target values would be monitored, by the Applicant’s sampling ground water from these monitoring wells during uranium-recovery operation and during aquifer restoration. Analytical laboratory analyses of the ground-water samples would yield constituent-concentration data.

6.3.2.1 Post-Licensing, Pre-Operational Ground-Water Sampling and Water-Quality Analysis

The post-licensing, pre-operational monitoring of ground water would provide water-quality data to establish NRC-approved constituent concentrations in the ore-zone aquifer pursuant to 10 CFR Part 40, Appendix A, Criterion 5B(5)(a) and UCL constituent concentrations for perimeter-monitoring wells and the wells in the overlying and underlying the ore-zone aquifer, which would be required in the Source and Byproduct Materials License. The UCLs for the perimeter wells and the wells in the overlying and underlying aquifers would be used by the Applicant to identify potential horizontal excursions of lixiviant outside of a wellfield and potential vertical excursions into the overlying or underlying aquifers (Strata, 2011b). Minimum spacing of the monitoring wells would be as noted in Strata’s license application and would required by the License, as indicated by Draft License Condition No. 11.3 (NRC, 2014b).

The Applicant also has proposed the installation of one well cluster for every 2 wellfield-hectares [4 wellfield-acres] for its post-licensing, pre-operational data-collection monitoring program. This density is consistent with the range of 1 well per 0.4 ha [1 ac] to one well per 2 ha [4 ac] discussed in the GEIS and the NRC’s *Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report*, NUREG–1569 (NRC, 2009b; NRC, 2003a). This well-cluster spacing has also been used historically at existing uranium-recovery facilities.

The Ross Project would include approximately 45 wells completed in the ore-zone aquifer (30 – 55-m [100 – 180-ft] thick sand unit) in the Lower Lance and Upper Fox Hills Formations (designated as the ore-zone [OZ] unit) to establish wellfield pre-operational data. At approximately half of those location (24 locations), an additional well would be completed in the underlying aquifer (3 – 9-m [10 – 30-ft]) thick sandy unit in the Fox Hills Formation (designated as the deep-monitoring [DM] unit below the ore zone) and the overlying aquifer in the first water-bearing unit above all zones containing uranium mineralization in the Lance Formation (designated as the shallow-monitoring [SM] unit), forming a three-well cluster at those locations. The wells completed in the SM and DM units would use a fully penetrating completion while the ore-zone wells would target specific roll fronts (see Figures 2.8 – 2.10). Beyond the six existing well clusters used for pre-licensing, site-characterization monitoring, the Applicant has proposed no additional surficial-aquifer (SA) wells in the wellfield (the SA is a shallow aquifer comprised of alluvial deposits associated with the recent stream channels). However, for wellfields located in an area in which the uppermost aquifer, the “SA aquifer,” is comprised of saturated unconsolidated alluvium, the Source and Byproduct Materials License would require that the Applicant monitor the SA aquifer as part of the excursion monitoring program (see Draft License Condition No. 11.5) (NRC, 2014b).

The Applicant has proposed obtaining at least four samples, with a minimum of two weeks between sampling events, for all perimeter, SM, OZ, and DM wells during post-licensing, pre-operational water-quality monitoring of each newly installed wellfield. In addition, the SA-well network would continue to be sampled on a quarterly basis during each wellfield's post-licensing, pre-operational data-collection efforts. The first and second sampling events would include laboratory analyses for the constituents listed in GEIS Table 8.2-1 (NRC, 2009b). However, the Applicant has proposed a reduced list of constituents for the third and fourth sampling events, the selections of which would be informed by the results of the previous two sampling events. Results from all of these sample analyses would be averaged arithmetically to obtain an average value as well as a maximum value for use in the NRC's determination of UCLs for excursion detection. The Applicant's proposed monitoring program will be modified as required by the Source and Byproduct Materials License.

6.3.2.2 Operational Ground-Water Sampling and Water-Quality Analysis

As described in GEIS Section 8.3.1.2 (NRC, 2009b), and as indicated by Condition Nos. 10.13 and 11.15 of the Draft Source and Byproduct Materials License (NRC, 2014b), the placement of monitoring wells would occur around the perimeter of wellfields, in the aquifers both overlying and underlying the ore zone, for the early detection of potential horizontal and vertical excursions of lixiviant. Three configurations of monitoring wells would be constructed to ensure detection of horizontal and vertical excursions: 1) wells through the entire targeted ore zone (i.e., the ore body or the uranium mineralization) at the perimeters of the wellfields; 2) wells completed in the aquifer underlying the ore zone; and 3) wells completed in the aquifer overlying the ore zone (Strata, 2011b). The design of a typical monitoring well is described in SEIS Section 2.1.1 (see also Figures 2.8 – 2.10 in that section). To detect whether an excursion of lixiviant has occurred, the monitoring results would be compared to the NRC-approved UCLs.

The Applicant proposed well spacing that meets the minimum requirement described in the GEIS as necessary to detect excursions (NRC, 2009b). However, the NRC staff has included Condition No. 11.3 in the Draft Source and Byproduct Materials License (NRC, 2014b), which would require a minimum density of one well per 0.8 ha [2 ac], a requirement based upon the NRC's evaluation of site-specific geologic and hydrogeologic conditions as well as the Applicant's proposed sequencing and area of individual wellfields. Wells completed in the aquifer underlying the ore zone and in the aquifer overlying the ore zone would be installed at a density of one well per 1 – 2 ha [3 – 4 ac] of wellfield for detection of vertical migration. The Applicant proposed a spacing of the perimeter-monitoring wells of 120 – 180 m [400 – 600 ft] apart and at a distance of approximately 120 – 180 m [400 – 600 ft] from the edge of the wellfield to detect potential horizontal excursions. The Applicant proposed that samples from these monitoring wells would be collected twice monthly to be analyzed for the NRC-approved excursion parameters (i.e., constituent concentrations) (Strata, 2011b).

Simulations by the Applicant have demonstrated that the proposed well spacing successfully detects hydraulic anomalies in the form of water-level increases well before lixiviant has actually moved beyond the active uranium-recovery areas (i.e., before a horizontal excursion has occurred) (Strata, 2011b). Consequently, water levels would be measured in the perimeter-monitoring wells to provide early detection of potential excursions or hydraulic anomalies.

Water levels would be routinely measured during well sampling in the perimeter, overlying, and underlying monitoring wells in order to provide an early warning for impending wellfield problems. An increasing water level in a perimeter-monitoring well has been shown to be an indication of a local-flow imbalance within the wellfield, which could result in a lixiviant excursion. An increasing water level in an overlying or underlying monitoring well could similarly be caused by the migration of lixiviant from the ore-zone aquifer, or it could indicate an injection well-casing failure. This monitoring would allow immediate corrective actions, thus reducing the likelihood of excursions.

6.3.3 Flow and Pressure Monitoring of Wellfields and Pipelines

GEIS Section 8.3.2 described the conduct of an operator's monitoring of flow rates and pressures of lixiviant pumped to injection wells and from recovery wells. These monitoring data would be used by the Applicant to manage the water balance for the entire wellfield and to maintain an inward gradient to reduce the likelihood of excursions (NRC, 2009b). To manage the water balance at the Ross Project, the Applicant has proposed flow meters and pressure transmitters on each of the pipelines to the module building and the respective injection and recovery wells. All instrumentation would be monitored at the module building and at the Central Processing Plant (CPP). The wellfield flows would be balanced based upon the module injection and recovery feeder-line meters. An individual well's flow target values would be determined on a per-well-pattern basis to ensure that local wellfield areas are balanced on at least a weekly basis. The maximum injection pressure would always be less than the respective geologic formation's fracture pressure (i.e., fractures in the rock would not occur, unlike during "fracking").

Each module building would have the capability of being isolated from the pipelines by manually operated butterfly valves contained in the manholes exposing the pipelines. The manholes would have leak-detection devices that would activate an audible and visible alarm at the CPP in the event of a leak. Pressure transmitters on each end of the trunk lines and feeder lines would relay pressure readings back to the CPP's 24-hour control room. In the event of a pressure reading that is outside of acceptable operating parameters, an audible and visible alarm would also occur at the CPP. Automatic sequential shutdown of the trunk-line pumps and/or module-building booster pumps and recovery-well pumps would automatically then occur if operating parameters do not return to normal ranges within a specified amount of time.

6.4 Meteorological Monitoring

The Applicant proposes to continue operating the meteorological monitoring station it installed in January 2010 as part of Strata's pre-licensing, site-characterization efforts (Strata, 2011a). The data collected at this station would include continuous measurements of wind speed, wind direction, temperature, relative humidity, precipitation, and evaporation.

6.5 Ecological Monitoring

Ecological monitoring would include both vegetation and wildlife surveys.

6.5.1 Vegetation Monitoring

The Applicant has proposed to monitor all disturbed lands on the Ross Project area for the presence of undesirable (i.e., noxious or invasive) vegetation species and to use control measures to prevent their spreading. Vegetation monitoring in reclaimed areas would be conducted according to U.S. Bureau of Land Management (BLM) requirements and would be in accordance with the decommissioning requirements in the Applicant's Source and Byproduct Materials License as well as the reclamation requirements in its WDEQ Permit to Mine (Strata, 2011a; WWC, 2012). Revegetation success would be monitored by the "extended reference area" concept, as defined in WDEQ/Land Quality Division (LQD), Guideline No. 2 (Strata, 2011a). The extended reference area would include all of the undisturbed portions of any vegetation type that has experienced disturbance in any phase of the Ross Project. At the end of decommissioning, quantitative vegetation data for extended reference areas representing each disturbed vegetation type would be directly compared by statistical analysis to quantitative vegetative data from reclaimed vegetation types. The duration of vegetation monitoring, and the target goals, would be defined in the to-be-required decommissioning plan (DP), as indicated in the Draft Source and Byproduct Materials License under Condition No. 10.3, and in the Restoration Action Plan presented in Strata's license application (NRC, 2014b; Strata, 2011b).

6.5.2 Wildlife Monitoring

The Applicant proposed annual wildlife surveys in and near the Ross Project area throughout the lifecycle of the Ross Project in order to document key wildlife species, population trends, and wildlife habitats (Strata, 2011a).

6.5.2.1 Annual Reporting and Meetings

The Applicant would coordinate its wildlife-monitoring program with the BLM's Newcastle Field Office and the Wyoming Game and Fish Department (WGFD). Consultation with the U.S. Fish and Wildlife Service (USFWS), the BLM, and the WGFD would be conducted prior to the Applicant's initiating a survey and would be documented in a work plan, with BLM and WGFD concurrence. The Applicant would prepare an annual monitoring report and submit it to the BLM, WGFD, and other interested parties by November 15 of each year. The monitoring report would include:

- Survey methods and results as well as observations of any trends and assessments of wildlife-protection measures implemented during the past year.
- Recommendations for changes in wildlife-protection measures for the coming year.
- Recommendations for modifications to wildlife monitoring or surveying.
- Recommendations for additional species to be monitored (e.g., a newly Federal- or State-listed species).

Data and mapping would be formatted to meet BLM requirements (i.e., geographic information systems [GIS] data and maps).

6.5.2.2 Annual Inventory and Monitoring

Wildlife surveying and monitoring would be performed by BLM or WGFD biologists or a qualified scientist under contract to the Applicant. All aspects of a regular and/or periodic monitoring program would be developed according to current regulatory and permitting guidelines and requirements. These would include field-survey and survey-equipment requirements; sample collection, storage, and analysis protocols as well as data reporting procedures; regulatory agency consultations and collaborations; and any other relevant survey- and monitoring-program components.

6.5.2.3 Wildlife Species

Mammals and certain birds as well as all wildlife on the BLM's Sensitive Species (BLMSS), Wyoming's Species of Greatest Conservation Need (SGCN), and USFWS's "Birds of Conservation Concern" (BCC) lists at the Ross Project area would be monitored in the Applicant's wildlife monitoring program.

Mammals

Opportunistic observations of all wildlife species would be conducted in late spring and summer, during the Applicant's completion of the surveys discussed below for sensitive species. No big-game crucial ranges, habitats, or migration corridors are recognized by the WGFD at the Ross Project area or the surrounding 1.6-km [1-mi] perimeter. A "crucial" range or habitat is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. Due to the lack of crucial big-game habitats, the WGFD did not require big-game surveys during the Applicant's pre-licensing, site-characterization monitoring it performed in 2009 and 2010 (Strata, 2011a). Long-term monitoring for big game is not anticipated and has not been proposed by the Applicant.

Protected Species and Other Birds

The Applicant also proposed to monitor protected species, using the following strategy (Strata, 2011a):

- Early spring surveys for and monitoring of sage-grouse leks within 2 km [1.2 mi] of the Ross Project area. All threatened and endangered species as well as those on the BLMSS's, Wyoming's SGCN, and USFWS's "Migratory Bird Species of Management Concern in Wyoming" (SMC) lists would be surveyed and monitored on the Ross Project area as well.
- Late spring and summer opportunistic observations of all wildlife species, including threatened, endangered, BLMSS, SGCN, SMC, and any other species of concern.
- Any other surveys as required by regulatory agencies.

Raptors

Only one raptor's nest was previously identified on the Ross Project area, and the opportunity for nesting is limited in the area due to a lack of suitable habitat (i.e., lack of trees and cliffs). However, the Applicant has committed to completing the following:

- Early-spring surveys for new and/or occupied raptor territories and/or nests.
- Late-spring and summer surveys for raptor reproduction at occupied nests.

The nearest human disturbance to active and inactive raptor nests, any visual barriers in the line of sight of raptor nests, and the prey abundance (e.g., jackrabbits and cottontails) would be reported in each annual report to allow an assessment of whether any raptor disturbance is related to uranium-recovery activities.

Migratory Birds

The Applicant would conduct nesting-bird surveys for nongame species during early summer, following recommended WDEQ techniques. All birds, observed or heard, and the vegetation and habitat type where they might be found would be recorded. These surveys would document all high-interest bird species identified by the BLM, WGFD, and USFWS.

6.6 References

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(US)NRC (U.S. Nuclear Regulatory Commission). "Radiological Effluent and Environmental Monitoring at Uranium Mills, Revision 1." Regulatory Guide 4.14. Washington, DC: USNRC. 1980. Agencywide Documents Access and Management System (ADAMS) Accession No. ML003739941.

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(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

WWC Engineering (WWC). Ross ISR Project, Permit to Mine Application, TFN 5 5/217, Submittal of Mine Plan Replacement Page per the Joint Stipulation Resolving EQC Docket No. 12-4803. October 24, 2012. ADAMS Accession No. ML12299A040.

7 COST-BENEFIT ANALYSIS

This section summarizes the costs and benefits associated with the Proposed Action and the two Alternatives. This discussion of the Ross Project's costs and benefits follows the United States (U.S.) Nuclear Regulatory Commission (NRC) guidance presented in the NRC's *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*, NUREG–1748 (NRC, 2003b). This discussion includes both the costs of each Alternative and a qualitative discussion of environmental impacts, as applicable.

7.1 Proposed Action

Benefits of the Proposed Action include the additional employment opportunities available to area residents, increased incomes to area residents, and additional tax revenues accruing to local jurisdictions and the State of Wyoming (Wyoming). Potential costs include both the internal costs of the Ross Project borne by Strata Energy, Inc. (Strata) (also referred to herein as the "Applicant"), and the potential external monetary costs that could be required by local public-service providers in response to Project activities as well as non-monetary costs associated with the potential environmental impacts.

7.1.1 Ross Project Benefits

The economic benefits of the Ross Project would be positive for Crook County and generally positive for residents directly or indirectly affected by the Project. The Applicant has committed to hiring local personnel and making equipment purchases at local suppliers whenever possible (Strata, 2012a), thereby maximizing the economic benefits to Crook County and neighboring counties.

7.1.1.1 Employment and Income

The Ross Project is expected to require a peak workforce of approximately 200 workers during its construction phase; 60 workers during Project operation; 20 – 30 workers during the aquifer-restoration phase; and 90 workers for facility decommissioning and site reclamation activities (see *Final Supplemental Environmental Impact Statement* [FSEIS] Section 4.11). This employment would be beneficial because it would reduce the local unemployment rate for the duration of construction, and some workers would likely continue through the operation phase of the Project. It is expected that workers would be paid the regional rates typical of Crook and Campbell Counties, where a higher percentage of jobs are in the relatively higher-paying energy industry. Based upon a weighted-average annual earnings per job of $61,400 (see FSEIS Section 3.11), earnings accruing to area residents would range from $1.2 million to $1.8 million during the aquifer-restoration phase to approximately $12.3 million during the Ross Project's construction phase. In addition, existing private-property landowners of the Ross Project area would be compensated for the loss of use of their land; however, the specific terms of this compensation is confidential.

7.1.1.2 Tax Revenues

Average annual tax revenues are estimated to be $2,785,000 per year during the Ross Project's operation (see FSEIS Section 4.11.1) and would total approximately $27,850,000 over the lifecycle of the Project. The State of Wyoming would benefit from the Ross Project, in part, from severance and royalty payments, estimated to be $10.9 million over the Project's lifecycle, whereas Crook County would benefit from gross production and property taxes, totaling $16.9 million over the lifecycle of the Project. In addition, some portion of Wyoming's severance and royalty payments would be distributed among all Wyoming cities and counties and, thus, all jurisdictions within the State are expected to benefit from increased State tax revenues (WLSO, 2010).

7.1.2 Ross Project Costs

Potential costs include both the internal costs of the Ross Project borne by the Applicant itself and the potential external costs potentially borne by local public-service providers in response to Project activities (i.e., local fire department costs), as well as non-monetary costs associated with the potential environmental impacts.

7.1.2.1 Internal Costs

All internal costs would be borne by the Applicant—that is, the direct financial costs of the construction, operation, aquifer restoration, and decommissioning of the proposed Ross Project would be paid by Strata. The primary internal costs would include:

- Capital costs associated with the Applicant's obtaining land and mineral rights as well as securing regulatory approvals including permits, licenses, and related environmental studies.
- Capital costs of facility construction and wellfield installation.
- Costs of facility and wellfield operation and maintenance.
- Costs of aquifer restoration.
- Costs of facility and wellfield decontamination, dismantling, and decommissioning.
- Costs of site restoration and reclamation.

The Applicant has estimated that these internal costs would total approximately $136.7 million (Strata, 2011a). The estimated decommissioning costs for the Ross Project would be determined prior to uranium-recovery operation, and a surety arrangement equal to the estimated decommissioning costs will be a condition of the Source and Byproduct Materials License. Each year, the decommissioning cost estimate would be reviewed by the NRC as well as the Wyoming Department of Environmental Quality (WDEQ), and adjustments would be made as necessary.

7.1.2.2 External Costs

Land Use

During the Proposed Action, impacts to local land use would occur. Land-use impacts could result from land disturbance during construction, operation, and decommissioning; from wildlife- and livestock-grazing restriction; from land access limitations; and from competition for mineral, oil, or gas rights. Land-use impacts during all phases of the Project would be SMALL. Access restrictions at the Ross Project area, however, would preclude the economic benefits from existing agricultural and grazing activities. If land access were to be assumed to be restricted across the entire Ross Project area—696 ha [1,721 ac]—and based upon a market value of products sold from crop and livestock sales in Crook County averaging $28 per acre in 2007 dollars (USDA, 2009), $48,188 in annual lost-agriculture sales could be estimated as the upper end of this potential loss, or $481,880 over the lifecycle of the Project. These losses would be offset by the compensation paid to the landowners, where the exact terms of the respective compensation is confidential.

Transportation

During the Proposed Action, the highest traffic volume would occur during the construction phase because of the relatively large workforce as well as the increased demand for materials and equipment at the Ross Project area. The Applicant estimated that the increased traffic would be approximately 400 passenger automobiles and 24 trucks per day, which, compared to 2010 levels, represents a significant traffic volume increase of approximately 400 percent on New Haven Road. Thus, construction-phase transportation impacts would be MODERATE to LARGE with respect to the traffic levels on local roads and the road surfaces (SMALL to MODERATE with mitigation), and SMALL with respect to traffic levels on Interstate highway system. All other phases would have less traffic related to commuting workers, but the impacts would still range from SMALL to LARGE. The increased traffic could result in more traffic accidents as well as significant wear and tear on local road surfaces. Mitigation measures would be in place and would reduce the range of these impacts to no more than MODERATE (on local roads).

Geology and Soils

Under the Proposed Action, potential impacts to geology and soils would occur due to the disturbance of 114 ha [282 ac] of the Ross Project area, or about 16 percent (Strata, 2011a). Other soils impacts would include the Applicant's clearing of vegetation; stripping of topsoils; excavating, backfilling, and compacting soils; grading of the land; and trenching for utilities and pipelines. There are limited potential impacts to geology because of the minor depth of disturbance associated with construction of the Ross Project. The potential impacts from soils loss would be minimized by proper design and operation of surface-runoff features and implementation of best management practices (BMPs). Impacts to geology and soils would be SMALL.

Water Resources

The Ross Project has the potential to impact quantity and quality of surface water and ground water during each phase of its lifecycle.

Surface Water

Under the Proposed Action, potential impacts to surface water would include increased sediment concentrations from runoff, contamination by a spill or unintended release of process solutions, and reduced volumes of water in the Oshoto Reservoirs and the Little Missouri River. Implementation of mitigation measures and BMPs would result in SMALL impacts to the quality of surface water. The minimal use of surface water during the Proposed Actions would potentially cause SMALL impacts to the quantity of surface water.

Ground Water

Under the Proposed Action, potential impacts to ground water are primarily a result of the consumptive use of ground water (i.e., removing more ground water than is re-injected in), excursions of lixiviant outside of the exempted aquifer, and spills and leaks of fuels and lubricants from construction equipment. Impacts to shallow (i.e., near-surface) aquifers would be SMALL. Short-term impacts to water quantity in the ore-zone and surrounding aquifers would be SMALL to MODERATE during restoration. Short-term impacts to water-quality in the ore zone and surrounding aquifers due to excursions could result in SMALL to MODERATE impacts during operations.

Ecology

Under the Proposed Action, potential environmental impacts to ecological resources, both flora and fauna, could occur during all phases of the Project; all impacts would be SMALL.

The impacts to local vegetation could include:

- Removal of vegetation from the Ross Project area.
- Modification of existing vegetative communities.
- Loss of sensitive plants and habitats.
- Potential spread of invasive-species and noxious-weed populations.
- Reduction in wildlife habitat and forage productivity.
- Increased risk of soil erosion and weed invasion.

Impacts to terrestrial wildlife could include:

- Loss, alteration, or incremental fragmentation of habitat.
- Displacement of and stresses on wildlife.
- Direct and/or indirect mortalities.

Aquatic species could be affected by:

- Disturbances of stream channels.
- Increases in suspended sediments.
- Pollution from spills and leaks.
- Reduction of habitat.

These impacts would be mitigated by, for example, the Applicant's implementing the standard management practices required or suggested by the Wyoming Game and Fish Department (WGFD).

Air Quality

Under the Proposed Action, impacts from nonradiological particulate emissions would primarily result from fugitive dust from local roads created by moving vehicles and mobile equipment throughout the Ross Project area and, to a far lesser extent, the processes and circuits implemented in the Central Processing Plant (CPP). Combustion-engine emissions from diesel-equipment operation would occur primarily during the construction, operation, and decommissioning phases. In general, however, uranium-recovery activities are not major air-emission sources. Air-quality impacts during all phases of the Ross Project would be SMALL.

Noise

Under the Proposed Action, there would be MODERATE, noise impacts to nearest residences near the Ross Project area during construction, operation, and decommissioning. These impacts would be the result of construction, operation, and decommissioning activities (e.g., well installation and CPP construction, uranium recovery, and CPP decontamination/demolishing and well abandonment) and the traffic that would be associated with the Ross Project. For example, during high truck-traffic events on New Haven Road during most phases (perhaps not during the aquifer-restoration phase) of the Ross Project, residents living on those routes could occasionally be annoyed by such noise. At farther offsite residences, communities, or sensitive areas that are located more than approximately 300 m [1,000 ft] from specific noise-generating activities, however, the impacts would be SMALL because noise levels quickly decrease with distance. There are no churches, schools, or community centers located less than 300 m [1,000 ft] from the Ross Project's boundaries. Impacts to workers at the Project also would be SMALL because of the Applicant's compliance with U.S. Occupational Safety and Health Administration (OSHA) noise requirements as discussed in its license application (Strata, 2011a).

Historical, Cultural, and Paleontological Resources

Under the Proposed Action, the impacts to historical, cultural, and paleontological resources within the Ross Project area could range from SMALL to LARGE. This assessment reflects the fact that the highest potential for adverse effects to historical and cultural resources would take place during the construction phase as well as the fact that efforts to evaluate historic and cultural properties and to determine adverse effects and mitigation are incomplete. A construction impact beyond MODERATE would not be anticipated because every effort would be made to avoid, minimize, and/or mitigate adverse effects to historical and cultural properties in accordance with the Ross Project Programmatic Agreement (PA) that is currently being prepared. However, a LARGE impact is not impossible, depending upon the significance and integrity of, and the extent of adverse effects on, previously identified historical and cultural properties or those potentially, inadvertently discovered.

Visual and Scenic Resources

Under the Proposed Action, short-term, but MODERATE, impacts to the visual and scenic resources of the Project area during construction would occur, and SMALL longer-term impacts for the remainder of the Ross Project would occur (see FSEIS Section 4.10). Potential visual and scenic impacts would result from the surface disturbance and construction of the following: 1) wellfields (including drill rigs, module buildings, wellhead covers, and roads; 2) the CPP;

3) surface impoundments; 4) the CBW; 5) access roads; 6) power lines; and 7) fencing. The nearest protected visual resource to the Ross Project is the Devils Tower National Monument (Devils Tower or Bear Lodge), which is approximately 16 km [10 mi] east of the Ross Project. Although the Project itself would not be visible from the lower park portion of the Tower, even after dark, climbers ascending to the top of the Tower might be able to see some of the Project's largest components (e.g., the CPP) as well as, in the night sky, the lights in the Project area. The visual impacts from the Ross Project would be consistent with the U.S. Bureau of Land Management's (BLM's) VRM Class III designation (BLM, 2007).

The degradation of views of the nighttime sky at four national parks (i.e., Yellowstone, Great Basin, Mesa Verde, and Chaco Canyon) has been evaluated by Mitchell et al. using the contingent valuation method (CVM) during summer surveys in 2007 (Mitchell et al., 2008). These surveys were designed to quantify the willingness-to-pay (WTP) to reduce light pollution in these areas. Over 50 percent of respondents were willing to pay a positive amount to address light pollution. The average amount individuals would be willing to increase their Federal tax to reduce light pollution was estimated to be $39.37 per year per person. When the self-reported survey characteristics are reviewed, there is a positive correlation between the extent individuals are exposed to light pollution and their willingness to pay to reduce it. Hence, people in rural areas are generally less willing to pay to reduce light pollution. There are 11 residences within Ross Project area where visual-resource impacts were evaluated (see FSEIS Section 4.10). Based upon an average household size of 2.41 persons per household in Crook County (USCB, 2012), an estimated 27 persons could be affected by light from the Project; the external costs associated with light pollution would be $1,063 per year or $10,630 over the lifecycle of the Ross Project.

Socioeconomics

Under the Proposed Action, most of the socioeconomic costs of the Ross Project would be SMALL (see SEIS Section 4.11.1.1), even during the phase with the most significant impacts, the construction phase. The Applicant has committed to hiring locally and, during peak construction-phase activities, only 52 additional residents would be expected to enter the region (i.e., Crook and Campbell Counties). Less significant impacts would occur in subsequent Project phases. Ross Project-related population increases would represent less than 0.1 percent of the 2010 population in the two-county region and, in general, existing community-service providers, such as local schools, health-service agencies, and police and fire-protection agencies are not expected to be adversely affected by this level of increased demand for public services.

There would be an increased need, however, for emergency-response services. The Applicant has entered into a Memorandum of Understanding (MOU) with Crook County (Strata and Crook County, 2011) that states the Applicant will coordinate emergency-management, hazardous-materials management, and fire-suppression planning with Crook County's Homeland Security Director and Crook County's Fire Warden and Fire Zone Warden. The Applicant has committed to maintaining the onsite personnel and equipment necessary to provide emergency services when environmental, safety, or health emergencies arise at the Ross Project. As such, these services would not represent a cost to local governments (Strata and Crook County, 2011).

The MOU also states the Applicant will:

- Provide electronic warning signs that would close county roads into the Ross Project area in the case of an emergency.
- Provide dust control for existing and increased traffic as a result of the Ross Project, as necessary, and as required by the WDEQ. This would include providing dust control over each one-quarter-mile segment of the county roads fronting the residences along any road designated by the County as an access road to the Ross Project, in order to minimize fugitive-dust impacts on nearby residents.
- Maintain and repair any damage caused by the Applicant's trucks or its contracted trucks as a result of their road use, as dictated and regulated by Crook County (Strata and Crook County, 2011).

These measures would minimize any costs that would be borne by local jurisdictions and area residents.

Environmental Justice

No minority or low-income populations have been identified in the Ross Project area. Therefore, there are no disproportionately significant or adverse impacts to minority and low-income populations by the Ross Project.

Public and Occupational Health and Safety

Under the Proposed Action, potential nonradiological and radiological impacts to the public's and workers' health and safety over the course of the Ross Project could result from accidental chemical or radiological releases; chemical or byproduct-material liquid spills or releases; particulate and gaseous emissions; vehicular and equipment accidents; worker injuries and illnesses; or fires. The Applicant has proposed to minimize these potential impacts through rigorous worker training, careful facility and wellfield design, operational controls, and a series of emergency-response protocols.

An important factor in the assessment of risks to public health and safety is the proximity of potentially impacted populations. The nearest incorporated community to the Ross Site is Moorcroft, Wyoming, with an estimated population of less than 1,000; Moorcroft is located approximately 35 km [22 mi] south of the Ross Project area. Unincorporated Oshoto is adjacent to the Ross Project area, but it has a population of fewer than 50 persons. In addition, the quantities of materials that could be released, even through the air pathway, would be small and, as discussed in FSEIS Section 4.7, would be dispersed and diluted. Workers involved in the response and cleanup of spills and other releases could receive MODERATE impacts; these would be mitigated to SMALL by the Applicant's establishing standard operating procedures (SOPs), employing BMPs, and instituting strict training requirements. Thus, little to no risk would be posed to the offsite public, and any impacts would be SMALL.

Waste Management

Under the Proposed Action, both liquid and solid wastes would be generated during all phases of the Ross Project's lifecycle. Several major waste streams are identified in FSEIS Section 4.14. At least four of these waste streams have the potential to impact the local communities.

The disposal of liquid byproduct-material waste would be accomplished by injection of this type of waste into a confined aquifer. The regulatory permitting process for this type of waste disposal would ensure that all mitigation measures to minimize related potential impacts would be taken. Ordinary solid waste would include trash, spent materials, and broken equipment. Hazardous waste, solid or liquid, would represent a very small volume of spent reagents and other items, such as batteries. Solid byproduct-material waste would consist of Ross Project equipment, process vessels, building components, and other items that could not be decontaminated and released for unrestricted use. All three types of these wastes would be disposed of at offsite waste-disposal facilities, and these wastes would have little impact on the respective disposal facilities' ultimate capacity due to the wastes' small cumulative volume. Thus, waste-management impacts during all phases of the Ross Project would be SMALL.

7.1.3 Findings and Conclusions

The Proposed Action would have a SMALL to MODERATE socioeconomic impacts on the two-county region, with MODERATE impacts associated with the benefits of the additional tax revenue that would accrue to Crook County. Regional benefits would include increased employment, economic activity, and tax revenues in the region and Wyoming. Because the Applicant has committed to hiring personnel locally, population increases and the subsequent need for additional public services would be negligible. Access restrictions to the Ross Project area would result in the loss of some economic activities (e.g., agriculture), but this loss would be offset to a degree by the Applicant's compensation to the affected landowners. A limited number of residents would also be affected by dust, noise, and/or light pollution from the Ross Project. However, in conclusion, the economic benefits of the Proposed Action would be greater than the associated costs.

7.2 Alternative 2: No Action

Under the No-Action Alternative, the NRC would not issue the Applicant a license to construct, operate, restore the aquifer, and decommission the proposed Ross Project. Area residents could be impacted by or reap benefits from some limited preconstruction activities, but no longer-term environmental impacts and/or economic benefits would accrue to area residents, local jurisdictions, or the State. Alternatively, there would be no potential costs borne by nearby jurisdictions and residents.

7.3 Alternative 3: North Ross Project

Construction, operation, aquifer restoration, and decommissioning of the North Ross Project are not expected to result in any significant differences in this cost-benefit analysis. Overall land-use impacts would be generally the same as for the Proposed Action, although impacts to dryland crop agriculture would be lower, while impacts to grazing activities would be greater. Small changes in traffic patterns on roads to and within the Ross Project area could result in a reduced traffic volume on New Haven Road that would be offset by increased traffic on other roads (e.g., D Road). These changing traffic patterns would very slightly increase noise and air-quality impacts, but these impacts would be offset by fewer directly affected residents. Impacts to other resources areas also are generally the same as for the Proposed Action. Thus, the major costs and benefits described for the Proposed Action would accrue similarly were the Project facility (i.e., the CPP, surface impoundments, and other structures including those for storage and parking) to be constructed and operated at the north site.

7.4 References

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8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

The environmental consequences of the Proposed Action, the Ross Project, and Alternative 3, the North Ross Project, are summarized next in Table 8.1.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
LAND USE				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.2.1.)	There would be SMALL unavoidable adverse impacts on land use over the lifecycle of the Ross Project because certain areas of the Project area would be fenced during the Project's construction, operation, aquifer restoration, and decommissioning. The area disturbed, however, is small—114 hectares (ha) [282 acres (ac)]. At the end of the Project, after facility decommissioning and site restoration have been fully accomplished, the former land uses of the Ross Project area would be restored.	There would be no irreversible or irretrievable impacts to land use in the area as a result of the Proposed Action. All land would be restored to its baseline uses post-Ross Project. Access roads would be removed, or they would be left as desired by the respective landowner(s).	There would be short-term land-use impacts during the Proposed Action, predominantly due to a decrease in the total area available for livestock grazing.	There would be no long-term impacts on land use within the Ross Project area. The land would be restored to its pre-licensing baseline and former land uses would be possible after decommissioning of the Project and the site's restoration.
Alternative 3: North Ross Project (See SEIS Section 4.2.3.)	Approximately the same number of acres would be taken out from service during Alternative 3. The area that would be disturbed would still be small. However, some livestock grazing could be diminished during the lifecycle of Alternative 3. However, as above, after complete facility decommissioning and site restoration have been accomplished, the former land use would be restored.	There would be no irreversible or irretrievable impacts to land use in the area as a result of Alternative 3. All land would be restored to its baseline uses.	There would be short-term impacts to land use in Alternative 3. The total area available for livestock grazing would be temporarily reduced.	There would be no long-term impacts on the land use of the area of Alternative 3. As above, the land would be restored and the former pre-licensing land use would be re-established after the decommissioning of the Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
TRANSPORTATION				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.3.1.)	During the four phases of the Proposed Action, the unavoidable impacts to transportation, which would be related specifically to traffic volumes, would range from SMALL (on Interstate highways) to MODERATE (on local roads). Because the Ross Project is located in a rural area of Wyoming, where traffic is sparse, the increase in traffic as a result of the Proposed Action could create MODERATE to LARGE unmitigated impacts on local and County roads. With the mitigation measures the Applicant has proposed, during all phases of the Ross Project, transportation impacts would be SMALL to MODERATE.	There would be no long-term irreversible or irretrievable environmental impacts from increases in transportation by the Proposed Action. Once the Ross Project has been decommissioned and the site restored, all traffic impacts of the Proposed Action would cease as all related traffic would be zero.	Transportation impacts to the vicinity of the Proposed Action would be SMALL to MODERATE, with mitigation. These impacts would include increased traffic counts and a slightly higher probability of vehicular accidents. All of these short-term impacts would cease after the decommissioning of the Ross Project.	The long-term impacts of the Proposed Action with respect to transportation resources would be enhanced road quality. During the Ross Project, the Applicant would ensure that the roads leading to and from the Project would be well built and maintained. Although the maintenance that would be provided by the Applicant would cease after the Proposed Action is complete, the remaining roads, however, would be of better quality than they are currently.
Alternative 3: North Ross Project (See SEIS Section 4.3.3.)	The construction and operation of the Central Processing Plant (CPP) at the north site would, in general, have the same transportation impacts as the Proposed Action, and these impacts would be SMALL to LARGE. With mitigation measures, the impacts would be SMALL to MODERATE.	There would be no irreversible impacts to land use in the area as a result of Alternative 3. All transportation impacts would cease at the conclusion of Alternative 3. Access roads would be removed, or they would be left as desired by the respective landowner(s).	There would also be short-term impacts to transportation in Alternative 3, and they would be the same as for the Proposed Action.	The long-term impacts of Alternative 3 would be the same as those in the Proposed Action, where roads would be improved by the Applicant and these improvements would remain after Alternative 3 was decommissioned and its site restored.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
GEOLOGY AND SOILS				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.4.1.)**	There would be SMALL unavoidable adverse potential environmental impacts to the geology and soils at the Proposed Action. Wind and water erosion are possible, but the Applicant would mitigate the potential for erosion with best management practices (BMPs) specifically related to erosion. (Fugitive dust is discussed under "Air Quality" in this Table.) There would be few geology and soils impacts during the Proposed Action.	There would be no irreversible or irretrievable commitment of geology or soil resources during the Proposed Action. No permanent changes would occur to the overall geology and soils of the Ross Project.	There would be some short-term potential impacts to soils under the Proposed Action, such as loss due to erosion. With the mitigation measures proposed by the Applicant, however, these potential impacts are unlikely, even over the short term.	There would be no long-term impacts to geology or soils during the Proposed Action at the Ross Project.
Alternative 3: North Ross Project **(See SEIS Section 4.4.3.)**	Alternative 3, as in the Proposed Action, would have the potential for wind or water erosion. With mitigation, however, little erosion would be expected. Greater soil disturbance for construction of the surface impoundments for Alternative 3 would be expected because of the site-specific topographic conditions. There would be SMALL impacts to the geology and soils at the Ross Project area.	There would be no irreversible or irretrievable impacts to geology or soils during Alternative 3.	There would be small impacts related to the potential for eroding soils during Alternative 3; these would be mitigated and, consequently, SMALL.	There would be no long-term impacts to geology or soils in Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: SURFACE WATER				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.5.1.)	There would be SMALL unavoidable adverse impacts on surface water over the lifecycle of the Ross Project. Surface water would be potentially impacted by sediment from storm-water run-off and crossing water features with roads and pipelines. The moisture conditions of wetlands situated along the Little Missouri River and adjacent to the Oshoto Reservoir would potentially be impacted. Accidental leaks, spills, and other releases of fluids would potentially impact surface water quality. With mitigation, however, little sedimentation would be expected and accidental releases would be contained.	There would be no irreversible or irretrievable impacts to surface water by the Proposed Action. Small amounts of surface water would be used for construction activities and dust control, but this water would be replaced by normal precipitation.	There would be some short-term potential impacts to surface water under the Proposed Action, such as increased sedimentation. With the mitigation measures proposed by the Applicant, however, these potential impacts are unlikely, even over the short term.	There would be no long-term impacts to surface water during the Proposed Action at the Ross Project area.
Alternative 3: North Ross Project (See SEIS Section 4.5.1.)	The construction and operation of the CPP at the north site in Alternative 3 would, in general, have the same surface water impacts as the Proposed Action; however the mitigation measures required to protect the two ephemeral drainages and the steeper land slopes at the North Ross Project would involve more engineering. With mitigation measures, the impacts would be SMALL.	As with the Proposed Action, there would be no irreversible or irretrievable impacts to surface water during Alternative 3.	The potential short-term impacts to surface water during Alternative 3 would be the same as for the Proposed Action.	There would be no long-term impacts to surface water at the North Ross Project under Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: GROUND WATER				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.5.1.)**	There would be SMALL unavoidable adverse impacts to water quality and MODERATE unavoidable adverse impacts to water quantity on ground-water resources over the lifecycle of the Ross Project. Aquifers would be impacted by water withdrawal and injection of lixiviant. Lowering of water levels would be seen within and outside the Project area. The water quality of the aquifers outside and below the exempted aquifer would temporarily be impacted if excursions of lixiviant were to occur. Ground water above the exempted aquifer would potentially by impacted by leaks from wells and releases at the surface. With mitigation, however, little potential for excursions, leaks and accidental releases would be minimized. There would be SMALL to MODERATE impacts to the ground water quantity and SMALL impacts to ground water quality at the Ross Project area.	There would be no irreversible or irretrievable impacts to ground water from the Proposed Action. The lower ground water levels in the ore-zone aquifer and the aquifer overlying the ore zone would be replaced by normal recharge over time. Excursions would be remediated by pumping out contaminated water. The water quality of the exempted aquifer would consequently be restored.	Lowering of water levels would be a short-term impact to ground water from the Proposed Action. Based upon historical experience with uranium-recovery projects, excursions of lixiviant could occur and create short-term impacts to water quality. The mitigation measures proposed by the Applicant and that will be required by permits and conditions in the Final Source and Byproduct Materials License, such as water-management actions to minimize water usage from the aquifers, tests to ensure integrity of the wells, and early detection of excursions would reduce these impacts at the Ross Project.	There would be no long-term impacts to ground water by the Proposed Action. The water levels would rebound through normal aquifer recharge and restoration activities would return the water-quality to aquifer-restoration target values.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WATER RESOURCES: GROUND WATER (*Continued*)				
Alternative 3: North Ross Project **(See SEIS Section 4.5.3.)**	The construction and operation of the CPP at the north site would have the same mitigated impacts to ground water as the Proposed Action except, during Alternative 3, fewer mitigation measures to minimize the potential impacts to the shallow, unconfined aquifer from spills and leaks of byproduct liquid waste from the impoundments would be required. The greater depth to the shallow aquifer below the impoundments at the north site would eliminate the need for the containment barrier wall to prevent ground-water flow in the area below the impoundments as in the Proposed Action. Mitigation of the potential for leaks from the impoundments at the north site would rely upon leak detection and monitoring systems as well as remediation if contaminants reached the ground water.	As described for the Proposed Action, there would be no irreversible or irretrievable impacts to ground water under Alternative 3.	The short-term impacts during Alternative 3 would be the same as described for the Proposed Action.	There would be no long-term impacts to ground water at the North Ross Project under Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
ECOLOGY				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.6.1.)**	There would be SMALL unavoidable impacts related to the ecology of the Proposed Action. Some wildlife could be displaced during Project activities, especially during construction and decommissioning. The areas where human activities would be conducted could interrupt wildlife and birds, including protected species, that presently occur on the site. In addition, some vegetative impacts could occur as the land is used for uranium recovery. However, once facility decommissioning and site restoration have been completed all of these impacts would diminish, or baseline conditions would be re-established, and the ecology of the Project area would be restored over time.	There would be no irreversible or irretrievable commitment of ecological resources during the Proposed Action. There are no Greater-sage-grouse leks on the Ross Project itself. If one or more were to become present, the Applicant would be required to alter its activities, as appropriate, at the Ross Project.	There would be some short-term impacts to the ecology of the Proposed Action which would include the disruption of some species of vegetation as well as the potential for wildlife, including birds, to move elsewhere, away from Ross Project activities and noise. These impacts would cease when the decommissioning and reclamation of the Ross Project area are complete and the local habitat is restored.	There would be no long-term impacts to the area of the Ross Project. At the time of its closure, a decommissioning plan would be required, and this plan would require restoration of the Project area to its former baseline conditions.
Alternative 3: North Ross Project **(See SEIS Section 4.6.3.)**	Alternative 3 would have the potential for the same impacts to the local ecology as the Proposed Action. These impacts, however, would be SMALL.	There would be no irreversible or irretrievable impacts to the local ecology during Alternative 3.	There would be small, short-term impacts related to the disturbance of native vegetation and nearby wildlife during Alternative 3; these would be SMALL and would be the same as the Proposed Action.	There would be no long-term impacts to ecology under Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
AIR QUALITY				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.7.1.)**	There would be unavoidable adverse effects to local air quality due to the emission of combustion gases and fugitive dusts during all of the phases of the Proposed Action. These impacts would be SMALL. Fugitive dusts would become airborne during construction activities (e.g., road construction and site clearing and contouring) as well as during vehicular use to, from, and on the Project area. The Applicant would have an Air Quality Permit, however, that would require air emissions to be mitigated so that emissions would be kept to a minimum.	No permanent changes would occur to the overall quality of air at or near the Ross Project.	There would be SMALL short-term potential impacts to air quality under the Proposed Action. Gaseous and fugitive-dust emissions would be generated during all phases of the Ross Project. With the mitigation measures proposed by the Applicant, and those required by its Air Quality Permit, however, these potential impacts would be short term.	There would be no long-term impacts to air quality at the Ross Project. Once the Proposed Action has been decommissioned and the Project area reclaimed and restored, all air-quality impacts would cease.
Alternative 3: North Ross Project **(See SEIS Section 4.7.3.)**	Under Alternative 3, the same air-quality impacts would occur as during the Proposed Action. Because the CPP would be located such that gravel-road surfaces would be used slightly more often, there could be slightly more fugitive dust generated under Alternative 3.	No permanent changes would occur to the overall quality of air at or near the North Ross Project.	As for the Proposed Action, Alternative 3 would generate gaseous and fugitive-dust emissions throughout its lifecycle. But these impacts would also be SMALL.	There would be no long-term impacts to air quality as a result of Alternative 3. Once facility at the north site has been decommissioned and the Project area reclaimed and restored, all air-quality impacts would cease.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
NOISE				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.8.1.)**	There would be would be SMALL to MODERATE unavoidable adverse noise impacts during the Proposed Action. Because the Ross Project has several residences located near its boundaries, the noise generated during the Project's lifecycle would be MODERATE to those nearest receptors due to increased vehicular noise such as supply deliveries, commuter traffic, and shipments from the Project. The four phases of the south Ross Project facility, including the CPP, surface impoundments, and other structures as well as the installation of wells would cause noise impacts that could not entirely be mitigated for nearby residents or eliminated completely for onsite workers; however, the noise impacts would be very short term and intermittent, and all noise would quickly diminish at greater distances from the Ross Project area.	There would be no long-term permanent noise impacts from the Proposed Action. Once the Ross Project has been decommissioned and the site restored, all Project-related noise would cease.	Short-term noise impacts in the vicinity of the Proposed Action would be SMALL to MODERATE. These impacts would include increased construction noise as well as increased vehicular noise. All such impacts, however, would cease after facility decommissioning and site restoration activities are complete.	There would be no long-term impacts by the Proposed Action with respect to noise.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
NOISE (*Continued*)				
Alternative 3: North Ross Project **(See SEIS Section 4.8.3.)**	During Alternative 3, there would be SMALL to MODERATE unavoidable adverse impacts with respect to noise. These impacts would be the same as in the Proposed Action, except some noise impacts would be diminished because construction and decommissioning activities at the north site would be a greater distance to the nearest residence.	There would be no long-term permanent noise impacts from Alternative 3. Once the north Ross Project has been decommissioned and the site restored, all Project-related noise would cease.	Short-term noise impacts in the vicinity of Alternative 3 would be SMALL to MODERATE. These impacts would include increased construction noise as well as increased vehicular noise. All such impacts, however, would cease after facility decommissioning and site restoration activities are complete.	There would be no long-term impacts under Alternative 3 with respect to noise.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
HISTORICAL, CULTURAL, AND PALEONTOLOGICAL RESOURCES				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.9.1.) **Alternative 3: North Ross Project** (See SEIS Section 4.9.3.)	Impacts on historic and cultural resources during the ISR construction phase would be SMALL to LARGE. To mitigate the impact, NRC, ACHP, BLM, Wyoming SHPO, Tribes, and the Applicant will develop and execute an agreement that would formalize a process for addressing adversely impacted resources during construction. If NRHP- eligible sites cannot be avoided then treatment plans would be developed. If other historic and cultural resources are encountered during the ISR lifecycle, the Applicant would notify the appropriate authorities per an unexpected discovery plan.	If archaeological and historic sites cannot be avoided, or the impacts to these sites cannot be mitigated, this could result in an irreversible and irretrievable loss of cultural resources.	There would be a SMALL to LARGE impact on historic and cultural resources during the ISR construction phase. The development of an agreement between NRC, ACHP, BLM, Wyoming SHPO, Tribes, and the Applicant would address adverse impacts to cultural and historic sites and historic properties of traditional religious and cultural importance to Native American tribes. If any unidentified historic or cultural resources are encountered, work would stop and appropriate authorities would be notified per the unexpected discovery plan.	If potential impacts from implementation of the proposed action are not mitigated, then long-term impacts to cultural and historic resources would result.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
VISUAL AND SCENIC RESOURCES				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.10.1.)**	There would be SMALL unavoidable impacts related to the visual and scenic resources at the Proposed Action. During the construction, earth-movement activities could be seen by a few of the nearby residents, who could experience MODERATE impacts. The lights of the Project could also be seen by some of the nearest neighbors. There would be many mitigation measures related to the lights of the Ross Project which would be implemented by the Applicant to diminish as much as possible the light emanating from the Proposed Action.	There would be no irreversible or irretrievable commitment of visual or scenic resources caused by the Proposed Action. All visual-resource impacts would be eliminated upon the Ross Project's facility decommissioning and site restoration activities. These activities would include restoring the baseline contours of the Ross Project area.	There would be some short-term impacts to the visual resources at the Proposed Action. These would include changes to the topography of the area; the presence of man-made structures; and light during nighttime hours. These impacts would cease when the decommissioning and reclamation of the Ross Project area are complete, when the baseline topography is restored and all lights are removed.	There would be no long-term impacts to the visual and scenic resources of the Ross Project area. At the time of the Ross Project's decommissioning, a decommissioning plan would be implemented, and this plan would require the restoration of the Project area to its former baseline conditions.
Alternative 3: North Ross Project **(See SEIS Section 4.10.3.)**	Alternative 3 would have the same potential for visual-resource impacts as the Proposed Action. These SMALL to MODERATE impacts would be even less than those of the Ross Project, because the natural topography of the north area would shield construction and operation activities related to the uranium-recovery facility. Thus, the closest residences' views would be less impacted as would their experience of light in the nighttime skies.	There would be no irreversible or irretrievable impacts to the visual and scenic resources caused by Alternative 3.	There would be some short-term impacts to visual and scenic resources at the Proposed Action; these impacts would be related to changes to the local topography, the presence of man-made structures, and the occurrence of night-time lighting as a result of Alternative 3.	There would be no long-term impacts to visual and scenic resources under Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
SOCIOECONOMICS				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.11.1.)	There would be SMALL unavoidable impacts related to the socioeconomics at the Proposed Action. These impacts, however, would be related to the increased tax revenues that local jurisdictions would collect related taxes. Other socioeconomic factors such as impacts to employment, income, demographics, housing, and education as well as demand for social and health services would be SMALL, while the impacts related to local tax revenues would be MODERATE during the construction and operation phases of the Ross Project.	There would be no irreversible or irretrievable commitment of socioeconomic resources during the Proposed Action. Socioeconomic impacts would be diminished upon the Ross Project's decommissioning. For example, the increased need for housing, although SMALL, would be eliminated after the Ross Project terminates.	There would be some short-term impacts to socioeconomic resources by the Proposed Action. These would include SMALL potential changes to local employment, income, demographics, housing, and education as well as demand for social and health services. However, the potential impacts to tax revenues would be MODERATE. All tax payments would also be eliminated at the conclusion of the Ross Project.	There would be no long-term impacts to socioeconomic resources by the Ross Project area. After the Ross Project's decommissioning, any increases that would have occurred in the employment, income, demographics, housing, and education sectors would have integrated and every worker would be able to relocate as s/he wishes. The demand for social and health services would be eliminated as would all tax revenues in the finance sector.
Alternative 3: North Ross Project (See SEIS Section 4.11.3.)	There would be the same SMALL to MODERATE socioeconomic impacts to the area surrounding Alternative 3. As the socioeconomic variables evaluated for this SEIS do not depend upon the geography of the Ross Project, the North Ross Project would accrue the same impacts as the Proposed Action.	There would be no irreversible or irretrievable commitment of socioeconomic resources during Alternative 3 as for the Proposed Action.	There would be some short-term impacts to socioeconomic resources caused by Alternative 3. These would include the same SMALL potential changes to local employment, income, demographics, housing, and education as well as demand for social and health services and MODERATE impacts to revenue of local jurisdictions.	There would be no long-term impacts to socioeconomic resources as a result of Alternative 3.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
ENVIRONMENTAL JUSTICE				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.12.)	There are no minority and low-income populations located within 6 km [4 mi] of the Ross Project area. Consequently, an environmental justice-analysis was not performed for this Proposed Action.			
Alternative 3: North Ross Project (See SEIS Section 4.12.)				

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
PUBLIC AND OCCUPATIONAL HEALTH AND SAFETY				
Alternative 1: Proposed Action Ross Project (See SEIS Section 4.13.1.) **Alternative 3: North Ross Project** (See SEIS Section 4.13.3.)	There would be a SMALL impact on public and occupational health. Construction and decommissioning would generate fugitive dust emissions that would not result in a significant dose to the public or site workers. The emissions from construction equipment would be of short duration and would readily disperse into the atmosphere.	Not applicable	There would be a SMALL impact from radiological exposure. Dose calculations under normal operations showed that the highest potential dose within the proposed project area is 5 percent of the 1 mSv [100 mrem] per year public dose limit specified in NRC regulations. The radiological impacts from accidents would be SMALL for workers if procedures to deal with accident scenarios are followed, and SMALL for the public because of the facility's remote location. The nonradiological public and occupational health impacts from normal operations, accidents, and chemical exposures would be SMALL if handling procedures are followed.	There will be no long-term impact to public and occupational health following the termination of the Final Source and Byproduct Materials License.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WASTE MANAGEMENT				
Alternative 1: Proposed Action Ross Project **(See SEIS Section 4.14.1.)**	There would be SMALL unavoidable adverse impacts as a result of waste management at the Proposed Action. The management of all waste streams (ordinary solid and domestic wastes, solid and liquid hazardous wastes, and all byproduct wastes) would be SMALL during all phases of the Ross Project. Many of the waste streams would be shipped off site to regulated (i.e., permitted or licensed as appropriate) facilities, which have undergone careful scrutiny by the respective regulatory agencies. In addition, discharge of small amounts of liquid byproduct material into the Class I deep-injection wells at the Project would comply with Underground Injection Control (UIC) Permit from the Wyoming Department of Environmental Quality (WDEQ).	There would be no irreversible or irretrievable resources committed to waste management, except for the respective liquid wastes which would be injected into the Deadwood and Flathead Formations approximately 8,000 feet below the surface. However, since these aquifers are not potable and have not been identified as a source of oil and gas resources, the injection of waste would not impact the aquifer's future use.	There would be few short-term impacts due to waste management at the Proposed Action. These short-term impacts, such as to transportation as well as public and occupational health and safety, which are described in this Table under those resource areas, would cease when waste is no longer generated or managed at the Ross Project. In addition, during the operation of the Proposed Action, there would be two double-lined surface impoundments with a maximum surface area of approximately 5.3 ha [13.2 ac] of stored liquid; the presence of these impoundments could have impacts to wildlife and birds. However, control features, such as an avian-deterrent system would be operated throughout the Ross Project. These surface impoundments would be completely removed during facility decommissioning and the area regraded and revegetated.	All Ross Project wastes would be either shipped offsite by the conclusion of the decommissioning phase, or would be disposed of in the Class I deep-disposal wells. During all phases of the Proposed Action permanent disposal or storage of both radiological and nonradiological wastes would represent a long-term, but SMALL, impact on the productivity of the off-site land allocated for these activities.

Table 8.1
Summary of the Environmental Consequences of the Proposed Action and Alternative 3
(*Continued*)

	Unavoidable Adverse Environmental Impacts	Irreversible and Irretrievable Commitment of Resources	Short-Term Impacts and Uses of the Environment	Long-Term Impacts and the Maintenance and Enhancement of Productivity
WASTE MANAGEMENT				
Alternative 3: North Ross Project **(See SEIS Section 4.14.3.)**	There could be SMALL unavoidable waste-management impacts at Alternative 3. These would be the same as those indicated above for the Proposed Action. The volume of demolition waste could be somewhat less than the Proposed Action's, because the containment barrier wall would not have been constructed.	This Alternative would also employ deep-disposal wells, so that the same commitment of the Deadwood and Flathead aquifer would occur.	The short-term impacts of Alternative 3's management of wastes would be the same as those for the Proposed Action.	The long-term impacts of Alternative 3's management of wastes would be the same as those for the Proposed Action.

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Rosebud Sioux Tribe
Tribal Historic Preservation Office
Rosebud, SD

Rick Thomas
Santee Sioux Tribe of Nebraska
Tribal Historic Preservation Office
Niobrara, NE

Dianne Desrosiers
Sisseton-Wahpeton Oyate
Tribal Historic Preservation Office
Sisseton, SD

Eric Longie
Spirit Lake Tribe
Tribal Historic Preservation Office
Fort Totten, ND

Wašté Wiŋ Young
Standing Rock Sioux Tribe
Tribal Historic Preservation Office
Fort Yates, ND

Elgin Crows Breast
Mandan, Hidatsa & Arikara Nation
Three Affiliated Tribes
Tribal Historic Preservation Office
New Town, ND

10.2 Tribal Government Officials (*Continued*)

Bruce F. Nadeau
Turtle Mountain Band of Chippewa
Tribal Historic Preservation Office
Belcourt, ND

Lyle Miller
Yankton Sioux Tribe
Tribal Historic Preservation Office
Wagner, SD

10.3 State Agency Officials

Mary Hopkins
Wyoming State Historic Preservation Office
Cheyenne, WY

Mark Rogaczewski
Wyoming Department of Environmental Quality/Land Quality Division
Sheridan, WY

Tanner Shatto
Wyoming Department of Environmental Quality/Air Quality Division
Sheridan, WY

John Passehl
Wyoming Department of Environmental Quality/Water Quality Division
Cheyenne, WY

Scott Talbott
Wyoming Game and Fish Department
Sheridan, WY

10.4 Local Agency Officials

Crook County Commissioners
Sundance, WY

10.5 Other Organizations and Individuals

Shannon Anderson, Esq.
Powder River Basin Resource Council
Sheridan, WY

Geoffrey H. Fettus, Esq.
Natural Resources Defense Council
Washington, DC

10.5 Other Organizations and Individuals (*Continued*)

Ralph Knode
Strata Energy, Inc.
Gillette, WY

Anthony Thompson, Esq.
Thompson & Pugsley, P.L.L.C.
Washington, DC

Echo Bohl
Crook County Library/Hulett Branch
Hulett, WY

Pamela Jespersen
Crook County Library/Moorcroft Branch
Moorcroft, WY

APPENDIX A
CONSULTATION CORRESPONDENCE

APPENDIX A: CONSULTATION CORRESPONDENCE

The *Endangered Species Act of 1973* (ESA), as amended, and the *National Historic Preservation Act of 1966* (NHPA), as amended, require that Federal agencies consult with applicable Federal and State agencies and groups prior to taking an action that may affect threatened and endangered species, essential fish habitat, or historical and archaeological resources. This Appendix lists the available Ross Project consultation documentation related to these Federal statutes.

Table A.1
Chronology of Consultation Correspondence

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (L. Camper)	Fort Peck Tribal Executive Board	November 19, 2010(1)	ML103160580
U.S. Nuclear Regulatory Commission (L. Camper)	Fort Belknap Community Council	February 9, 2011(2)	ML110400321
Turtle Mountain Band of Chippewa Indians (K. Ferris)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	April 14, 2011	ML111080059
U.S. Nuclear Regulatory Commission (K. Hsueh)	Sisseton-Wahpeton Lakota Tribal Historic Preservation Office (D. Desrosiers)	August 11, 2011(3)	ML112220386
U.S. Nuclear Regulatory Commission (K. Hsueh)	Fish and Wildlife Service U.S. Dept. of the Interior (M. Sattelberg)	August 12, 2011	ML112200151
Apache Tribe of Oklahoma (L. Guy)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	August 19, 2011	ML11336A224
U.S. Nuclear Regulatory Commission (A. Persinko)	Wyoming State Historic Preservation Office (M. Hopkins)	August 19, 2011	ML112150393
U.S. Nuclear Regulatory Commission (A. Persinko)	Advisory Council on Historic Preservation (J. Fowler)	August 19, 2011	ML112150427

Table A.1
Chronology of Consultation Correspondence
(*Continued*)

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Dept. of the Interior Fish and Wildlife Service (M. Sattelberg)	U.S. Nuclear Regulatory Commission (K. Hsueh)	September 13, 2011	ML112770035
Advisory Council on Historic Preservation (C. Hall)	U.S. Nuclear Regulatory Commission (A. Persinko)	September 13, 2011	ML112770035
Wyoming Game and Fish Department (J. Emmerich)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	September 22, 2011	ML112660130
U.S. Nuclear Regulatory Commission (L. Camper)	U.S. National Park Service Devils Tower National Monument (D. FireCloud)	December 5, 2011	ML113120356
U.S. Nuclear Regulatory Commission (K. Hsueh)	Strata Energy, Inc. (M. James)	December 6, 2011	ML113200121
Advisory Council on Historic Preservation (C. Vaughn)	U.S. Nuclear Regulatory Commission (A. Persinko)	December 12, 2011	ML113480465
U.S. Nuclear Regulatory Commission (K. Hsueh)	Fort Peck Tribe (D. Youpee)	December 22, 2011[(3)]	ML113420504
Strata Energy, Inc. (M. James)	U.S. Nuclear Regulatory Commission (K. Hsueh)	January 12, 2012	ML120720266
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (C. Vaughn)	January 31, 2012	ML113490371
Rosebud Sioux Tribe (R. Eagle Bear)	U.S. Nuclear Regulatory Commission (A. Bjornsen)	February 1, 2012	ML120390551

Table A.1
Chronology of Consultation Correspondence
(*Continued*)

Author	Recipient	Date of Letter	ADAMS Accession Number
Strata Energy, Inc. (R. Knode)	U.S. Nuclear Regulatory Commission (K. Hsueh)	August 31, 2012	ML12248A421
U.S. Nuclear Regulatory Commission (K. Hsueh)	Santee Sioux Tribe of Nebraska (R. Thomas)	September 20, 2012(3)	ML12264A220
WWC Engineering (B. Schiffer)	U.S. Nuclear Regulatory Commission (J. Moore)	October 16, 2012	ML12311A338
U.S. Nuclear Regulatory Commission (K. Hsueh)	Kiowa Indian Tribe (J. Eskew)	November 21, 2012(3)	ML12325A776
Standing Rock Sioux Tribe (W. Young)	Makoche Wowapi (T. Mentz)	November 27, 2013	ML12334A305
Cheyenne River Sioux Tribe (S. Vance)	Makoche Wowapi (T. Mentz)	November 27, 2013	ML12335A218
Rosebud Sioux Tribe (R. Eagle Bear)	Makoche Wowapi (T. Mentz)	November 28, 2013	ML12335A227
Strata Energy, Inc. (R. Knode)	Makoche Wowapi (T. Mentz)	February 15, 2013	ML13063A235
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (R. Currit)	March 8, 2013	ML13044A326
U.S. Nuclear Regulatory Commission (K. Hsueh)	Tribal Historic Preservation Officers	March 11, 2013(3)	ML13070A373
U.S. Nuclear Regulatory Commission (L. Camper)	Flandreau-Santee Sioux (A. Reider)	March 22, 2013(4)	ML13085A005

Table A.1
Chronology of Consultation Correspondence
(*Continued*)

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (K. Hsueh)	U.S. National Park Service Devils Tower National Monument (J. Keck)	March 22, 2013	ML13067A198
U.S. Nuclear Regulatory Commission (K. Hsueh)	U.S. Department of the Interior Fish and Wildlife Service (M. Sattelberg)	March 22, 2013	ML13067A194
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (R. Nelson)	March 22, 2013	ML13067A075
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (M. Hopkins)	March 22, 2013	ML13067A173
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming Game and Fish Department (S. Talbott)	March 22, 2013	ML13067A142
Rosebud Sioux Tribe (R. Eagle Bear)	U.S. Nuclear Regulatory Commission (J. Moore)	March 25, 2013	ML13121A295
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (K. Hsueh)	March 28, 2013	ML13101A403
Advisory Council on Historic Preservation (C. Vaughn)	U.S. Nuclear Regulatory Commission (K. Hsueh)	May 3, 2013	ML13196A368
U.S. Department of Interior Fish and Wildlife Service and U.S. National Park Service (R. Stewart)	U.S. Nuclear Regulatory Commission (C. Bladey)	May 8, 2013	ML13144A826

Table A.1
Chronology of Consultation Correspondence
(*Continued*)

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (J. Moore)	Rosebud Sioux Tribe (R. Eagle Bear)	May 10, 2013[(5)]	ML13137A070
Wyoming Game and Fish Department (M. Konishi)	U.S. Nuclear Regulatory Commission (C. Bladey)	May 10, 2013	ML13137A086
Standing Rock Sioux Tribe (M. Wilson)	U.S. Nuclear Regulatory Commission (C. Bladey)	May 13, 2013	ML13137A055
Northern Arapaho THPO	U.S. Nuclear Regulatory Commission	July 22, 2013	ML13204A158
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (C. Vaughn)	August 14, 2013	ML13197A139
U.S. Nuclear Regulatory Commission (K. Hsueh)	Blackfeet Tribe (J. Murray)	September 19, 2013[(3)]	ML13262A186
U.S. Nuclear Regulatory Commission (K. Hsueh)	Advisory Council on Historic Preservation (C. Vaughn)	September 19, 2013	ML13253A212
U.S. Nuclear Regulatory Commission (K. Hsueh)	Wyoming State Historic Preservation Office (R. Currit)	September 20, 2013	ML13241A257
Strata Energy, Inc. (M. Griffin)	U.S. Nuclear Regulatory Commission (K. Hsueh)	September 27, 2013	ML13282A336
Wyoming State Historic Preservation Office (R. Currit)	U.S. Nuclear Regulatory Commission (K. Hsueh)	October 22, 2013	ML13302B421

Table A.1
Chronology of Consultation Correspondence
(*Continued*)

Author	Recipient	Date of Letter	ADAMS Accession Number
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	October 22, 2013[(6)]	ML13309A116
Advisory Council on Historic Preservation (J. Fowler)	U.S. Nuclear Regulatory Commission (A. Macfarlane)	October 28, 2013	ML13303B046
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	October 29, 2013[(6)]	ML13309A066
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	November 5, 2013[(6)]	ML13311A120
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	November 13, 2013[(6)]	ML14015A455
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	November 20, 2013[(6)]	ML13325A009
U.S. Nuclear Regulatory Commission (K. Hsueh)	Strata Energy, Inc. (M. Griffin)	November 27, 2013	ML13322B209
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	December 11, 2013[(6)]	ML13345B320
WWC Engineering (B. Schiffer)	U.S. Nuclear Regulatory Commission (J. Moore)	January 7, 2014	ML14015A445
U.S. Nuclear Regulatory Commission (J. Moore)	Advisory Council on Historic Preservation (J. Eddins)	January 17, 2014[(6)]	ML14021A081

(1) Similar letters sent to Cheyenne River Sioux Tribe (J. Plenty), Crow Creek Sioux Tribe (L. Thompson, Jr.), Lower Brule Sioux Tribal Council (M. Jandreau), Oglala Sioux Tribal Council (T. Two Bulls), Rosebud Sioux Tribal Council (R. Bordeaux), Santee Sioux Nation (R. Trudell), Standing Rock Sioux Tribe (R. Thunder), Three Affiliated Tribes Business Council (M. Wells), Northern Cheyenne Tribe (L. Spaug), Cheyenne and Arapaho Tribes (D. Flyingman), Arapaho Business Committee (H. Spoonhunter), Crow Tribal Council (C. Eagle), and Eastern Shoshone Tribe (I. Posey).

(2) Similar letters sent to Standing Rock Lakota Tribal Council (C. Murphy), Crow Tribal Council (C. Eagle), Apache Tribe of Oklahoma (H. Kostzuta), Sisseton-Wahpeton Lakota (A. Grey, Sr.), Yankton Lakota Tribe (R. Courneyor), Blackfeet Tribal Business Council (W. Sharp), Crow Creek Sioux Tribal Council (B. Sazue), Lower Brule Sioux Tribal Council (M. Jandreau), Spirit lake Tribal Council (M. Pearson), Oglala Lakota Tribal Council (T. TwoBulls), Shoshone Business Council (I. Posey), Northern Cheyenne Tribal Council (G. Small), Rosebud Sioux Tribal Council (R. Bordeaux), Fort Peck Tribal Executive Board (A. Stafne), Cheyenne and Arapahoe Tribes of Oklahoma (J. Boswell),Turtle Mountain Chippewa Tribal Council (R. Marcellias), Santee Sioux Nation (R. Trudell), Arapaho Business Council (H. Spoonhunter), Three Affiliated Tribes Business Council (M. Levings), Kiowa Indian Tribe of Oklahoma (D. Tofpi), Flandreau Santee Lakota Executive Committee (G. Bouland), Confederated Salish & Kootenai (E. Moran), and Cheyenne River Lakota Tribal Council (J. Plenty).

(3) Similar letters sent to the Tribal Historic Preservation Officers: Fort Peck Tribal Executive Board (D. Youpee), Fort Belknap Community Council (D. Belgard), Standing Rock Lakota Tribal Council (W. Young), Crow Tribal Council (D. Old Horn), Yankton Lakota Tribe (L. Gravatt), Blackfeet Tribal Business Council (J. Murray), Crow Creek Sioux Tribal Council (W. Wells), Lower Brule Sioux Tribal Council (C. Green), Spirit lake Tribal Council (A. Shaw), Oglala Lakota Tribal Council (W. Mesteth), Shoshone Business Council (W. Ferris), Northern Cheyenne Tribal Council (C. Fisher), Rosebud Sioux Tribal Council (R. Eagle Bear), Cheyenne and Arapahoe Tribes of Oklahoma (D. Hamilton, Santee Sioux Nation (L. Ickes), Arapaho Business Council (D. Conrad), Three Affiliated Tribes Business Council (E. Crows Breast), Kiowa Indian Tribe of Oklahoma (J. Eskew), Flandreau Santee Lakota Executive Committee (J. Weston), Confederated Salish & Kootenai (C. Burke), and Cheyenne River Lakota Tribal Council (S. Vance), Sisseton-Wahpeton Lakots (D. Desrosiers).

(4) Similar letters sent to Tribal Chairman: Three Affiliated Tribes (T. Hall), Crow Creek Tribe (B. Sazue), Rosebud Sioux Tribe (C. "Whitey" Scott), Kiowa Indian Tribe of Oklahoma (A. Poppah), Chippewa Cree Tribe (K. Blatt), Standing Rock Sioux Tribe (C. Murphy). Fort Peck Tribes (F. Azure), Confederated Salish & Kootenai Tribe (J. Durglo), Cheyenne River Sioux Tribe (K. Keckler), Eastern Shosone (D. Sinclair), Crow Tribe (D. Old Coyote), Blackfeet Tribe (W. Sharp, Jr.), Spirit Lake Tribe (R. Yankton, Sr.), Northern Cheyenne Tribe (J. Robinson), Fort Belknap Tribe (T. King), Yankton Sioux Tribe (T. Cournoyer, Sr.), Oglala Sioux Tribe (B. Brewer), Cheyenne and Arapaho Tribe (J. Chief-Boswell), Lower Brule Sioux Tribe (M. Jandreau), Santee Sioux Nation (R. Trudell), Northern Arapaho Tribe (D. O'Neal, Sr.), Sisseton-Wahpeton Oyate Tribes (R. Shepherd).

(5) Email was also to: Yankton Lakota Tribe (L. Gravatt), Crow Creek Sioux Tribe (W. Wells), Northern Cheyenne Tribe (C. Fisher), and Santee Sioux Tribe (R. Thomas), Turtle Mountain Band of Chippewa Indians (B. Nadeau and B. Grant), Ethno Tech (D. Schwab), RESPEC (C. Chapman), Strata Energy, Inc. (M. Griffin).

(6) Email was also sent to: U.S. Nuclear Regulatory Commission (E. Monteith), Wyoming State Historic Preservation Office (R. Currit), Wyoming State Historic Preservation Office (M. Hopkins), WWC Engineering (B. Schiffer), Strata Energy, Inc. (M. Griffin), Bureau of Land Management (A. Tratebas), Kiowa Indian Tribe of Oklahoma (J. Eskew), U.S. Nuclear Regulatory Commission (J. Olmstead), Blackfeet Tribe (J. Murray), U.S. Nuclear Regulatory Commission (J. Fringer), Cheyenne and Arapahoe Tribes of Oklahoma (M. Anquoe), Cheyenne River Lakota Tribe (S. Vance), Arapaho Chippewa Cree Tribe (A. Windy Boy), Confederated Salish and Kootenai Tribes (F. Auld), Crow Tribe (H. Two Leggings), Crow Creek Sioux (W. Wells), Flandreau Santee Lakota (J.B. Weston), Fort Belknap (M. Belgarde), Fort Peck (D. "Curley" Youpee), Lower Brule Lakota (C. Green), Northern Cheyenne Tribe (C. Fisher), Oglala Lakota Tribe (M. Mesteth), Rosebud Sioux Tribe (R. Eagle Bear), Santee Sioux Nation (R. Thomas), Shoshone Tribe (W. Ferris); Sisseton-Wahpeton Lakota (D. Desrosiers); Spirit Lake (D. Smith), Standing Rock Lakota (W. Young and T. Clouthier), Three Affiliated Tribes (E. Crows Breast), and Yankton Lakota Tribe (L. Gravatt).

APPENDIX B
PUBLIC-COMMENT RESPONSES

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ABBREVIATIONS/ACRONYMS

ACHP	Advisory Council on Historic Properties
ACL	Alternate Concentration Limit
ADAMS	Agencywide Documents Access and Management System
AEA	Atomic Energy Act of 1954, As Amended
ALARA	As Low As Reasonably Achievable
APE	Area of Potential Effect
AQD	Air Quality Division (Wyoming Department of Environmental Quality)
ASLB	Atomic Safety Licensing Board
BACT	Best Available Control Technology
BLM	U.S. Bureau of Land Management
BMPs	Best Management Practices
CAA	Clean Air Act
CBM	Coal Bed Methane
CBW	Containment Barrier Wall
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPP	Central Processing Plant
CR	County Road
dB	Decibel
dBA	A-weighted Decibel
DFP	Decommissioning Funding Plan
DM	Deep Monitoring Zone or Unit
DP	Decommissioning Plan
DSEIS	Draft Supplemental Environmental Impact Statement
EIS	Environmental Impact Statement
EO	Executive Order
EOR	Enhanced Oil Recovery
EPA	U.S. Environmental Protection Agency
ER	Strata Energy, Inc.'s *Environmental Report*
FSEIS	Final Supplemental Environmental Impact Statement
FONSI	Findings of No Significant Impact
FR	Federal Register
GEIS	Generic Environmental Impact Statement
HAP	Hazardous Air Pollutant
ISR	In-Situ Recovery
IX	Ion Exchange

LQD	Land Quality Division (Wyoming Department of Environmental Quality)
MCLs	Maximum Contaminant Levels
MIT	Mechanical-Integrity Test
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act of 1969
NESHAPS	National Emission Standards for Hazardous Air Pollutants
NHPA	National Historic Preservation Act of 1966, As Amended
NOA	Notice of Availability
NOI	Notice of Intent
NPS	U.S. National Park Service
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSDWUMR	Nebraska-South Dakota-Wyoming Uranium Milling Region
OSHA	Occupational Safety and Health Administration/ U.S. Department of Labor
OZ	Ore Zone
PA	Programmatic Agreement
RAI	Request for Additional Information
RAP	Restoration Action Plan
RFFA	Reasonably Foreseeable Future Action
RO	Reverse Osmosis
ROD	Record of Decision
ROI	Region of Influence
RP	Ross Project
SA	Surficial Aquifer
SDWA	Safe Drinking Water Act
SEIS	Supplemental Environmental Impact Statement
SER	Safety Evaluation Report
SGCN	(Wyoming) Species of Greatest Conservation Need
SM	Shallow Monitoring Zone
SOP	Standard Operating Procedure
SU	Standard Unit (pH)
TCP	Traditional Cultural Properties
TDS	Total Dissolved Solids

TENORM	Technologically Enhanced Naturally Occurring Radioactive Material
THPO	Tribal Historic Preservation Office
TLD	Thermo Luminescent Dosimeter
TR	Strata Energy, Inc.'s *Technical Report*
TRG	Target Restoration Goal
TRV	Target Restoration Value
UCL	Upper Control Limit
UIC	Underground Injection Control
UMTRCA	Uranium Mill Tailings Radiation Control Act of 1978
U.S.	United States
USDOT	U.S. Department of Transportation
USDW	Underground Source of Drinking Water
USFWS	U.S. Fish and Wildlife Service
WAQSR	Wyoming Air Quality Standards and Regulations
WDEQ	Wyoming Department of Environmental Quality
WGFD	Wyoming Game and Fish Department
WOGCC	Wyoming Oil and Gas Conservation Commission
WQD	Water Quality Division
WSOC	Wyoming Species of Concern
WWDC	Wyoming Water Development Commission
WWUMR	Wyoming West Uranium Milling Region
WYPDES	Wyoming Pollutant Discharge Elimination System

APPENDIX B: PUBLIC-COMMENT RESPONSES

B.1 Overview

On March 29, 2013, the United States (U.S.) Nuclear Regulatory Commission (NRC) staff published a notice in the *Federal Register* (78 FR 19330) requesting public review and comment on the *Draft Environmental Impact Statement (DSEIS) for the Ross In-Situ Recovery (ISR) Project in Crook County, Wyoming*. This SEIS is a *Supplement to the Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities* (NUREG–1910, the “GEIS”) (74 FR 65808) in accordance with 10 CFR Part 51, “Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.” The subject of this environmental review is known as the Ross Project. The NRC staff established May 13, 2013, as the deadline for submitting public comments on the DSEIS. Forty-three documents were submitted to the NRC by e-mail and U.S. mail containing comments on the proposed Ross Project.

B.2 Public Participation

Public participation is an essential component of the NRC’s environmental-review process. This section describes the process for public participation during the NRC staff’s development of the SEIS. The NRC conducted an open, public SEIS development process consistent with the requirements of the *National Environmental Policy Act of 1969* (NEPA) and NRC regulations. The NRC staff met with Federal, State, and local agencies and authorities as well as public organizations during a site visit to gather site-specific information. The NRC provided a 45-day public-comment period for agencies, organizations, and the general public to review the DSEIS and provide comments.

B.2.1 Notice of Intent to Develop the SEIS

The NRC staff published a “Notice of Intent” (NOI) to prepare the Ross Project SEIS in the *Federal Register* (76 FR 71082) on November 16, 2011, in accordance with NRC regulations.

B.2.2 Public Participation Activities

As described in SEIS Section 1, the NRC staff met with Federal, State, and local agencies and authorities during the course of an expanded site visit to the proposed Ross Project site and its vicinity. The purpose of this visit and these meetings was to gather additional site-specific information to assist with the Ross Project environmental review. As part of information gathering, the NRC staff also contacted potentially interested Native American Tribes and local authorities, entities, and public interest groups in person and via e-mail and telephone. The NRC staff also held 10 public meetings or teleconferences with the Applicant from 2010 through 2012. Meeting notices and summaries are available through the NRC website: http://www.nrc.gov/materials/uranium-recovery/license-apps/ross.html.

B.2.3 Issuance and Availability of the SEIS

On March 29, 2013, the NRC staff published a “Notice of Availability” (NOA) for the DSEIS in the *Federal Register* (78 FR 19330). In this notice, the NRC staff provided information on how to access or obtain a copy of the DSEIS for the Ross Project. Electronic versions of the DSEIS and supporting information were made available through the NRC’s Agencywide Documents

Access and Management System (ADAMS), which is accessible through the NRC website: http://www.nrc.gov/readingrm/adams.html. The public may examine and have copied, for a fee, the SEIS and other related publicly available documents from the NRC Public Document Room. Copies of the DSEIS were also publicly available at Crook County Libraries in Hulett and Moorcroft, Wyoming.

B.2.4 Public Comment Period

In the NOA for the DSEIS cited above, the NRC indicated that public comments on the DSEIS should be submitted by May 13, 2013. Members of the public were invited and encouraged to submit related comments through different media. Electronically, comments could be submitted to the Federal rulemaking website. Written comments could be submitted by mail or facsimiles. The 45-day period for public comments (i.e., from March 29, 2013, to May 13, 2013) met the minimum 45-day comment period required under NRC regulations.

B.3 Comment Review Methods

The NRC staff received 1,120 comments from 43 documents via e-mail and U.S. mail during the comment period. Each of these comments has been considered carefully, and each has been summarized and responded to in this Appendix. Each comment was individually identified, uniquely numbered, and responded to by the NRC, using a systematic approach which involved identifying individual comments from the source documents, entering comment information into a database, sorting comments by topic, and then identifying and distributing to individual NRC staff members for review, summary, and response.

The NRC staff reviewed all comment documents and identified, marked, and consecutively numbered individual comments in each document. Comment numbers followed a three-digit numbering system separated by a hyphen. The comment number to the left of the hyphen is the source-document number (i.e., each commenter was assigned its own number). The number to the right of the hyphen is a consecutive number for each comment identified in a specific source document. Table B.1 provides an alphabetical list of all commenter names, their affiliations, and the unique document numbers assigned to all of their comments (i.e., the number to the left of the hyphen). Table B.2 provides this same information sorted numerically by source comment-document number. Readers can use these tables to electronically search this Appendix to locate comments submitted by specific individuals or organizations as well as to find individuals or organizations associated with comments described in Section B.5.

In addition to the numbering, each unique comment was also assigned a topic category to facilitate NRC's sorting and reviewing comments on similar topics. Topic categories are aligned with the topics included in Section B.5 of this Appendix. Following the initial comment identification review, the identified comments were entered into a database that allowed individual comments to be sorted by topic and distributed to staff for further consideration. The NRC staff then continued sorting and reviewing all comments within specific topic categories, developed comment summaries and responses for this Appendix, and made changes to the SEIS, as appropriate, to address the public comments. Based on the similarity of comments related to a specific topic, as appropriate, the NRC staff consolidated same or similar comments within each topic to facilitate developing summaries and responses. This approach allowed multiple, similar comments to be addressed with a single response to avoid duplication of effort and to enhance readability of this Appendix. A response has been provided for each comment or group of comments. Each response indicates whether the DSEIS was modified in the FSEIS as a result of the comment.

B.4 Major Issues and Topics of Concern

The majority of comments received addressed specific items within the scope of the DSEIS for the Ross Project. Topics raised included, but were not limited to, a variety of concerns about the purpose, need, and scope of the SEIS; regulatory issues; NEPA-related concerns; the description of the ISR (i.e., uranium-recovery) process; land use; transportation; surface water, ground water, and wetlands; ecological resources; air quality; noise; historical and cultural resources and Tribal concerns; scenic and visual resources; socioeconomics; occupational and public health and safety; waste management; and cumulative impacts.

Other comments addressed topics and issues that are not applicable to the Ross SEIS, including general support or opposition to uranium mining or milling; discussion of the legacy of past uranium mining and milling; evaluation of the NRC regulatory program or licensing process; identification of environmental impacts at disposal facilities for byproduct material and wastes; and comments not specifically directed toward the SEIS. For example, some comments were exclusively directed toward the NRC's GEIS for in situ uranium milling, NUREG–1910 (NRC, 2009b).

Table B.1
Names of Commenters
(by Last Name with Affiliation, Document Number, and ADAMS Accession Number)

Last Name	First Name	Affiliation	Comment Document Number	ADAMS Accession Number
Ames-Curtis	Juli	No known affiliation	RP034	ML13137A090
Anderson	William	No known affiliation	RP025	ML13137A008
Anderson	Shannon	Powder River Basin Resource Council	RP041	ML13137A021
Baker	Jerri	No known affiliation	RP022	ML13137A010
Brennan	Tamra	Protect Sacred Sites	RP042	ML13137A056
Concerned Community Members		Residents and Landowners of Oshoto	RP016	ML13137A014
Dale	John	Truth about Mining	RP002	ML13130A232
Dale	John	No known affiliation	RP007	ML13137A004
DeCory	Jace	No known affiliation	RP033	ML13137A089
Durrum	Kathey	No known affiliation	RP003	ML13130A236
Fettus	Geoffrey	Natural Resources Defense Council	RP032	ML13137A120

Table B.1
Names of Commenters
(by Last Name with Affiliation, Document Number, and ADAMS Accession Number)
(Cont.)

Last Name	First Name	Affiliation	Comment Document Number	ADAMS Accession Number
Furois	Therese	No known affiliation	RP004	ML13130A233
Goodvin	Terry	No known affiliation	RP018	ML13137A013
Griffin	Evelyn and Marvin	No known affiliation	RP014	ML13137A016
Griffin	Mike	Strata Energy, Inc.	RP024	ML13137A106
Hasselstrom	Linda M.	No known affiliation	RP019	ML13144A830
Hilding	Nancy	No known affiliation	RP038	ML13137A087
Hilding	Nancy	Prairie Hills Audubon Society	RP039	ML13137A085
Jackson	Sherri	No known affiliation	RP012	ML13137A018
Johnson	Andy	Dakota Rural Action - Black Hills Chapter	RP029	ML13137A088
Jones	James	No known affiliation	RP027	ML13137A051 & ML13137A053 [Duplicate]
Katus	Jean	No known affiliation	RP021	ML13137A009
Knudson	Rodney	Ranchers and Neighbors to Protect Our Water	RP028	ML13137A050
Konishi	Mark	Wyoming Game and Fish Department	RP036	ML13137A086
Larson	Patsy	No known affiliation	RP010	ML13137A007
Leas	Rebecca	No known affiliation	RP015	ML13137A015
Lloyd	Lisa	U.S. Environmental Protection Agency Region 8	RP035	ML13144A827
Lord	Rebecca	No known affiliation	RP023	ML13137A012
Parkhurst	Gena	No known affiliation	RP031	ML13137A091
Patterson	Cynthia	No known affiliation	RP013	ML13137A017

Table B.1
Names of Commenters
(by Last Name with Affiliation, Document Number, and ADAMS Accession Number)
(Cont.)

Last Name	First Name	Affiliation	Comment Document Number	ADAMS Accession Number
Pendery	Bruce	Wyoming Outdoor Council and the Sierra Club	RP020	ML13137A011
Pfeifer	Jeanette	No known affiliation	RP008	ML13137A005
Reid	Justine	No known affiliation	RP009	ML13137A006
Stewart	Robert	U.S. Department of the Interior	RP017	ML13144A826
Taylor	Joanna	No known affiliation	RP011	ML13137A019
Tope	Wilma	No known affiliation	RP043	ML13137A057
Uptain	Douglas	No known affiliation	RP030	ML13137A054
Viviano	Pamela	No known affiliation	RP040	ML13137A052
Watson	Donna	Action for the Environment	RP026	ML13137A020
Waugh	Kelly	No known affiliation	RP005	ML13130A237
Waugh	Scott	No known affiliation	RP006	ML13130A234
Wilson	Mary	Standing Rock Sioux Tribe	RP037	ML13137A055
Wolken	Paige	U.S. Army Corps of Engineers/Wyoming Office	RP001	ML13101A118

Table B.2
Comment-Document Numbers
(by Comment-Document Number, with Commenter Name, Affiliation, and ADAMS Accession Number)

Comment Document Number	Last Name	First Name	Affiliation	ADAMS Accession Number
RP001	Wolken	Paige	U.S. Army Corps of Engineers/Wyoming Office	ML13101A118
RP002	Dale	John	Truth about Mining	ML13130A232
RP003	Durrum	Kathey	No known affiliation	ML13130A236
RP004	Furois	Therese	No known affiliation	ML13130A233
RP005	Waugh	Kelly	No known affiliation	ML13130A237
RP006	Waugh	Scott	No known affiliation	ML13130A234
RP007	Dale	John	No known affiliation	ML13137A004
RP008	Pfeifer	Jeanette	No known affiliation	ML13137A005
RP009	Reid	Justine	No known affiliation	ML13137A006
RP010	Larson	Patsy	No known affiliation	ML13137A007
RP011	Taylor	Joanna	No known affiliation	ML13137A019
RP012	Jackson	Sherri	No known affiliation	ML13137A018
RP013	Patterson	Cynthia	No known affiliation	ML13137A017
RP014	Griffin	Evelyn and Marvin	No known affiliation	ML13137A016
RP015	Leas	Rebecca	No known affiliation	ML13137A015
RP016	Concerned Community Members		Residents and Landowners of Oshoto	ML13137A014
RP017	Stewart	Robert	U.S. Department of the Interior	ML13144A826
RP018	Goodvin	Terry	No known affiliation	ML13137A013

Table B.2 Comment-Document Numbers (by Comment-Document Number, with Commenter Name, Affiliation, and ADAMS Accession Number) (Cont.)				
Comment Document Number	**Last Name**	**First Name**	**Affiliation**	**ADAMS Accession Number**
RP019	Hasselstrom	Linda M.	No known affiliation	ML13144A830
RP020	Pendery	Bruce	Wyoming Outdoor Council and the Sierra Club	ML13137A011
RP021	Katus	Jean	No known affiliation	ML13137A009
RP022	Baker	Jerri	No known affiliation	ML13137A010
RP023	Lord	Rebecca	No known affiliation	ML13137A012
RP024	Griffin	Mike	Strata Energy, Inc.	ML13137A106
RP025	Anderson	William	No known affiliation	ML13137A008
RP026	Watson	Donna	Action for the Environment	ML13137A020
RP027	Jones	James	No known affiliation	ML13137A051 & ML13137A053 [Duplicate]
RP028	Knudson	Rodney	Ranchers and Neighbors to Protect Our Water	ML13137A050
RP029	Johnson	Andy	Dakota Rural Action Black Hills Chapter	ML13137A088
RP030	Uptain	Douglas	No known affiliation	ML13137A054
RP031	Parkhurst	Gena	No known affiliation	ML13137A091
RP032	Fettus	Geoffrey	Natural Resources Defense Council	ML13137A120
RP033	DeCory	Jace	No known affiliation	ML13137A089
RP034	Ames-Curtis	Juli	No known affiliation	ML13137A090
RP035	Lloyd	Lisa	U.S. Environmental Protection Agency Region 8	ML13144A827
RP036	Konishi	Mark	Wyoming Game and Fish Department	ML13137A086
RP037	Wilson	Mary	Standing Rock Sioux Tribe	ML13137A055

Table B.2 Comment-Document Numbers (by Comment-Document Number, with Commenter Name, Affiliation, and ADAMS Accession Number) (Cont.)				
Comment Document Number	Last Name	First Name	Affiliation	ADAMS Accession Number
RP038	Hilding	Nancy	No known affiliation	ML13137A087
RP039	Hilding	Nancy	Prairie Hills Audubon Society	ML13137A085
RP040	Viviano	Pamela	No known affiliation	ML13137A052
RP041	Anderson	Shannon	Powder River Basin Resource Council	ML13137A021
RP042	Brennan	Tamra	Protect Sacred Sites	ML13137A056
RP043	Tope	Wilma	No known affiliation	ML13137A057

B.5 Comments Summaries and Responses

B.5.1 General Opposition

Comments: RP002-001; RP022-002; RP022-003; RP022-004; RP025-002; RP025-004; RP029-006; RP033-001

The commenters expressed concern about potential problems with in situ uranium recovery and how the process could impact water resources. Another commenter noted that uranium recovery should only be performed in cases where it is needed. Another commenter expressed concern regarding the effects uranium recovery might have for the next generation and indicated that the commenter is not aware of any uranium mine that has *not* had effects.

Response: *The NRC recognizes that some commenters are not supportive of uranium mining, milling, or other uranium-recovery techniques. These comments are beyond the scope of this SEIS, which focuses on the environmental impacts of a specific license application. Further, the NRC has no role in deciding whether uranium mining, milling, or recovery is needed or not; the agency only has a role in deciding whether or not to issue a source and/or byproduct materials license. Regarding impacts to water resources, this topic is specifically discussed in SEIS Section 4.5. No changes were made to the SEIS beyond the information provided in this response.*

B.5.2 General Environmental Concerns

Comment: RP028-003

The commenter stated that the world is moving away from nuclear power because of the long-term detrimental effect of every stage of the nuclear fuel cycle, from mining to final disposal.

Response: *The NRC recognizes that some commenters are not supportive of nuclear power or uranium mining or milling. These comments are beyond the scope of the SEIS. However, the NRC does recognize the potential environmental impacts associated with uranium recovery, including leaks, spills, and excursions of the liquid mixtures used to mobilize and recover uranium (e.g., lixiviant), which could occur at the Ross Project. These potential impacts are discussed in Section 4.5.1 of the SEIS. No change was made to the SEIS beyond the information provided in this response.*

Comments: RP038-001; RP039-001

The commenter stated that the Federal government should not approve of more uranium extraction until such time as the government decides how to manage the high-level radioactive waste that is currently stored in containers at nuclear power plants, with no permanent place to dispose of it. The commenter noted that future storage of radioactive wastes generated by the future use of the uranium is a connected action to the Proposed Action and a pending disaster for future generations. Therefore, the commenter requested that the NRC not limit its SEIS discussion to the waste generated specifically at the Ross Project, but expand its discussion to all wastes at the remote facilities that the uranium is shipped to, stored, and used, as well as the transportation wastes produced. The commenter asked that the FSEIS include a discussion of inter-generational responsibility and requested that the FSEIS discuss specifically where and how radioactive wastes generated by the future use of recovered uranium derived from the Ross Project will likely be stored and how much the storage of that radioactive waste will cost taxpayers.

Response: *The NRC notes that the U.S. and other nations are working on solutions for the disposal of spent (i.e., irradiated) nuclear fuels and other high- and low-level radioactive wastes generated at commercial nuclear power plants. Information on storage and disposal of radioactive waste can be found on the NRC website (*http://www.nrc.gov/waste.html*). The interim storage and final disposal of spent fuel generated at commercial nuclear power plants and other radioactive wastes not generated at the Ross Project, however, is beyond the scope of this SEIS. The scope of the SEIS is described in SEIS Section 1.4. The NRC staff prepared this SEIS to analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the Proposed Action and of reasonable alternatives. The scope of this SEIS evaluates both radiological and nonradiological (including chemical) impacts associated with the Proposed Action and the two Alternatives discussed in this SEIS. This document also describes the unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources as a result of the proposed Ross Project. No change was made to the SEIS beyond the information provided in this response.*

Comment: RP039-002

One commenter noted that the risk and the environmental impacts of nuclear war as well as nuclear winter should be discussed in the SEIS as a connected action. The commenter asked that the SEIS discuss the percentage of the world's uranium supply that would be made available by the Ross Project, noting that the existence of this uranium would allow other uranium supplies to be used for war rather than the generation of electricity.

Response: *The environmental impacts of nuclear war are outside the scope of this SEIS. The scope of this SEIS is described in SEIS Section 1.4. The NRC staff prepared this SEIS to* *analyze the potential environmental impacts (i.e., direct, indirect, and cumulative impacts) of the Proposed Action and the reasonable alternatives. The scope of the SEIS evaluates both radiological and nonradiological (including chemical) impacts associated with the Proposed Action and the two Alternatives discussed in this SEIS. This document also identifies unavoidable adverse environmental impacts, the relationship between short-term uses of the environment and long-term productivity, and irreversible and irretrievable commitments of resources. No change was made to the SEIS beyond the information provided in this response.*

B.5.3 Executive Summary

Comments: RP024-024; RP024-025

The commenter requested that the Executive Summary accurately reflect the respective discussion and conclusions in SEIS Section 4.4 regarding geology and soils impacts during the aquifer-restoration phase of the Ross Project. The commenter also stated that there were additional facts that should be summarized in the Executive Summary text that support the respective conclusions. In particular, the commenter asked for more specific information regarding any expected changes to the rock matrix in the ore-zone aquifer as well as other information regarding any relationship of uranium recovery to the subsidence of local soils and/or geological fault activation.

Response: *The NRC has revised the Executive Summary text to ensure its consistency with FSEIS Section 4.4. The text is now a concise summary of the information provided in FSEIS Section 4.4.*

B.5.4 Purpose, Need, and Scope of the SEIS/GEIS

B.5.4.1 Description of the SEIS/GEIS Purpose and Need

Comment: RP024-066

The commenter suggested that the first page of Section 1 in the SEIS clarify that the GEIS and SEIS were prepared based upon 10 CFR Part 51.20(b)(8), which requires an EIS-level analysis for all new source-material (and/or byproduct-material) uranium-recovery and uranium-milling licenses.

Response: *The commenter is correct that the GEIS and this SEIS were prepared based upon the requirement at 10 CFR Part 51.20(b)(8). However, the NRC staff does not find that this level of detail is necessary for the section of the SEIS referenced in this comment. This information is provided in the SEIS in Section 1. Therefore, no changes to the SEIS were made in response to this comment.*

Comment: RP032-001

The commenter noted that DSEIS Section 1.3 stated, “The purpose and need for this Proposed Action is to provide an option that allows the Applicant to recover uranium and produce yellowcake at the Ross Project area.” The commenter expressed concern that the purpose and need as stated could facilitate future expansion with minimal or no further environmental review. The commenter also noted that the Proposed Action includes the recovery of vanadium, which was not included in the purpose and need statement. The commenter suggested that a more appropriate purpose and need would be stated as follows:

> The purpose and need for the proposed action -- the granting of an NRC license to recover uranium from [name wellfield areas] and process it at [name Central Processing Facility] for [x years]—is to ensure, through a rigorous nuclear safety and NEPA review process prior to licensing, that the uranium recovery activities and associated environment, safety, and health risks and environmental impacts described in the license application and applicant's *Environmental Report*, faithfully represent the full range of activities, risks, and impacts that will arise as a result of the licensed activity, and that all these activities will be conducted in a manner that: (1) ensures adequate protection of public health and safety and the common defense and security; (2) identifies and seeks to avoid or minimize all reasonably foreseeable environmental impacts, while mitigating any unavoidable adverse environmental impacts.

Response: *The statement of the purpose and need in DSEIS Section 1.3 is derived from the proposed Federal action. Under the* Atomic Energy Act of 1954 *(AEA), the NRC has statutory authority to issue licenses for the possession and use of certain AEA-regulated radioactive materials and the particular activities involving these materials. Based upon the NRC's statutory authority, the proposed Federal action is the NRC's decision whether to grant or to deny a license to a private party that would allow the conduct of uranium-recovery operations to extract uranium and produce yellowcake at a particular site.*

The recovery and production of vanadium requested by the Applicant is attendant to the recovery of uranium and production of yellowcake and does not alter the process from what it would be for uranium recovery only. The purpose and need statement for this proposed Federal action must consider the Applicant's request in providing an option that would allow the Applicant to recover uranium and to produce yellowcake at the Ross Project. Therefore, the purpose and need of this Proposed Action encompasses the recovery and production of vanadium.

The NRC would not accept a proposed purpose and need statement if it is unduly narrow, but the NRC also allows deference to the business decisions of an applicant. If the NRC decides to grant the license request, the specific applicant must comply with the specific license requirements, NRC's regulatory requirements, and any other relevant local, State, or Federal requirements to operate its facility. No changes were made to the SEIS beyond the information provided in this response.

B.5.4.2 Use of the GEIS in Site-Specific Environmental Reviews

Comments: RP011-001; RP012-001; RP013-001; RP014-001; RP015-001; RP016-010; RP019-001; RP021-001; RP023-001; RP027-001; RP029-005; RP030-001; RP032-078; RP033-002; RP034-001; RP039-005; RP040-002; RP041-001; RP043-005

The commenters stated that the GEIS should not be used when analyzing the environmental and other impacts of the Ross Project with respect to water, land, air, ecology, occupational and public health and safety. One commenter stated the tiering off the GEIS was only used as a way to streamline and speed up the review process. Another commenter stated that to do so "was arbitrary, capricious, and frankly ridiculous."

Response: *As discussed in SEIS Section 1.1, the NRC staff prepared this SEIS for the Ross Project consistent with its regulations under 10 CFR Part 51 that implement NEPA and with its guidance for environmental reviews as found in NUREG–1748 (NRC, 2003b). In addition, the GEIS provides a starting point for all of the NRC's NEPA analyses for site-specific license applications for new ISR facilities, such as Strata Energy, Inc.'s (Strata) (herein referred to as the "Applicant"), license application for the proposed Ross Project. This SEIS is a supplement to the GEIS and incorporates by reference relevant information contained in the GEIS as well as its findings and conclusions concerning potential environmental impacts.*

The NRC's analysis of the potential environmental impacts to land, water, air, and ecology as well as public and occupational health are found in SEIS Sections 4.2.1, 4.5.1, 4.7.1, 4.6.1, and 4.13.1, respectively. These SEIS Sections consider the site-specific information provided in the license application by the Applicant. The site-specific analyses determined that, for the proposed Ross Project, the significance of potential impacts would be SMALL to MODERATE after mitigation measures are considered; the final significance depends upon the respective resource area. The site-specific determination draws on the evaluation found in the GEIS and the NRC staff's independent evaluation of the site-specific information provided in the Applicant's license application and its responses to the NRC's requests for additional information (Strata, 2011a; Strata, 2012a). No changes were made to the SEIS beyond the information provided in this response.

Comment: RP024-071

The commenter suggested adding a discussion of the concept of "tiering" from the GEIS prior to the scoping discussion. The commenter also suggested that the FSEIS include a statement indicating that the NRC is not required to conduct any form of scoping for an SEIS under 10 CFR Part 51, but it did so anyway for the GEIS.

Response*: The GEIS is a generic analysis of the potential impacts of individual ISR facilities in a specified geographic area. The GEIS for ISR facilities serves as the starting point for environmental reviews of site-specific ISR license applications. The NRC "tiers" an SEIS from the GEIS by incorporating applicable GEIS discussions by reference and by adopting relevant GEIS environmental impact conclusions.*

The NRC conducted scoping in developing the GEIS. Scoping provides a means by which the scope of issues to be addressed in the environmental review related to the Proposed Action are identified. The scoping process for the GEIS identified local conditions and potential impacts that could be considered generically and those that need to be analyzed using site-specific information in an SEIS. SEIS Section 1.4.2 describes the scoping activities conducted for the development of the GEIS and future supplements to the GEIS.

The NRC's NEPA-implementing regulations, specifically 10 CFR 51.26(d) and 51.92(d), provide that the NRC staff need not conduct a scoping process when a supplement to an EIS is prepared. Nevertheless, the NRC staff has the discretion to decide whether to incorporate a scoping process when preparing a SEIS. During the development of this SEIS, the NRC staff conducted additional scoping activities, which are described in Section 1.4.2 of the SEIS. SEIS Section 1.4.2 has been revised to include the information regarding tiering and scoping that is provided in this response.

Comment: RP024-074

The commenter noted that the DSEIS stated that "Some issues and concerns raised during the scoping process of the GEIS were determined to be outside the scope of the GEIS" and "are also outside the scope of this SEIS" (NRC, 2009b). The commenter stated that it is important to provide a complete discussion of all of these items in order to ensure that the FSEIS is fully accurate and inclusive.

Response: *The quoted text is from SEIS Section 1.4.4, "Issues Outside the Scope of the SEIS." A list of topics that were considered outside the scope of the GEIS (NRC, 2009b) and this Ross Project SEIS is provided in this Section in the SEIS. In addition, a citation for Appendix A of the GEIS is provided for readers who wish to review additional details regarding the topics that are considered outside the scope of both documents. Therefore, no changes were made to the SEIS beyond the information provided in this response.*

B.5.4.3 References

Duke Energy Corp. (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-14, 55 NRC 278, 295. 2002.

Kleppe v. Sierra Club, 427 U.S. 390, 410 n. 20. 1976.

(US)NRC (Nuclear Regulatory Commission). "Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report." NUREG–1569. Washington, DC: USNRC. 2003a. ADAMS Accession No. ML032250177.

(US)NRC. "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

B.5.5 SEIS/GEIS Methods and Approach

B.5.5.1 Reliance on Regulatory Compliance to Limit Impacts

Comment: RP032-091

The commenter asserted that DSEIS Section 5, "Cumulative Impacts," did not present a quantitative analysis of cumulative impacts, or even substantive discussions of qualitative factors. In addition, the commenter questioned the use of regulations and monitoring programs in environmental-impact analyses and suggested that regulatory compliance should not serve as a substitute for thorough analysis of impacts and presentation of findings within the SEIS.

Response*: The NRC staff believes that the information presented in SEIS Chapter 5 is valid and relevant to the assessment of potential cumulative impacts. Regulatory requirements do mitigate potential impacts and are used in the impact analyses for the NRC to establish an upper bound on possible impacts. Mitigation measures are described throughout SEIS Sections 4 and 5, and additional monitoring measures are described in Section 6.*

The NRC does not agree with the commenter's premise that SEIS Section 5 did not present quantitative analysis of cumulative impacts or even substantive discussions of qualitative factors. The NRC staff acknowledges that quantitative analysis of potential cumulative impacts is constrained by the limited availability of quantitative data from past, present, and reasonably foreseeable future actions (RFFAs). However, assumptions regarding the relative size of RFFAs compared to the Ross Project have been used where appropriate to apply quantitative information related to the impact analyses. Quantitative data can be found throughout Section 5 in the SEIS. For example, in the cumulative-impact analysis of water resources, the NRC staff assumed that the impacts to water quantity would be roughly proportional to the size of a potential future uranium-recovery project compared to the Ross Project. Note that the NRC has revised the cumulative-impact analyses presented in the FSEIS in Section 5 to improve the transparency and clarity of the analyses as a result of this comment and others.

B.5.5.2 SEIS/GEIS Methods and Approach to Impact Significance

Comments: RP024-056; RP024-057; RP024-472

The commenter requested that "MODERATE" be changed to "SMALL to MODERATE" for consistency throughout the SEIS, particularly in the Executive Summary and Section 4.5.1.2.

Response: *Although other comments included factual or editorial bases for a request to change the significance of the potential impacts in particular findings in the SEIS (viz. Comments Nos. RP024-019, RP024-020, RP024-220, RP024-221, and RP024-379), these comments related to the Executive Summary and SEIS Section 4.5.1.2 do not. The NRC does not agree that a finding of MODERATE significance should be changed to "SMALL to MODERATE" for consistency throughout the SEIS. When the significance of an impact's finding ranged from SMALL to MODERATE, then the SEIS included the range; when it did not, and the significance was MODERATE in all cases, then no range of significance was appropriate. The NRC consequently notes that "SMALL to MODERATE" indicates a different range of magnitudes related to resource-area impacts (i.e., a different range of "significance") than does simply "MODERATE." No changes were made to the SEIS beyond the information provided in this response.*

B.5.6 Regulatory Issues and Process

B.5.6.1 NRC Policies and Practices

B.5.6.1.1 NRC Licensing Process

Comment: RP024-001

The commenter stated that it commends the work completed by the NRC staff and its preparation of the DSEIS in a timely manner. Consistent with the conclusions in the GEIS and publication of the *Safety Evaluation Report* (SER), the commenter agrees with the NRC staff's conclusion that the Applicant be issued a license by the NRC.

Response: *The NRC recognizes that the commenter supports the staff's environmental review for the proposed Ross Project. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP041-013

The commenter stated that the DSEIS did not discuss source and byproduct materials license requirements and how they will or will not mitigate impacts. The commenter also noted that before the DSEIS was released for public review and comment, the NRC essentially finalized Strata's license and had met with Strata several times to negotiate license conditions. The commenter expressed concern that the negotiations were not carried out under NEPA's public-review and comment processes and stated that the NRC acted prior to its NEPA review. The commenter further commented that by negotiating with Strata, the NRC has been locked into positions that would be difficult to reverse after its NEPA review is complete. Therefore, the commenter stated that the NRC needs to re-release a new draft of the DSEIS with the Draft Source and Byproduct Materials License included as an appendix and its conditions fully discussed and analyzed throughout the text of the document. The commenter stated that this is particularly important because the NRC license is the only source of binding and enforceable mitigation measures specific to the Ross Project and, therefore, the license conditions should be the only source of mitigation measures that can be relied upon by the agency to reduce impacts related to Strata's Ross Project.

Response: *The development of a Draft Source and Byproduct Materials License for the Ross Project is part of the NRC's licensing process for the Ross Project. However, the conditions of the Draft License are subject to change prior to issuance of a final license and the development of the Draft License does not guarantee that such a license would be issued. Meetings between the NRC and the Applicant to negotiate the conditions of the Draft License were publicly noticed. The public was invited to observe the meetings or participate by phone and the public could ask questions at the end of the business portions of the meetings.*

The NRC staff's Draft License has been prepared concurrently with this SEIS. The DSEIS included requirements from the Draft License that were available at the time that the DSEIS was being prepared. Following completion of the DSEIS, the NRC staff has continued to develop the Draft License. The FSEIS includes additional requirements from the Draft License that were not available to be included in the DSEIS.

The NRC implements best management practices (BMPs), mitigation measures, and management actions for the Ross Project so as to avoid and reduce environmental impacts. By license condition, the NRC also requires Applicants of ISR facilities to obtain the necessary permits and licenses from the appropriate regulatory authorities prior to operating the facility (Draft License Condition No. 12.1) (NRC, 2014b). Mitigation may be imposed as a requirement other agencies establish through required permits the Applicant must obtain for the proposed Ross Project. The NRC staff believes the appropriate mitigation measures have been described under the Proposed Action. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP024-068

The commenter noted the following statement in SEIS Section 1.2: "Based upon the application, the NRC's Federal action is the decision to either grant or deny the license," is incorrect. The commenter requested a revision to the SEIS that would state that the NRC is empowered under the AEA to act in one of three ways: 1) grant a requested licensing action, 2) grant a requested licensing action with conditions, or 3) deny a requested licensing action.

Response: *Under the AEA, the NRC has statutory authority to issue licenses for the possession and use of AEA-regulated radioactive materials and particular activities involving these materials. Based on the NRC's statutory authority, the proposed Federal action is the NRC's decision whether to grant or deny a private party's license application to conduct uranium-recovery operations to extract uranium and produce yellowcake at a particular site. If the NRC staff decides to grant the license request, it may do so with conditions, but the Federal action is the decision to grant or deny the license. The Applicant must comply with the license requirements, NRC regulatory requirements, and any other relevant local, State, or Federal requirements to operate its facility. No changes were made to the SEIS beyond the information provided in this response.*

B.5.6.1.2 Adequacy of NRC Regulations and Practices

Comment: RP032-004

The commenter noted that neither the specific aquifer-restoration standards that would be applied to the ore zone's (OZ) ground water nor the analysis that demonstrated that such standards would be protective of the surrounding ground water were provided in the DSEIS. Moreover, the commenter noted that "3,000 drillholes and wells" would suggest, on the contrary, that there is a potential for substantial fluid migration and degradation of ground-water quality outside of the OZ.

Response: *The NRC disagrees with this comment. As discussed in SEIS Section 4.5.1.3, Condition No. 10.6 in the Draft Source and Byproduct Materials License for the proposed Ross Project would require that hazardous constituents in the ground water of the exempted aquifer be restored to the numerical ground-water standards as required by 10 CFR Part 40, Appendix A, "Criteria Related to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for Their Source Material Content," Criterion 5B(5) (NRC, 2014b). The Applicant's meeting these standards for the exempted aquifer would ensure that present or potential future sources of drinking water outside of the exempted aquifer would be protected. This requirement is the* *basis for the determination in SEIS Section 4.5.1.3, that the long-term impacts to the aquifer outside the exempted aquifer would be SMALL.*

Criterion 5B(5) of Appendix A requires that the concentration of a given hazardous constituent at the point of compliance (i.e., edge of exempted aquifer) must not exceed 1) the NRC-approved post-licensing, pre-operational concentration of that constituent in ground water (5B(5)(a)); 2) the respective numeric value in the table included in Paragraph 5C of Criterion 5B(6) if the specific constituent is listed in the table and if the post-licensing, pre-operational concentration of the constituent is below the value listed (5B(5)(b)); or 3) an Alternate Concentration Limit (ACL) that the Commission establishes for the constituent (5B(5)(c)). To achieve this requirement, Criterion 5B(6) states that, conceptually, post-licensing, pre-operational concentrations pose no incremental hazard and the numeric limits in Paragraph 5C pose acceptable hazards, but these two options might not be practical. In this case, the NRC may establish an ACL if the licensee has demonstrated that such an ACL does not present a significant hazard to present or potential future sources of drinking water outside of the exempted aquifer.

As discussed in FSEIS Sections 2.1.1.1 and 4.5.1.2, Condition No. 10.12 of the Draft License would require that the Applicant attempt to locate and plug all historical drillholes located within the perimeter monitoring-well rings for each wellfield (NRC, 2014b). The hydrologic tests necessary for the hydrologic-test data package that would be required by License Condition No. 10.13 would ensure that the Applicant identify any communication between the ore-zone and the surrounding aquifers from historical drillholes that could still need to be properly abandoned. As described in SEIS Section 4.5.1.2, the impacts to the aquifers were determined to be SMALL by the NRC staff, because of the mitigating effects of the Applicant's plugging drillholes and subsequent hydrologic testing. FSEIS Sections 2.1.1.1 and 4.5.1.2 have been revised to clarify these requirements and the associated process of the NRC's determining ground-water-restoration compliance. (Also see Comment Nos. RP024-013, RP024-161, RP024-169, RP024-170, RP024-425, and RP041-006 among others related to water-protection standards.)

B.5.6.1.3 Regulatory Definitions

Comments: RP024-004; RP024-115; RP024-146; RP024-160; RP024-177; RP024-180: RP024-181; RP024-182; RP024-199; RP024-202; RP024-206; RP024-375; RP024-381; RP024-384; RP024-568; RP024-579; RP024-585; RP024-703; RP024-736

The commenter recommended that the SEIS use the modifier “11e.(2)” instead of using the term “byproduct material” throughout the SEIS. The commenter noted that other classes of byproduct material are defined by the AEA and three of these classes are not applicable to the Ross Project.

Response: *Since the GEIS was prepared, the NRC staff has elected not to use the modifier “11e.(2)” in documents prepared for a Part 40 source and byproduct materials license for the following reason: in response to the* Uranium Mill Tailings Radiation Control Act of 1978 (*UMTRCA*)*, the definition of byproduct material included in Part 40 expanded the definition of 11e.(2) byproduct material as was used in the AEA. The definition of byproduct material (under Part 40) would include those materials defined by 11e.(2) in the AEA. Therefore, the lack of the “11e.(2)” modifier to “byproduct material” does not diminish its applicability. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-084

The commenter suggested that DSEIS Section 1.7.3.1 be updated to indicate that a new Memorandum of Understanding (MOU) was signed by the U.S. Bureau of Land Management (BLM) on February 12, 2013, and by the NRC on February 4, 2013.

Response: *The commenter is correct that, on February 12, 2013, the NRC and the BLM entered into an MOU that sets forth the cooperative working relationship between the NRC and the BLM, primarily for the purpose of enhancing each agency's compliance with the NEPA and Section 106 of the National Historic Preservation Act of 1966 (NHPA). The MOU supersedes the original MOU entered into between the NRC and the BLM on November 30, 2009. The new MOU was signed while the DSEIS was in the final-printing review stage; thus, the signing of the new MOU was not captured in the DSEIS. Therefore, FSEIS Section 1.7.3.1 has been revised to reflect this new information.*

Comment: RP024-140

The commenter noted that the description of "Aquifer Exemption" that appears in the text box entitled "What are underground injection control permits?" in DSEIS Section 2.1.1.1 does not include the criteria for an aquifer exemption when the aquifer is mineral producing.

Response: *The NRC has revised the "What are underground injection control permits?" text box in SEIS Section 2.1.1.1. The following clause was added: "…and whether the aquifer contains minerals that are expected to be commercially producible…" to the list of criteria for an aquifer exemption in the respective text box in FSEIS Section 2.1.1.1.*

Comment: RP024-141

The commenter suggested that the text box entitled "What are underground injection control permits?" in DSEIS Section 2.1.1.1 be revised to remove the statement, "This Class includes all wells that dispose of waste on a commercial basis," under the description of "Industrial and Municipal Waste Disposal Wells," because Class II and V wells also may dispose of waste.

Response: *The NRC agrees with the commenter and has revised the "What are underground injection control permits?" text box in FSEIS Section 2.1.1.1 by deleting the statement that "This Class includes all wells that dispose of waste on a commercial basis" under the description of "Industrial and Municipal Waste Disposal Wells."*

Comment: RP024-184

The commenter recommended revising the definition of "liquid byproduct waste" in the text box entitled "What types of wastes would be generated at the proposed Ross Project?" in DSEIS Section 2.1.1.5, which currently states that the waste "is contaminated with byproduct material." The commenter suggests either removing the statement or revising the text to make the definition compatible with the "11e.(2) byproduct material definition" in 10 CFR Part 40.4.

Response: *The NRC staff agrees that the definition of "liquid byproduct waste" as stated in the text box is not appropriate. The "waste" is the "byproduct material" and is not "contaminated with byproduct material." The text box in FSEIS Section 2.1.1.4 entitled "What types of wastes would be generated at the proposed Ross Project?" has been revised to define "Liquid*

Byproduct Material" as a type of liquid waste generated that would be generated by the proposed Ross Project, in addition to hazardous and sanitary wastes (i.e., domestic waste) as well as well-development and ground-water-sampling waste waters.

Comment: RP024-209

The commenter asserted that the following statement in DSEIS Section 2.1.1.7 was inconsistent with the Draft Source and Byproduct Materials License: "A decommissioning funding plan (DFP) would be required from the Applicant as an NRC license condition; the DFP would contain a decommissioning cost estimate, the amount of which the Applicant would be required to maintain in a financial-surety arrangement" (NRC, 2014b). The commenter requested that the FSEIS be revised for consistency with the Conditions of the Draft License. The commenter pointed out that Draft License Condition No. 9.5 states that 1) "Within 90 days of NRC approval of a revised closure (decommissioning) plan and its cost estimate, the licensee shall submit, for NRC staff review and approval, a proposed revision to the financial assurance arrangement if estimated costs exceed the amount covered in the existing arrangement" and 2) "The licensee shall continuously maintain an approved surety instrument for the Ross Project, in favor of the State of Wyoming (Wyoming)." The commenter requested that the statement identified above be revised for consistency with the Draft License.

Response: *The NRC agrees with the commenter's recommendations. FSEIS Section 2.1.1.7 has been revised accordingly. The statement noted by the commenter as inaccurate and the succeeding statements were replaced with a discussion of Condition No. 9.5 of the Draft Source and Byproduct Materials License.*

Comment: RP024-749

The commenter suggested that the SEIS not use the term "impoundments" because this term implies tailings that are produced during ore milling and such tailings are not generated by an ISR facility. The commenter suggested that, for consistency with the license application and the Draft Source and Byproduct Materials License, the term "ponds" should be used throughout the SEIS (NRC, 2014b).

Response: *The commenter is correct that Strata's license application and the early drafts of the License use the term "pond(s)" when describing the proposed surface impoundments that would be used to retain and store liquid byproduct material. Nonetheless, the NRC disagrees that the term "impoundments" implies tailings, and the SEIS clearly states that the impoundments would be used to store waste waters and liquid byproduct material. By virtue of being in the license application and in the Draft Source and Byproduct Materials License, the ponds are "regulated" features, a view which may not be obvious to the average person reading the SEIS. When the phrase "surface impoundments" is used in the SEIS, rather than the term "ponds," it becomes clearer that the surface impoundments are, in fact, regulated. Thus, the NRC staff has determined that the term "impoundments" and the phrase "surface impoundments" are more consistent with the pertinent regulations (e.g., see the definition of "surface impoundment" under 10 CFR Part 40, Appendix A). No changes were made to the SEIS beyond the information provided in this response.*

B.5.6.1.4 NRC NEPA Process Implementation

Comments: RP032-002; RP032-067; RP041-009

The commenters stated that the NRC violated NEPA by failing to include the project encompassing the entire Lance District as within the scope of this SEIS. The commenters stated that the Ross Amendment Area 1, Kendrick Satellite Area, Richards Satellite Area, and Barber Satellite Area, all potential satellite areas to the Ross Project, are actions connected to the Proposed Action (i.e., licensing of the Ross Project). One commenter noted that meaningful consideration of impacts in the SEIS is limited to the Ross Project wellfields only, even though the capacity of the proposed Central Processing Plant (CPP) has been sized to accommodate a throughput four times greater than that required by the Ross Project alone, and it would thus enable the simultaneous uranium recovery in additional areas. One commenter asked if construction of the CPP would be economically viable if its feedstock were limited to the Ross Project and, if not, the commenter asked why the scope of the Proposed Action in the SEIS is limited to the Ross Project. The other commenter expressed concern that the satellite areas could be licensed through amendments to the license for the Ross Project, so that there would be no opportunity for a contested hearing and a NEPA “Findings of No Significant Impact" (FONSI) would be prepared for each additional satellite operation (NRC, 2014b). One commenter stated that the entire “Affected Environment” section of the SEIS (Section 3) should be revised to encompass a description of the wider area that could be “solution mined” as a direct consequence of the NRC’s proposed licensing action (i.e., the wider area would include the following: “Ross Permit Area”; “Ross Amendment Area #1”; “Kendrick Production Unit (Amendment Area #2)”; “Richards Production Unit (Amendment Area #3)”; “Barber Production Unit (Amendment Area #4)”; “Warren Project”; “Richards Project,” “Osborne Project”; “Chatterton Project”; “Brooks Project”; “Carey Project”; “Houx Project”; “Clark Project”; “Lucas Project”; and “Emerson Project.”).

Response: *As noted in SEIS Section 2.1.1, Strata informed the NRC via its license application that it has identified four other uranium-bearing areas that would extend the area of uranium recovery to the north with the Ross Amendment Area 1 and to the south of the Lance District with the Kendrick, Richards, and Barber satellite areas. If the NRC approves the Ross Project license application, Strata would only be authorized to operate on the Ross Project site, so development of the wider area described by the commenter would not be a direct consequence of licensing the Ross Project. Furthermore, granting a license to Strata for the Ross Project would not commit the Agency to subsequent approvals of Strata’s proposed satellite areas. If Strata were to submit a license-amendment application to the NRC to expand operations into any of the satellite areas, the NRC would offer an opportunity for a hearing and the NRC staff would prepare an SER and a NEPA document.*

The Supreme Court has stated that agencies need not consider “possible environmental impacts of less imminent actions when preparing the impact statement on proposed actions.” Kleppe v. Sierra Club, 427 U.S. 390, 410 n. 20 (1976). The Commission has agreed that to bring NEPA into play, a possible future action must at least constitute a “proposal” pending before the Agency, and it must in some way be interrelated with the action that the Agency is actively considering. See Duke Energy Corp. (McGuire Nuclear Station, Units 1 & 2; Catawba Nuclear Station, Units 1 & 2), CLI-02-14, 55 NRC 278, 295 (2002). The NRC categorized Strata’s Lance District plans provided in its license application as reasonably foreseeable actions, so they are considered in the cumulative-impact analyses of this SEIS. Should any of the contemplated actions later reach the stage of an actual proposal, the environmental impacts *of the Ross Project, if licensed, can be considered when preparing the comprehensive statement on the cumulative impacts of that proposal. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-005

The commenter noted that the significance of potential environmental impacts in the DSEIS is categorized as SMALL, MODERATE, or LARGE and stated that this impact-classification method is inadequate and that the DSEIS illustrates these problems. Specifically, the commenter stated that the SMALL, MODERATE, and LARGE terms are not tied to any consistent set of quantitative or otherwise objectively ascertainable metrics for one's assessing and comparing the impacts of uranium-recovery activities.

Response: *SEIS Section 1.4.3 provides a summary of the methodology for and describes the types of considerations the NRC staff used to determine the significance of identified impacts as SMALL, MODERATE, or LARGE. According to the Council on Environmental Quality (CEQ), the significance of impacts is determined by one's considering both context and intensity (40 CFR Part 1508.27). The NRC established this standard of significance for its assessment of environmental impacts during the conduct of environmental reviews originally in its* Generic Environmental Impact Statement for License Renewal of Nuclear Plants *(NRC, 1996a), which used the CEQ regulations as a basis for these significance levels. This SEIS was prepared in accordance with NRC guidance presented in NUREG–1748*, Environmental Review Guidance for Licensing Action Associated with NMSS Programs *(NRC, 2003b), which incorporates these significance-level categories. See also Comment Nos. RP024-056, RP024-057, and RP024-472. Therefore, no changes were made to the SEIS as a result of this comment.*

Comment: RP041-006

The commenter stated that the DSEIS's failure to disclose baseline water quality violates NEPA's public disclosure and analysis requirements. The commenter refers to the information provided in pleadings in the license-intervention proceeding before the Atomic Safety Licensing Board (ASLB) regarding contentions claiming flaws in the Applicant's water-sampling regime and claiming that neither the Applicant nor the NRC has properly put forward the correct and accurate data to determine baseline water quality. The commenter incorporates the pleadings by reference into this comment. The commenter goes on to state that the NRC fully acknowledges that baseline water quality has yet to be established and disclosed and that this failure has to two important consequences: 1) the DSEIS cannot analyze or disclose impacts related to excursions because those yet-to-be-determined baseline water-quality values would be used to determine whether excursions have occurred through the Applicant's monitoring program; and 2) the DSEIS cannot analyze or disclose impacts related to the failure (or even the unlikely success) of the Applicant to restore water quality to baseline conditions because the NRC does not yet know what those baseline restoration targets are. This commenter stated that because of 1) and 2) above, the most important impact analyses would occur post-NEPA and after the NRC has made its decision. Therefore, the commenter finds that, in addition to violating basic NEPA principles regarding the importance for upfront disclosure and analysis prior to the NRC's making its decision, the failure also violates NEPA's dual purpose of disclosing the information to the public to facilitate meaningful participation through the public-comment process. Through NEPA, the commenter stated, an agency "must insure that environmental information is available to public officials and citizens before decisions are made and before actions are taken," (40 Code of Federal Regulations [CFR] Part 1500.1[b].) The commenter stated that the public is prevented from participating in the NRC's NEPA process because the public is left with nothing on which to comment.

Response: *As the commenter notes, this comment was also raised as a contention against the Applicant's* Environmental Report *(ER) and later as a contention against the DSEIS in pleadings before the ASLB. Therefore, the NRC staff's responses to this contention are incorporated by reference into this comment response, and can be accessed through the NRC's Agencywide Documents Access and Management System (ADAMS) at Docket No. 04009091. According to 10 CFR Part 51.45, which falls under Subpart A (i.e., NEPA) regulations implementing Section 102(2), an application submitted to the Commission for a license is required to include an ER, which shall contain a description of the environment affected by a proposed action. Also, according to NUREG–1748 (NRC, 2003b), which is the guidance document that the Applicant and the NRC staff used to prepare the ER and the SEIS, respectively, the description of the affected environment focuses on the baseline conditions (i.e., the status quo). 10 CFR Part 51 does not define the specific information about the environment affected that an Applicant shall provide or that the NRC staff must include in its NEPA document. Regarding water quality, NUREG–1748 states that the SEIS should include a description of site-specific and regional data on the characteristics of surface- and ground-water quality in sufficient detail to provide the necessary data for other reviews dealing with water resources. The Applicant included information regarding the affected environment, including an analysis of the site-specific surface- and ground-water quality, in its license application for the proposed Ross Project. The NRC staff reviewed this information, found it acceptable, and then the staff used it to prepare SEIS Section 3, "Affected Environment," and Section 4, "Environmental Impacts and Mitigation Measures." An analysis of the environmental impacts to ground-water quality due to excursions and an analysis of the impacts following the aquifer-restoration phase are provided in Section 4 of this SEIS.*

According to 10 CFR Part 40, Appendix A, Criterion 5B(5), at the point of compliance, the concentration of a hazardous constituent must not exceed 1) the Commission approved background [in this SEIS, "post-licensing, pre-operational"] concentration of that constituent in the ground water; 2) the respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background [in this SEIS, "post-licensing, pre-operational"] level of the constituent is below the value listed; or 3) an ACL established by the Commission. The commenter finds that the SEIS fails to disclose post-licensing, pre-operational water-quality values because the commenter improperly equates the 10 CFR Part 40, Appendix A, statement "Commission approved background [in this SEIS, "post-licensing, pre-operational"] concentrations of hazardous constituents in the ground water at the points of compliance" to the "description of the environment affected" and the "description of the site-specific data on the characteristics of ground-water quality" that are to be included in the NEPA document per 10 CFR Part 51 and NUREG–1748, respectively (NRC, 2003b). These concepts are not equivalent. The Commission-approved concentrations would be determined following the Applicant's submission of a hydrologic-test data package to the NRC for approval, which would occur after the Applicant is granted a license but before uranium-recovery operation begins. The 10 CFR Part 51 "description of the environment affected" and the NUREG–1748 "description of the site-specific data on the characteristics of ground-water quality" are information that must be reasonably obtained prior to the NRC's granting of a license as it is information that the NRC staff must use to develop the NEPA document, which must occur prior to the NRC's granting the license.

The commenter states that, unless the SEIS discloses the 10 CFR Part 40, Appendix A, Criterion 5B(5) Commission-approved concentrations of hazardous constituents measured at the point of compliance within the Ross Project area, the SEIS cannot fully disclose or analyze the environmental impacts to ground water during an excursion or following aquifer restoration. The NRC staff does not agree with this assertion. In the case that the Applicant is not able to restore the ground-water constituents to the 5B(5) concentrations or in the case of an excursion, the NRC staff's knowledge of what these 5B(5) concentrations are would not allow the NRC staff to predict exactly how the concentrations would change or how ground-water quality as a whole would change any better than the NRC staff can predict this without having these 5B(5) concentrations. In the case that the Applicant is able to restore the ground-water's hazardous-constituent concentrations to those of 5B(5), then, as stated in Section 4 of the SEIS, the site-specific ground-water quality would not be expected to change from the quality presented in Section 3 of the SEIS. Therefore, notwithstanding the fact that these point-of-compliance, specific hazardous-constituent concentrations would not be Commission approved until after a license is granted and thus cannot be legally obtained by the Applicant prior to the granting of the license, the collection of this information is neither required by 10 CFR Part 51 nor would it affect the water-quality-impacts analysis presented in the SEIS. Therefore, no changes were made to the SEIS beyond the information provided in this response.

Comment: RP041-018

The commenter stated that, as the comments regarding the GEIS and the Ross Project DSEIS that are presented in the comment document which accompanied this commenter's comments demonstrated, the GEIS and the DSEIS were inadequate pursuant to NEPA, the NRC's regulations implementing NEPA (10 CFR Part 51), and the CEQ regulations implementing NEPA. Therefore, the commenter stated that NRC must withdraw the Ross Project DSEIS, significantly amend it to address the deficiencies described in the comments, and reissue the DSEIS for additional public comment. The commenter also noted that, during these efforts, the NRC should not rely on the GEIS for any site-specific analyses.

Response: *The NRC disagrees with the commenter and believes that the SEIS for the Ross Project now adequately addresses all public comments and does not need to be reissued for additional public comment. For further information on how the SEIS tiers from the GEIS, please refer to Section B.5.4.2 of this Appendix B. The NRC staff has prepared this Ross Project SEIS consistent with its regulations under 10 CFR Part 51 that implement NEPA and its guidance for conducting environmental reviews as found in NUREG–1748 (NRC, 2003b). Pursuant to 10 CFR Part 51.73, the NRC staff issued the DSEIS for the Ross Project for public comment on March 29, 2013 (78 FR 19330). The comment period for the document closed on May 13, 2013. As discussed in Section B.3 of this Appendix B, 1,120 public comments from 43 comment documents were received on the DSEIS, among which were the comments presented by the commenter. Consistent with 10 CFR Part 51.91(a), the NRC considered and responded to all comments received. No changes were made to the SEIS beyond the information provided in this response.*

B.5.6.1.5 Miscellaneous NRC Policies and Practices

Comment: RP024-054

Due to the fact that the SER was finalized in February 2013, and the NRC issued a Draft Source and Byproduct Materials License for the Ross Project, the commenter stated that the following caveat in the DSEIS is unnecessary: "Unless safety issues mandate otherwise, the preliminary NRC staff recommendation…" (NRC, 2014b).

Response: *The text quoted by the commenter is from DSEIS Section 2.4, "Preliminary Recommendation." The full quote is as follows: "Unless safety issues mandate otherwise, the preliminary NRC staff recommendation to the Commission* related to the environmental aspects of the Proposed Action *is that a source and byproduct materials license for the Proposed Action be issued as requested" [emphasis added]. The conclusion provided in this statement is related only to the environmental aspects of the Proposed Action. Thus, the caveat is necessary and no changes were made to the SEIS beyond the information contained in this response.*

Comment: RP024-080

The commenter suggested that DSEIS Table 1.2, "Environmental Approvals for the Proposed Ross Project" be revised to remove "Permit application to construct holding (storage) ponds (40 CFR 61.07)" because, as the commenter stated, this permit was not discussed in the license application and is not relevant to any ponds at the proposed Ross Project.

Response: *DSEIS Table 1.2, "Environmental Approvals for the Proposed Ross Project" was developed based upon the information submitted by the Applicant in its ER Table 1.6-1. During preparation of this FSEIS, the NRC staff requested that the Applicant provide an updated Table 1.6-1. FSEIS Table 1.2 has been revised to reflect the more recent information provided by the Applicant.*

Comment: RP035-012

The commenter recommended that the FSEIS discuss the applicability of Subpart W of 40 CFR Part 61 and provide a detailed description of surface-impoundment design and size. The commenter also highlighted the fact that the U.S. Environmental Protection Agency (EPA) is currently considering revisions to 40 CFR Part 61, Subpart W, that could result in changes to the requirements in 40 CFR Part 61.

Response: *The EPA asserts that 40 CFR Part 61, Subpart W, applies to water-storage surface impoundments. The authority for EPA's 40 CFR Part 61 is derived from the* Clean Air Act *(CAA), over which the NRC does not have jurisdiction. To be in compliance with 40 CFR Part 61, Subpart W, new facilities would have to meet specific effluent limits, size limits, and liner-construction designs as specified in 40 CFR Part 61, Subparts A and W. Specifically, the Applicant must submit an application to the EPA for the construction of the surface impoundments pursuant to 40 CFR Part 61.07 and must monitor radon effluents during impoundment operation to demonstrate compliance pursuant to 40 CFR Part 61.253. These requirements, as applicable, would be satisfied by the Applicant in its design of the Ross Project surface impoundments. SEIS Section 2.1.1.1 includes the description of the currently proposed surface-impoundment design and size as well as references to the Applicant's license application, which contains detailed design descriptions and drawings (Strata, 2011b). Regarding the potential revisions to 40 CFR Part 61, Subpart W, the NRC reviews the license applications it receives vis-à-vis the regulations in place at the time of review. No changes were made to the SEIS beyond the information provided in this response.*

B.5.6.2 References

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for License Renewal of Nuclear Plants." NUREG–1437. Washington, DC: USNRC, Office of Nuclear Reactor Regulation. May 1996a. ADAMS Accession No. ML13106A241.

(US)NRC. "Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills." Washington, DC: USNRC. 1996b. ADAMS Accession No. ML091420242.

(US)NRC. "Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report." NUREG–1569. Washington, DC: USNRC. 2003a. ADAMS Accession No. ML032250177.

(US)NRC. "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Staff Assessment of Ground Water Impacts from Previously Licensed In-Situ Uranium Recovery Facilities." Memorandum from C. Miller to Chairman Jaczko, et al. Washington, DC: USNRC. July 10, 2009d. ADAMS Accession No. ML091770385.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

WDEQ/LQD (Wyoming Department of Environmental Quality/Land Quality Division). "Noncoal In Situ Mining," *Rules and Regulations*, Chapter 11. Cheyenne, WY: WDEQ/LQD. 2005.

B.5.7 Public Involvement

Comment: RP024-072

The commenter suggested that a statement be added to the FSEIS to indicate that a public hearing has been granted.

Response: *The commenter is correct that a hearing has been granted. Section 1.4.2 of the FSEIS has been revised to provide additional details about the ongoing administrative hearing-related activities.*

B.5.8 Federal and State Agencies

B.5.8.1 Clarification of Other Federal and State Regulations and Practices

Comment: RP024-088

The commenter suggested that the FSEIS include a definition of the term "commenting agency."

Response: *A commenting agency is a public agency with jurisdiction over a particular natural resource, but is neither a lead agency nor a responsible party. The term "commenting agency" has also been used by the NRC and U.S. National Park Service (NPS) at Devils Tower National Monument (Devils Tower or Bear Lodge) to indicate that the NPS at Devils Tower would be notified of the availability of the DSEIS, provided a copy, and provided an opportunity to comment during the public-comment period. Section 1.7.3.2 of the FSEIS has been revised to clarify the role of the NPS as a commenting agency.*

Comment: RP041-015

The commenter stated that the DSEIS did not meet the BLM's requirements for NEPA analysis. The commenter noted that, while the DSEIS contained a purpose and need statement from the BLM, no other mention of the BLM's approval process for the Ross Project is included in the document. Additionally, although Section 1.7.3.1 of the DSEIS says that the NRC coordinated with the BLM, it does not appear to the commenter as though the DSEIS was jointly prepared by both Federal agencies. The commenter also noted that no one from the BLM is listed as a preparer of the SEIS in Section 9 of the DSEIS. The commenter stated that the SEIS would need to comply with CEQ's NEPA regulations if the SEIS is intended to meet the BLM's NEPA requirements. The commenter asked if the SEIS was indeed a joint document and, if not, then what NEPA analysis the BLM would conduct and why the NRC and BLM chose to divide the BLM's analysis from the NRC's analysis, which, the commenter stated, prevented either agency from conducting a true, comprehensive "hard look" of the environmental impacts related to the Ross Project.

Response: *The SEIS has been prepared by the NRC staff with the BLM as a cooperating agency and, as such, BLM staff participation is documented in the Administrative Record and does not need to be documented in the SEIS. The NRC, as the lead agency, has the responsibility to prepare the document to the level of compliance with NEPA that it is required by its policy and guidance. The BLM has regulatory policy and guidance that it must abide by as well. The BLM is aware of the differences between both agencies' requirements and, as a cooperating agency, is working with the NRC staff to ensure that both agencies' requirements* *are met. Prior to the completion of the FSEIS, the BLM will evaluate the document to confirm that the FSEIS meets the BLM's NEPA requirements. If not, then the BLM will use the appropriate NEPA process to tier to and/or supplement the SEIS to address BLM's specific requirements. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-107; RP024-211; RP024-367

The commenter suggested that the NRC staff modify any statement throughout the DSEIS which indicated that, "No radioactive materials would be present at the Ross Project during preconstruction activities." The commenter indicated that all similar statements in DSEIS Sections 2 and 3 should include a discussion of technologically enhanced naturally occurring radioactive material (TENORM) drillhole cuttings as well as muds and fluids associated with well construction and completion activities.

Response: *The NRC staff agrees with the recommendation and has revised FSEIS Section 2.1.1.1 to include a discussion of TENORM drillhole cuttings associated with well-construction and well-completion activities as well as fluids such as drilling muds and waste water. FSEIS Sections 3.13.1 and 3.13.2 were also revised as a result of these comments to achieve more clarity in the respective texts.*

B.5.9 ISR Process Description

B.5.9.1 Wellfields

Comment: RP032-013

The commenter requested addditional information regarding the final areal extent of the installed wellfields.

Response: *The final areal extent of the wellfields cannot exceed the boundary of the exempted aquifer. The individual boundaries of a particular wellfield, and the configuration of injection and recovery wells therein, would be determined by the Applicant after receiving its Source and Byproduct Materials License from the NRC (NRC, 2014b). Based upon a wellfield's unique boundaries, the Applicant would install monitoring wells, and it would then collect post-licensing, pre-operational water-quality data from these monitoring wells. (See NRC's responses to Comment Nos. RP032-003 and RP041-012 for information on the size of the exempted aquifer underlying the Ross Project area and the NRC's responses to Comment Nos. RP032-019 and RP032-031 for information regarding wellfield configurations.) No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-014

The commenter asked for additional information on the total number of wells planned and/or likely to be located within a floodplain.

Response: *The total number of wells expected to be located within a floodplain of the Project area is unknown. However, the floodplain, as shown in SEIS Figure 3.13, would be only a small portion of the total Ross Project area. Consequently, the floodplain itself would be expected to contain only a commensurately small percentage of the recovery, injection, and/or monitoring* *wells proposed for the Project area. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-022

The commenter noted that Figure 2.4 in DSEIS Section 2.1.1 indicates the location of a large number of overlapping wellfield perimeters representing potentially thousands of Underground Injection Control (UIC) Class III Wells within the Ross Project area. The commenter asked that the FSEIS include tables and map(s) showing the number and locations of all prospective UIC Class I or Class III mining wells (or wellfields if the specific well locations are unknown) and the targeted aquifer(s) that would be part of the Lance District development. The commenter requested that the Class III wells or wellfields discussed in the tables or map(s) be classified as currently proposed for the Ross Project, targeted by the Applicant for future development in the Lance District, or other reasonably foreseeable ISR projects in the Lance District. The commenter requested that the FSEIS include a scientifically and technically adequate discussion of the cumulative environmental impacts that the UIC mining wells for uranium extraction could have on the NEPA-defined region of interest surrounding the Ross Project, including the adverse impacts of all other reasonably foreseeable UIC Class III mining wells and UIC Class I disposal well activities in the same NEPA region of interest.

Response: *A map or table showing the location of all UIC Class I and Class III wells proposed to be developed by the Applicant in association with development of the proposed Ross Project and potential future satellite areas within the Lance District cannot be provided in the SEIS as this information is not currently available. Please see the NRC staff's response to Comment RP032-021 for a discussion of the Ross Project UIC Class I wells. The NRC notes that SEIS Figure 2.4 is a map showing the locations of the proposed Ross Project wellfields. Although a similar figure showing the locations of the wellfields within the potential Lance District satellite areas is not available, SEIS Figure 2.2 does show the locations of the potential satellites within which the wellfields would be located.*

SEIS Section 4.5 provides a detailed analysis of the impacts to water quality that could result from the various phases of the Ross Project due to the installation of wellfields. Impacts to surface water due to the discharge of well-drilling fluids from the installation, development, and testing of wells are analyzed in this section. Water-quality and water-quantity impacts on ground water due to wells are discussed in this SEIS section. In addition, the impacts resulting from vegetation and soil disturbance associated with wellfield installation and impacts to wetlands are also discussed in this SEIS Section. Finally, SEIS Section 4.5 provides an analysis of the impacts to water quality due to the plugging and abandoning of wells. SEIS Section 5 provides additional analyses in Sections 5.6 and 5.7 regarding the cumulative impacts to geology and soils as well as water quality due to the wells. Therefore, no changes were made to the SEIS beyond the information provided in this response.

Comment: RP035-022

The commenter referenced a sentence in DSEIS Section 2.1.1.1, "The Applicant proposes that wells configured in a line-drive pattern would likely require increased aquifer restoration efforts; therefore, the Applicant would make limited use of line-drive patterns. Where it is not possible to avoid the use of line-drive patterns, the Applicant would perform additional computer modeling to determine the most efficient well spacing so as to facilitate aquifer restoration." The commenter recommended that the NRC explain how the line-drive well pattern is designed and why aquifer-restoration efforts employing this pattern would enhance mitigation measures.

Response: *A line-drive pattern was described by the Applicant in its ER as the arrangement of injection and recovery wells that would be used on narrow ore bodies within the ore zone. This type of pattern is generally a row that is one or two wells wide, as illustrated in Figure 1.2-11 of the ER (Strata, 2011a). As noted in DSEIS Section 2.1.1.1, a line-drive pattern would likely require increased aquifer-restoration effort; this effort could increase because the liklihood of lixiviant outside the recovery wells could be greater in a line-drive arrangement than with 5-spot or 7-spot patterns. Therefore, the Applicant committed to only limited use of the line-drive pattern. Where it would not be possible to avoid the use of line-drive patterns, the Applicant would perform additional computer modeling to determine the most efficient well spacing so as to facilitate subsequent aquifer restoration. Information about line-drive wellfield patterns' potentially requiring more aquifer-restoration effort compared to other wellfield patterns has been added to Section 2.1.1.1 of the FSEIS.*

B.5.9.2 Uranium-Recovery Operation

Comment: RP024-100

The commenter disagreed with the statement in DSEIS Section 2.1.1, "In situ pressures in ISR injection wells are only slightly above the in situ aquifer pressure." The commenter noted that the license application indicates that the maximum injection pressure would be less than the respective formation's fracture pressure (Strata, 2011b). In addition, the UIC Class III Permit requires that the injection pressure be maintained below the respective formation's fracture pressure.

Response: *The NRC agrees with the commenter's statement. It has revised the text in FSEIS Section 2.1.1, replacing the phrase, "only slightly above the in situ aquifer pressure" with "maintained at less than the fracture pressures of the formations in which ISR is occurring."*

Comment: RP024-112

The commenter suggested that the NRC revise DSEIS Section 2.1.1.1 in order to make clear that the chemical-storage area at the Ross Project would have two distinct sections (one inside the CPP and one outside). The commenter also suggested including a discussion of the primary controls associated with the chemical-storage area.

Response: *The NRC staff does not agree that further clarification is required in SEIS Section 2.1.1.1, as the text is clear regarding division of the chemical-storage area into two sections as well as the primary controls for containment in the event of accidental releases or spills. Section 2.1.1.1 in the SEIS contains the following statement: "The chemical-storage area would be constructed with secondary containment, which would consist of a concrete berm as part of the floor area that would be able to contain at least 110 percent of the volume of the largest tank (Strata, 2011b). The space would be divided into two areas, one inside the CPP and one outside." Thus, the SEIS does explain that there is a supplemental secondary containment that would ensure accidental releases or other spills would be contained and not allowed to spread within the storage area. Moreover, the SEIS explains that, with respect to chemical-storage tanks, each would be clearly labeled to identify the contents. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-012

The commenter stated that the DSEIS provides incomplete and misleading information in DSEIS Section 2.1.1.1, Ross Project Facility, where it is noted that "The excess capacity in the yellowcake production circuit would allow processing of loaded ion-exchange (IX) resin brought to the Ross Project from other ISR or water treatment facilities." The commenter contended that loaded resin brought to the Ross Project's CPP would first originate in the Applicant's own potential satellite areas in the Lance District, and not from other uranium-recovery or water-treatment facilities. Also, the commenter asserted that any excess capacity would likely be allocated, first, to additional uranium-bearing lixiviant arriving by pipeline at the Ross Project's CPP from the Applicant's own contiguous wellfield operations.

Response: *The NRC staff does not agree that the information provided in the DSEIS Section 2.1.1.1, Ross Project Facility, regarding the Applicant's intended use of the excess capacity in the yellowcake-production circuit is incomplete or misleading. The SEIS does discuss clearly the Applicant's proposal to process material from its own potential satellites. For example, it is stated in the SEIS, based upon the Applicant's own ER, that "The Applicant proposes to construct and operate a single facility to serve the Ross Project as well as other potential ISR satellites (i.e., wellfields) within the Lance District. It could also process uranium-loaded resin from other ISR and water-treatment operations, which would be trucked into the facility" (Strata, 2011a). However, the NRC staff has revised the statement in FSEIS Section 2.1.1.1 called out by the commenter, and it now clarifies that the IX resin could come to the Ross Project's CPP from the Applicant's own satellites if any were to be licensed.*

Comment: RP032-026

The commenter indicated that the DSEIS Section 2.1.1.2 stated, "The excess water, referred to as 'production bleed,' is a byproduct material that must be properly managed and disposed. For the Ross Project, the Applicant proposes a production-bleed range from 0.5 percent to 2 percent, and averaging 1.25 percent of the injection volume." The commenter asked that the NRC provide a NEPA-compliant quantification and sensitivity analysis of the environmental consequences in the event the required bleed range to prevent excursions exceeds that proposed by the Applicant by technically plausible margins and/or the average bleed rate exceeds 1.25 percent of the injection volume. The commenter asked for the following information: 1) the maximum observed peak bleed rate and maximum bleed volume for an ISR wellfield to date in the Nebraska-South Dakota-Wyoming Uranium Milling Region (NSDWUMR); 2) the maximum observed average bleed rate and total bleed volume for an ISR wellfield in the NSDWUMR; 3) the proposed and/or estimated total "injection volume" for the Ross Project, and the technically supported range of uncertainty that surrounds this number; 4) the proposed or estimated total injection volume for potential future ISR satellite efforts in the Lance District and a technically supported range of uncertainty that surrounds this number; and 5) a description of the relationship between expected and actual wellfield bleed rates.

In addition, the commenter asked for a discussion on higher than expected bleed rates and the maximum safe capacity of the reverse-osmosis (RO) circuit in the Ross Project CPP, the capacity of planned surface impoundments, the capacity of planned storage impoundments, and the permitted capacities of the UIC Class I deep-injection wells. The commenter asked for the bleed rate and injection volumes at which the capacity of the RO circuit would be exceeded; where excess bleed would be stored until it could be processed in the CPP; and what temporary waste-storage capacity would be available to deal with higher-than-expected bleed production.

Response: *The NRC did not analyze a scenario in which the production bleed exceeded that presented in the Proposed Action. When preparing an SEIS, the NRC staff takes a "hard look" at the environmental impacts of the particular Proposed Action. The "hard look" standard does not, however, require that the Staff address every conceivable environmental impact in an environmental-review document (e.g., this SEIS). For example, the NRC staff need not discuss remote and highly speculative consequences. To the contrary, a "hard look" under NEPA requires only that the NRC staff provide "[a] reasonably thorough discussion of the significant aspects of the probable environmental consequences." Further, analysis of the uncertainty of operating parameters is not required for the SEIS. As the Commission has explained, "NEPA does not call for certainty or precision, but an estimate of anticipated (not unduly speculative) impacts." The proper inquiry under the "hard look" standard is not whether an effect is "theoretically possible," but whether it is "reasonably probable that the situation will occur."*

The requests by the commenter for: 1) expected and observed or actual maximum and average bleed rates and volumes; and 2) a description of the relationship between expected and actual wellfield bleed rates associated with licensed ISR wellfields within the NSDWUMR are outside the scope of this Ross Project SEIS.

As provided in FSEIS Figures 4.2 and 4.3, the anticipated injection rates would range from 18,500 – 28,300 L/min [4,900 – 7,460 gal/min] with a typical rate of 28,030 L/min [7,406 gal/min]. NRC staff's impact analysis does not require the total injection volume. As presented in SEIS Section 4.5.1, the impacts to water quantity were determined by the results projected from the ground-water drawdown model which was based upon the estimated withdrawal rates and bleed percentages. The Applicant's license application, the pumping tests, and the hydrologic model support the principle that the hydraulic properties at the Ross Project area are amenable to the injection, withdrawal, and bleed rates within the range of parameters proposed by the Applicant (Strata, 2011b). The hydrologic tests required for the hydrologic-test data package which would be in turn required by License Condition No. 10.13 would refine and optimize the bleed rates within the proposed range (0.5 to 2 percent) for each proposed wellfield (NRC, 2014b).

Information on injection rates and the range of uncertainty that could be proposed for potential satellite areas in the Lance District is not available. Please see the NRC's responses to Comment Nos. RP032-002, RP032-067, and RP041-009, which describe the environmental review process that the NRC staff would follow if Strata were to submit a license amendment application to the NRC to expand its operation into any of the Lance District satellite areas.

A discussion of higher than expected bleed rates that is requested by the commenter is outside the scope of this SEIS. As described in the first paragraph of this response, NEPA does not require analysis of the uncertainty of operating parameters but only the analysis of reasonably probable situations. Responding to the request for the maximum safe operating capacity of the RO circuit proposed for the Ross Project CPP is also outside the scope of this SEIS. As described in Sections 4.5.1.2 and 4.5.1.3, the capacity of the proposed CPP would be adequate to support the anticipated production of water recovered from the Project wellfields. In response to Comment No. RP035-006, supplemental figures that depict the Project's water balances (i.e., the rates of injection, recovery, bleed, and disposal) produced during different Project processing phases have been added to the FSEIS Section 4.5.1 (i.e., Figures 4.2, 4.3, and 4.4). The rate of water recovery from the wellfields would depend upon the rate of injection, which is a variable that can be controlled by operations.

The bleed-water volume would be stored in the surface impoundments described in SEIS Sections 2.1.1.1, 4.4.1.2, and 4.5.1.2. The surface impoundments would provide reserve capacity in the event that unforeseen operating conditions generate more than anticipated liquid byproduct material. Condition No. 10.8 in the Draft Source and Byproduct Materials License for the Ross Project indicates that the surface impoundments be used as described by the Applicant in its license application (NRC, 2014b). This License Condition would limit the operating capacity of each impoundment to be one-third to one-half of the total capacity in order to preserve reserve capacity at all times (Strata, 2011b). The capacity of the UIC Class I deep-injection wells is discussed in the response to Comment Nos. RP017-011 and RP032-055. Storage tanks would provide storage at the location of the deep-injection wells. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP032-027

The commenter referenced DSEIS Section 2.1.1.2 statement, "The Applicant proposes a maximum injection pressure ... less than the pressure rating for operation of the pipes and other equipment (Strata, 2011b)." The commenter requested information on the pressure rating for the operation of the pipelines and other equipment to be used in the injection and recovery circuits of the Ross Project and the potential future uranium-recovery satellite areas in the Lance District. In addition, the commenter noted the statement in DSEIS Section 2.1.1.2, "... pressure requirements within a specific wellfield generally tend to increase with time." The commenter asked for a discussion of the following: 1) wellfield injection-pressure requirements over time, including the range of expected and maximum plausible values for minimum, maximum, and average wellfield-injection pressure over the life of the wellfield, and 2) the relationship, if any, between injection pressure, wellfield pressure, wellfield balance, and the likelihood of excursions. The commenter asked if the likelihood of excursions increases with greater injection pressures and if the available regulatory record of excursions at uranium-recovery facilities shows any correlation between injection pressure and the likelihood of excursions.

Response: *The pressure rating for the pipes and other equipment used in the injection and recovery circuits requested by the commenter is not available nor is that information necessary for the respective impact assessment in the SEIS. The important point is that the Applicant commits to maximum injection pressures that are less than the pressure ratings of the pipes and associated equipment, which ensures the integrity of the pipes and equipment. In addition, the maximum injection pressures would be less than the pressures necessary to cause fractures in the confining layers of rock. As described in SEIS Section 2.1.1, the Wyoming Department of Environmental Quality (WDEQ) Permit to Mine includes approval for the Applicant to operate the UIC Class III injection wells associated with uranium recovery. The WDEQ Permit to Mine imposes standards on the pressures in the Class III wells in a wellfield per Wyoming's* Rules and Regulations*, Chapter 11, "In-Situ Mining" (WDEQ/LQD, 2005). The approved WDEQ Permit to Mine would include maximum and average injection volumes and/or pressures necessary to ensure that fractures are not initiated in the confining zone, that injected fluids do not migrate into any unauthorized zone, and that formation fluids are not displaced into any unauthorized zone.*

Operating requirements of the WDEQ Permit to Mine specifies that, at a minimum, the fluid and fracture pressures of the production zone be calculated to ensure that the pressure in the production zone during injection does not initiate new fractures or propagate existing fractures. The WDEQ/LQD Rules Chapter 11, <u>NonCoal In Situ Mining</u> *Section 11, specifies that "In no* *case will injection pressure initiate fractures in the confining zone, if confinement is present, or cause the migration of injection or formation fluids into an unauthorized zone." Although pressures could increase over time, pressures would not exceed the maximum allowable injection pressures. Condition No. 10.14 of the Draft Source and Byproduct Materials License for the Ross Project indicates that during wellfield operations, injection pressures are not to exceed the maximum operating pressures as specified in the Applicant's license application (NRC, 2014b). Information has been added to FSEIS Section 2.1.1 to explicitly describe the requirements within the WDEQ's Permit to Mine and the specifications in Draft License Condition No. 10.14 that pertain to injection pressures.*

NRC was unable to locate information on the relationship of injection pressures and excursions. However, the NRC does not agree that there is a relationship between injection pressures and excursions. Within an aquifer with porosity and permeability sufficient for the ISR process, injection pressures would dissipate within a short distance from the injection well; whereas, excursions are influenced by ground-water flow patterns at the perimeter of the wellfields.

Information on the pressure ratings of the pipes and equipment that could be proposed for potential satellite areas in the Lance District is not available. Please see the NRC's responses to Comment Nos. RP032-002, RP032-067, and RP041-009, which describe the environmental-review process that the NRC staff would follow if Strata were to submit a license-amendment application to the Commission to expand its operation into any of the Lance District satellite areas.

Comment: RP032-028

The commenter referenced DSEIS Section 2.1.1.2 statement, "The Applicant suggests that, in order to maintain flow rates and wellfield balance, some wellfields would require flexibility in their allowable injection pressure." The commenter requested information on the following: 1) The practical meaning of the phrase "flexibility in their allowable injection pressure." 2) The methodology through which "flexibility" would be provided. 3) The purpose of the NRC's allowing flexibility. The commenter asked if the flexibility would permit the Applicant's proposed maximum injection pressure to be exceeded and, if so, by how much and for how long. Similarly, the commenter asked if the likelihood and/or potential severity of leaks would be increased.

Response: *As described in the NRC staff's response to Comment No. RP032-027, the maximum allowable injection pressure is the limit that would be specified in the Source and Byproduct Materials License for the Ross Project as well as in the WDEQ's Permit to Mine. This maximum injection pressure cannot be exceeded if the Applicant is to remain in compliance with the License. Such compliance would be monitored by the requirement that injection pressures and flow rates be measured and recorded daily by the inline computer system and/or by a wellfield operator according to Condition No. 10.14 in the Ross Project's Draft License. In the context of the subject statement, "flexibility" refers to the Applicant's using less pressure in wellfields that are of lesser depth, as stated in SEIS Section 2.1.1.2. The purpose of NRC allowing flexibility would be to allow the Applicant to operate in the most efficient manner. In no case would such flexibility allow the Applicant's licensed maximum injection pressure to be exceeded. As described in the response to Comment No. RP032-027, there is no relationship between injection at pressures below the maximum allowed and leaks and excursions. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-035

The commenter noted that DSEIS Section 2.1.1.2 states, "The Applicant estimates that 0.1 – 2 kg [~ 2 – 4 lb] of V_20_5 would be produced for every 1 kg [~ 2 lb] of U_30_8." The commenter then asked what accounts for the variability in the estimated yield of co-produced vanadium?

Response: *The concentrations of metals within a given ore varies naturally, as determined by the geologic processes that formed the ore (Rose et al., 1979). No changes were made to the SEIS beyond the information provided in this response.*

B.5.9.3 Decommissioning

Comment: RP024-105

The commenter referred to the statements in DSEIS Section 2.1.1:

> In Section 2 of the GEIS, the four stages in the life of an ISR facility are described: 1) construction, 2) operation, 3) aquifer restoration, and 4) decommissioning (NRC, 2009). The decommissioning phase would include facility decontamination, dismantling, demolition, and disposal as well as site reclamation and restoration. Although NRC recognizes that these four phases could be performed concurrently, and in practice early wellfields would undergo aquifer restoration while other wellfields are being installed, the GEIS determined that describing the ISR process in terms of these stages aids in the discussion of the ISR process and in the evaluation of potential environmental impacts from an ISR facility.

Based upon the subject statements in DSEIS Section 2.1.1, the commenter stated that the NRC's description of "decommissioning" was inconsistent with its application of 10 CFR Part 40.42, "Timeliness in Decommissioning" regulation to uranium-recovery wellfields. The commenter noted that nowhere in the DSEIS's description did it reference ground-water restoration, aquifer-stabilization monitoring, and wellfield decommissioning, but rather the SEIS merely stated "facility" decommissioning. The commenter suggested that some uranium-recovery facilities decommission wellfields after aquifer restoration has been completed, and some after all facility operations are completed. Therefore, this regulation would apply to uranium-recovery wellfields and the FSEIS's description should reflect that fact.

Response: *According to the Commission decision regarding Hydro Resources, Inc. (NRC, 2000b), NRC staff is required to review a decommissioning plan prior to issuing a license. NUREG–1569 contains NRC staff guidance for reviewing decommissioning plans (NRC, 2003a). NRC addresses the decommissioning/restoration activities to be included in the application including ground-water restoration, soils reclamation, building decommissioning, and post-decommissioning surveys. Therefore, the intent of the aforementioned Commission decision and NUREG–1569 is to review a decommissioning plan that addressed full facility build-out for the life of the facility.*

Unlike other facilities, the precise as-built conditions are unknown prior to operations because continued exploration may result in alterations to proposed wellfields. Such alterations affect the required wellfield infrastructure. Therefore, a more detailed decommissioning plan would be required 12 months prior to decommissioning a facility or a portion thereof. This plan would comply with 10 CFR 40.42. With respect to schedule and in accordance with 10 CFR 40.42, the *licensee would be required to complete site decommissioning within two years after approval of the DP or as otherwise specified in the Plan.*

As stated in generic letters to licensees dated July 7, 2008 (e.g., NRC, 2008 [ADAMS Accession No. ML081480293]), the timeliness and decommissioning regulations apply to ISRs and under provisions of 10 CFR 40.42(d) for separate outdoor areas, the subsurface ground water restoration of individual wellfields is interpreted as decommissioning; therefore, alternate schedules must be submitted if ground water restoration/decommissioning of the wellfield would require more than two years.

Ground-water restoration of the wellfield aquifer is separate from the decommissioning/reclamation of the surface features at a wellfield including the abandonment of all wells. A licensee is required to receive NRC approval of the wellfield restoration prior to performing decommissioning/reclamation of the surface features. SEIS references to "facility" decommissioning include wellfield decommissioning. Ground-water restoration is discussed in SEIS Sections 2.1.1.3 and 4.5.1.3. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP024-488

The commenter noted that Condition No. 10.3 of the Draft Source and Byproduct Materials License requires the Applicant to submit a detailed Decommissioning Plan (DP) for NRC staff review and approval at least 12 months prior to initiation of any planned final Ross Project decommissioning (NRC, 2014b). For consistency, the commenter suggested that DSEIS Section 4.6.1.4 be revised to reflect this requirement.

Response: *Although the NRC staff acknowledges the commenter is correct that Condition No. 10.3 in the Draft License (NRC, 2014b) indicates that the Applicant would submit a detailed DP for NRC staff review and approval at least 12 months prior to initiation of any final Ross Project decommissioning, the NRC staff does not find that this information regarding the timing of the DP is particularly relevant to the discussion in SEIS Section 4.6.1.4. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP032-045; RP032-046; RP032-047; RP032-048

The commenter provided several closely related comments:

1) The commenter noted that DSEIS Section 2.1.1.4 stated, "Prior to the Ross Project's facility decontamination, dismantling, and decommissioning, and the Project site's reclamation and restoration, appropriate cleanup criteria for surfaces would need to be established in concert with NRC requirements, and a Ross Project-specific decommissioning plan would need to be accepted by the NRC." The commenter asked what the current NRC requirements are for "appropriate cleanup criteria for surfaces" of uranium-recovery facilities during decommissioning, and the commenter further asked when and how the criteria required for cleanup of surfaces at the Ross Project facility would be determined.

2) The commenter also asked that the NRC provide the earliest and latest dates at which facility decontamination, dismantling, and decommissioning could reasonably be expected to occur based upon the current plans of the Applicant. In particular, the commenter requested

clarification on the timing of the Applicant's submittal of a DP as well as the timing of the NRC's approval of that DP.

3) The commenter also asked if the "Ross Project facility" named above is the same as the "Lance Projects Central Processing Plant (CPP)," described by the Applicant's (i.e., Strata Energy, Inc.'s) parent company, Peninsula Energy, Ltd., in releases to the global investing community. If so, the commenter asked why the CPP is referred to by a different name in the DSEIS.

4) Additionally, the commenter requested a table showing the expected levels of radioactive and chemical contamination before and after decontamination of a typical uranium-recovery facility similar in size to the Ross Project CPP. If the data requested are time dependent, the commenter asked that the NRC indicate how the contamination levels pre- and post-decontamination could vary with a plant's operating history. Finally, the commenter asked what would happen if a contaminated area of the Ross Project could not economically meet the cleanup criteria established in the DP.

Response: *1) As stated in SEIS Section 4.13.1.4, the protection of workers and the public would be ensured through the NRC's approval of a DP and/or a Restoration Action Plan (RAP) as well as through its verification that radiation doses that result from exposures during decommissioning would comply with the NRC's 10 CFR Part 20 limits. The Ross Project area could be released for unrestricted use in conformance with the related conditions of the Source and Byproduct Materials License and the dose criteria for unrestricted release in 10 CFR Part 40, Appendix A. The criteria in 10 CFR Part 40, Appendix A, limit the dose from radiological contamination that may exist at the Ross Project, after decommissioning is complete, to levels that are sufficiently low to protect public health and safety.*

2) License Condition No. 10.3 of the Draft License indicates that the Applicant submit a detailed DP to the NRC staff for review and approval at least 12 months prior to initiation of any final Ross Project decontamination, dismantling, and/or decommissioning of Project areas and structures. A Draft RAP for the Project area was submitted by the Applicant in its Technical Report *(TR) (see Addendum 6.1-A in Strata, 2011b). The DP would represent the as-built conditions at the Ross Project. The primary steps involved in decommissioning an ISR facility are discussed in Section 2.6 of the GEIS.*

As shown in SEIS Figure 2.6, the Applicant has estimated that the decommissioning of the Ross Project could begin between four and six years after regulatory approval of the Ross Project, if the Ross Project were not expanded into the Lance District. If the Ross Project were to be expanded into the Lance District through future license amendments, then, as shown in SEIS Figure 2.6, the Applicant has estimated that decommissioning of the facility components (e.g., CPP, surface impoundments, and so forth) could begin between six and eight years after regulatory approval of the Ross Project. As stated in the GEIS, Section 2.6, unless otherwise acknowledged by the NRC, licensees are required under 10 CFR Part 40.42 to complete decommissioning within two years from the time the DP has been approved.

3) The Ross Project facility or CPP is the same facility the commenter refers to as the Lance Project CPP. The term "Ross Project facility" is used in this SEIS because the license application that was submitted to the NRC, and the Proposed Action discussed in this SEIS, is for the NRC to authorize the Applicant to construct and operate an uranium-recovery facility and *wellfields at the Ross Project area. The term "Ross Project facility" is consistent with the license application, the NRC staff's SER, and the Draft License (NRC, 2014a; NRC, 2014b).*

4) SEIS Section 4.13.1 discusses the radiological and nonradiological impacts during Ross Project throughout its lifecycle. As stated in SEIS Section 4.13.1.2, GEIS Sections 4.4.11.2.1 and 4.4.11.2.4 presented historical data for ISR facilities, and the GEIS was used in the development of this SEIS. This SEIS has concluded in Section 4.13.1.2 that the potential radiation doses to occupationally exposed workers and members of the public during normal operations would be SMALL. Calculated radiation doses from the releases of radioactive materials to the environment from the Ross Project are very small fractions of the limits in 10 CFR Part 20, which have been established by the NRC for the protection of public health and safety. In addition, the Applicant is required to implement an NRC-approved radiation protection program to protect occupational workers and ensure that radiological doses are as low as reasonably achievable (ALARA). The Applicant's proposed radiation protection program would include implementation of management controls, engineering controls, radiation-safety training, radon monitoring and sampling, and audit programs. The types and quantities of chemicals (hazardous and nonhazardous) proposed for use at the Ross Project would be consistent with those evaluated in the GEIS. In addition, the Applicant proposed to implement the occupational health and safety protection plans presented for typical ISR facilities in the GEIS and to comply with the requirements of regulations governing the use and storage of chemicals. Therefore, the NRC staff concluded that the nonradiological impacts to public and occupational health and safety during normal operations of the Proposed Action would be SMALL. The NRC's response to Comment No. RP032-051 contains additional information regarding radiation-dose limits.

The NRC staff has revised the FSEIS text to elaborate and confirm that appropriate cleanup criteria would be identified as applicable in the Applicant's DP and that the DP would be required of the Applicant if the Ross Project were to be licensed by the NRC. In addition, FSEIS Section 4.13.1.4 now notes that any area, item, or surface that cannot be economically decontaminated, where "economically decontaminated" would be defined by the Applicant, would be shipped to a properly licensed radioactive-waste disposal facility.

Comment: RP032-051

The commenter requested additional information on how an evaluation of potentially contaminated soils would be conducted as part of decommissioning. Specifically, the commenter:

1) Asked whether the soils beneath the surface impoundments would be examined for chemical contamination.

2) Asked if the mud pits would be subject to the same radiation surveys performed on buildings, structures, and equipment, and asked whether mud-pit areas that met cleanup criteria would be suitable for reseeding and livestock grazing.

3) Requested the specific criteria that would be applied to determine the choice between "disposed of appropriately" and "released for unrestricted use."

4) Inquired as to the total hectares [acres] of mud pits and associated land that would be examined for radioactive and/or chemical contamination as well as a description of the size of

the area around and down gradient from the mud pits that would be examined for contamination.

5) Asked that information on the size of potentially impacted soils as a result the Applicant's use of mud pits be provided for the potential satellite areas in the Lance District.

6) Asked for a characterization of any potential risks to livestock, wildlife, food chains, surface water or shallow ground water due to the Applicant's use of mud pits, which would be left in place because they cannot economically be remediated to meet cleanup criteria.

Response:

1) The U.S. Environmental Protection Agency (EPA) regulates most types of hazardous-chemical contamination and/or hazardous wastes. During decommissioning, soil samples could be tested for hazardous constituents, based upon EPA regulations at 40 CFR Part 262, if any EPA-regulated hazardous constituents had been managed in the surface impoundments (i.e., passed through, accumulated in, or stored in).

2). The Applicant would conduct radiation surveys of the onsite mud pits using the same standard, contemporary radiation-survey methods as would be used to survey buildings, structures, and equipment at the Project site. The NRC-approved DP will include the specific details required to effectively decontaminate, dismantle, and decommission the Ross Project, such as survey procedures, sampling locations, analytical parameters, applicable cleanup criteria, and expected waste management techniques (i.e., decontamination of surfaces when possible and/or disposal at an identified disposal facility that is licensed or permitted to accept such wastes).

The Applicant would dismantle, decontaminate, and decommission the Ross Project area so that it can be released without restrictions (i.e., "unrestricted release). Unrestricted release would mean that any land use could be employed at the Project area, including the landowner's reseeding as well as livestock and wildlife grazing.

3) 10 CFR Part 20, Subpart E, 40.36, and 40.42 contain the NRC's basic requirements for decommissioning. The phrases "unrestricted release" and "disposed of appropriately" are not mutually exclusive; they go hand in hand. A site may be released for unrestricted use when survey and/or sample results show that all surfaces, equipment, structures, and environmental media that are to remain at the site are below the applicable cleanup criteria, such as those limits (i.e., radiation doses) specified in 10 CFR Part 20 and other NRC guidance and all articles, surfaces, structures, and/or media that cannot be released without restriction are disposed of appropriately in a licensed disposal facility.

4) The total area to be surveyed by the Applicant upon its entering the decommissioning phase would be identified and discussed in its proposed DP, which would be required to be submitted to the NRC one year before decommissioning commences (NRC, 2014b, License Condition No. 10.3). Thus, detailed information regarding the areal extent subject to surveying and decommissioning activities at each mud pit is not available at this time. However, as stated in GEIS Section 4.4.3.4, any areas potentially impacted by operations would be included in surveys to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6-(6) (NRC, 2009b). The EPA issues the regulations that govern the material disposed of in the mud pits, *which is called TENORM; these regulations can be found at 40 CFR Part 192. In addition, the dried pits would be reclaimed and restored by grading and reseeding according to WDEQ/LQD requirements usually within one construction season, as discussed in FSEIS 2.1.1.5, Liquid Effluents.*

5) Specific information regarding the areal extent subject to decontamination and decommissioning activities in the Lance District's potential satellite areas is not available and is outside the scope of this SEIS. However, as with the Ross Project, any areas potentially impacted by operations of future Lance District satellites would be included in decommissioning surveys for the satellite facilities to ensure all areas of elevated soil concentrations are identified and properly cleaned up to comply with NRC regulations at 10 CFR Part 40, Appendix A, Criterion 6-(6) (NRC, 2009a).

6) License Condition 9.5 would require that the Applicant maintain an NRC-approved financial surety arrangement, consistent with 10 CFR 40, Appendix A, Criterion 9, adequate to cover the estimated costs for decommissioning and decontamination, if accomplished by a third party, which includes offsite disposal of radioactive solid process or evaporation pond residues, and ground-water restoration. The surety shall also include the costs associated with all soil and water sampling analyses necessary to confirm the completion of decontamination. FSEIS Sections 2.1.1.4, 2.1.1.5, 3.13.1, and 4.14.1 have been revised to provide more clarity on the decommissioning process, including the management of the mud pits, the procedures for surveys, sampling and analysis protocols, types of wastes, the management of the wastes (e.g., radioactive, hazardous, construction, and other commonly generated wastes such as domestic wastes).

B.5.9.4 Restoration Action Plan

Comment: RP024-210

The commenter requested that the Applicant's RAP be included wherever decommissioning plans are discussed, for example, in DSEIS Section 2.1.1.7.

Response: *The NRC has revised the text of the FSEIS throughout to include references to both a DP and the RAP, including a reference to Addendum 6.1-A of the TR (Strata, 2011b), when one or the other are mentioned.*

B.5.9.5 Monitoring

Comment: RP024-132

The commenter pointed out that DSEIS Section 2.1.1.1 incorrectly stated that the monitoring-well ring around the perimeter of each wellfield would be used to detect "horizontal and vertical excursions." The commenter emphasized that the monitoring wells that would installed in the underlying and overlying aquifers would be used to detect vertical excursions, while the perimeter monitoring-well ring would be used to detect horizontal excursions.

Response: *The NRC staff has revised FSEIS Section 2.1.1.1 as suggested by the commenter. The FSEIS Section 2.1.1.1 text has been clarified; it now states that the Applicant would install a monitoring-well ring around the perimeter of each wellfield for the detection of horizontal* *excursions and that monitoring wells completed in the underlying and overlying aquifers would be used to detect vertical excursions.*

Comment: RP024-134

The commenter noted that the statement in DSEIS Section 2.1.1.1, "During uranium-recovery wellfield operation, the Applicant would sample ground water from the wells and compare the analytical values to the NRC-specified baseline constituent concentrations to determine whether an excursion…," is inconsistent with the license application and the Draft Source and Byproduct Materials License (NRC, 2014b). The commenter suggested that the statement be revised to read "compare the analytical values to the respective UCLs [upper control limits]…" so that it is consistent with Condition No. 11.3 of the Draft License.

Response: *The text in Section 2.1.1.1 of the FSEIS has been revised as suggested by the commenter; the text now reads: "The Applicant would compare the analytical ground-water data with the UCLs to determine whether an excursion has occurred."*

Comments: RP024-133; RP024-135; RP024-338

The commenter suggested that the NRC staff make clear in FSEIS Section 2.1.1.1 that pre-licensing, site-characterization data were collected in accordance with the NRC's guidance found in Chapter 2 of NUREG–1569 (as opposed to Chapter 5 of NUREG–1569, which includes guidance on post-licensing, pre-operational baseline data collection).

Response: *The NRC staff agrees that the FSEIS should clarify that pre-licensing, site-characterization data collection has already been performed by the Applicant. The data that were accrued by the analyses of site-characterization samples are presented in SEIS Section 3, "Affected Environment," predominantly in SEIS Sections 3.3, 3.4, and 3.5 ("Geology and Soils," "Water Resources," and "Air Quality," respectively). During its preparation of the SEIS, the NRC staff also focused its evaluation on the pre-licensing, site-characterization data using the guidance provided in NUREG–1748 for environmental-review documents (NRC, 2003b). The NRC also agrees that the FSEIS should clarify that post-licensing, pre-operational data that would be intended to satisfy the requirements of 10 CFR Part 40, Appendix A, have not yet been collected. As a result of this comment, the NRC staff has made that clarification throughout this Appendix B as well as the FSEIS where appropriate.*

Comment: RP024-142

The commenter referred to the text box located in DSEIS Section 2.1.1.1 entitled "What are underground injection control permits?" The commenter asked that the information included in this text box be revised to also include the fact that monitoring and recovery wells would be regulated by Wyoming through WDEQ's Water Quality Division (WQD) *and* its Land Quality Division (LQD). The two WDEQ Divisions cooperate through an MOU that facilitates uranium-recovery oversight by the WDEQ.

Response: *The NRC agrees with the commenter that this information should be included in the subject text box to more fully describe the WDEQ's permitting arrangements. The text box has been revised in FSEIS Section 2.1.1.1; it now reads: "The corresponding monitoring and recovery wells are regulated through the WDEQ by both its Water Quality Division (WQD) and*

Land Quality Division (LQD), which cooperate through a Memorandum of Understanding (MOU) which facilitates in situ uranium-recovery oversight by the WDEQ/LQD."

Comment: RP024-443

The commenter disagreed with the statement in DSEIS Section 4.5.1.2, "The NRC would require an early-warning system of pressure transducers to detect anomalous hydrostatic pressure increases in the perimeter monitoring wells." The commenter requested that this statement be revised for consistency with the license application, where the Applicant commits to measuring water levels in monitoring wells during its semi-monthly sampling campaigns. The commenter highlighted that the Source and Byproduct Materials License would not require pressure transducers to be installed in wells.

Response: *The NRC staff has revised the text in FSEIS Section 4.5.1.2 as the commenter suggested. The statement quoted by the commenter has been replaced with "In addition to sampling the monitoring wells for water-quality parameters, the Applicant commits to measuring water levels during the semi-monthly sampling to detect anomalous hydrostatic pressure increases, which might signal an operational upset (Strata, 2011b)."*

Comment: RP032-016

The commenter referenced the statement in DSEIS Section 2.1.1.1, "After initial testing by the Applicant, the well would be retested at five year intervals," which refers to the mechanical integrity testing (MIT) that would be required of the Applicant. The commenter asked what assurance would be derived from the five-year retesting interval, given that the operating lifetime of the average ISR injection or recovery well is considerably less than five years. The commenter asked that data on the number of wells, as a percentage of the total licensed and operated for in situ injection or recovery in the NSDWUMR region or in Wyoming, that have been retested for mechanical integrity prior to well plugging and abandonment be supplied.

Response: *The data requested by the commenter on retesting of injection and recovery wells in either the NSDWUMR region or in Wyoming for mechanical integrity are not available; the collection of such data by the NRC staff is beyond the scope of this SEIS. The five-year retesting timeframe was established by the EPA in its UIC Program, which is administrated by the WDEQ in Wyoming.*

The MIT committed to by the Applicant in its license application was described in SEIS Section 2.1.1.1. In addition, Condition No. 10.4 of the Draft License would require the Applicant to develop and implement written standard operating procedures (SOPs) prior to the Ross Project's operation for construction and installation activities (NRC, 2014b), including MIT of pipelines prior to their burial to ensure mechanical integrity. During the time between the initial MIT of wells and the retesting in five years, the requirement for regular ground-water sampling of monitoring wells as well as the commitment by the Applicant in its license application to measure water levels in monitoring wells would both ensure that a breach of integrity in a well structure or pipeline would be detected.

Further, as described in SEIS Section 2.1.1.2, daily measurements of the injection pressures and the lixiviant flow rates of the injection wells would detect leaks in a well or pipeline between MIT. License Condition No. 10.14 would also require weekly inspections of wellfield pipelines, wellheads, and module buildings in accordance with those approved by the NRC; additionally

License Condition No. 11.1(B) would require that the results of the daily pressure and flow-rate monitoring activities be submitted quarterly or made available for inspection upon request. NRC staff would verify that the MIT procedures are appropriate and that the testing has been performed as described in the Applicant's SOPs during a pre-operational inspection. In addition, NRC staff would review MIT testing records and other compliance issues during routine annual or semi-annual inspections. As part of an NRC staff review of environmental impacts to ground water at previously licensed ISR projects, it was determined that a small percentage of the wells tested failed and, with one exception, the data from the respective project's ground-water monitoring did not identify any impact attributable to well failure (NRC, 2009d). See also Comment Nos. RP024-443, RP032-036, RP032-037, RP032-041, and RP032-042 for information related to ground-water and water-level monitoring. The NRC has revised the FSEIS by discussing Condition No. 10.14 of the Draft License in FSEIS Section 2.1.1.1 and discussing the NRC staff's review of environmental impacts to the ground water at previously licensed ISR projects in FSEIS Section 4.5.1.3.

Comment: RP032-017

The commenter referenced the statement in DSEIS Section 2.1.1.1, "The Applicant would test for leaks with fresh water on the pipelines prior to their burial, in order to ensure the pipelines' mechanical integrity." The commenter requested additional information on: 1) the specific standards, approved test protocols, and hardware inspections that the NRC generally requires and specifically intends to apply to the Ross Project and the potential satellite areas in the Lance District in order to ensure the mechanical integrity of buried pipelines; 2) the leak-detection and warning systems that the NRC would require to ensure that the Applicant promptly addresses leaks and spills; and 3) the NRC verification techniques and protocols that would evaluate a licensee's compliance with buried pipeline-integrity requirements.

Response: *According to License Condition No. 10.5 of the Draft Source and Byproduct Materials License for the Ross Project (NRC, 2014b), the MIT of wells and pipelines in Ross Project wellfields would be conducted in accordance with the Applicant's SOPs, which are reflected in the commitments in Strata's license application. SEIS Section 2.1.1.1 includes the text box, "What is mechanical-integrity testing (MIT)?" which provides the quantitative requirements for MIT, as described in the GEIS. In addition, SEIS Section 2.1.1.1 references the Applicant's license application, which provides details of the MIT that would be conducted. The Applicant's commitment to conducting MIT conforms to the procedure described the GEIS and required by the WDEQ (NRC, 2009b). The well-integrity information obtained by MIT would be documented and filed onsite, and the information would be provided to the WDEQ on a quarterly basis. The NRC would also review this documentation during facility inspections.*

SEIS Section 4.5.1.2 describes the leak- and spill-detection features that would reduce the likelihood and magnitude of pipeline leaks. License Condition No. 10.4 would require that the licensee develop and implement written SOPs prior to operation for all routine operational activities involving radioactive materials, and would require daily measurement of injection pressures and flow rates as well as weekly inspections of wellfield piping, wellheads, and module buildings to detect leaks and spills. Leak-detection devices would be installed in manholes along the pipelines. Further, the Applicant would monitor recovery and injection pipelines and immediately shut down the respective pumps if a leak or spill were to be detected (Strata, 2011b). The CPP would include a control room where a master-control system would allow remote monitoring and control of each wellfield engaged in uranium recovery. Operators would be located in the control room 24 hours a day and would use a computer-based station to *command the master-control system. In addition, related information on the schedule for MIT and water-level monitoring to ensure well and pipeline integrity between MIT is discussed in the NRC staff's related response to Comment No. RP032-016. The same requirements for MIT would be required in any license amendments for the potential satellite areas in the Lance District. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-030

The commenter referenced the statement in DSEIS Section 2.1.1.2, "The monitoring of water levels that would be performed would serve to avert a potential excursion." The commenter then asked: 1) Which specific "water levels" would be monitored, how would they be monitored, and where would they be monitored? 2) How does the NRC infer from water levels, scientifically, that an excursion is about to occur as opposed to its detecting an excursion which is already in progress? 3) What has been the record at uranium-recovery facilities of licensees using such water-level measurements to avert excursions from occurring? 4) How many excursions that were later confirmed to have occurred were correctly forecast by such water-level measurements, and why did such water-level measurements fail to avert them?

Response: *1) The statement referenced by the commenter refers specifically to water levels in the perimeter monitoring wells. The Applicant has committed to measuring water levels in all monitoring wells semi-monthly, as discussed in the NRC staff's responses to Comment Nos. RP024-443, RP032-019, and RP032-031 (i.e., the frequency of water-level measurements). The method of water-level measurement is not specified because the method for water-level measurements is simply and straightforwardly the distance from the ground's surface to the top of the water contained within a monitoring well.*

2) Water-level data from the semi-monthly measurements of the monitoring wells' water levels would indicate hydrologic imbalances in a wellfield, if imbalances were to occur. Hydrological imbalances can lead to excursions. Operational adjustments by the Applicant, such as changing flow rates of injection and recovery wells or shutting down individual injection wells, could correct hydrologic imbalances and might serve to recover an excursion before it would be detected by water-quality monitoring.

In addition, water-level measurements in perimeter monitoring wells are essential for the Applicant to document the "net inward gradient" during uranium-recovery operation throughout a given wellfield's operation and restoration (until the Applicant initiates the ground-water-stabilization period); this net inward gradient would be required by the Source and Byproduct Materials License for the Ross Project. (See also Comment Nos. RP032-036, RP032-037, RP032-041, and RP032-042 for information related to ground-water monitoring requirements found in the Draft License.) As described in SEIS Section 2.1.1.2, the Applicant's monitoring of perimeter wells' water levels would ensure that a net inward hydraulic gradient is maintained in a given wellfield. A constant inward gradient would serve to reduce the potential of an excursion. FSEIS Section 2.1.1.2 has been revised to replace the phrase "serve to avert" with "reduce the potential" in the statement that was the subject of this comment.

3 and 4) Specific analyses regarding the success of water-level measurements in forecasting excursions at other uranium-recovery facilities, as requested by the commenter, is not available. Similarly, no data are available regarding the success or failure of water-level information with respect to actual excursions. However, the NRC believes that monitoring-well water levels are an effective tool to reduce the potential for excursions because water levels reflect ground-water *flow directions and excursions occur when the ground-water flow is directed outside of a wellfield.*

Comment: RP032-053

The commenter inquired about how the Applicant's compliance with "local, State, and Federal requirements related to air quality as well as occupational health and safety" would be ascertained. The commenter also requested information regarding other ISR facilities and their respective compliance with radon-related requirements such as effluent monitoring, ventilation, and personnel protection.

Response: *If the Ross Project were to be licensed, the NRC staff would inspect the Project as would be specified in the Source and Byproduct Materials License that the Applicant would be issued. These inspections would specifically evaluate compliance with all effluent limits and radiation-dose standards, including those pertaining to air emissions and direct radiation, with which Strata would be required to comply. Wyoming (i.e., the WDEQ/Air Quality Division [AQD]) would also perform inspections and audits related to the Air Quality Permit that the agency has already issued to the Applicant for the Ross Project (see the WDEQ/AQD's "Permit to Construct, Air Quality Permit No. 12198") (WDEQ/AQD, 2011). Because the Ross Project has not yet received a license from the NRC, the NRC has no compliance data available for the Project itself. Compliance at other ISR facilities, operations, or projects are not within the scope of this SEIS, which addresses only the potential environmental impacts of the Ross Project. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP032-071; RP032-077; RP035-035

The commenters recommended that the NRC staff include a map that clearly depicts the locations of the 29 water-supply wells within the Ross Project area and the surrounding 2-km (1-mi) area.

Response: *As discussed in FSEIS Sections 3.5.3, 3.12.1, and 6.2.5, these 29 water-supply wells have been monitored by the Applicant for ground-water quality for site-characterization purposes and to include related pre-licensing water-quality data in its license application. In addition, the Applicant has proposed that it would monitor these 29 wells throughout the lifecycle of the Ross Project. A map depicting the 29 water-supply wells that have been, and would be, monitored for ground-water quality by the Applicant throughout the Project's lifecycle has been added as Figure 3.15 to FSEIS Section 3.5.3 (Strata, 2011a).*

Comment: RP035-041

The commenter stated that including an adaptive-management approach for responding to unanticipated water-quality-monitoring results that are outside the range of expected values in the environmental-monitoring plan would be valuable additional mitigation measure.

Response: *The NRC staff agrees that an adaptive management approach would help to reduce the likelihood of a water-quality incident's occurring and increase the likelihood that water-quality incidents are resolved efficiently. The Draft Source and Byproduct Materials License includes several conditions that would require the Applicant to submit reports on a regular basis, reports that would document corrective actions taken in response to events with environmental consequences (NRC, 2014b). For example, Condition No. 11.6 of the Draft*

Source and Byproduct Materials License would require that the Applicant submit a written report to the Commission detailing conditions leading to a spill or incident/event (including wellfield excursions), corrective actions taken, and results achieved. An inherent benefit to these reporting requirements is that they would permit the Applicant and the NRC staff to employ lessons learned from past incidents/events to address future incidents/events. This is a form of adaptive management that would be required by the NRC Source and Byproduct Materials License. No changes have been made to the SEIS beyond the information provided in this response.

B.5.9.6 Aquifer Protection and Restoration

Comment: RP024-162

The commenter indicated that the description of the purpose of an aquifer exemption in relation to underground source of drinking water (USDW) protection in DSEIS Section 2.1.1.3 did not adequately address the protection of adjacent aquifers and suggested that the discussion be revised.

Response: *The NRC staff has revised the text in FSEIS Section 2.1.1.3 to discuss that ground water in aquifers outside of the aquifer-exemption boundaries (i.e., those boundaries that define the exempted portion of the ore-zone aquifer, where uranium recovery is permitted) are protected as USDWs. As such, the USDWs must meet the water-quality requirements in 10 CFR Part 40, Appendix A, Criterion 5B(5).*

Comments: RP024-163; RP024-165

The commenter identified the five proposed aquifer-restoration activities described in DSEIS Section 2.1.1.3 by the statement, "The aquifer-restoration activities proposed for the Ross Project are the same as those methods described in Section 2.5 of the GEIS: 1) ground-water transfer, 2) ground-water sweep, 3) RO with permeate injection, 4) ground-water recirculation, and 5) stabilization monitoring (Strata, 2011a; NRC, 2009b)." The commenter indicated these five activities are consistent with Strata's license application; however, the commenter suggested including a statement to describe how the Applicant proposes to use these activities with flexibility. The commenter also suggested revising the following statement in DSEIS Section 2.1.1.3: "The Applicant's proposed restoration methodology would include ground-water sweep, permeate injection, and ground-water recirculation." The commenter asked that the two statements be made consistent within Section 2.1.1.3 of the FSEIS.

Response: *The NRC staff agrees that these statements should be made consistent. The staff has revised the text in FSEIS Section 2.1.1.3 by adding the following statement: "The Applicant's proposed aquifer-restoration methodology would use all of the five activities described in the GEIS, which would be applied in a flexible manner so as to optimize the overall aquifer-restoration process."*

Comment: RP024-166

The commenter referenced a statement in DSEIS Section 2.1.1.3, "The water removed from the aquifer during the sweep first would be passed through an IX system to recover uranium and then be disposed of as excess permeate." The commenter then opined that the statement is inconsistent with Strata's license application, because the application does not describe the two-phase RO system.

Response: *The NRC agrees with the commenter and has revised the text in FSEIS Section 2.1.1.3 in order to provide a clear explanation that water from the ground-water sweep would be first passed through the IX system to recover uranium and vanadium, then it would be treated by the two-phase RO system. After that, the water would be reused or disposed of as excess permeate. This statement is now consistent with the license application.*

Comment: RP024-168

The commenter suggested that Section 2.1.1.3 in the FSEIS include a discussion of ground-water transfer, as described in the Applicant's TR Section 6.1.2, which has been proposed by the Applicant as an aquifer-restoration activity.

Response: *The NRC agrees with the commenter, and it has revised the text in FSEIS Section 2.1.1.3 by adding a definition and an additional statement which describe ground-water transfer: "Ground-water transfer is the movement of ground water between a wellfield entering restoration and another wellfield where uranium recovery is beginning, or between areas within the same wellfield that are in different stages of aquifer restoration. The objective of ground-water transfer is to blend ground-water compositions, and it generally does not generate liquid effluents (NRC, 2009a)." This revision makes Strata's license application and FSEIS Section 2.1.1.3 consistent.*

Comment: RP024-171

The commenter suggested that the NRC add a discussion of the pore-volume estimate prepared by the Applicant for the Ross Project to FSEIS Section 2.1.1.3. The commenter also suggested that the NRC address how this estimate relates to the Applicant's RAP, which was included as Addendum 6.1-A in its TR (Strata, 2011b).

Response: *The NRC staff has revised the text in FSEIS Section 2.1.1.3, which now clearly explains that the Applicant estimated and committed to 9.5 pore volumes of ground-water sweep, injection of permeate, and ground-water recirculation during aquifer restoration. The costs of restoration using 9.5 pore volumes were included in the Applicant's decommissioning-funding estimate, which in turn was used as the Applicant's basis for its financial-assurance surety. The estimate and the accompanying financial surety instrument are described in the Applicant's RAP. The NRC staff found that the Applicant's estimate of 9.5 pore volumes was acceptable because the estimate is within the range currently used by the uranium-recovery industry, and the Applicant commits to minimizing inefficiences and adjusting the decommissioning estimate based upon its future experience (NRC, 2014a).*

Comments: RP024-172; RP024-173; RP024-175

The commenter questioned the purpose of aquifer stabilization as described in DSEIS Section 2.1.1.3 by the statement: "The purpose of stabilization during aquifer restoration is to establish a chemical environment that would reduce the solubility of dissolved constituents such as uranium, arsenic, and selenium, as described in GEIS Section 2.5.4." The commenter also noted that the discussion in the DSEIS section includes the Applicant's use of a chemical reductant to immobilize uranium and dissolved species, even though the Applicant did not specifically commit to the use of reductants. The commenter also noted that the Source and Byproduct Materials License would require the Applicant to specifically submit a plan for the NRC's review before biological or chemical reductants could be used. Therefore, the commenter suggested omitting or revising the discussion of aquifer stabilization.

In addition, the commenter referred to two related statements in DSEIS Section 2.1.1.3: "The need for aquifer stabilization would be determined on a case-by-case basis..." and "The Applicant would reinitiate the entire aquifer-restoration phase if stabilization monitoring determines it is necessary." The commenter then remarked that these statements were inconsistent with Strata's license application. The commenter observed that the concept of aquifer stabilization as used in the license application applied to monitoring and not the use of biological or chemical reductants. The commenter pointed out that, rather than iterate the entire aquifer-restoration process, additional evaluation would be performed by the Applicant in order to identify any hot spots and to observe any significant increasing trends. This additional evaluation could include additional monitoring, fate-and-transport modeling, or additional aquifer-restoration actions.

Response: *The NRC staff has revised the text in FSEIS Section 2.1.1.3 to clearly distinguish between the general description of the aquifer-stabilization process included in the GEIS and the Applicant's proposed aquifer-restoration techniques as set forth in Strata's license application as well as those techniques that will be required by the Source and Byproduct Materials License issued to Strata. In addition, supplemental information has been added to FSEIS Section 2.1.1.3 regarding the Applicant's commitments to aquifer stabilization and stabilization monitoring. This information supports the NRC's determination in its SER that the license application provides reasonable assurance the Applicant would restore ground water to the respective ground-water protection standards of 10 CFR Part 40, Appendix A, Criterion 5B(5) and that the extent of restoration activities undertaken ensures compliance with ground-water protection standards that are protective of human health and the environment as required by 10 CFR Part 40, Appendix A, Criterion 5D (NRC, 2014a).*

The statements on aquifer restoration referenced by the commenter have been modified to accurately reflect the commitment by the Applicant and the Draft Source and Byproduct Materials License. The revised text in FSEIS Section 2.1.1.3 reflects these modifications, which now states that "Further analysis and evaluation would be conducted in the event that water-quality parameters exhibit a statistically significant increasing trend or areas of ground water not meeting the water quality protection standards are identified within the aquifer (Strata, 2011b). This analysis may include additional monitoring and flow transport modeling. If the evaluation reveals that ground water outside the exempted aquifer could potentially be affected, the Applicant may repeat a previous phase of active restoration."

Comments: RP024-152; RP032-037; RP032-042

One commenter noted that the DSEIS states that, as aquifer restoration occurs in depleted wellfield modules, uranium-recovery operation would be ongoing in subsequent wellfield modules and asked a series of questions related to this topic.

1) Could the difference between a "well[field] module" and a "wellfield" for the purposes of establishing accountable units for implementing and assessing aquifer restoration be clarified?

2) How many lixiviant injection and uranium-recovery wells would comprise a typical Ross Project well[field] module? How many such modules would comprise a wellfield? How many wellfields would ultimately be deployed pursuant to the NRC's granting of a license to the Ross Project?

3) Would the post-licensing, pre-operational constituent concentrations found in perimeter ground-water monitoring wells and baseline recovery wells be applied for the purpose of determining the target restoration values (TRVs) to individual well modules, or to a group of several well modules, or to a wellfield?

4) What is the approved standard for each constituent that would be subjected to monitoring to demonstrate that the approved standard has been met for aquifer restoration and that would be used to demonstrate that any adjacent nonexempt aquifers are unaffected? Who would conduct this quarterly sampling and, if it is the Applicant, how would the NRC obtain independent verification of the results? What happens if quarterly sampling demonstrates that one or more adjacent non-exempted aquifers are affected?

5) How many discrete environmental accountancy areas (i.e., groups of location-specific UCLs and TRVs) would be established within the Ross Project to detect and control excursions and set standards for aquifer restoration?

6) Who is responsible for establishing and maintaining this large and complex dataset of water-quality measurements, and where would it be maintained?

7) How would the relevant UCLs and TRVs applicable to each specific well[field] module be communicated to the field personnel responsible for detecting and preventing excursions and assessing aquifer-restoration progress and success at particular sites?

8) With a small workforce attending to so many individual environmental-compliance units that must monitored and assessed, how would the Applicant and the NRC avoid confusion or misapplication of standards between units?

9) Would the NRC provide a description of its process for reviewing and validating the environmentally protective character of UCLs and TRVs proposed for inclusion in the Ross Project license over time, and would the NRC describe how it would verify the authenticity of the large number of site-specific datasets required? If there are differences in view between the NRC and the Applicant on the establishment or revision of UCLs and TRVs, how would these differences be adjudicated and resolved? Who within NRC holds the final decision authority on such matters? The other commenter discussed UCLs are subject to the NRC's review and approval, noting Condition No. 10.13 in the Draft Source and Byproduct Materials License.

10) Would the NRC provide a map showing the location and planned restoration sequence of the Ross Project "well[field] modules" that would undergo restoration, relative to those modules in which "ISR operation would be ongoing" at the same time? Would the NRC provide detailed topographic and stratigraphic maps showing the location, relative to the Ross Project, of all subsequent well[field] modules in contiguous areas currently scheduled for Lance District development in which uranium recovery would be ongoing while Ross Project well[field] modules are undergoing restoration? Would all "well[field] modules" undergoing restoration be hydrologically upgradient of well[field] modules in which uranium recovery would be ongoing?

11) Would the NRC define a "baseline recovery well," as the term is used in the Applicant's ER, and describe how it would be used to establish UCLs and TRVs?

Response: *With respect to 1) and 2), the Ross Project production area (all wellfields and the processing facility, including the CPP) consists of 50.6 – 58.7 ha [125 – 145 ac] within the licensed area. The proposed wellfields are divided into two "mine units," under the WDEQ Permit to Mine, which are further delineated into wellfield modules. (See NRC's response to Comment No. RP032-040 as well for a discussion of wellfield modules and accounting units.) The total number of wellfield modules for the proposed Ross Project is estimated to be between 15 – 25. The primary components of a wellfield module, including the injection well, the recovery well, the shallow[-aquifer] monitoring well, the deep[-aquifer] monitoring well, and the perimeter monitoring well, are illustrated in SEIS Figure 2.7. The Applicant proposes that each wellfield module would consist of 40 recovery wells. The total number of injection wells would be a multiple of the total number of recovery wells and would depend on the "spot pattern" used. Each wellfield module would undergo aquifer restoration. As Condition No. 10.6 of the Draft License indicates, sampling conducted by the Applicant during restoration-stability monitoring shall include the specified production-zone- (i.e., ore-zone-) aquifer wells used to define the wellfield's baseline levels (NRC, 2014b). As Draft License Condition No. 11.3 also indicates, post-licensing, pre-operational ground-water quality would be established by the Applicant's collection of samples from the injection wells, the recovery wells, the shallow monitoring wells, the deep monitoring wells, and the perimeter monitoring wells prior to uranium-recovery operation.*

Currently, Condition No. 11.4 of the Draft License addresses the establishment of UCLs (NRC, 2014b):

> 11.4 Establishment of UCLs. Prior to injection of lixiviant into a wellfield, the licensee shall establish excursion control parameters and their respective upper control limits (UCLs) in the designated overlying aquifer, underlying aquifer and perimeter monitoring wells in accordance with Section 5.7.8.2 of the approved license application. The default excursion parameters for wells in the ore zone and overlying aquifer are chloride, conductivity, and total alkalinity. The default excursion parameters for wells in the underlying aquifer are sulfate, conductivity, and total alkalinity. The UCLs shall be established for each excursion control parameter and for each well, wellfield or subset of the wellfield, as appropriate, based on the mean plus five standard deviations of data collected for LC11.3. The UCL for chloride can be set at the background [in this SEIS, "post-licensing, pre-operational"] mean concentration plus either five standard deviations or 15 mg/l, whichever is higher.

3) As stated in the SER (NRC, 2014a), the NRC staff acknowledges that the Applicant refers to the "baseline" values as TRVs or target restoration goals (TRGs), although such references are not derived from NRC-implementing regulations. As discussed in SEIS Section 6.3.2, the post-licensing, pre-operational data would be collected from each individual wellfield as its installation is completed, but prior to the Applicant's initiating uranium recovery. Each wellfield's monitoring data would be used to establish NRC-approved UCLs. Thus, the excursion indicators and the aquifer-restoration target values would be wellfield specific. SER Section 5.7.8.3.1.2 states, "During the construction phase, the Applicant proposes to conduct a background [in this SEIS, "post-licensing, pre-operational"] monitoring program for each wellfield to define its 'primary' restoration goals [restoration standards] and determine its upper control limits (UCLs) for the excursion monitoring program."

4) As described in the response to 3) above, the post-licensing, pre-operational data for each wellfield that would be used to establish the restoration standards and UCLs would be collected as wellfield installation is completed. Therefore this information is not currently available. Regular sampling would be conducted by the Applicant in accordance with the license, if granted. If an excursion is detected, the following would occur according to Draft License Condition No. 11.5 (NRC, 2014b):

> If, at any well during a semi-monthly sampling event, the concentrations of any two excursion indicator parameters exceed their respective UCL or any one excursion indicator parameter exceeds its UCL by 20 percent, then the excursion criterion is exceeded and a verification sample shall be taken from that well within 48 hours after results of the first analysis are received. If the verification sample confirms that the excursion criterion is exceeded, then the well is placed on excursion status. If the verification sample does not confirm that the excursion criterion is exceeded, a third sample shall be taken within 48 hours after results of the first verification sampling are received. If the third sample shows that the excursion criterion is exceeded, the well shall be placed on excursion status. If the third sample does not show that the excursion criterion is exceeded, the first sample shall be considered to be an error and routine excursion monitoring is resumed (the well is not placed on excursion status).
>
> Upon confirmation of an excursion, the licensee shall notify NRC as stated below, implement corrective action, and increase the sampling frequency for the excursion indicator parameters at the well on excursion status to at least once every seven days. Corrective actions for confirmed excursions may be, but are not limited to, those described in Section 5.7.8.2 of the approved license application. An excursion is considered corrected when concentrations of all indicator parameters defining the excursion status are at or below the UCLs defined in LC [Draft License Condition] 11.4 for three consecutive weekly samples.
>
> For wellfields located in an area in which the uppermost aquifer, the “SA Aquifer”, is comprised of saturated unconsolidated alluvium, the licensee will include monitoring wells in the SA Aquifer in that area of the wellfield as part of the excursion monitoring program as described above. The hydrologic-test data package must include sufficient justification on the locations, baseline [in this SEIS, “post-licensing, pre-operational”] sampling if the frequency is less than quarterly and operational sampling if the frequency is less than semi-monthly for wells in the uppermost aquifer. The justification must demonstrate that the wells provide early detection of a release (including a surficial release).
>
> If a vertical excursion is detected during operations, then injection of lixiviant into the production area surrounding the monitoring well will cease until the licensee demonstrates to the satisfaction of NRC that the vertical excursion is not attributed to leakage through any abandoned drillhole.
>
> If an excursion is not corrected within 60 days of the initial confirmation, the licensee shall either: (a) terminate injection of lixiviant within the wellfield, or a portion of the wellfield provided the licensee demonstrates to NRC that only a portion of the wellfield is within the area of influence for the excursion) until the excursion is corrected; or (b) increase the financial surety in an amount to cover the full third-party cost for correcting and cleaning up impacts that may be attributed to the excursion. The surety increase shall remain in force until the NRC has verified that the excursion has been corrected and appropriate remedial actions have been undertaken. The written 60-day excursion report shall identify which course of action the licensee is taking if the excursion has not been corrected. Under no circumstances does this condition eliminate the requirement that the licensee

> remediate the excursion to meet ground-water protection standards as required by LC [License Condition No.] 11.3.
>
> The licensee shall notify the NRC Project Manager (PM) by telephone or email within 24 hours of confirming a lixiviant excursion, and by letter within 7 days from the time the excursion is confirmed, pursuant to this LC [License Condition] 9.3. A written report describing the excursion event, corrective actions taken, and the corrective action results shall be submitted to the NRC within 60 days of the excursion confirmation. For all wells that remain on excursion status after 60 days, the licensee shall submit a report as discussed in LC [License Condition No.] 11.1(A).

5) For those wells used to define restoration standards, the Applicant proposes a density of one well to a maximum of every 1.6 ha [4 ac] of production (i.e., uranium-recovery) area (Strata, 2011a). Based upon the currently defined production wellfield area, the Applicant estimates 24 such wells, encompassing both mine units within the Ross Project. The Applicant commits to one such well per wellfield module (see SER Figure 5.7-1) (NRC, 2014a).

Wells to be used for excursion-detection monitoring consist of those wells in the overlying and underlying aquifers in addition to wells in the ore-zone aquifer's perimeter-monitoring ring surrounding the production area (Strata, 2011a). Wells in the underlying and overlying aquifers would be completed as well clusters at the locations of the post-licensing, pre-operational monitoring wells for the ore-zone aquifer (i.e., 24 locations within both mine units). Wells in the perimeter-monitoring ring would be completed approximately 120 m [400 ft] from the closest production-unit wells, at a spacing of approximately 120 m [400 ft] within the monitoring-well ring that surrounds the mine unit (Strata, 2011b).

6) As currently stated in Draft License Condition Nos. 11.4 and 11.5, above, the Applicant would be responsible for collecting and maintaining the water-quality-measurement dataset. Condition No. 11.1 in the Draft License addresses the monitoring, recording, and bookkeeping requirements (NRC, 2014b):

> 11.1 In addition to reports required to be submitted to NRC staff or maintained on-site by the applicable parts of Title 10 of the Code of Federal Regulations, the licensee shall prepare the following reports related to operations at the facility:
>
> A) A quarterly report that includes a summary of the excursion indicator parameter concentrations, corrective actions taken, and the results obtained for all wells that were on excursion status during that quarter. This report shall be submitted to NRC within 60 days following completion of the reporting period.
>
> B) A quarterly report summarizing daily flow rates and pressures for each injection manifold within the operating system. This report shall be made available for inspection upon request.
>
> C) A semi-annual report that discusses: status of wellfields (or wellfield modules if appropriate) in operation (including last date of lixiviant injection), progress of wellfields (wellfield modules) in restoration, status of any long term excursions and a summary of MITs during the reporting period. This report shall be submitted to NRC within 60 days following completion of the reporting period.
>
> D) Consistent with Regulatory Position 2 of Regulatory Guide 4.14 (as revised), a semiannual report that summarizes the results of the operational effluent and

environmental monitoring program. For this program, the nearby water supply wells are those within 2 km of the perimeter ring monitoring wells for all wellfields undergoing recovery operations or restoration. This report shall be submitted to NRC within 60 days following completion of the reporting period.

E) An annual report pursuant to LC [License Condition No.] 9.4(E).

F) An annual report that summarizes modifications to the inventory of nearby water supply wells and land-use survey within 2 kilometers of any production area. This report shall be submitted to NRC within 90 days following completion of the reporting period.

7) As indicated by the Draft Source and Byproduct Materials License (NRC, 2014b), the Applicant would be required to measure the excursion parameters at all wells on a semi-monthly basis. If the UCLs are exceeded (and the well is on excursion status), the Applicant would be required to notify NRC within a short time frame (48 hours), perform weekly sampling and corrective actions until the parameters are below the UCLs. By license condition, if the well is on excursion status for 60 days, the Applicant would be required to stop operations in that area and/or post additional surety to clean up the area.

The TRVs (i.e., ground-water protection standards) will be evaluated by NRC staff upon completion of restoration and stabilization of a wellfield. The Applicant could not complete decommissioning of the wellfield until the NRC staff approves that the restoration is protective of human health and the environment.

8) The Radiation Safety Officer would have to meet the qualifications specified in the Source and Byproduct Materials License and would be responsible for ensuring the Applicant's compliance with NRC regulations. Also, the NRC staff would perform routine inspections, generally semi-annually, to ensure all programs are in compliance with the applicable regulations.

9) As stated in the GEIS (NRC, 2009b), Section 2.2, "Preconstruction," the NRC verifies the accuracy of the water-quality data by ensuring that the Applicant's or licensee's procedures include 1) acceptable sample-collection methods, 2) a set of analytical parameters that is appropriate for the respective project and the uranium-extraction method, and 3) collection of sample sets that are sufficient to represent the natural spatial and temporal variations in water quality.

Condition No. 10.13 of the Draft Source and Byproduct Materials License currently addresses the wellfield package (NRC, 2014b):

10.13 Wellfield Package. Prior to conducting principal activities in a new wellfield, the licensee shall submit a hydrologic test data package (wellfield package) to the NRC. The initial wellfield package will be submitted for NRC staff review and verification. Each wellfield package shall be submitted at least 60 days prior to the planned start date of lixiviant injection. In each wellfield data package, the licensee will document that: (1) all perimeter monitoring wells are screened in the appropriate horizon in order to provide timely detection of an excursion; and (2), the baseline [in this SEIS, "post-licensing, pre-operational"] values to establish ground-water protection standards and UCLs for the Wellfield in accordance with LC 11.3. The wellfield package will adequately define heterogeneities that may affect the chemical signature and ground-water flow paths within the ore zone as described in Sections 2.7.3.2.3, 3.1.1 and 5.7.8.1 of the approved license application.

If there are differences in view between the NRC and the Applicant on the establishment of UCLs and TRVs, the NRC may elect to issue a generic letter to all licensees with that respective type of license to clarify what is expected by NRC staff. In the end, the NRC staff will have to approve, by a finding of reasonable assurance, that the final state of the restoration is protective of human health and the environment. It is unlikely that TRVs will be revised (an ACL is not a revised TRV – however, an ACL will have to be approved by staff). In order to modify a UCL, the licensee would submit a request to the Commission to review and approve.

The Decommissioning and Uranium Recovery Licensing Directorate within the Division of Waste Management and Environmental Protection is responsible for overseeing licensed uranium-recovery operations. Additional information about the NRC's oversight of licensed uranium-recovery operations is provided on the NRC's public web site at http://www.nrc.gov/materials/uranium-recovery/inspections.html.

10) The response to Comment No. RP032-022 provided within this Appendix B discusses the locations of wellfields within the proposed Ross Project and potential Lance District satellite areas.

In Section 3.2. of its license application, the Applicant stated that aquifer restoration would begin approximately 6 – 12 months after operation has been completed in the wellfield modules, which would occur concurrently with operation of other wellfield modules. Figure 1.3-1 of the Applicant's ER and Figure 2.6 of this SEIS both provide the projected Ross Project schedule, including the timing of the aquifer-restoration phases for each proposed mine unit. However, it should be noted that, although the ER figure indicates that operation of Mine Unit 1 and Mine Unit 2 would begin concurrently, Condition No. 10.19 of the Draft License states that the Applicant shall confine its operations to wellfields within Mine Unit 1 until use of the three industrial wells, "19XX18," "22x-19," and "789V" have ceased operation or have diminished to an acceptable level that has been reviewed and verified by NRC staff. Therefore, the timing of the development and restoration of each wellfield module cannot be provided with accuracy at this time, and it is also cannot be stated at this time whether all wellfield modules undergoing restoration would be hydrologically upgradient of wellfield modules in which uranium recovery would be ongoing. However, as stated in the response above to Question 9, prior to operation, the NRC would verify the accuracy of the water-quality data of each wellfield module.

11) The term "baseline recovery well" is not used in the SEIS. The process to establish "baseline" (i.e., post-licensing, pre-operational) water quality is discussed in FSEIS Section 2.1.1.1, Condition No. 11.3 of the Draft Source and Byproduct Materials License, and in this Appendix B in response to Comment No. RP032-036.

Comment: RP024-218

The commenter noted that the statement in DSEIS Section 2.2.3, which indicated that the permeate stored in the surface impoundments would be reused as "lixiviant or process water," ignores the primary use of permeate, which is injection into wellfield modules undergoing RO treatment with permeate injection.

Response: *The NRC staff has revised the text in FSEIS Section 2.2.3 to clarify that re-used permeate could be injected into wellfield modules as they undergo RO treatment.*

Comment: RP032-038

The commenter noted the statement in DSEIS Section 2.1.1.3, "The pumping rates used would depend on the hydrologic conditions at the Ross Project, and the duration of the aquifer sweep and the volume of water removed would depend on the volume of the aquifer affected by the ISR process." The commenter then asked: 1) for an explanation of the specific existing, planned, or expected hydrologic conditions at the Ross Project that will affect the pumping rates, duration, and volume of water removed during aquifer sweep; 2) why these particular hydrologic conditions have not already been ascertained or modeled based on the results of pre-licensing site investigations; and 3) how the hydrologic uncertainties affect the forecast efficacy of the NRC's efforts to ensure environmentally protective aquifer restoration. In addition, the commenter asked for: 4) a detailed and adequate NEPA discussion that relates the prevailing uncertainties in hydrologic knowledge of the Ross Project and potential development in the Lance District to the Applicant's ability to achieve, and the NRC's ability to enforce the ground-water protection standards; 5) the range of potential environmental outcomes, in terms of the restoration of the relevant baseline water quality concentrations, arising from uncertainties in hydrologic knowledge of the Ross Project and the Lance District; and 6) for the likelihood of achieving representative sets of post-mining water quality concentrations for the relevant constituents that must be monitored and controlled to ensure public health and safety and minimize harmful environmental impacts and the irretrievable commitment of natural resources (based upon the record of previous and ongoing ISR operations in the NSDWUMR and within Wyoming).

Response: *The sentence referenced from DSEIS Section 2.1.1.3 refers to the rate, duration, and volumes of water removed by the ground-water sweep during restoration. The purpose of ground-water sweep is twofold: 1) to reduce the total concentrations of salts in ground water to levels that are amenable to the ground-water treatment equipment, and 2) to capture any lixiviant that moved away from the edge of the production area.*

1 and 2) The hydrologic conditions that may affect the pumping rate are the porosity and permeability. The duration of the sweep and volume of water removed by the ground-water sweep depend upon the extent of ground water affected by lixiviant. The level of detail on the hydrological conditions that would affect the pumping rate would not be known until the wellfield hydrologic test data package is developed and operational data are collected on the hydrologic conditions, if the License is granted. The level of hydrologic detail that ultimately would influence the pumping rate during aquifer restoration is not necessary for impact analysis in the SEIS because of the overall requirement that restoration achieve ground water protection standards. There is no reason to ascertain or model, based on the results of pre-licensing, site-characterizations investigations, greater hydrologic detail than presented in the license application (Strata, 2011a; Strata, 2012b).

3) Variation or uncertainties in the hydrologic conditions would not affect NRC's requirements for aquifer restoration that meets ground-water protection standards. Additional information on the hydrologic conditions would be included in the wellfield hydrologic-test data package currently discussed in Draft License Condition 10.13 and described in response to Comments RP032-037; RP032-042. Although the NRC staff has set limits for the Applicant on timing to complete *the aquifer restoration, the NRC does not impose timing for various phases of restoration efforts, within the overall aquifer-restoration phase for each wellfield.*

4, 5, and 6) There is no relationship between the current uncertainties in hydrologic knowledge of the Ross Project and the range of potential environmental outcomes, or the Applicant's ability to achieve and the NRC's ability to enforce the water-protection standards. This lack of relationship is a result of the Commission's requirement that the Applicant would achieve water-protection standards in all cases, as described in the response to Comment Nos. RP032-004, RP032-020, RP032-36, 032-041, and 041-006. Please also see the NRC's response to Comment No. RP032-026 for a discussion of the requirements to consider uncertainties in operating parameters.

Please see the NRC's responses to Comment Nos. RP032-002, RP032-067, and RP041-009, which describe the environmental-review process that the NRC staff would follow if Strata were to submit a license-amendment application to the Commission to expand its operation into any of the Lance District satellite areas.

Additional information related to aspects of ground-water restoration that are the subject of this comment has been added to the FSEIS. Section 2.1.1.3 of the FSEIS has been revised to clarify the purpose of ground-water sweep in the overall sequence of activities for ground-water restoration. The results (i.e. the constituent concentrations) achieved by ground-water restoration of uranium-recovery wellfields located in NSDWUMR and within Wyoming that have been recently approved by NRC have been added to FSEIS Section 4.5.1.3. In addition, Appendix B1, which describes Commission's process for approving and implementing ACLs has been added.

Comment: RP032-039

The commenter referenced the following statements in DSEIS Section 2.1.1.3: "The Applicant's aquifer restoration plan calls for removing up to 0.5 pore volumes of water during ground-water sweep (Strata, 2011b). Additional pumping would occur in select areas that would be identified during facility operation. The pumping rate is estimated at 280 L/min [75 gal/min] from well[field] modules in the ground-water sweep stage." The commenter stated that these statements disclose very little information about the likely range of environmental impacts from aquifer restoration activities. The commenter then asked a series of questions about ground-water quantity impacts that could be associated with aquifer restoration under the Proposed Action:

1) If an Applicant's aquifer-restoration plan would call for the removal of "up to" 0.5 pore volumes during ground-water sweep, does this mean that this number represents a hard-and-fast regulatory limit on the amount of water that would actually be removed during ground-water sweep?

2) Would the NRC provide a table showing the actual pore volumes removed from prior and ongoing uranium-recovery facilities in a) this GEIS uranium-milling region and b) within Wyoming that have undergone "aquifer restoration"?

3) Would the NRC provide a table showing expected and maximum allowable pore volumes per well[field] module (or other applicable unit for aquifer restoration) that would be removed in the course of aquifer-restoration activities during the Ross Project?

4) Would the NRC provide a discussion: a) comparing the environmental risks and benefits from high levels of pore-volume removal from the ore-bearing aquifer with the environmental risks and benefits of failing to attain Final License-specified TRVs (or other standards) for aquifer restoration; b) describing the methodology the NRC and/or the Applicant would employ to evaluate environmental-restoration decisions regarding this tradeoff and the point at which concerns regarding the consumptive use of ground water may trump the achievement of particular TRVs? (That is, does the NRC consider consumptive use when determining when to conclude aquifer restoration?)

5) Would the NRC provide pore-volume and gallons-withdrawn estimates for the potential Lance District development?

Response: *The text quoted by the commenter was taken from DSEIS Section 2.1.1.3. The analysis of environmental impacts to ground water is presented in SEIS Section 4.5, and in particular, SEIS Section 4.5.1.3 provides an analysis of the potential impacts to water resources during the aquifer-restoration phase of the Proposed Action. When discussing consumptive-use impacts during aquifer restoration, the DSEIS stated the following:*

> The magnitude of potential impacts to water quantity of the OZ aquifer and the surrounding aquifers during the aquifer-restoration phase of the Proposed Action would be greater than from its operation because of the greater consumptive use of ground water (Strata, 2011a). Ground water modeling estimates of the drawdown in the shallow-monitoring (SM) aquifer during both Ross Project operation and aquifer restoration were less than 5 m [15 ft]. The exempted OZ aquifer was predicted to experience significant drawdowns in three wells on the Ross Project area, with minor drawdowns in wells within 3 km [2 mi] of the Project. The conservative regional impact analysis conducted by the ground-water modeling predicts a reduction in the available head in wells used for stock, domestic, and industrial use. Although these effects would be localized and short-lived, the Applicant would commit to provide an alternative source of water of equal or better quantity and quality, subject to Wyoming water-statute requirements, in the event that aquifer-restoration operations prevent the full use of a well under a valid water right (Strata, 2011a; Strata, 2012a). Consequently, the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE.

As noted by the commenter, the DSEIS discussed the Applicant's expected removal of 50 percent of the wellfield-module pore volume (PV) (i.e., 0.5 PV) during ground-water sweep. As discussed in Section 6.1.4.2 of the Applicant's license application (Strata, 2011b), for each wellfield module, the reverse-osmosis (RO) treatment with the permeate-injection phase is expected to remove 8 PVs, and the recirculation phase is expected to use 1 PV. Therefore, the Applicant has indicated that it would remove a total of 9.5 PVs during the overall aquifer-restoration phase.

The Applicant's estimate of the number of pore volumes to be removed during aquifer restoration is not a regulatory limit. Similarly, the Source and Byproduct Materials License will not include a maximum allowable pore-volume removal value. Therefore, a table with these values cannot be provided. However, as noted in the SEIS, the GEIS provides a discussion of the operational history at NRC-licensed ISR facilities (NRC, 2009b). Specifically, GEIS Section 2.11.5 provides historical information regarding the quantity of ground water used at ISR facilities during the aquifer-restoration phase. As set forth in the response to Comment No. 024-171, NRC staff found the Applicant's estimate of 9.5 pore volumes to be acceptable because *the estimate was within the range currently used by the industry, and the Applicant has committed to minimizing inefficiences and adjusting the the estimate based upon future experience (NRC, 2014a).*

SEIS Section 5.7.2 provides an analysis of the potential cumulative impacts to ground-water resources during the aquifer-restoration phase of the Proposed Action. The NRC staff concludes that consumptive-use cumulative impacts to the area aquifers, including impacts due to the potential Lance District satellite areas, will not adversely impact nearby use of the ground-water resource because of the minimal mutual interference (i.e., minimal overlap of the cones of depression associated with drawdowns) from the Ross Project and the potential satellite facilities due to the distances between satellites, taking into account other reasonably foreseeable uses of the ground water resources, and the expected recovery of the water levels in the aquifer at each satellite following completion of the restoration activities. Therefore, the combined total volume of ground water that would be removed by these projects is not relevant to the Ross Project cumulative impacts analysis and is not presented in the SEIS.

Comment: RP035-008

The commenter noted that the DSEIS states, “Following aquifer restoration, the Applicant would monitor the ground water by quarterly sampling to demonstrate that the approved standard for each constituent has been met and that any adjacent nonexempt aquifers are unaffected.” The commenter suggested that the FSEIS include specific direction for the Applicant’s determination of whether adjacent, nonexempt aquifers are protected and the mitigation measures that would be employed to address any impacts to these aquifers.

Response: *The specific text quoted by the commenter is taken from DSEIS Section 2.1.1.3. This section of the FSEIS has been revised to include additional information regarding the Applicant’s aquifer-stabilization methods and related mitigation measures. Please see responses to Comment Nos. RP032-037 and RP032-042 for further information regarding the NRC’s requirements for the Applicant’s monitoring of potential excursions outside of the exempted portion of the ore-zone aquifer as well as response to Comment No. RP032-065 regarding the proposed mitigation measures related to potential excursions.*

B.5.9.7 Gaseous or Airborne Particulate Emissions

Comment: RP024-191

The commenter suggested that the NRC staff include a discussion in FSEIS Section 2.1.1.5 of the benefits that accrue by the Applicant’s employing pressurized, downflow IX columns.

Response: *The NRC staff has revised the text in FSEIS Section 2.1.1.5 to note that the Applicant’s use of pressurized, downflow IX columns would keep most of the radon trapped in pregnant lixiviant in the solution, rather than allow its release into the atmosphere of the CPP. This would minimize the potential radiation exposures of nearby occupational workers in the CPP.*

Comment: RP024-192

The commenter could not confirm the statement made in DSEIS Section 2.1.1.5 that, “The Applicant has committed that these discharges would meet all local, State, and Federal requirements related to air quality as well as occupational health and safety" as appearing in Strata's license application or its responses to the NRC's Requests for Additional Information (RAIs). In addition, the commenter requested illumination on any local and state requirements for radon.

Response: *The DSEIS statement was based upon the cumulative individual commitments of the Applicant in its license application to 1) adhere to the terms of its Air Quality Permit issued by the WDEQ/AQD, which reflect State requirements as well as EPA's Federal regulations found at 40 CFR Part 61, the "National Emission Standards for Hazardous Air Pollutants" (NESHAPS), which include radon and other radionuclides; and 2) satisfy the requirements of NRC's radiation-exposure regulations found at 10 CFR Part 20, which relate to occupational and public health and safety. (See SEIS Sections 3.7.3.1 and 3.7.3.2 for a discussion of Federal and Wyoming air-quality rules). FSEIS Section 2.1.1.5 has been revised to read, "The Applicant has committed that its air discharges would meet all State requirements as continued in its Air Quality Permit as well as the NRC's 10 CFR Part 20 occupational health and safety requirements (Strata, 2012b)."*

Comment: RP024-194

The commenter noted that the statement in DSEIS Section 2.1.1.5, Airborne Emissions, that potential radioactive particulate emissions would be "mitigated by design features to prevent releases into the atmosphere as described in this section of the SEIS" could be made more specific.

Response: *FSEIS Section 2.1.1.5 has been revised to explain more clearly that the potential for radioactive-particle emissions would be mitigated by specific design features of the low-temperature, vacuum-dryer systems, which would mitigate releases into the atmosphere. The dryers are described in SEIS Section 2.1.1.2.*

B.5.9.8 References

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for License Renewal of Nuclear Plants." NUREG–1437. Washington, DC: USNRC, Office of Nuclear Reactor Regulation. May 1996a. ADAMS Accession No. ML13106A241.

(US)NRC. "Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills." Washington, DC: USNRC. 1996b. ADAMS Accession No. ML091420242.

(US)NRC, U.S. Department of Defense, U.S. Department of Energy, and U.S. Environmental Protection Agency. "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)." NUREG–1575. Washington, DC: USNRC. Rev. 1, 2000/Updates, 2001.

(US)NRC. "Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report." NUREG–1569. Washington, DC: USNRC. 2003a. ADAMS Accession No. ML032250177.

(US)NRC. "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Consolidated Decommissioning Guidance, Volumes 1, 2, and 3." NUREG–1757. Washington, DC: USNRC. Vols. 1 and 2, 2006. Vol. 3, 2012. ADAMS Accession No. ML12048A683.

(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Staff Assessment of Ground Water Impacts from Previously Licensed In-Situ Uranium Recovery Facilities." Memorandum from C. Miller to Chairman Jaczko, et al. Washington, DC: USNRC. July 10, 2009d. ADAMS Accession No. ML091770385.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Rose, Arthur W., Herbert E. Hawkes, and John S. Webb. *Geochemistry of Mineral Exploration.* Second Edition. New York: Academic Press. 1979.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

WDEQ/AQD (Wyoming Department of Environmental Quality/Air Quality Division). *Permit to Construct, Air Quality Permit #12198*. Cheyenne, WY: WDEQ/AQD. 2011. ADAMS Accession No. ML112770430.

B.5.10 Financial Surety

Comment: RP032-059

The commenter stated that the subject of financial surety is of concern because of a history of failures in efforts to adequately restore contaminated aquifers at ISR facilities. Therefore, the commenter asked the NRC to provide a full and comparative analysis of each and every original financial surety required by the NRC or relevant State agencies for ISR facilities, the basis for the initial surety requirement, the license conditions requiring each of these surety arrangements, the adequacy of the surety estimates for funding the entirety of ground-water restoration and decommissioning the facility, how often updates were required of each surety at each ISR mining site, and the entity that provided funding for continuing restoration if a surety was not adequate to meet the costs of restoration and decommissioning.

Response: *The adequacy of the Applicant's financial assurance is evaluated as part of the NRC safety evaluation rather than as part of the environmental review. It is beyond the scope of this SEIS to provide an analysis of the operational history of ISRs. No changes were made to the SEIS beyond the information provided in this response.*

B.5.11 Alternatives

Comment: RP016-009

The commenter stated that the site identified as Alternative 3: North Ross Project was unrealistic due to the fact that the respective current landowner has stated that the Applicant would not be able to purchase the land required under this Alternative. Therefore, the commenter noted that the only reasonable alternatives are the Proposed Action and the No-Action Alternative.

Response: *Alternative 3 was considered to be a reasonable alternative under the site-specific environmental review given the Proposed Action and site conditions. Based on the purpose and need statement, Alternative 3 was found to be appropriate in this analysis, regardless of whether the land is currently available for purchase. As described in SEIS Section 2.1, the NRC staff considered a range of reasonable alternatives that included the Proposed Action and the No-Action Alternative. SEIS Section 2.2 also describes the other alternatives considered by the staff, and the reasons the alternatives were eliminated from detailed analysis. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP017-010

The commenter stated that Alternative 3, the North Ross project site, is preferable over the other alternatives. The commenter recommended that, if the North Ross project site is not chosen as the preferred alternative, mitigation measures be applied to the chosen alternative to match the level of resource protection described in Alternative 3. The commenter also stated that the protection of resources—including surface water, ground water, and visual and scenic resources—are all of concern for Devils Tower.

Response: *While the NRC staff considered possible reasonable alternatives to the Proposed Action in the SEIS as part of its NEPA analysis, the NRC only has the statutory authority to grant or deny the license application for the Proposed Action. The NRC cannot grant a license for a site analyzed as a reasonable alternative. That being said, overall impacts from both Alternative 1 (Proposed Action) and Alternative 3 (North Ross Site) are the same for surface water (SMALL), ground water (SMALL to MODERATE), and visual and scenic resource impacts (SMALL to MODERATE). The mitigation measures for ground water differ for Alternative 3 and Alternative 1 because of the difference in hydrology at the two sites. In Alternative 3, the depth to the unconfined shallow ground-water aquifer is greater, eliminating the need for a containment barrier wall (CBW). Due to the lack of a CBW that would be needed, the consumptive ground-water use under Alternative 3 would be less than the Proposed Action. With respect to surface water, storm-water control systems would be more involved at the North Ross site due to the two ephemeral drainages present, compared to only one stream at the Proposed Action site. Due to the topography surrounding the North Ross site, this Alternative would be less visible to neighboring properties and would shield them more from light pollution. However, under the Proposed Action, mitigation measures are in place to minimize these impacts. The Applicant proposes a number of mitigation measures under the Proposed Action* *to limit light pollution. These can be found in Section 4.10.1.1. The Applicant would also mitigate visual impacts by phasing the construction activities. The impacts to visual resources are also expected to be short-term. The Applicant performed an additional viewshed analysis demonstrating that the Ross Project would not be visible from the base of Devils Tower or from the Visitor's Center and that it would be unlikely that the Project area would be visible to climbers scaling the Monument due to the distance between the Project area and Devils Tower. (See SEIS Section 4.10.1.1 for more information).*

The NRC may impose best management practices (BMPs), mitigation measures, and management actions that avoid and reduce environmental impacts through license conditions within the limits of the authority granted by Congress. The appropriate mitigation measures for the Proposed Action have been described in surface water, ground water, and visual and scenic resource impacts, which can be found in Sections 4.5.1 and 4.10.1. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP024-096

The commenter asked that Figure 2.6 be revised to more accurately reflect the schedule proposed by the Applicant (Strata, 2012a).

Response: *The NRC agrees with this request and has made the revisions to FSEIS Figure 2.6.*

Comment: RP024-376

The commenter noted that the DSEIS incorrectly suggested that the underlying aquifer would require restoration under Alternative 3: North Ross Project.

Response: *The NRC staff has revised the text in FSEIS Section 4.2.3 to clarify that the underlying aquifer would* not *require restoration under Alternative 3.*

Comment: RP032-061

The commenter stated that neither the ER nor the DSEIS contain evidence that other CPP location alternatives were screened for their environmental advantages and disadvantages prior to selecting the North Ross Project for detailed NEPA analysis. The commenter asked that the NRC explain why the Ross Project site and the North Ross Project site were deemed more reasonable than other potential CPP location alternatives, including the Barber site, and provide evidence that an environmentally-based screening process was used to identify environmentally preferred sites.

Response: *The Federal action and the purpose and need for the Federal action define the range of reasonable alternatives. By letter dated January 4, 2011, Strata submitted an application for an NRC Source and Byproduct Materials License that would allow Strata to construct and operate ISR wellfields and a processing facility at the proposed Ross Project area. Based upon the application, the NRC's Federal action is the decision to either grant or deny a license. The purpose and need for the proposed Federal action does consider the Applicant's goals and objectives to extract uranium from a particular location, which helps define reasonable alternatives to the proposed Federal action.*

Reasonable alternatives considered in a site-specific environmental review depend on the Federal action and site conditions, as required under 10 CFR Part 51. As stated in SEIS Section 2.1.3, the North Ross Project is included as Alternative 3 in this SEIS because of the expected differences in the depth of ground water between the north and south sites. However, the NRC staff's decision to analyze the North Ross Site in this SEIS, along with the Ross Project, is not an indication that the NRC staff determined that the North Ross Site or the Ross Project site have been deemed to be more reasonable locations for the CPP than other locations.

While the NRC staff considered reasonable alternatives to the Proposed Action in the environmental review, including the No-Action Alternative (Alternative 2), the only action within the NRC decisionmaking authority is to approve or not approve the Applicant's license application as submitted. The NRC under NEPA can examine a reasonable alternative to a proposed Federal action that the NRC may not have regulatory authority to impose. However, in order to be considered reasonable, an alternative must meet the purpose and need of the proposed project. The NRC will not accept an Applicant's proposed purpose and need if it has been unduly narrowed to prevent NEPA consideration of reasonable alternatives, but the NRC also allows deference to a business decision of an Applicant when making this determination. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP041-008

The commenter stated that the NRC improperly rejected the North Ross Project alternative and that the DSEIS failed to include a range of alternatives commensurate with NEPA's requirements. Stating that the alternatives consideration is the heart of the NEPA process, designed to allow the agency to consider options that would reduce impacts to the human environment, the commenter noted that the NRC considered only three alternatives—one of which is the legally required No-Action Alternative. The commenter pointed out that DSEIS Section 2.1.3 detailed reasons why Strata rejected the North Ross Project location, but that the DSEIS also gave reasons, in DSEIS Section 4.5.3, why Alternative 3 would reduce impacts to ground-water and surface-water resources, including the Little Missouri. The commenter stated that the FSEIS needed to fully disclose the rationales behind the NRC rejecting this reasonable—and perhaps more protective—alternative.

Response: *The proposed Federal action as well as the purpose and need for the Federal action define the range of reasonable alternatives. As a regulatory agency, the NRC's Federal action for the Ross Project, as defined in SEIS Section 1.3, is the decision to either grant or deny a license. As stated in SEIS Section 1.3, the purpose and need for the Proposed Action is to provide an option that allows the Applicant to recover uranium and to produce yellowcake at the Ross Project site. Alternative 3: North Ross Project, was not rejected; this Alternative was considered for detailed analysis (as explained in SEIS Section 2.1). The alternatives that were not considered for detailed analysis are listed in SEIS Section 2.2. SEIS Section 1.3 states the following about the NRC's role in determining the location of an ISR facility: "This definition of purpose and need reflects the Commission's recognition that, unless there are findings in the safety review required by the AEA, as amended, or findings in the NEPA environmental analysis that would lead the NRC to reject a license application, the NRC has no role in a company's business decision to submit a license application to operate an ISR facility at a particular location."*

The NRC staff concluded, as noted in FSEIS Section 2.4, that the applicable environmental-monitoring program described in Section 6 and the proposed mitigation measures discussed in Section 4 would eliminate or substantially lessen the potential adverse environmental impacts associated with the Proposed Action. Therefore, the NRC staff's recommendation to the Commission related to the environmental aspects of the Proposed Action, as stated in SEIS Section 2.4, is that, unless safety issues mandate otherwise, a Source and Byproduct Materials License for the Proposed Action be issued as requested. The information requested to be added to the SEIS by the commenter is already included in the document. Therefore, no changes were made to the SEIS beyond the information provided in this response.

B.5.11.1 References

10 CFR Part 51. Title 10, "Energy," CFR, Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions." Washington, DC: GPO.

(US)NRC (Nuclear Regulatory Commission). "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

B.5.12 Land Use

B.5.12.1 Ownership Issues, Surface, and Mineral Rights

Comment: RP024-372

The commenter requested clarification of DSEIS Section 4.2, where it is stated, "These potential impacts could be greater in the areas where there are higher percentages of private land ownership." The commenter wanted the purported difference in potential impacts to privately owned land versus public lands clarified.

Response: *The rationale behind the statement that the commenter quotes is the concept that, if public land were to be taken out of the public domain until the Ross Project has been fully decommissioned and restored, then any benefits that such public land offers would not be available until after Project decommissioning and site restoration (e.g., hunting, recreating). The NRC staff has revised the text in FSEIS Section 4.2 to clarify these different impacts.*

B.5.12.2 Amount of Land Affected and Type, Degree, and Duration of Potential Impacts

Comments: RP003-002; RP039-018

The commenters expressed concern about the loss of public land use as well as the risks to the public from uranium in general. The commenters were concerned about clean water, uncontaminated food supply, and increased cancer rates.

Response: *As outlined in FSEIS Section 3.2, the majority (79.4 percent) of the Ross Project area is privately owned. The public land that would be disturbed covers a small area and there is no public path to this land (i.e., private land surrounds the public land). As noted in many sections of the FSEIS, including SEIS 4.2.1.4, the Ross Project area would be fully reclaimed and restored. This means no contamination of either chemicals or radioactiviy would remain once the Project ceases. Therefore, the NRC concludes that the impacts to public lands, including livestock grazing and recreational opportunities, are SMALL. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-366

The commenter disagrees with the statement in DSEIS Section 3.12.2.1 that Oshoto has "only a very small population (approximately 50 persons)." The commenter stated that Oshoto is a ranching community composed of ranches scattered throughout the area and suggested revising the statement as follows: "The Ross Project area is adjacent to the unincorporated ranching community of Oshoto."

Response: *The NRC staff has revised the text in SEIS Section 3.12.2.1 for clarity regarding the nature of the Oshoto community.*

Comment: RP032-006

The commenter quoted a passage from the DSEIS's Executive Summary (page xxiv of the DSEIS), which stated:

> ***Construction***: Impacts would be SMALL. The Ross Project area comprises a total of 697 ha [1,721 ac] in the north half of the approximately 90-km^2 [56-mi^2] Lance District. This area is currently used for livestock grazing, wildlife habitat, some agriculture, and some oil production. A total of 113 ha [280 ac] of land, which represents 16 percent of the Ross Project area, would be disturbed during the construction of a CPP, surface impoundments, and other auxiliary structures such as storage areas and parking lots. The wellfields would be sequentially developed over the Ross Project lifecycle. All disturbed areas would be fenced and, thus, somewhat limit grazing by livestock, access by wildlife, and recreational opportunities.

The commenter then asked the size of the total land area, including wellfields, which would remain fenced during construction, so that the basis for a "SMALL" impact was merited.

Response: *As detailed in FSEIS Section 4.2.1.1, the maximum area that would be fenced at any time at the Ross Project would be less than 12 percent of the Project area (approximately 83 ha [205 ac]). The NRC considers a SMALL impact, for the reasons outlined in GEIS Section 4.3.1.1, because the amount of area disturbed by the construction would be very small in* *comparison to the available land, the majority of the area would not be fenced, grazing would be restricted from only a small portion of the available land, and the open spaces for hunting would be minimally impacted by the fencing. The Executive Summary is meant to be a succinct abridgment of the impacts of the Proposed Action and not an exhaustive comparison of the impacts of different Project activities. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-007

The commenter referred to a statement in the Executive Summary, "No new facilities would be constructed that would result in additional land disturbance during operation, although well drilling would continue as the wellfields would be sequentially developed." The commenter stated that the statement was misleading because wellfields and associated infrastructure would continue to be built throughout the majority of the operational period.

Response: *For the purposes of this FSEIS, "facility," as defined in the Executive Summary, means the portion of the Project that includes the CPP, chemical storage, warehouse, maintenance and administration buildings, impoundments and the deep-injection wells. Land disturbance would occur during operations through the construction of additional wellfields. Although this disturbance, which includes all of the construction activities associated with wellfield development, is included in the estimate of the total land that will be disturbed, the NRC agrees that the sequencing of land disturbance could be clarified in the Executive Summary. The FSEIS's Executive Summary has been revised to clarify this information.*

Comment: RP032-079

The commenter referred to Table 4.1 in the DSEIS, which presented a summary of the acreage disturbed by different activities during construction of the Ross Project, and asserted that the impacts to land use would be greater than the area of land that would be disturbed by the uranium-recovery facility and wellfields. In addition, the commenter questioned the estimate of impacts due to construction of the pads associated with the already-permitted five UIC Class I deep-disposal wells, which Table 4.1 lists as having individual areas of 76 m x 76 m [250 ft x 250 ft].

Response: *As outlined in FSEIS Section 4.2.1.1, the discussion of land-use impacts focuses on the total amount of land disturbed over the entire lifecycle of the Ross Project (approximately 16 percent), and the amount that would be fenced at any one time (approximately 12 percent). Although this land would be fenced, it would still be available for some current uses, such as oil and gas production, wildlife habitat, and some livestock grazing. As discussed in the GEIS, land-use impacts are judged to be SMALL when they range from 50 – 750 ha [120 – 1,900 ac], and the Ross Project area would be within that range.*

The NRC staff agrees with the commenter about the area of land disturbance resulting from five 76 m x 76 m [250 ft x 250 ft] pads constructed at the sites of the UIC Class I wells. As a result, Table 4.1 in the FSEIS has been corrected from 2 ha [5 ac] to 3 ha [7 ac] of land disturbance per deep-disposal well. Other references to the total land disturbance as a result of the pads constructed at the deep-disposal have also been corrected throughout the FSEIS. Potential impacts to geology and soils, ground water, and ecology that may be related to the acreage of *land disturbance are evaluted in FSEIS Sections 4.4, 4.5, and 4.6, respectively. (Comment No. RP032-023 also addresses this discrepancy and corrects the calculation.)*

Comments: RP036-006; RP036-055

The commenters noted that, although there are no public roads to the BLM parcel, the parcel is accessible by foot through an adjacent State-owned parcel and, therefore, could be accessible to the public.

Response: *The NRC agrees with the commenter and has edited the text in FSEIS Section 3.2.2 to clarify that the BLM parcel is not accessible by public roads; however, the parcel is accessible by foot.*

Comment: RP036-019

The commenter noted that the land-use impacts would be less if the Ross Project were to be constructed at Alternative 3's North Site because there is no current dryland crop agriculture or livestock pasture there to be impacted (see DSEIS Section 4.2.3). The commenter requested that the NRC staff claify the land-use impacts between Alternatives 1 and 3, particularly in terms of agricultural land use and livestock pasture.

Response: *The text in FSEIS Section 4.2.3 has been clarified to note that there would be fewer impacts to dryland crop agriculture and livestock pasture in Alternative 3, but that, taken together, all impacts would be quite similar to Alternative 1. The NRC concluded that the land-use impacts in Alternative 3 would be generally the same as Alternative 1. Because of the proposed mitigation measures described in FSEIS Section 4.2.3, the land-use impacts resulting from both Alternatives would be SMALL, despite their small differences in the types of agricultural and habitat land use. FSEIS Section 4.2.3 has been edited for clarity.*

Comments: RP036-044; RP036-045

The commenter requested clarification regarding the future land use related to oil and gas development in the land-use cumulative-impacts study area. The commenter also requested that a reference be provided for the estimate of disturbance at each drilling location, as the cumulative-impacts aalysis of land use uses 1.11 ha [2.75 ac] as the average disturbance caused by drilling and well installation. However, the commenter stated that it is unclear whether that size refers to an existing well pad that has been partially decommissioned and the area reclaimed, or whether it refers to a pad surrounding a well that is in current production. The commenter further stated that the DSEIS does not adequately address the cumulative impacts of oil and gas development vis-à-vis long-term habitat fragmentation.

Response: *SEIS Section 5.4 explains that oil and gas production in the Ross Project area has decreased by 60 percent, and the BLM indicates that the number of producing wells will decrease in the coming years (BLM, 2009e). Therefore, the cumulative impacts from oil and gas activity will actually decrease in the future, compared to the 2010 levels included in the GEIS. The NRC has added a reference (BLM, 2009e) for the well-pad disturbance area in SEIS Section 5.4. In addition, the potential cumulative impacts to habitat fragmentation at and near the Ross Project are discussed in FSEIS Section 5.8.1, Terrestrial Ecology. Also see Comment Nos. RP036-017, RP036-021, RP036-027, RP036-032, RP036-047 through -051, and RP039-010.*

B.5.12.3 References

(US)BLM. *Update of the Task 2 Report for the Powder River Basin Coal Review Past and Present and Reasonably Foreseeable Development Activities.* Prepared for BLM High Plains District Office and Wyoming State Office. Fort Collins, CO: AECOM. 2009e. ADAMS Accession No. ML13014A657.

WWC Engineering. *Permit to Mine Application, Ross ISR Project, No. TFN 5 5/217: Submittal of Mine Plan Replacement Page per the Joint Stipulation Resolving EQC Docket No. 12-4803.* October 24, 2012. ADAMS Accession No. ML12299A040.

B.5.13 Transportation

Comments: RP003-003; RP005-001

The commenters noted concern about the increased traffic on local roads.

Response: *The NRC recognizes that there would be a significant increase in traffic on local roads, particularly during the 12 – 18 months of construction-related activities. As discussed in FSEIS Section 4.3.1.1, numerous mitigation measures would be initiated by the Applicant and Crook County to help reduce these impacts. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP005-003; RP005-004; RP005-005; RP006-001; RP008-001; RP009-001

The commenters expressed concern about the maintenance of local roads, given the increase in traffic.

Response: *As detailed in SEIS Section 4.3.1.1, the Applicant has entered into an MOU with Crook County that contains road maintenance commitments (Strata and Crook County, 2011). No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP016-004; RP032-080

The commenters requested additional information on the specific location of the CPP and whether moving the CPP to an alternate location could reduce transportation impacts.

Response: *The location of the CPP for the Proposed Action is shown in SEIS Figures 2.4 and 2.5. The NRC staff evaluated the transportation impacts of the Ross Project, including consideration of the number of vehicles that would be accessing the Project area per day. If the CPP were to be moved to an alternative location, that move would not diminish the number of vehicles per day associated with Project construction or operation. Furthermore, the Applicant needs to also consider the location of the CPP in conjuction with other site attributes (e.g., topography) as well as its location relative to the uranium-recovery wellfields. Although the Applicant's moving the CPP within the Ross Project area might slightly shorten the distance to the Plant for trips from some locations* inside *the Project area, it might not have any impact on trips originating from* outside *the Project area, as those vehicles might turn into the area at what would be the same access road and then take a right turn rather than a left turn to the CPP. Nonetheless, relocation of the CPP would not significantly alter the transportation impacts as* *the same number of vehicles would still travel the same Crook County and local roads. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP016-005; RP024-495

The commenters stated that the description of the New Haven and D Road roadbeds is correct in SEIS Section 3.3, but is inconsistent in SEIS Section 4.7.1.1.

Response: *The NRC agrees with the commenter and has revised SEIS Section 4.7.1.1 accordingly.*

Comment: RP016-006

The commenter provided several examples of mitigation measures proposed by the Applicant, but expressed concern over enforcement of mitigation measures.

Response: *The NRC notes that many of the mitigation measures are memorialized in the MOU with Crook County, signed by the Applicant on April 6, 2011; this MOU is an agreement that stays in place throughout the life of the Ross Project. The MOU requires a single point of authority contact with respect to road issues, dust control, enforcement of speed limits, education of employees, compliance with weight limits, etc. This MOU is an agreement that stays in place throughout the life of the Ross Project. Other mitigation techniques, e.g., daylight deliveries and construction activities, benefit safety for the company as well as maintain positive community relations. The Applicant has made these commitments in good faith and has stated they will implement these mitigation measures. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP017-025

The commenter advised that the NPS promotes valuable and laudable protection of soundscapes (the human perception of the natural acoustical environment in units managed by NPS) and suggested that the NPS Acoustical Toolbox may be of use in reducing noise impacts, levels, and vibration.

Response: *The noise mitigation measures committed to by the Applicant are found at SEIS 4.8.1.1 through 4.8.1.4. These measures include nighttime drilling and equipment operations restrictions; speed limit enforcement; road maintenance; daytime delivery of materials; and restrictions on compression brakes, loud engines and exhaust systems. Many of the concepts in the NPS Toolbox are incorporated into both the design of the CPP and in BMPs, such as keeping the doors closed to the CPP whenever possible, "first move forward" policies, etc. Carpooling will be encouraged to minimize the noise of commuting traffic. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-379

The commenter questioned the conclusion that the impacts to local roads would be MODERATE to LARGE, given the extensive mitigation measures proposed by the Applicant.

Response: *The GEIS rated the potential impacts to local roads as SMALL to MODERATE, based on the assumption that ISR activities in the Wyoming East Uranium Milling Region would* *not bring significant increases in daily traffic (NRC, 2009b, pg 4.3-3). The GEIS further states that "[r]oads with the lowest average annual traffic counts would have higher (MODERATE) traffic and potential infrastructure impacts." However, the GEIS based this analysis on a minimum all-vehicle traffic count in the region of 340 vehicles per day, and an average of 900 vehicles per day. Compared to 340 vehicles per day, the increase resulting from an ISR project that contributes 400 vehicles per day during construction, as is projected for the Ross Project, would represent a 117 percent increase in traffic. Because of the low traffic count near the Ross Project prior to construction, the increase is actually 400 percent. This is a significant increase compared to the analysis in the GEIS, and therefore the classification of LARGE is appropriate. After construction, when the traffic count decreases, the increase in traffic will be more similar to that discussed in the GEIS. Therefore the impact during operation was classified as SMALL to MODERATE. Responses to similar comments are included at Comment Nos. RP024-019, RP024-020, RP024-056, RP024-057, RP024-220, RP024-221, and RP024-472. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-380

The commenter requested that the mitigation measures in the SEIS include the potential implementation of a park-and-ride system.

Response: *The NRC staff included the possibility of employee carpooling or a park-and-ride system in SEIS Section 4.3.1.1. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-517; RP024-518

The commenter questioned the speed ranges cited for examination of noise levels on roads in the vicinity of the Project area. Specifically, the concern was that the speeds cited in a U.S Department of Transportation (USDOT) study for heavy trucks and passenger vehicles were much greater than the posted speed limits in the vicinity of the Ross Project area, which are “55 mi/hr” for cars and “45 mi/hr” for trucks on D Road and “45 mi/hr” on New Haven Road. The commenter also stated the the speed limit range for heavy trucks does not match the information presented in the USDOT report. The commenter suggested revising the statement to reflect noise levels at the current posted speed limits.

Response: *The NRC acknowledges that the upper end of the speed ranges cited as examples by the USDOT were greater than the speed limits in the vicinity of the Ross Project. However, the intent of the USDOT comparison, and its conclusion that heavy trucks generate more noise than passenger vehicles within the same speed range, is valid. The statement has been revised to cite the lower speed range, which is more consistent with the speed limits on D Road and New Haven Road. USDOT findings are consistent with the results of the noise level monitoring study conducted by the Applicant at nearby residences. In this study, the maximum recorded noise level at the residence was generated by a bentonite truck at 73.4 dBA. The text in FSEIS Section 3.8 has been revised to highlight the fact that the noise measured during the passing of a bentonite truck in the Applicant’s noise study was lower than either of the ranges for medium and heavy trucks.*

Comment: RP024-639

The commenter requested clarification on cumulative impacts to the transportation system within its designated study area, in particular, the local roads and the NRC's evaluation of the impacts of the Ross Project.

Response: *The cumulative impacts discussed under "Transportation," SEIS Section 5.5, include the impacts from all past, present and reasonably foreseeable future actions (RFFAs). These RFFAs include coal-bed methane (CBM) production projects, oil and gas production operations, surface-coal mining, uranium recovery, and other developments and projects. Given the number of planned and potential projects in the transportation cumulative-impacts study area, the NRC staff concluded that the impacts to the transportation system by the Ross Project itself, particularly to the local- and county-road network, would be MODERATE to LARGE. Even with the SMALL impacts to the Interstate-highway system, the cumulative impacts would be MODERATE due to the potentially significant increase in traffic volumes on local roads. The discussion in SEIS Section 5.5 has been clarified in the SEIS as a result of this comment.*

Comment: RP032-081

The commenter stated that the conclusion in DSEIS Section 4.3.1.2 that increasing the shipment of resins received at the CPP daily from one (as assumend in the GEIS) to four (as proposed by the Applicant) would not affect the risk of accidents is unsubstantiated. The commenter also stated that the increased risk arising from shipping four times the yellowcake output obtainable from the Ross Project alone is not even evaluated.

Response: *The SEIS does not state that there would be no increased risk arising from an increase in the number of resin shipments. The SEIS states that the risks in either case would be small. The NRC staff substantiates this conclusion in SEIS Section 4.3.1.2. This Section of the SEIS states, "[a]lthough the number of shipments proposed by the Applicant is higher than the one truck per day assumed in the GEIS, the other three factors evaluated in the GEIS would ensure that the probability of an accident that involves uranium-bearing IX resin would be small. Compliance with the applicable NRC and USDOT regulations for shipping IX resins would also reduce the risk of accidents involving these shipments." Regarding yellowcake shipments, the SEIS evaluates, in Section 4.3.1.2, the impacts from accidents resulting from shipments of yellowcake. The analysis assumes that there would be 75 shipments of yellowcake per year. This number of shipments of yellowcake is based on the maximum annual production rate, which includes yellowcake produced from toll milling. The SEIS concludes that impacts due to a potential accident involving the transportation of yellowcake during the operations phase of the Ross Project would be SMALL. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-240; RP035-027

The commenters asked for clarification regarding the transportation route from Interstate (I)-90 to the Ross Project area and asked that a figure be added to better illustrate the local transportation routes. One commenter wondered if the scale of DSEIS Figure 3.4 could be changed to a larger scale.

Response: *The description in SEIS Section 3.3 is correct. Although the Project site is north of I-90, one must first travel south from the Interstate to get to the proper access roads. From I-90 eastbound, one turns right on US 14/16 for approximately 1/3 of a mile, heading south, then turns west on WY 51 and continues to Bertha Road (County Road [CR] 12), and then turns north to pass under I-90. Please refer to SEIS Figure 2.1 for an additional illustration of the local transportation route. In preparing the SEIS, the NRC staff used the figures that are included in the license application. Thus, the two figures, FSEIS Figures 2.1 and 3.4, taken together provide the NRC's best possible maps. The respective scales could not be changed.*

Comment: RP036-020

The commenter requested clarification on the transportation mitigation measures, and whether or not the mitigation measures identified in SEIS Section 4.3.1.1 would be applied throughout the Project life.

Response: *As stated in SEIS Sections 4.3.1.2, 4.3.1.3 and 4.3.1.4, the mitigation measures outlined in SEIS Section 4.3.1.1 (construction) would also be implemented in subsequent Project phases. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP036-046

The commenter noted that the mitigation measures proposed for traffic impacts resulting from the Ross Project should be required of other projects in the Lance District.

Response: *Specifying mitigation measures for future projects in the vicinity is beyond the scope of the Ross Project SEIS. No changes were made to the SEIS beyond the information provided in this response.*

B.5.13.1 References

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

Strata (Strata Energy, Inc.) and Crook County. Memorandum of Understanding for Improvement and Maintenance of Crook County Roads Providing Access to the Ross ISR Project. Sundance, WY: Crook County. 2011. ADAM Accession No. ML111170303.

B.5.14 Geology and Soils

B.5.14.1 Soil Disturbance Concerns

Comment: RP032-084

The commenter asked for the NRC staff's justification underlying its statement in DSEIS Section 5.6 that "[t]he Nubeth area was restored and these past activities are consequently no longer relevant for the geology and soils cumulative-impacts analysis."

Response: *The area impacted by the Nubeth Joint Venture (Nubeth) research and development operation was small (approximately 3 ha [7 ac] and only one 5-spot well pattern). Final approval of Nubeth's decommissioning was granted by the appropriate regulatory agencies (including the NRC) in 1983 through 1986 (ND Resources, 1985a; ND Resources, 1985b). Nubeth's decommissioning included the removal and transport of 165 tons of contaminated soil offsite (ND Resources, 1985a). After the soil was removed, a gamma-radiation survey of the area was conducted; the survey encompassed Nubeth's processing facility, wellfields, and storage surface impoundment. Soil samples were collected and analyzed for radium-226 and uranium. Based upon the gamma survey and soil analyses, the levels of radiological parameters in soil from all areas were found to be within the local background. Following verification of the soil surveys by the NRC, stockpiled topsoil was applied and leveled, and the vegetation was reseeded. Based upon the final regulatory approval as well as the data that are available for review, the NRC staff concluded that there are currently no impacts to the local soils within the Ross Project area resulting from the Nubeth operation. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-085

The commenter referred to the following statement made in SEIS Section 5.6: "These impacts would dissipate quickly once site restoration is complete, within five years or less; therefore, the time period for this geology and soils cumulative-impacts evaluation is 19 years from the licensing of the Ross Project, or the year 2032." The commenter then inquired as to the basis for the NRC's conclusion that the geology and soils impacts by the Ross Project would dissipate quickly once the area has been reclaimed and restored. The commenter also asked for examples of geology and soil disturbances that are expected at the Ross Project in addition to previously observed instances in similar projects and their observed recovery times. In light of the data the commenter asks for, the commenter wondered whether a "five-year recovery buffer" is conservative.

Response: *The basis for the NRC's conclusion that impacts to geology and soils would dissipate quickly once area reclamation and restoration is complete is discussed in the impact assessment found in SEIS Section 4.4.1. Impacts to geology and soils would be SMALL after mitigation by meeting reclamation and restoration requirements. Site reclamation and restoration would be conducted by the Applicant both as individual wellfields are retired (after successful aquifer restoration) and during the final Project decommissioning phase. All potential impacts to the geology and local soils would be mitigated. Mitigation techniques that would be implemented by the Applicant include rapid topsoil replacement from soil piles (created during Project construction and wellfield development) as well as deliberate reseeding of disturbed land with native vegetation varieties. The Applicant would accomplish this restoration within one season of a wellfield's decommissioning. As described in SEIS Section 4.2.1.4 revegetation* *would be completed in accordance with an approved restoration action plan, which is required by Applicant's Permit to Mine issued by WDEQ. Oversight and approval by State regulatory agencies would ensure that the reclamation and restoration of all impacted soils within the Ross Project area are conducted in compliance with applicable requirements. In addition, Strata's license application included a RAP as Addendum 6.1-A to its TR, which would be implemented during Project decommissioning.*

The five-year recovery buffer was selected by the NRC as a reasonable timeframe, which would allow the re-establishment of biota that assist in the development of a natural soil structure as well as regrowth of mature native vegetation. The NRC based the five-year timeframe on guidance by the University of Wyoming that notes successful reclamation may take up to five years in environments similar to that at the Ross Project (Norton and Strom, 2013). The timeframe for recovery of impacts to geology would be within the five-year timeframe since the impacts to geology are primarily from drill holes and wells and those impacts would be stabilized immediately upon plugging and abondoning the wells and holes. No changes were made to the SEIS beyond the information provided in this response.

B.5.14.2 Miscellaneous Geology and Soils Comments

Comments: RP015-003; RP026-001; RP026-002; RP028-002

The commenters expressed concern about impacts to the Madison aquifer from the UIC Class I deep-injection wells.

Response: *The NRC staff finds that impacts to the Madison-Formation aquifer are highly unlikely. As described in SEIS Section 3.4.1.2, the Deadwood and Flathead Formations that would receive liquid byproduct material through the UIC Class I injection wells are separated from the Madison Formation by at least 120 m [400 ft] of impermeable rock (i.e., the Red River Formation and the Icebox Shale). In addition to the confining properties of the 120 m [400 ft] of impermeable rock, the Applicant's monitoring of the injection pressure, as required by the UIC Class I Permit, would allow its detection of loss of the well casing's integrity, as discussed in SEIS Section 4.5.1.2. In the event that a UIC Class I well loses integrity, waste injection into that particular well would be suspended for well repair, thus preventing impacts to the aquifers above the Deadwood and Flathead Formations. The NRC staff has revised the text in SEIS Section 3.4.1.2 to provide further information regarding the thickness of rock separating the Madison Formation from the Deadwood and Flathead Formations. No change was made to the SEIS beyond the information provided in this response.*

Comments: RP024-247; RP024-248

The commenter suggested that the NRC staff add more detail in FSEIS Section 3.4.1.2 in its description of the thickness of the alternating layers within the lower and upper units of the Fox Hill Formation as well as the mineralization of the Fox Hills Formation and Lance Formation and the overlying confining unit.

Response: *To minimize redundancy in the SEIS text, the level of detail requested by the commenter is included in SEIS Section 3.5.3, "Ground Water," but it was not repeated in SEIS Section 3.4.1. A referral to SEIS Section 3.5.3 has been added to FSEIS Section 3.4.1.*

Comment: RP024-254

The commenter requested that the statements describing the six faults mapped by Buswell (1982) be revised. The commenter stated that more contemporary studies completed by the Applicant have invalidated the presence of the faults.

Response: *The NRC staff agrees with the comment and revised the text in SEIS Section 3.4.4 to revise the six faults mapped by Buswell (1982). The statement in FSEIS Section 3.4.4, "These faults are due to heterogeneity of the lithology among the shale and sandstone intervals within the upper Cretaceous Formations" has been revised to read, "Instead, it appears that the variability in stratigraphic elevations is due to heterogeneity in thickness of the various shale and sandstone intervals within the upper Cretaceous Formations."*

Comment: RP032-070

The commenter asserted that the data and discussion on ground-water quality in DSEIS Section 3.5.3 was vague, disconnected, and inadequate. The commenter specifically noted that data from existing wells completed in the Lance and Fox Hills aquifers outside of the previous Nubeth research and development project are not included in DSEIS Tables 3.6 and 3.7.

Response: *The NRC assumes that the commenter is referring to the water-quality data from the 29 water-supply wells that are outside the Ross Project area, since the Nubeth operation occupied only a small portion of the area of the Ross Project. The water-quality data from the 29 water-supply wells are described in FSEIS Section 3.5.3. Because the NRC received several public comments requesting the water-quality data from the 29 water-supply wells as well as water-quality data from Project monitoring wells, the NRC staff has added an Appendix C to the FSEIS, which includes all water-quality data generated by the Applicant through its sampling and analysis efforts. The map indicating the location of the 29 water-supply wells, which were monitored for ground-water quality by the Applicant for the license application and are proposed for continued monitoring during life of the Proposed Action, has been added as Figure 3.16 to FSEIS Section 3.5.3. Additional ground-water-quality data collected for the Nubeth project have also been added to FSEIS Table 3.7, and more supplemental discussion of the water-quality data after the aquifer restoration of the Nubeth project has been added to FSEIS Section 5.7.2. Please see the NRC staff's responses to Comment Nos. RP032-071, RP032-077, RP035-035, RP032-018, and RP032-072 for further information regarding ground-water quality in water-supply wells.*

Comment: RP032-008

The commenter noted the statement in the Executive Summary of the SEIS, "Operation: The impact [on ground water] would range from SMALL to MODERATE (depending upon whether excursions occur)." The commenter asked why, if a major excursion were to occur and remain undetected for an extended period, for example, would the impact not be "LARGE"?

Response: *The statement referenced by the commenter was taken from the Executive Summary of the DSEIS, which was intended to summarize SEIS Section 4.5.1. In, particular; the impacts of the Ross Project on ground-water quality throughout the Ross Project's lifecycle are presented in that SEIS Section. As described in SEIS Sections 2.1.1.1, 2.1.1.2, 4.5.1.2, and 4.5.1.4, monitoring wells would be placed around the perimeter of each wellfield as well as in the aquifers both overlying and underlying the target ore zone according to Condition Nos.*

10.13 and 11.5 in the Draft Source and Byproduct Materials License for the Ross Project (NRC, 2014b). This placement of ground-water wells is designed to provide timely detection of horizontal and vertical excursions (NRC, 2014b). In developing the required spacing between ground-water wells and the distance to the monitoring-well perimeter ring, the NRC has taken into account the respective aquifer's characteristics so as to minimize the possibility that an excursion would not be detected. Corrective actions indicated by Draft License Condition No. 11.5, in the event of an excursion, would ensure that the excursion impacts are mitigaged and do not become LARGE.

The texts in the SEIS Sections referenced above have been revised to clarify the NRC's analyses of ground-water impacts, including the parameters, methodology, and conclusions of these analyses. These revised texts discuss the requirements that would be included in the Final License, as currently included conditions in the Draft License for the Ross Project, which are intended to increase the probability that excursions would be detected in a timely manner (NRC, 2014b). In addition, the text now discusses the respective Draft Source and Byproduct Materials License Conditions intended to avert excursions more completely and describes the Draft License Conditions that discuss corrective actions were an excursion to occur. Please see the response to Comment No. RP032-033 for additional information on actions required of the Applicant that would mitigate the consequences of an excursion so that the impacts would not be LARGE, were the Ross Project to be licensed by the NRC.

B.5.14.3 References

Buswell, M.D. *Subsurface Geology of the Oshoto Uranium Deposit, Crook County, Wyoming,* M.S. Thesis, South Dakota School of Mines and Technology. Rapid City, SD: South Dakota School of Mines and Technology. 1982.

ND Resources*. Final Decommissioning Report for Nubeth R&D Solution Mining Project*. Crook County, WY: ND Resources, Inc. March 1985a. ADAMS Accession No. ML13274A058.

ND Resources*. Final Decommissioning Report for Nubeth R&D Solution Mining Project Volume 2*. Crook County, WY: ND Resources, Inc. March 1985b. ADAMS Accession No. ML13274A126.

Norton, Jay and Calvin Strom. *Reclamation Considerations for Oil and Gas Lease Contracts on Private Lands*. University of Wyoming Extension Reclamation Issue Team and the Wyoming Reclamation and Restoration Center. Laramie Wyoming, April 2013.

(US)NRC (Nuclear Regulatory Commission). "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

B.5.15 Ground-Water Resources

B.5.15.1 Concerns about ISR and Ground-Water Contamination

Comments: RP003-001; RP004-001; RP016-003; RP029-001

The commenters expressed concern about the potential for contamination of water resources in the neighborhood of the Ross Project.

Response: *NRC licensing and regulatory requirements for ISR facilities at 10 CFR Part 40, as well as NRC's requirement that licensees obtain all necessary permits and licenses from the appropriate regulatory authorities prior to operating their facility, generally serve to limit the potential for contaimination of water resources outside the areas of the wellfields in ore-zone aquifers. As described in SEIS Section 4.5, the impacts to water resources would be SMALL except for the MODERATE impacts to the ore-zone aquifer during the operation and restoration phase. The monitoring network for ground water, which would be required by the Source and Byproduct Materials License and, which is currently discussed in Draft License Condition Nos. 10.13 and 11.5 and also described in SEIS Sections 2.1.1.1 and 6.3.2, ensures prompt detection of leaks, spills, and excursions that may cause short-term impacts to water resources (NRC, 2014b). However, the mitigation measures described in Draft License Condition No. 11.5 would limit these impacts, and corrective actions would quickly remediate any releases (NRC, 2014b). NRC regulations require that ground-water quality within the production zone (i.e., the ore zone of the exempted aquifer) be returned to the standards identified in 10 CFR Part 40, Appendix A, Criterion 5B(5). Restoration of the ground water in the ore zone of a particular wellfield would eliminate that wellfield as a source of potential impacts to ground-water resources in the vicinity of the Ross Project. In addition, as described in the SEIS Section 2.1.1.7, the NRC requires the Applicant to post a finacial surety that would cover the anticipated and delayed aquifer-restoration costs (as well as facility decontamination and decommissioning costs) to comply with 10 CFR Part 40, Appendix A, Criterion (9). The NRC would review the adequacy of this instrument annually. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-013; RP024-161; RP024-169; RP024-170; RP024-425

The commenter recommended revising several statements in the DSEIS to include more specific information about: 1) the applicability of 10 CFR Part 40, Appendix A, Criterion 5B(5) to ground-water restoration and wellfield decommissioning; 2) the conclusions of the NRC staff with respect to its evaluation of ground-water impacts outside the exempted aquifers (NRC, 2009d); and 3) the role of wellfield balance in an operator's averting and detecting excursions. The commenter asked that the concept of "baseline conditions," in particular, be discussed further. The commenter also asked that the "purpose of aquifer restoration" be clarified in the FSEIS text. DSEIS Sections specifically identified by the commenter included the following: the Executive Summary, Section 2.1.1.3, and Section 4.5.1.2, Ground Water.

Response: *The NRC staff generally agrees with the suggested revisions. The following statement was added to FSEIS Section 4.5.1.3: "The purpose of aquifer restoration is to return the ground-water quality at a specified point of compliance, generally defined as the boundary of the exempted aquifer, to the ground-water protection standards specified at 10 CFR Part 40, Appendix A. The restoration of an exempted aquifer to meet the standards in Criterion 5B(5)(a) would ensure that a present or potential future USDW outside of the exempted aquifer would be* *protected (NRC, 2003b). Criterion 5B(5) of Appendix A requires that the concentration of a given hazardous constituent at the point of compliance must not exceed: 1) the NRC-approved concentration of that constituent in ground water (5B(5)(a)); 2) the respective numeric value in the table included in Paragraph 5C of Criterion 5B(6), if the specific constituent is listed in the table and if the level of the constituent is below the value listed (5B(5)(b)); or 3) an ACL the NRC establishes for the constituent (5B(5)(c)).”*

The purpose of aquifer restoration has been clarified in FSEIS Section 2.1.13 in this way: “The purpose of aquifer restoration is to restore the ground-water quality at the point of compliance within the exempted aquifer to the ground-water protection standards specified at 10 CFR Part 40, Appendix A, Criterion 5B(5), so as to ensure no hazard to human health or the environment.” By Criterion 5B(4), the NRC staff can consider the existence of an exempted aquifer as defined by EPA but only in determinations of either 1) to exclude a constituent from the ground-water protection monitoring program, or 2) an ACL. Per definitions in Appendix A, the compliance period for which the ground-water protection monitoring program would be performed is from the time the Commission sets the ground-water protection standards until license termination. Thus, the ground-water protection program is continuous throughout operation, aquifer restoration, and possibly the post-closure (post-reclamation) period as determined by the NRC.

Historically, the NRC staff have assigned the point of compliance as referenced in 10 CFR Part 40, Appendix A, Criterion 5B(5) as the boundaries of the EPA-defined exempted aquifer; during operation, the wells used to monitor the point of compliance are those monitoring wells in the excursion-monitoring program. During site reclamation and restoration, until complete site closure, the wells that would be used by the Applicant to monitor the point of compliance are predominantly the wellfields’ post-licensing, pre-operational monitoring wells, although monitoring for compliance continues at the wells in the excursion-monitoring program. Criterion 5B(1) states that hazardous constituents entering the ground water from a licensed facility must not exceed the established ground-water protection standard beyond the point of compliance.

To achieve this requirement, Criterion 5B(6) provides that, although Criterion 5B(5)(a) poses no incremental hazard and Criterion 5B(5)(b) limits the hazards to acceptable levels, a licensee’s meeting these criteria might not be achievable. Therefore, the ground-water protection standard would then be based upon Criterion 5B(5)(c), an ACL. For the use of an ACL to be acceptable, the licensee must demonstrate that the ACL does not present a significant hazard.

Additional details about the ground-water protection standards as discussed in this response have been added to FSEIS Sections 2.1.1, 2.1.1.2, 4.5.1.2, and 4.5.1.3. A summary of the conclusions from the NRC’s review of ground-water impacts outside the exempted aquifers has been added to FSEIS Section 4.5.1.3 (NRC, 2009d). Please also see the NRC’s responses to Comments Nos. RP024-013, RP024-161, RP024-169, RP024-170, RP032-020, RP032-036, and RP032-041. Finally, the NRC has added Appendix B1 to this Appendix in the FSEIS to offer additional information on the NRC’s process for applying 10 CFR Part 40, Appendix A, Criteria 5B(5) in general and ACLs in particular.

Comment: RP024-221

The commenter recommended that the potential magnitude of ground-water impacts during the operation and aquifer-restoration phases of the Ross Project in DSEIS Section 2.4 be changed from “MODERATE” to “SMALL to MODERATE.”

Response: *Although the NRC staff concluded that ground-water impacts during operation and aquifer restoration would be SMALL to MODERATE (See SEIS Sections 4.5.1.2 and 4.5.1.3), the NRC staff does not agree that the commenter's suggested revision to the text in DSEIS Section 2.4 is appropriate. At the beginning of DSEIS Section 2.4, the text stated: "Potential adverse impacts to all environmental resource areas are expected to be SMALL, with the exception of… ." Therefore, following this statement, DSEIS Section 2.4 provided detailed information about resource areas with MODERATE and LARGE impacts and did not specifically address SMALL impacts.*

DSEIS Section 2.4 provided the NRC staff's preliminary recommendation regarding the Proposed Action, based on the findings in the DSEIS, and provided a detailed summary of the DSEIS findings. However, it should be noted that, Section 2.4 of the FSEIS provides the NRC staff's final recommendation regarding the Proposed Action but does not include the detailed summary of the SEIS findings, which were the subject of this comment. No changes to the SEIS were made beyond the information provided in this response.

Comment: RP032-025

The commenter highlighted the following statement in SEIS Section 2.1.1.2: "Comparison of the Applicant's expected concentration ranges of chemical constituents in the pregnant lixiviant with the typical lixiviant chemistry presented in Table 2.4-1 of the GEIS shows consistency between the Ross Project and the GEIS, except for higher concentrations of uranium and vanadium that could be present in the pregnant lixiviant at the Ross Project (Strata, 2011b; NRC, 2009b)." The commenter asked what would account for this discrepancy and would the varying concentrations be a result of differing ISR processing techniques, or would they result from differing ore bodies underlying the Ross Project and/or the Lance District from which uranium would be recovered? The commenter requested that the FSEIS provide a discussion of the environmental impacts of these higher concentrations relative to aquifer restoration, radiation exposures, and waste-disposal techniques.

Response: *The concentrations of uranium and vanadium in a lixiviant are primarily determined by the grade of the ore being recovered. Table 2.4-1 of the GEIS presents typical lixiviant concentrations from an alkaline lixiviant, which is the same type proposed for the Ross Project. The range of uranium and vanadium concentrations presented as "typical" for lixiviant in the GEIS are < 0.01 – 500 mg/L and < 0.01 – 100 mg/L, respectively. By comparison, the Applicant has estimated typical lixiviant would contain uranium and vanadium concentrations as < 1 – 700 mg/L and < 1 – 400 mg/L. Compared to the typical lixiviant described in the GEIS, the slightly higher estimated concentrations of uranium and vanadium in the Ross Project's lixiviant could indicate a higher than typical ore-grade.*

The higher range of concentrations estimated by the Applicant for lixiviant uranium and vanadium does not affect the NRC staff's environmental-impact assessment. Ground-water restoration would still remove the residual lixiviant from the wellfields such that, independent of the initial water quality, aquifer restoration would continue until the ground-water quality is returned to the standards identified in 10 CFR Part 40, Appendix A, Criterion 5B(5). Also, radiation exposures would be of minimal or no concern under normal facility-operating conditions because Project workers or the public would not generally come in contact with the lixiviant, regardless of the concentration of radioactive species it may contain. Please refer to the NRC staff's Ross Project SER Section 7.3.2 for a full analysis of potential radiation exposures in the case of accidents (NRC, 2014a), as well as SEIS Section 4.13.1, which *discusses the health and safety of occupational workers and the nearby public. The IX process proposed for the Ross Project at the CPP would remove the uranium and vanadium, as the two resources of economic value, from the lixiviant. After removal of these resources, the byproduct waste water from the process would be depleted in uranium and vanadium; and, therefore, the impacts of waste disposal are not related to the levels of uranium and vanadium initially in the lixiviant. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP032-043; RP032-044

The commenter noted that the DSEIS stated:

> If the oxidized (i.e. the more soluble) state is allowed to persist after uranium recovery is complete, metals and other constituents such as arsenic, selenium, molybdenum, uranium and vanadium could continue to leach and remain at elevated levels. To stabilize these constituent concentrations, the pre-operational oxidation state in the ore zone must be reestablished as much as possible.

The commenter also noted that the DSEIS stated:

> The Applicant would reinitiate the entire aquifer restoration phase if stabilization monitoring determines it is necessary. Both WDEQ and the NRC must review and approve all monitoring results before aquifer restoration would be considered to be complete.

The commenter then asked a series of questions regarding these statements:

1) For the purposes of the SEIS analysis, what has the NRC deemed to be “elevated levels” for the above-named constituents?

2) Would the NRC provide the range of historically and geotechnically indicated minimum, maximum, and most-likely (i.e., expected) elevated levels for each of the above named constituents that could result from the NRC's decision to grant a source and byproduct materials license, and discuss the scientific and technical basis for the information provided?

3) What is the pre-operational oxidation state in the proposed ore zones of the Ross Project and the potential Lance District development shown in SEIS Figure 2.6? Would the pre-operational oxidation state of these ore zones differ from their pre-licensing baseline state? If so, please identify the known and likely factors contributing to this difference. If not, why would the NRC not employ the measured, pre-licensing baseline oxidation state of the ore zone as the value to be reestablished as much as possible?

4) How much is “as much as possible”? What would be the metrics that the Applicant would employ, and/or those that the NRC would enforce, to establish that “the pre-operational oxidation state in the ore zone” has been reestablished as much as is possible? How would the NRC go about independently confirming or otherwise verifying the authenticity, accuracy, and completeness of the monitoring results that it would review and approve for the Ross Project and other potential Lance District development?

5) Would “as much as possible” be less that the TRVs specified in the Applicant's license application? If so, what elevated concentrations of the “dissolved metals” enumerated on page

2-34, line 33-34 of the SEIS would be deemed acceptable for terminating the aquifer-stabilization phase during aquifer restoration under the Ross Project's to-be-issued license?

6) What are the specific environmental-monitoring benchmarks that would determine whether it is necessary to "reinitiate the entire aquifer-restoration phase" for the Ross Project and the potential Lance District satellite areas? Which of these standards or criteria would be considered binding upon the NRC and the Applicant, and which could be abandoned or modified at will using the NRC's enforcement discretion? Would the NRC please provide the approved standard for each constituent that would be used to conduct this quarterly monitoring, and the standards for its determining that any adjacent, nonexempt aquifers are unaffected. What does "adjacent" mean in this context? Which official or officials within the NRC would be entrusted with the responsibility and authority to approve monitoring results and declare aquifer restoration to be complete?

7) For how long would the license, if issued, require the Applicant to monitor the ground water by quarterly sampling to demonstrate that the approved standard for each constituent were met and that any adjacent nonexempt aquifers were unaffected?

Response: *The quoted text from DSEIS Section 2.1.1.3 was taken from the GEIS, and, in both documents, the text is located within the discussion of stabilization following aquifer restoration. The subject paragraphs within DSEIS Section 2.1.1.3 that discussed aquifer stabilization have been revised to clarify the commitment made by the Applicant as stated in the license application, the review by the NRC staff of the Strata's license application in the SER, and the current conditions of the Draft License (Strata, 2011b; NRC, 2014a; NRC, 2014b). The specific revisions to these paragraphs are described in the responses to Comments Nos. RP024-172 and RP024-173.*

1) The statement in DSEIS Section 2.1.1.3 referred to by the commenter was a description of the aquifer-restoration process. The use of the phase, "elevated levels" in this statement in the FSEIS means concentrations of a given constituent that would not meet ground-water protection standards.

2) The NRC staff does not compile the routine monitoring data collected by ISR licensees during ground-water restoration that would be necessary to produce a range of historically and geotechnically indicated minimum, maximum, and most-likely concentrations of constituents during ground-water restoration. To perform the data analysis requested by the commenter would be outside the scope of this SEIS.

3) In the SEIS and the GEIS, the term "pre-operational" within the discussion of the pre-operational oxidation state is the same as the post-licensing, pre-operational state. Pre-operational oxidation state refers to the condition of low levels of oxygen in the ground water that exists before the introduction of lixiviant. As described in SEIS Section 2.1.1, the uranium ore is deposited in "roll-fronts," which form in geologic time when the geochemical condition within an aquifer changes from oxygenated to oxygen-deficient, which in turn causes uranium to precipitate as a coating on sand grains. As discussed in SEIS Section 2.1.1.3, other parameters that respond to the changing conditions caused by introduction of lixiviant are arsenic, selenium, molybdenum, and vanadium. The oxidation state can be inferred by the suite of elements and minerals present in the ground water during restoration.

4) and 5) The phrase, "as much as possible" in the subject statement, "To stabilize these constituent concentrations, the pre-operational oxidation state in the ore zone must be reestablished as much as possible," refers to the geochemical reactions within the aquifer. Attainment of the pre-operational oxidation state of the aquifer would result in a decrease in concentrations of those parameters that respond to oxidation conditions described in the response to part 3 of this comment. There is no quantitative measure to the phase "as much as possible" since the ground-water protection standards apply to constituent concentrations and not oxidation conditions. However, if an application for an ACL is received by the NRC, consistent with the "as low as reasonable achievable" philosophy, NRC staff would evaluate whether the licensee did as much as possible to achieve the lowest possible concentrations of water-quality parameters during ground-water restoration. The ground-water protection standards are discussed in FSEIS Sections 2.1.1.3 and 4.5.1.2 and in the responses to Comment Nos. RP024-013, RP024-161, RP024-169, RP024-170, RP032-020, RP032-036, and RP032-041.

6) and 7) Re-initiation of aquifer restoration would be required of the Applicant if the monitoring data were to show a lack of compliance with the ground-water protection standards approved by the NRC as described in SEIS Sections 2.1.1.3 and 4.5.1.2 and in the response to Comment No. RP032-020. In the SEIS, the term "adjacent aquifer," means "the aquifers immediately above, below, and surrounding the production aquifer." Condition No. 11.1 of the Draft License, an extract of which is provided in this Appendix B in response to Comment No. RP032-037, addresses monitoring, recording, and bookkeeping requirements. With respect to the requirements and extent of aquifer-restoration-stability monitoring, Condition No. 10.6 of the Draft License for the proposed Ross Project states the following:

> The licensee shall conduct sampling of the parameters included in the baseline [in this SEIS, "post-licensing, pre-operational"] sampling under LC 11.3 during the restoration stability period in accordance with Section 6.1.2.5 of the approved application. The sampling consists of eight samples during a 12 month period. The sampling shall include the specified production zone aquifer wells used to define the baseline [in this SEIS, "post-licensing, pre-operational"] levels. The Applicant shall continue the stability monitoring until the data show, for all parameters monitored, no statistically significant increasing trend, which would lead to an exceedance of the relevant standard in 10 CFR Part 40, Appendix A, Criterion 5B(5).

(Note that the words "will" and "shall" are used in the Draft License to denote specific requirements.)

As stated in GEIS Section 2.5, "The EPA, or the State authorized to implement the EPA's Underground Injection Control [UIC] program, reviews any aquifer-restoration plans for compliance with the applicable terms and conditions of the UIC-permit requirements. The NRC staff reviews any aquifer-restoration plans for compliance with the license to protect human health, safety, and the environment (NRC, 2009b)."

The NRC's Project Manager is responsible for reviewing and overseeing the NRC staff's review of the information submitted by the Applicant. The Decommissioning and Uranium Recovery Licensing Directorate within the Division of Waste Management and Environmental Protection is responsible for overseeing licensed uranium-recovery operations. As discussed in the responses to Comment Nos. RP024-013, RP024-161, RP024-169, RP024-170, and in SEIS Section 2.1.1.3, the compliance period for which the ground-water protection monitoring *program would be performed is from the time the Commission sets the ground-water protection standards until the respective license's termination. Thus, the ground-water protection program is continuous throughout the operation, aquifer-restoration, and possibly the post-closure (i.e., post-reclamation) phases as determined by the NRC.*

Comment: RP035-034

The commenter suggested that the NRC staff revise the summary of the operational monitoring program presented in Table 6.1 of the SEIS in Section 6.2, Radiological Monitoring, to include the location, analytical parameter, sampling frequency, and number of sample locations as well as the expected range of values for radionuclides based upon pre-licensing, site-characterization water-quality data. It was noted that the data the commenter suggests adding to Table 6.1 are summarized in the DSEIS Section 3.5.3, Table 3.6.

Response: *In response to other comments (Comment Nos. RP032-018, RP032-070, RP032-071, RP032-072, RP032-077, and RP035-035) all data obtained by ground-water monitoring by several parties, including Nubeth, for all constituents have been added to the FSEIS as Appendix C. A map depicting the location of the 29 water-supply wells now discussed in FSEIS Section 3.5.3, which were also monitored for ground-water quality, has been added to the FSEIS as Figure 3.16. Other maps indicating the locations of monitoring wells that would be sampled within the Project area are shown on SEIS Figure 3.15 in Section 3.5.3. However, no changes were made to Table 6.1 as the information in that table and in Section 6 describe the operational environmental monitoring program. The data in Appendix C are a different set than data that will be accrued by the Applicant's monitoring the operation, aquifer restoration and decommissioning phases.*

Comment: RP039-011

The commenter requested that, if any polluted water would reach South Dakota and/or Montana, the NRC discuss those water-quality issues over the border as well as any "assimilative capacity concerns."

Response: *The direction of ground-water flow in all of the aquifers below the Ross Project area is to the west, toward the axis of the Powder River Basin. Therefore, water flow to South Dakota or Montana is not plausible. No changes were made to the SEIS beyond the information provided in this response.*

B.5.15.2 Importance of Water and Consumptive Water Use

Comment: RP024-652

The commenter requested clarification of the following statement in the DSEIS: "It is likely that ground-water drawdowns at the uranium-recovery wellfields in the Lance District would overlap spatially and temporally." The commenter pointed out that minor overlap is possible, but it would be imperative that the Applicant minimize the overlap so as to ensure that interference between wellfields does not occur.

Response: *The NRC staff agrees with the commenter's suggestion that, although minor spatial overlap of ground-water drawdown from different wellfields could potentially occur, the overlap would not be great. The schedule for development of the Ross Project shown in Figure 2.6 of* *the FSEIS suggests that operations at other uranium-recovery projects in the Lance District could occur concurrently with the Ross Project as well. In addition, as described in FSEIS Section 5.7.2, extrapolation of the ground-water model performed for the Ross Project indicated a potential for overlap of ground-water drawdowns from wellfield development. The NRC staff agrees that minimizing overlap would be necessary for the Applicant to conduct effective uranium recovery as well as successful ground-water restoration. The statement noted by the commenter was deleted from FSEIS Section 5.1.2 and has been replaced with a paragraph that provides the additional information contained in this response.*

Comment: RP032-040

The commenter noted DSEIS Section 2.1.1.3 statement, "The Applicant proposes to use ground-water sweep selectively (for example, around the perimeter of the wellfield) rather than throughout the entire well module to minimize the consumptive use of ground water." The commenter asserted that the statement was ambiguous as to what the environmental baseline accounting unit for aquifer restoration would be. The commenter asked that the NRC clarify if that unit would be a wellfield, an entire well module, or a group of several well-modules.

Response: *The accounting unit is that component which would be used by the Applicant and the NRC to establish and apply water-protection standards. The Applicant proposed that "mine unit" be the accounting unit and, as noted in SEIS Section 2.1.1.1, the Applicant proposed that two such units would be established within the proposed Ross Project: one unit north and one unit south of the Little Missouri River. The NRC allows licensees flexibility in achieving the ground-water standards by their implementing various aquifer-restoration techniques. However, for the NRC staff to approve an aquifer restoration as successful (i.e., to accept that the aquifer's water quality meets all water-quality target concentrations), the entire unit must be fully restored.*

Note that the term "well module" was used in error in the DSEIS; the correct term is "wellfield module." The FSEIS has been revised to correct this error throughout its text. The NRC's approval of aquifer restoration would be done on a wellfield-by-wellfield basis or on a grouping of wellfields within a single unit.

B.5.15.2.1 Exploratory Drillholes, Abandoned Wells, and Old Mines

Comments: RP007-001; RP010-001; RP010-002; RP011-002; RP013-002; RP014-002; RP015-002; RP016-001; RP016-002; RP018-001; RP019-002; RP020-004; RP025-001; RP028-001; RP029-002; RP030-002; RP034-002; RP039-013; RP040-004; RP041-010; RP042-002

The above commenters all expressed concern regarding the thousands of abandoned drillholes from prior uranium-exploration activities in the Ross Project area. Many commenters stated that these drillholes should be plugged prior to operation of the Ross Project, so that ground-water contamination would not occur.

Response: *Condition No. 10.12 of the Draft Source and Byproduct Materials License would require the Applicant to attempt to locate all historical drillholes (i.e., boreholes) within the perimeter-well ring at each wellfield and properly plug (i.e., properly "abandon") the drillholes prior to operation. In the unlikely event that Strata does not locate all the abandoned drillholes, monitoring wells would be installed to detect any excursions that might occur, including those* *that might occur as a result of unplugged drillholes (see FSEIS Section 2.1.1.1) (NRC, 2014b). In response to this comment, FSEIS Section 4.5.1.2 has been revised to provide additional information regarding the requirements for plugging and abandoning historic drillholes in the Ross Project area.*

Comment: RP024-031

The commenter questioned the statement in the DSEIS's Executive Summary, "After uranium recovery operation is complete, unidentified, improperly abandoned wells (i.e., from previous subsurface explorations not associated with the Applicant or its activities) could continue to impact aquifers above the ore-zone and adjacent aquifers by proving hydrologic connections between aquifers." The commenter noted that Condition No. 10.12 of the Draft Source and Byproduct Materials License requires the Applicant to locate and abandon all historical drillholes located within the perimeter-well ring for each wellfield (NRC, 2014b). In addition, the commenter pointed out that the Applicant committed in its license application to properly plug and abandon all drillholes and wells from its own activities (i.e., drillholes from ore zone-delineation efforts and geotechnical investigations, ground-water monitoring wells used for pre-licensing site characterization, and injection and recovery wells from uranium-recovery activities) within the perimeter-well ring of each wellfield as well as to conduct pumping tests that would verify hydrologic isolation in each wellfield prior to each wellfield's operation. Therefore, the commenter stated that the potential impacts from historical drillholes would be less under the Proposed Action than the No-Action Alternative (i.e., Alternative 2).

Response: *The commenter's statement that the potential environmental impacts from historical drillholes would be less under the Proposed Action than the No-Action Alternative is not relevant to the SEIS text in the Executive Summary, as the information in the Summary is meant to be a succinct abridgment of the impacts of the Proposed Action and not an exhaustive comparison of the impacts of different Alternatives. The impacts of the historical drillholes under the Proposed Action and other alternatives are discussed in SEIS Sections 4.4.1.4, 4.4.2, and 4.4.3. Potential impacts to water quality by movement of lixiviant through improperly abandoned drillholes are discussed in SEIS Section 4.5.1. The commenter is correct, however, that Draft License Condition No. 10.12 does address historical drillholes.*

*Draft License Condition No. 10.12 states that, "Prior to conducting tests for a hydrologic-test data package, the [L]icensee will attempt to locate and abandon all historical drillholes located within the perimeter-well ring for the [w]ellfield. The [L]icensee will document such efforts to identify and properly abandon all drillholes in the hydrologic-test data package." The NRC staff notes that the commenter indicated that the Applicant would be required to locate and abandon all historical drillholes located within the perimeter-well ring for each wellfield, whereas Draft License Condition No. 10.12 states that the Applicant "*will attempt *to locate and abandon all historical drillholes located within the perimeter-well ring for the [w]ellfield [emphasis added]." Therefore, when the NRC staff analyzed the potential impacts to ground-water resources during the decommissioning phase in SEIS Section 4.5.1.4, the NRC conservatively accounted for the potential for unidentified, improperly abandoned historical wells to be present. No changes were made to the SEIS beyond the information provided in this response. However, in preparing the FSEIS, the NRC staff has included more of the applicable, explicit references to the specific numbers of the Draft License Conditions, including Draft License Condition No. 10.12. The NRC was finalizing the Draft License at the same time that the DSEIS was in the final publication-review stage, and it was not available for explicit citation as it was for the FSEIS.*

Comment: RP024-176

The commenter noted the following statement in DSEIS Section 2.1.1.3: "All injection, recovery, and monitoring wells and drillholes would be plugged and abandoned in place according to applicable regulations after ground-water restoration is approved by the NRC and WDEQ (WDEQ/LQD, 2005)." The commenter suggested that the NRC staff delete "and drillholes" from the statement, because under Condition No. 10.12 of the Draft Source and Byproduct Materials License, all drillholes associated with the Applicant's activities (i.e., drillholes from ore-body delineation efforts and geotechnical investigations), as well as all historical drillholes within the perimeter-well ring of each wellfield, would be plugged and abandoned prior to uranium-recovery operation (NRC, 2014b).

Response: *The NRC staff has revised the FSEIS text in Section 2.1.1.3 by deleting the phrase, "and drillholes" from the noted statement.*

Comment: RP032-060

The commenter asked how many previous drillholes are believed or known to exist on the Ross Project site and the area encompassed by future potential Lance District development. The commenter also asked how many of these holes have been located and plugged to-date (May 9, 2013) by the Applicant.

Response: *Previous drillholes known to exist within the Ross Project site are due to the Nubeth pilot project. The total number of Nubeth exploration holes known to exist within the Ross Project site is 1,483 (Strata, 2014c). As of May 9, 2013, 625 Nubeth exploratory drillholes have been located and 86 have been plugged by Strata (Strata, 2014c). The requested information for the future potential Lance District development is not currently available and is outside the scope of the license application. No changes were made to the SEIS beyond the information provided in this response.*

B.5.15.2.2 Control of Operational Impacts, Excursion of ISR Solutions, and History

Comments: RP011-003; RP012-002; RP013-005; RP014-004; RP015-004; RP019-004; RP020-005; RP020-006; RP021-002; RP022-001; RP023-004; RP029-003; RP030-004; RP031-001; RP034-004; RP039-015; RP040-006; RP041-003; RP041-004; RP041-005; RP042-004

The commenters expressed concern regarding the record of spills, excursions, surface-impoundment and pipeline leaks, spills, and lixiviant excursions at ISR facilities. In addition, they also expressed concern regarding the potential failure of aquifer restoration, noting that no other uranium-recovery project has yet to restore an aquifer to pre-operational water quality.

Response: *As discussed in GEIS Section 2.11.2, the NRC staff has reviewed the record of spills and leaks at operating ISR facilities as well as the requirements for an operator's reporting incidents of releases and implementing corrective actions (NRC, 2009b). The analysis of impacts to soil, surface water, and shallow ground water from spills and leaks are provided in the SEIS Sections 4.4.1.2 and 4.5.1.2. As described in these sections of the SEIS, impacts to soil and water resources would be mitigated by the operational controls that would be in place to reduce the likelihood of releases, in addition to the requirements for reporting and taking corrective action. The NRC's assessment determined that the impacts that could result from* *leaks and spills from pipes and from the surface impoundments at the Ross Project would be SMALL.*

The NRC staff has compiled information on the history of excursions in GEIS Section 2.11.4. SEIS Sections 2.1.1.1 and 2.1.1.2 describe the operating practices that the NRC requires of licensees that are designed to minimize the likelihood of impacts from excursions. The history of excursions at licensed ISR facilities was considered in the impact analysis in SEIS Section 4.5.1.2. Please see the NRC's responses to Comment Nos.032-030, 032-033, 032-034, 032-037, 032-042, and 035-041 for additional information on required mitigation measures to avert excursions and correct them, if they were to occur.

The NRC staff's conclusions regarding potential environmental impacts to ground water following aquifer restoration for the proposed Ross Project are provided in SEIS Section 4.5.1.3. The NRC is aware of the potential for some water-quality constituents in the ground water within the ore zone of the exempted aquifer to be greater than the post-licensing, pre-operational concentrations (NRC, 2009d). However, the constituent concentrations within the uranium-recovery area at the completion of aquifer restoration must meet the standards listed in 10 CFR Part 40, Appendix A, Criterion 5B(5). These standards are described in the NRC's responses to Comment Nos. RP032-004, RP041-006, RP024-162, RP024-013, RP024-161, RP024-169, RP024-170, RP024-425, and RP032-020. As discussed in SEIS Section 2.1.1.1, a licensee is required to have a UIC Class III Permit from the EPA or an EPA-authorized State agency before operating NRC-licensed uranium-recovery wellfields. This permit must exempt that portion of the aquifer that will undergo uranium recovery from the classification as a USDW; therefore, restoration of the exempted aquifer is performed for the purpose of protecting the ground water outside the exempted aquifer.

In response to the commenters concerns that no uranium-recovery project has yet to restore an aquifer to pre-operational water quality, the NRC staff examined ground-water data from the NRC-licensed ISR facilities for which NRC recently approved aquifer restoration (COGEMA's Irigaray/Christensen Ranch facility, Power Resources Inc.'s Smith Ranch/Highland Uranium Project facility, and Crow Butte Resources' Crow Butte facility). The NRC staff has approved 11 wellfield restorations at these 3 facilities. Aquifer-restoration activities are also continuing at wellfields for which restoration has not yet been approved by the NRC. The aquifer-restoration data show that pre-operational concentrations are attainable for many parameters (i.e., 50 to 70 percent of the 35 parameters commonly monitored), but the pre-operational concentrations have not been attained for other constituents; in particular, the major and trace cations with solubilities most susceptible to the oxidation state of the aquifer water (i.e., iron, manganese, arsenic, selenium, uranium, and vanadium) as well as radium-226 (NRC, 2009c). However, for the approved aquifer restorations, ground-water quality in the exempted aquifer met all regulatory standards for the respective State's or EPA's UIC program and had the water-quality values designated for its class of use prior to uranium-recovery operation. In addition, water-quality modeling shows that concentrations decrease over time due to natural attenuation and that drinking-water standards are met at the perimeter of the exempted aquifer. Therefore, the impacts to ground water outside of the exempted aquifer for each of the approved aquifer restorations do not pose a risk to human health and the environment. This information on NRC-approved aquifer restorations at the NRC-licensed uranium-recovery facilities has been added to FSEIS Section 4.5.1.3.

Comment: RP032-064

The commenter referenced the following statement in the SEIS Section 2.1.1.2: "If a vertical excursion occurs, then the Applicant's injection of lixiviant would cease, and for any excursion, corrective action would be initiated." The commenter questioned why the Conditions in the Draft Source and Byproduct Materials License for the Ross Project would require cessation of lixiviant injection only in the case of a "vertical excursion," rather than all excursions (NRC, 2014b).

Response: *As described in SEIS Section 2.1.1.2, GEIS Section 4.11.4 documented that vertical excursions tend to be more difficult to recover than horizontal excursions. Historically, the source of a vertical excursion is something other than built-up pressure, which is generally the source of horizontal excursion and an attribute of the uranium-recovery process that can be readily adjusted (i.e., the pressure relieved). Pressure relief would reverse horizontal excursions. The probable cause for a vertical excursion is a failed casing in a nearby injection well. Therefore, immediate cessation of lixiviant injection is a prudent corrective action to prevent more from escaping. For a horizontal excursion, although cessation of injection is not a requirement, reducing the rate of injection might be performed in combination with increased pumping. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-033

The commenter referred to the following statement in SEIS Section 2.1.1.2: "If an excursion cannot be recovered within 60 days of confirmation (measured by a concentration of more than 20 percent of any excursion indicator), the Applicant would be required either to terminate lixiviant injection within the wellfield until aquifer cleanup is complete (for horizontal excursions) or to increase the surety for the ISR project by an amount sufficient to cover the full third-party cost of correcting and remediating the excursion."

Then the commenter asked several questions about excursion confirmation and subsequent actions: Is confirmation of an excursion the same as initially detecting it? What constitutes confirmation of an excursion for the purpose of triggering a licensee's 24-hour notice requirement to the NRC? How soon after confirmation of a vertical excursion would lixiviant injection be required to cease? How soon following the 60-day period for retrieving a horizontal excursion would the Applicant have to decide whether to terminate lixiviant injection within the wellfield or increase the surety?

In addition, the commenter noted that SEIS Figure 2.4 showed contiguous and overlapping wellfields and asked questions about exursions as applied to adjacent wellfields: If a horizontal excursion affects a neighboring wellfield that is under construction or an area designated for future wellfield development, would that count as an excursion? Can a hydrologic cone of depression designed to prevent lixiviant excursions encompass multiple, contiguous wellfields such that the area monitored for excursion becomes enlarged to cover multiple wellfields?

Response: *Responses to the commenter's questions about excursion confirmation and subsequent actions are provided in the NRC staff's responses to Comment Nos. RP032-037 and RP0032-042 as well as in FSEIS Sections 2.1.1.2 and 4.5.1.2. These responses describe the criteria for the Applicant's monitoring for and detecting, confirming, and correcting excursions as set forth in Condition No. 11.5 of the Draft Source and Byproduct Materials License (NRC, 2014b). For purposes of this SEIS, confirmation is equivalent to verification of* *the UCL exceedence for two of the three sampling events associated with the initial detection of exceedence. If the initial detection is confirmed (verified) by the second or third sampling event, then the well is placed on excursion status, which begins the time period for the license conditions' reporting requirements.*

As described in the NRC staff's response to Comment No. RP032-064, after a well is placed on excursion status for a vertical excursion, by license condition, the Applicant will cease production immediately in the area surrounding that particular well. The production in that area will not be re-initiated until the Applicant can demonstrate to the satisfaction of the NRC staff that the continued operations are safe. Injection of lixiviant would be stopped at 60 days if the horizontal excursion has not been corrected or the surety is not adjusted to account for any corrective actions that will be needed.

As established in SEIS Section 2.1.1.1, the Applicant proposed perimeter monitoring wells at a distance of approximately 120 m [400 ft] from the edge of each wellfield to allow the detection of potential horizontal excursions in advance of an excursion affecting the surrounding aquifer. A horizontal excursion is the movement of lixiviant outside of the perimeter-well ring of a wellfield regardless of the use or planned use of the adjoining area. For abutting wellfields that are sequentially operated, the perimeter-well ring for the initial wellfield would likely contain temporary wells in the area in which the two wellfields abut. After production begins in the abutting wellfield, excursion monitoring at the temporary monitoring wells in the initial wellfield perimeter well ring would be discontinued and a new perimeter-well ring would be established combining the remaining wells in the initial wellfield perimeter-well ring with new wells in the perimeter-well ring surrounding the abutting wellfield. If a temporary well for the initial wellfield goes on excursion status during its sole operation, that area would be incorporated into the combined wellfield when the abutting wellfield begins operation and thus the excursion status for that temporary well would no longer be applicable. The area between abutting wellfields would become part of the wellfield area and subject to restoration requirements. If an excursion were to occur in a temporary well or extend to an area of a subsequent wellfield prior to or during its construction, the water quality of that area would not be included in the post-licensing, pre-operational data for the subsequent wellfield. The Applicant would be required to obtain sufficient, representative samples from areas unaffected by any operations for any subsequent operations.

Finally, the commenter raises the point of potential mutual interference of abutting and/or nearby wellfields. Mutual interference occurs when the cone of depression from operations at one wellfield affects ground-water flow at another wellfield. Mutual interference would not result in a large excursion over multiple wellfields; however, it may result in the potential migration of ground water from an abutting wellfield, though that abutting wellfield has maintained its inward gradient. In those cases, the mutual interference may eventually result in an excursion at the abutting wellfield. This situation would be more likely to occur when one wellfield is in restoration and the bleed (and resulting cone of depression) is larger than the normal bleed at a nearby wellfield in operation or another phase of restoration. No matter what the cause for the excursion, the Applicant would be required to perform corrective actions for an excursion whether or not it occurred during operation or restoration, or, attributed to pumping at that particular wellfield or by mutual interference. In determining the appropriate corrective action, the Applicant would have to evaluate the root causes of the excursion.

No changes were made to the SEIS beyond the information provided in this response.

B.5.15.2.3 Aquifer Exemptions and Post-Licensing, Pre-Operational Water Quality

Comment: RP024-143

The commenter recommended clarifying that while the aquifer exemption requires EPA approval as an amendment to Wyoming's State plan under the Safe Drinking Water Act (SDWA), the UIC wells are approved solely by WDEQ/WQD as the State has "primacy" for such wells under the same statute.

Response: *The NRC has revised the "What are underground injection control permits" text box in SEIS Section 2.1.1.1 to clarify the regulatory requirements for aquifer exemptions and UIC wells as a result of this comment.*

Comments: RP032-003; RP041-012

The commenters referenced the following statement taken from the DSEIS Executive Summary: "The ore zone [OZ] is that portion of the aquifer that has been permanently exempted by the EPA from requirements as an underground source of drinking water under the Safe Drinking Water Act [SDWA]." One commenter noted that the geographic extent and boundaries of the OZ that has been permanently exempted is not given with any precision in the SEIS and that the NRC has not disclosed the status of the aquifer exemption. Another commenter asked that the SEIS disclose the status of the aquifer exemption process, fully describe the scope of the exemption (preferably through a map or diagram in the SEIS), and explain how the exemption does or does not affect how the NRC determines and assesses impacts related to water quality and quantity. The commenters asked that the FSEIS describe how the aquifer exemption will be expanded or if additional aquifer exemptions will be needed for future ISR projects in the Lance District. One commenter asked if the NRC is aware of any SDWA exemption proposed or granted that covers some or all of the potential satellite areas discussed in the SEIS. The commenter also asked for the basis of the Applicant's confidence in building a CPP facility that is four times the size of that needed for the Ross Project and twice the size of the facility analyzed in the GEIS.

Response: *At the time the DSEIS was issued, the aquifer exemption had not been granted. The aquifer exemption process is now described in FSEIS Section 2.1.1.1. The Applicant submitted the Statement of Basis for exemption as a source of drinking water and reclassification of the portion of the aquifer proposed for uranium recovery as Appendix D12 to its application submitted to WDEQ/LQD for a Permit to Mine. On May 15, 2013, the EPA approved the exemption of the aquifer per the request by WDEQ in accordance with the Underground Injection Program and the Memorandum of Agreement (MOA) between Wyoming and the EPA (EPA, 2013). Table 1.2 in the FSEIS has been updated to include the status of reclassification and exemption approval. The horizontal area of the exempted aquifer is defined as the area within the perimeter monitoring wells around each wellfield plus an approximately 30-m [100-ft] buffer outside the monitoring wells (EPA, 2013). This area of the exempted aquifer is approximately the area of the wellfields that contains the allowance for future drilling as shown in SEIS Figure 2.4. The NRC would require an aquifer exemption for amendments to the license boundary to include satellite areas. The EPA specifies that the exemption approved on May 15, 2013, only applies to the Ross Project's location and area described in the Applicant's Application to WDEQ for its Permit to Mine. Because Condition No. 12.1 in the Draft Source and Byproduct Materials License for the proposed Ross Project would require clear delineation of the approved aquifer-exemption areas and boundaries for the Class III wells* *before approving operations at any wellfield, the DSEIS considered an approved exemption in the impact analysis (NRC, 2014b). In addition to updating SEIS Table 1.2, NRC has revised the FSEIS, adding to Section 2.1.1.1 the new sentence "However, the maximum area of the wellfields would not exceed the total area of the exempted aquifer; this area has been approved as 500 feet from the outer edges of the wellfields indicated in SEIS Figure 2.4 (EPA, 2013)". The NRC staff is not aware of any SDWA exemption proposed or granted that covers some or all of the potential satellite areas discussed in the SEIS. The NRC does not assess applicants' confidence in the economic viability of their proposed projects.*

Comment: RP032-018

The commenter requested a map depicting the name, location, and targeted aquifers of all pre-existing wells and monitoring wells that contributed pre-licensing, site-characterization water-quality data. The commenter also requested information on the specific regulatory function of these pre-licensing, site-characterization measurements of water quality in the NRC's regulatory scheme to guard against aquifer degradation. The commenter asked if the pre-licensing water quality would be the standard by which lixiviant "excursions" outside the OZ and/or aquifer restoration to "pre-mining" conditions would be judged under the proposed license.

Response: *As described in NRC's* Standard Review Plan for In-Situ Leach Uranium Extraction License Applications*, NUREG–1569 (NRC, 2003a), a license applicant, in support of its application, must provide pre-licensing, site-characterization information, including water-quality data from and in the vicinity of the site. NUREG–1569 provides an NRC-accepted list of constituents to be sampled and analyzed for determining water quality and a method for applicants to propose a list of constituents that may be more tailored to a particular location. NRC guidance dictates that, for an applicant to determine pre-licensing, site-characterization ground-water quality, at least four sets of samples, spaced sufficiently in time, should be collected and analyzed for each constituent. As documented in SEIS Sections 3.5.3 and 5.7.2, the pre-licensing, site-characterization water quality would be compared with water-quality standards and would be used to define pre-licensing, site-characterization conditions and to identify the cumulative impacts of uranium-recovery activities. In addition, the pre-licensing water-quality data are used to determine if the water quality varies seasonally. Also, in the event of a spill or MIT failure, the pre-licensing data can be used to determine when corrective actions are complete.*

The pre-licensing, site-characterization water-quality data would not be used in an assessment of potential excursions. The water-quality data that would be used in that assessment would be collected from monitoring wells installed around, above, and below individual wellfields at a given site after *licensing but* before *injection of lixiviant commences (i.e., post-licensing, pre-operational data) (see the NRC's responses to Comment Nos. RP032-019 and RP032-031).*

The Applicant has provided pre-licensing, site-characterization water-quality data, which are described in SEIS Section 3.5.3 and included in their entirety as Appendix C to the FSEIS. A map of the monitoring wells installed by the Applicant for pre-licensing, site-characterization water-quality data is presented in Section 3.5.3 as Figure 3.14. A map indicating the locations of the water-supply wells within a 3-km [2-mi] radius of the Ross Project, those that have been sampled for water quality, has been added to the FSEIS in Section 3.5.3 as Figure 3.16. The aquifers sampled by the wells are described in SEIS Section 3.5.3. The well designations (i.e., names or numbers) are noted in Figure 3.16 and described in the text of SEIS Section 3.5.3.

The NRC staff has provided all of the pre-licensing, site-characterization water-quality data collected by the Applicant in Appendix C for the public's ease in reading and understanding the FSEIS.

Comments: RP032-019; RP032-031

The commenter referenced the following statement from DSEIS Section 2.1.1.1:

> Prior to commencing ISR operations, these wells would allow sampling and analysis of ground water and, in this SEIS, this type of monitoring is called "post-licensing, pre-operational." The resulting post-licensing, pre-operational data would be used to determine concentration-based levels that would permit identification of any excursions from the respective wellfields; these would be called the Ross Project's upper control limits (UCLs). These post-licensing, pre-operational baseline values would be established for each separate wellfield (and they would be codified in the Applicant's NRC license).

The commenter asked:

1) What is the scientific and technical rationale for NRC's using post-licensing, pre-operational data, rather than pre-licensing measurements, to establish baseline water-quality values to detect excursions?

2) How is the potential problem avoided where each operational wellfield would degrade the post-licensing, pre-operational baseline water quality of subsequent downgradient monitoring wells targeting the same aquifers?

3) What assurance is there that the "post-licensing, pre-operational baseline" water quality is not impacted by the construction of other injection and recovery wells as well as by previous and ongoing exploratory drilling?

4) What information on the sequence for installing monitoring wells and establishing water-quality indicators that are used to detect excursions can the NRC provide?

In addition, the commenter inquired about additional methods used to detect excursions. The commenter asked additional questions related to ground-water monitoring required to detect an excursion by referencing the information provided in SEIS Section 2.1.1.1, "Water-quality indicators in the ground water from monitoring wells that would be established after wellfield installation would also be used to detect whether an excursion has occurred." The commenter then queried:

5) Would the water-quality indicators, or the monitoring wells, or both, be established after wellfield installation?

6) Why would the monitoring wells be established after wellfield installation since monitoring wells are part of wellfield installation?

7) What prevents the prior drilling, construction, and pressure testing of previously constructed injection and recovery wells from impacting the baseline water-quality indicators?

8) What other methods would be used to detect an excursion?

The commenter also referred to the statement in SEIS Section 2.1.1.2, "The monitoring of water levels that would be performed would serve to avert a potential excursion." Then the commenter opined that water-level measurements would be used to avert a potential excursion as opposed to detecting one that has already occurred.

Response: *1, 4, 5, 6) SEIS Sections 2.1.1.1 and 4.4.1.2 describe the requirements for the post-licensing, pre-operational installation of monitoring wells and water-quality data collection. The rationale for using post-licensing, pre-operational water-quality data to calculate UCLs for the detection of excursions is that the excursion monitoring program is part of the NRC-required ground-water detection monitoring program. The purpose of this detection monitoring program is to identify ground water impacted by uranium recovery if it is released to the environment outside the wellfields. To achieve this objective, a robust evaluation of the post-licensing, pre-operational data is required in order to set appropriate threshold or action levels (i.e., UCLs). In the event that the UCLs are exceeded, a licensee must initiate actions to minimize and/or correct any impacts due to an excursion.*

The robust evaluations require detailed site-specific characterization of the hydrogeology and geochemistry of a specific wellfield. Once a licensee identifies an area that meets its production criteria, the production area (wellfield) properties are characterized and documented in the wellfield data package. In addition to geochemistry, the wellfield data package also demonstrates that the monitoring wells around, above and below the wellfields are properly located and establish the point of compliance. The location of monitoring wells and the collection of water-quality data must be specific to each individual wellfield and the boundaries of a wellfield and the configuration of injection and recovery wells would only be determined by the Applicant after it receives its Source and Byproduct Materials License from NRC.

A significant number of monitoring wells and ground-water samples are required for calculation of the UCLs compared to the data required for the pre-licensing site characterization. The interested reader is directed to a compilation of the post-licensing, pre-operational data for three existing NRC-licensed ISR facilities at http://www.nrc.gov/info-finder/materials/uranium/licensed-facilities/crow-butte/isr-wellfield-ground-water-quality-data.html; http://www.nrc.gov/info-finder/materials/uranium/licensed-facilities/willow-creek/isr-wellfield-ground-water-quality-data.html; or http://www.nrc.gov/info-finder/materials/uranium/licensed-facilities/smith-ranch/isr-wellfield-ground-water-quality-data.html. Also see the response to Comment RP032-020 which discusses the process required by the NRC of the Applicant to establish post-licensing, pre-operational water quality; how these water-quality data would be used to establish UCLs; how the UCLs and ground-water monitoring would be used for the detection of excursions; and how the post-licensing process would be assessed in the NEPA review.

The water-quality indicators are proposed by the Applicant in its license application and approved by the NRC (Strata, 2011a; NRC, 2014b). Typical excursion indicators are chloride, specific conductance, and total alkalinity (NRC, 2009a). These parameters are generally appropriate as indicator parameters because they are more highly concentrated in lixiviants than in natural ground waters. As indicated by Draft License Condition No. 10.13, a hydrologic-test data package would be submitted by the Applicant for the NRC's approval. License Condition No. 10.13 would also require that the hydrologic-test data package document that all perimeter monitoring wells are screened in the appropriate geological stratum in order to provide timely detection of an excursion.

2) The concern expressed by the commenter that operational wellfields could potentially degrade the post-licensing, pre-operational water quality of subsequent downgradient monitoring wells targeting the same aquifers is addressed by the requirements contained in the Draft License. Excursions, if present outside a wellfield, would be corrected by the Applicant's pumping and recovering the impacted ground water. Therefore, impacted ground water would not generally migrate to adjacent wellfields or into an aquifer that has not been developed as a wellfield. In the unlikely event of an excursion impacting an adjacent wellfield that is currently being developed, the area of the aquifer that is impacted by the excursion would be avoided for the purposes of establishing the monitoring wells and collecting water-quality data for the UCLs.

3 and 7) There would be minimal potential for water quality in monitoring wells to be impacted by the Applicant's installation of injection and recovery wells or by its delineation wells. This is because no chemicals are used during the drilling of these wells that would impact the water quality, and the disturbance as a result of installation of drillholes, both operational and delineation, is localized.

8) In addition to regular sampling of the monitoring wells and the corresponding analysis of the samples for excursion indicators, water levels in the monitoring wells would be measured at each sampling event. (See also responses to Comment Nos. RP024-443, RP032-036, RP032-037, RP032-041, and RP032-042 for information related to ground-water and water-level monitoring.) An increasing water level in a perimeter monitoring well has been shown to be an indication of a local flow imbalance within a wellfield, which could result in an excursion. An increasing water level in an overlying or underlying monitor well could be caused by the migration of lixiviant from the ore zone or by failure of the casing in an injection well. Due to the confining pressure of the ore-zone aquifer, pressure propagates quickly through the aquifer and water levels would be affected in the monitoring wells days before impacts to water quality would be detected (Strata, 2011b). As discussed in response Comment No. RP032-030, the Applicant's measuring of the water levels in the monitoring wells would indicate hydrologic imbalances in the wellfields and could trigger corrective actions necessary to adjust the injection and recovery flow rates or a shutdown of individual injection wells before the excursion would be detected by water-quality monitoring. If a potential excursion were to be discerned by the Applicant's obtaining water-level measurements, this would allow the ground water impacted by lixiviant to be "recovered" (i.e., withdrawn and treated) before it reaches the perimeter monitoring wells; thus, this type of monitoring would serve as early detection of an excursion.

The NRC staff has revised the FSEIS by providing clarification of the requirements and the sequence of monitoring-well installation, post-licensing, pre-operational water quality collection, and development of excursion-indicator levels as well as adding information on Draft License Condition Nos. 10.13 and 11.3 to SEIS Sections 2.1.1.1, 2.1.1.2, 4.5.1.2, and 6.3.2. See also the NRC's response to 4) of Comment No. RP032-030 regarding a change made in FSEIS Section 2.1.1.2 to a related statement.

Comment: RP032-020

The commenter submitted a multiple-part comment requesting information and asking questions about the process required by the NRC of the Applicant to establish baseline water-quality characterization after the Source and Byproduct Materials License is issued; how the baseline water-quality data would be used to establish UCLs; how the UCLs and ground-water monitoring would be used for the detection of excursions; and how the post-licensing process would be assessed in the NEPA review. The individual comments grouped under Comment No. RP032-020 are summarized below.

1) The commenter referenced the following sentence in DSEIS Section 2.1.1.1: "Later, prior to actual uranium-recovery wellfield operation, but after the initial Source and Byproduct Materials License is issued for wellfield construction, the ground water in each wellfield would be analyzed for the post-licensing, pre-operational baseline concentrations of constituents specified by the NRC (NRC, 2003a)." The commenter asked if the "post-licensing, pre-operational baseline concentrations of constituents" referenced in the sentence above are the same as the UCLs subsequently described in the SEIS and, if not, why and how they differ? In addition, the commenter asked when and how the NRC would employ these "post-licensing, pre-operational baseline concentrations" to measure and mitigate adverse impacts on ground water?

2) The commenter requested that the SEIS provide a map indicating the sequence, timing, and sampling locations for the pre-operational water-quality baseline samples for each wellfield proposed or planned for development in the Ross Project as well the potential development in the Lance District.

3) The commenter noted that the pre-licensing, site-characterization concentrations provided in the DSEIS as Table 3.7 were frequently given as a range rather than a single value. The commenter asked how the data in SEIS Table 3.7 would be used to establish UCLs and to support ground-water monitoring. In addition, the commenter asked how baseline monitoring would be used to control excursions and to establish TRVs for aquifer restoration, and how the NRC would evaluate and compare the environmental-protection effectiveness of prospective UCLs and "post-licensing, pre-operational baseline concentrations" that have not yet been established.

4) The commenter requested additional information on the NRC's rationale for its establishing UCLs after wellfield licensing and construction, rather than before.

5) The commenter noted that the use of TRVs in the Applicant's ER (i.e., Strata, 2011a) and, although this term did not appear to be used in the SEIS, the commenter asked how TRVs relate to the terminology used in the SEIS and how the concept of a TRV would be used in the Ross Project. In addition, the commenter asked if a comparative analysis was performed for the SEIS on alternative TRVs and how NRC's regulations and policies are incorporated into the analysis of reasonable alternatives.

6) The commenter requested clarification of the terms, "wellfield," "wellfield area," and "wellfield module" that are used in the SEIS. (See also NRC's response to Comment No. RP032-040, which defines and clarifies the term, "wellfield module.") In addition, the commenter asked how many wellfields were shown in Figure 2.4 of the SEIS, and if the shaded areas marked "Wellfield Perimeter Accounting for Future Drilling" in Figure 2.4 were used in the impact analyses of the Proposed Action and cumulative-impact analyses of the SEIS.

Response:

1) The phrase, "post-licensing, pre-operational baseline concentrations of constituents" in the statement referenced by the commenter includes the water-quality data used to calculate the UCLs subsequently described in Section 2.1.1 of the FSEIS and in Appendix B1. The NRC's *requirements and process employed to use the post-licensing, pre-operational concentrations to control impacts on ground water is described in the following paragraphs.*

In accordance with the GEIS (NRC, 2009b), the Applicant's TR (Strata, 2011b), and Condition No. 11.3 in the Draft License for the Ross Project, monitoring wells would be required around the perimeter of each wellfield and in the overlying and underlying aquifers. As described in SEIS Sections 2.1.1.1 and 2.1.1.2, these monitoring wells would be sampled, and the results of the sample analyses (as concentrations of constituents specified by the NRC) would be used by the NRC to establish the post-licensing, pre-operational ground-water quality.

Indicator parameters were selected from the constituents for which analyses have been and would be performed. SEIS Sections 2.1.1.1 and 2.1.1.2 describe the process used by the NRC for development of UCLs for each indicator parameter. UCLs would be calculated from the post-licensing, pre-operational monitoring of the perimeter wells as well as the wells tapping the aquifers above and below the ore-zone aquifer. As indicated in Draft License Condition No. 11.4, the default parameters for wells in the OZ and the overlying aquifer are chloride, conductivity, and total alkalinity. The default excursion parameters for wells in the underlying aquifer are sulfate, conductivity, and total alkalinity. These parameters are not subject to geochemical retardation in aquifers and would be the first parameters whose concentrations would increase due to an excursion of lixiviant. UCL values are calculated as the mean concentrations of the appropriate set of wells plus five standard deviations to account for spatial variability.

Condition No. 11.5 of the Draft License discusses the requirements for the excursion-monitoring program in which samples would be regularly collected from the monitoring wells and analyzed for the indicator parameters. Measured concentrations in the monitoring wells that exceed the UCLs of the indictor parameters could indicate an excursion, which would then trigger additional monitoring, sampling, and analysis. The UCLs would be compared to monitoring data produced twice monthly. If the concentrations of any two excursion-indicator parameters were to exceed their respective UCL or any one excursion parameter was to exceed its UCL by 20 percent or greater, then the excursion criterion is exceeded and verification sampling would be done within 48 hours. Upon confirmation of an excursion, the Applicant would notify the NRC, implement corrective action, and increase monitoring frequency. The NRC staff has revised FSEIS Sections 2.1.1.1 and 4.5.1.2 by including text from Draft License Condition No. 11.5 as a result of this comment.

2) The sequence of activities that establish post-licensing, pre-operational water quality is described in paragraph 1) of this response. A map of the proposed monitoring wells would be submitted to the NRC as part of the hydrologic-test data package required in advance of operation, and therefore is not yet available. Information on pre-operational water quality within the potential satellite areas in the Lance District is also not available. The NRC staff's responses to Comment Nos. RP032-002, RP032-067, and RP041-009 describe the environmental-review process that the NRC would follow if the Applicant were to submit a license-amendment application to the NRC in order to expand its operation into any of the satellite areas.

3) The ground-water-quality data provided in DSEIS Table 3.7 were expressed as a range of values because many of the measurements were less than the respective laboratory's limits of detection, and values less than a detection limit are not amenable to calculating average values. However, additional data from Table 3.7 have been included in Table 3.6 in the FSEIS, which *has also been revised to include the minimum and maximum values as well as the average values where an average value is appropriate.*

The pre-licensing, site-characterization concentrations provided in the SEIS are not used to develop UCLs or ground-water protection standards for the site-specific ground-water detection monitoring program that is required for each wellfield pursuant to 10 CFR Part 40 Appendix A, Criterion 7A. The pre-licensing, site-characterization concentrations provided in the SEIS are used to evaluate whether or not the setting is amenable to ISR operations including whether or not seasonal fluctuations could affect subsequent sampling or the characterization of the geochemistry (e.g., whether or not the typical excursion parameters used at ISR facilities would be suitable for this setting, and what are cleanup targets should a spill or release occur in the future).

Sampling to establish excursion UCLs and ground-water protection standards (TRVs) would be conducted as described in SEIS Sections 2.1.1.1, 2.1.1.3, and 4.5.1.2; and in response to Comment Nos. RP032-019, RP032-031 RP032-037; RP032-042. The UCLs and ground-water protection standards would be developed using strict statistical analysis for a site-specific ground-water detection monitoring program for each production area (i.e., wellfield or mine unit area) surrounded by a perimeter-well ring. In establishing these standards, the site-specific programs would also establish the point of compliance for which the standards apply. Please see responses to Comments RP024-013; RP024-161; RP024-169; RP024-170; RP024-425 for the wells assigned as the point of compliance.

The chemical analysis, well completion details, wellfield geometry, hydrogeologic evaluation and ground-water protection standards for operations (i.e., UCLs) and restoration would be included in a hydrologic-test data package completed prior to operations at a wellfield. Condition No. 10.13 of the Draft License would require that each hydrologic-test data package be submitted to the NRC before conducting principal activities in a new wellfield. The data package for the first wellfield would require verification by NRC staff to ensure the Applicant provides an analysis consistent with its commitments in the license application, license conditions and regulations. .

The NRC staff would utilize the Applicant's wellfield data package in the evaluation to determine whether the Applicant's restoration of a wellfield after the uranium recovery operations are complete and meet the ground-water protection standards; and thus are protective of human health and the environment as an unrestricted use area. As noted in the SEIS, in responses to other comments in this Appendix, and in Appendix B1, the ground-water protection standards permit the use of an ACL established by the Commission. In the case of an ACL, the Applicant (then a "Licensee") would be required to submit a license-amendment request to the NRC to approve and thus establish ACLs for those constituents that do not meet the standards in 10 CFR Part 40, Appendix A, Criteria 5B(5)(a) and (b).

A license-amendment request for an ACL would be evaluated by the NRC staff based upon the standards in 10 CFR Part 40, Appendix A, Criterion 5B(6). In accordance with 10 CFR Part 40, Appendix A, Criterion 5B(6), the NRC staff would only consider requests for an ACL(s) after a licensee has demonstrated that restoring the constituent at issue to post-licensing, pre-operational or maximum contaminant levels (MCLs) (i.e., maximum contaminant concentrations) is not practical for a specific site. To determine whether a licensee has undertaken "reasonable restoration efforts," the NRC staff would consider the aquifer-restoration methods applied and their effectiveness in achieving aquifer-restoration goals at a specific site. If the NRC concludes reasonable efforts were not applied, the licensee would be required to continue restoration *efforts until reasonable efforts have been demonstrated before a request for an ACL could be submitted.*

The NRC staff has revised FSEIS Sections 2.1.1.1, 2.1.1.2, 2.1.1.3, 4.5.1.2, and 4.5.1.3, to provide greater clarification on the application of 10 CFR Part 40, Appendix A, Criterion 5B(5). In addition, the NRC has attached Appendix B1, which discusses the requirements for ACLs established by 10 CFR Part 40, Appendix A, Criterion 5B(5), to this Appendix B. Finally, ACL application-review procedures for the NRC staff are described in the NRC's "Staff Technical Position, Alternative Limits for Title II Uranium Mills (NRC, 1996b) and NUREG–1724 (NRC, 2000).

4) The responses to the previous portions of this Comment No. RP032-020 provide information on the process and the logical sequence of activities related to ground-water protection. The commenter's request to provide additional information on the rationale for previously established NRC policies is beyond the scope of this Ross Project SEIS.

5) "TRV" is an industry term for ground-water protection standards that is not used by the NRC. Rather, ground-water protection standards for each wellfield are established per 10 CFR Part 40, Appendix A, Criterion 5B(5)(a) as described in the response to 4).

The NRC staff did not conduct a comparative analysis of alternative ways of meeting the ground-water protection standards allowed under 10 CFR Part 40, Appendix A, Criterion 5B(5), which establishes the ground-water protection standards required for aquifer restoration and allows three options for meeting these standards. Under Criterion 5B(5), the concentration of a hazardous constituent must not exceed one of three standards: a) the Commission-approved background [in this SEIS, "post-licensing, pre-operational"] concentration of that constituent in the ground water; b) the respective value given in the table in paragraph 5C of Criterion 5B(5) if the constituent is listed in the table and if the background [in this SEIS, "post-licensing, pre-operational"] level of the constituent is below the value listed; or c) an ACL established by the Commission. Consideration of the technical feasibility and environmental benefits and costs of the optional ground-water protection standards of Criterion 5B(5) would be given at the time the NRC reviews a RAP submitted by a licensee. As reported in the NRC staff's response above to this Comment No. RP032-020, 4), the NRC has revised the FSEIS by attaching Appendix B1 to this Appendix B and by integrating additional information into FSEIS Sections 2.1.1.3 and 4.5.1.3 where the NRC's process for applying 10 CFR Part 40, Appendix A, Criteria 5B(5) is discussed.

6) The terms "wellfield" and "wellfield area" are synonymous. As described in FSEIS Section 2.1.1, a "wellfield module" is a group of wells within a wellfield connected with piping to a central collection facility called a "module building" or a "header house." A wellfield would contain multiple modules. This comment identified an error in the DSEIS that has been corrected. In the Executive Summary and in Section 2.1.1.1, where this phase, "The Ross Project would host 15 – 25 wellfield areas" occurs, the text has been corrected to read, "Ross Project would host 15 – 25 wellfield modules." (See NRC's response to Comment No. RP032-040 as well for a discussion of wellfield modules and accounting units.)

Comments: RP032-036; RP032-041

The commenter asked to be directed to the location in the SEIS that demonstrates the following or that an analysis be provided in the FSEIS that demonstrates the following:

1) The post-licensing, pre-operational constituent concentrations in ground water will fairly represent the baseline water quality of the target aquifer before wellfield development activities commence under the proposed Ross Project and the potential Lance District satellites;

2) Aquifer restoration would restore the small segment of the mined aquifer within each wellfield to the NRC's post-licensing, pre-operational determination of baseline conditions, much less any scientifically credible representation of pre-ISR water quality;

3) The NRC's license required standards for aquifer restoration;

4) The integrated summation of the hundreds of individually variable wellfield target restoration values would actually restore the overall pre-mining water quality over the entire extent of the aquifer that has been mined and adversely affected by mining;

5) There is reason to conclude from the record of previous NRC-regulated mining operations that the target restoration values, established post-licensing as wellfield expansion proceeds, will be achieved in practice prior to wellfield abandonment, and will ensure that the NRC protects public health and safety;

6) That Maximum Concentration Limits or ACLs will ensure adequate protection of the public health and safety and avoid, minimize, or mitigate other adverse environmental impacts.

Response: *ISR facilities operate by first extracting uranium from specific areas called wellfields. After uranium recovery has ended, the ground water in the wellfield contains constituents that were mobilized by the lixiviant. Licensees shall commence aquifer restoration in each wellfield soon after the uranium recovery operations end (NRC, 2009b). Aquifer restoration criteria for the site-specific constituents are determined either for each individual well or as a wellfield average.*

NRC licensees are required to return water-quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations: "5B(5)—At the point of compliance, the concentration of a hazardous constituent must not exceed—(a) The Commission approved background [in this SEIS, "post-licensing, pre-operational"] concentration of that constituent in the ground water; (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background [in this SEIS, "post-licensing, pre-operational"] level of the constituent is below the value listed; or (c) An alternative concentration limit established by the Commission." It is outside the scope of this SEIS to evaluate the NRC's regulations regarding aquifer restoration and to provide an analysis to demonstrate that the regulations are sound.

1) The post-licensing, pre-operational constituent concentrations discussed in this SEIS are equivalent to the Commission-approved "background concentrations of hazardous constituents" in ground water defined by 10 CFR Part 40, Appendix A, Criterion 5B(5). Condition No. 11.3 of the Draft Source and Byproduct Materials License would require the establishment of post-licensing, pre-operational ground-water quality (NRC, 2014b):

> 11.3 Establishment of Background Water Quality. Prior to injection of lixiviant in a wellfield, the licensee shall establish background [in this SEIS, "post-licensing, pre-operational"] groundwater quality data for the ore zone, overlying and underlying

aquifers. The background [in this SEIS, "post-licensing, pre-operational"] water quality sampling shall provide representative baseline [in this SEIS, "post-licensing, pre-operational"] data and establish groundwater protection standards and excursion monitoring upper control limits, as described in Section 5.7.8 of the approved license application and this license condition.

The data for each mine unit shall consist, at a minimum, of the following sampling analyses:

A) Ore Zone. To establish a Commission-approved background [in this SEIS, "post-licensing, pre-operational"] concentration pursuant to Criterion 5B(5)(a) of 10 CFR Part 40 Appendix A, samples shall be collected from production and injection wells at a minimum density of one production or injection well per two acres of wellfield production area, or, if a wellfield production area is sufficiently isolated from the other wellfield production areas in the Wellfield, a minimum of two wells. Wells selected for the baseline [in this SEIS, "post-licensing, pre-operational"] data will be the same ones used to measure restoration success and stabilization.

B) Perimeter Monitoring Wells. Samples shall be collected from all perimeter monitoring wells that will be used for the excursion monitoring program. The perimeter wells will be installed for a wellfield in accordance with information presented in Section 3.1.6 of the approved license application. In no case will the perimeter monitoring wells be installed outside of the exempted aquifer as defined by the Class III UIC permit issued by the WDEQ.

C) Overlying and Underlying Aquifers. Samples shall be collected from all monitoring wells in the first overlying and first underlying aquifer at a minimum density of one well per 4 acres of wellfield.

D) Sampling and Analyses. Four samples shall be collected from each well to establish background [in this SEIS, "post-licensing, pre-operational"] levels. The sampling events shall be at least 14 days apart. The samples shall be analyzed for parameters listed in Table 5.7-2 of the approved license application. The third and fourth sample events can be analyzed for a reduced list of parameters; the parameters that can be deleted from analysis are those below the minimum analytical detection limits (MDL) during the first and second sampling evens provided the MDLs meet the data quality objectives for the sampling.

E) Background Water Quality. For the perimeter ring monitoring wells (Section B) and monitoring wells in the overlying and underlying aquifers (Section C), the background [in this SEIS, "post-licensing, pre-operational"] levels shall be the mean values on a parameter-by-parameter, well-by-well, wellfield or sub-set of the wellfield basis, as deemed appropriate, in accordance with Section 5.7.8.1 of the approved license application. The UCLs for monitoring wells in the perimeter ring and overlying and underlying aquifers are established be License Condition [No.] 11.4. For the ore zone monitoring wells, the background [in this SEIS, "post-licensing, pre-operational"] levels shall be established on a parameter-by-parameter basis using either the wellfield, sub-set of the wellfield or well-specific mean value. The established background [in this SEIS, "post-licensing, pre-operational"] value for each parameter shall be based upon the mean value plus a statistically valid factor to account for spatial variability in the data, in accordance with Section 6.1.1.1 of the approved license application.

2) through 6) Condition No. 10.6 of the Draft License addresses the NRC's required standards for ground-water restoration.

> 10.6 Groundwater Restoration. The licensee shall conduct groundwater restoration activities in accordance with Section 6.1.5 of the approved license application. Permanent cessation of lixiviant injection in a production area would signify the licensee's intent to shift from the principal activity of uranium recovery to the initiation of groundwater restoration and decommissioning for any particular production area. If the licensee determines that these activities are expected to exceed 24 months for any particular production area, then the licensee shall submit an alternate schedule request that meets the requirements of 10 CFR 40.42.
>
> Restoration Standards. Hazardous constituents in the groundwater shall be restored to the numerical groundwater protection standards as required by 10 CFR Part 40, Appendix A, Criterion 5B(5). In submitting any license amendment application requesting review and approval of proposed alternate concentration limits (ACLs) pursuant to Criterion 5B(6), the licensee must also show that it has first made practicable effort to restore the specified hazardous constituents to the background [in this SEIS, "post-licensing, pre-operational"] or maximum contaminant levels (whichever is greater).
>
> Restoration Stability Monitoring. The licensee shall conduct sampling of the parameters included in the baseline [in this SEIS, "post-licensing, pre-operational"] sampling under LC 11.3 during the restoration stability period in accordance with Section 6.1.2.5 of the approved application. The sampling consists of eight samples during a 12 month period. The sampling shall include the specified production zone aquifer wells used to define the baseline [in this SEIS, "post-licensing, pre-operational"] levels. The Applicant shall continue the stability monitoring until the data show, for all parameters monitored, no statistically significant increasing trend, which would lead to an exceedance of the relevant standard in 10 CFR Part 40, Appendix A, Criterion 5B(5).

Further guidance for the NRC's evaluation of ACLs for uranium-recovery facilities is currently being developed for a revision of NUREG–1569 (NRC, 2003a). Existing guidance for the NRC's review of ACLs for conventional mills can be found in NUREG–1620, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of UMTRCA (NRC, 2003c). *Further explanation of the ground-water protection standards found at 10 CFR Part 40, Appendix A, Criterion 5B(5) were added to FSEIS Sections 2.1.1.1 and 4.5.1.3. (See also the NRC staff's response to Comment No. RP032-020 for additional information on ground-water protection standards.) In addition, Appendix B1 has been attached to this Appendix to provide further information on ACLs.*

Comment: RP032-066

The commenter referenced the following statement in SEIS Section 2.4, "Regarding ground water, the portion of the aquifer(s) designated for uranium recovery must be exempted as underground sources of drinking water before ISR operations begin." The commenter then asked several questions:

1) Why is this exemption necessary if, as claimed in the same paragraph, "Strata would also be required to restore ground-water parameters affected by the ISR operations to levels that are protective of human health and safety?" In other words, if Strata must restore ground-water parameters affected by ISR operations to levels that are "protective of human health and

safety," why is it necessary to exempt the aquifer in the future from serving as a potential source of drinking water?

2) What are the levels for key constituents of the "restored" mined-out aquifer that the NRC deems "protective of human health and safety?" If these levels are truly protective of human health and safety, why can't the restored aquifer serve as a source of drinking water? If it can't serve this function, is it reasonable or legitimate to say that the aquifer has been "restored" to a level that is "protective of human health and safety," including future uses that humans depend on, such as watering livestock and crop irrigation?

3) The only way to decipher and make sense of this apparent contradiction, which arises from purposefully vague writing, is to interpret the phrase "restore ground-water parameters affected by ISR operations" as excluding the mined aquifer itself. Then the problematic phrase reduces to, "Strata will protect human health and safety as it relates to current and future uses of aquifers beyond the ore zone." The commenter asked NRC to clarify what the referenced statement in Section 2.4 is intended to convey.

Response: *The statement subject to the commenter's questions is found in DSEIS Section 2.4, Preliminary Recommendation, which summarized with a bulleted and numbered list the key points of the impact analysis described throughout DSEIS Section 4. Please see the NRC's responses to Comment Nos. RP024-013; RP024-161; RP024-169; RP024-170 for a discussion of the applicability of 10 CFR Part 40, Appendix A, Criterion 5B(5) to ground-water restoration and wellfield decommissioning.*

As discussed in Section 2.1.1.1 of the FSEIS, by EPA regulations, an exemption from protection as an Underground Source of Drinking Water (USDW) in the SDWA is required prior to any injection for uranium recovery activities (see 40 CFR Part 146). The applicable criteria to permit the ore zone to be an exempted aquifer is a demonstration that it cannot now and will not in the future serve as a source of drinking water because of the mineralization. EPA's requirement for an exempted aquifer for ISR operations is monitoring to ensure no fluid migration to the surrounding USDW's.

The WDEQ UIC program and its regulations are slightly more stringent than EPA's. Wyoming requires operators to return the ore-zone water quality to the pre-mining class of use, which is generally livestock water supply or industrial uses.

The water-quality levels for key constituents in the aquifer of the restored wellfields would be established by the ground-water protection standard as specified in 10 CFR Part 40, Appendix A, Criterion 5B(5). To ensure protection of the ground water outside the exempted aquifer, the NRC requires that once uranium recovery is complete, ground-water quality at the point of compliance must not exceed the ground-water protection standard as specified in 10 CFR Part 40, Appendix A, Criterion 5B(5) which would ensure protective of human health and safety beyond the exempted aquifer. Historically, the NRC staff has assigned the point of compliance at the boundaries of the EPA-defined exempted aquifer. During operation, the point of compliance wells are those monitoring wells in the excursion-monitoring program; during site reclamation and restoration, until complete closure, the compliance wells are principally the wellfields' post-licensing, pre-operational monitoring wells located within the wellfields, although monitoring for compliance continues at the wells in the excursion-monitoring program. A detailed explanation of the constituents and their protective levels established by Appendix A, *Criterion 5B(5) is included in the response to Comment Nos. RP024-013, RP024-161, RP024-169, and RP024-170.*

Additional text explaining the ground-water protection standards and how they are implemented has been added to FSEIS Sections 2.1.1.1, 2.1.1.3, 4.5.1.2, 4.5.1.3, and 5.4.1.3. Appendix B-1 was also added to this FSEIS. This Appendix describes how ACLs are developed per the ground-water protection standards and how these standards ensure public health and safety.

DSEIS Section 2.4 provided the NRC staff's preliminary recommendation regarding the Proposed Action, based on the findings in the DSEIS, and provided a detailed summary of the DSEIS findings. However, it should be noted that, Section 2.4 of the FSEIS provides the NRC staff's final recommendation regarding the Proposed Action but does not include the detailed summary of the SEIS findings, which were the subject of this comment.

B.5.15.2.4 Impact Analysis for Ground-Water Use

Comment: RP024-216

The commenter requested clarification on the ground-water impacts of a "permanent mine pit," given that the WDEQ would not allow an open-pit mined area to remain following site reclamation and restoration.

***Response**: Although not an accepted practice, WDEQ Rules and Regulations at Chapter 3, "Noncoal Environmental Protection Performance Standards" do not specifically express a prohibition of an operator's leaving mine pits at a closed site (WDEQ/LQD, 2006). Nevertheless, the NRC staff has revised the text in FSEIS Section 2.2.1 to indicate that there would be the potential for impacts from mine pits remaining from conventional mining, if such open pits were allowed.*

Comment: RP040-008

The commenter expressed concerns about the consumptive use of ground water and requested that climate change be included in the impact analysis for ground-water use.

***Response:** The NRC staff did not explicitly include climate change in the consumptive-use analysis because the impacts of climate change on recharge to the aquifer are not known. Reduced precipitation that could result from climate change would not necessarily result in less recharge to the aquifer. Water levels currently measured in the Lance and Fox Hills aquifers do not exhibit seasonal variation or sensitivity to frequency and intensity changes to precipitation events. The Applicant's ground-water model determined that infiltration from the land surface to the aquifer is only approximately 0.2 – 0.56 cm/yr [0.07 – 0.22 in/yr]. Most of that precipitation is lost to runoff, evaporation, and transpiration. The amount of precipitation available for recharge to the aquifer is primarily controlled by soil type and runoff conditions, and it could be little affected by the variation in the amount of precipitation.*

In response to Comment No. RP035-006, the NRC staff has added quantitative information on the estimated rates of consumptive use of ground water to FSEIS Section 4.5.1. During the period where uranium-recovery operation would be concurrent with aquifer restoration (i.e., during most of the Ross Project), consumptive use of ground water would be approximately 859 L/min [227 gal/min], or approximately 3 percent of the ground water withdrawn from the

Project's recovery wells. During the final two years of the Ross Project, during the period when aquifer restoration would occur without wellfield operation, consumptive use of ground water would be approximately 720 L/min [190 gal/min]. No changes were made to this SEIS beyond the information provided in this response.

B.5.15.3 Miscellaneous Ground Water Comments

Comment: RP024-030

The commenter noted the statement in the DSEIS's Executive Summary, "With respect to the deep aquifers where injection of liquid byproduct wastes would occur, regular monitoring of the water quality of the injected brine is required by the permit; thus, the potential impacts of the Ross Project's operation to ground-water quantity and quality in the deep aquifers would be SMALL." The commenter suggested that the NRC staff modify this statement to indicate that potential impacts to deep aquifers would be limited by the water quality in exempted aquifers and the limited zone of influence, in addition to the monitoring requirements.

Response: *The NRC staff has revised the text in the Executive Summary in the FSEIS to address the commenter's suggestion as follows: "With respect to the deep aquifers into which injection of liquid byproduct materials would occur, the WDEQ/WQD determined by way of its issuance of the UIC Class I Permit to Strata that, at the depths and locations of the injection zones specified in the UIC Permit, the use of ground water from the Flathead and Deadwood Formations is economically and technologically impractical (WDEQ/WQD, 2011b). In addition, Strata projected from regional water quality data from that the TDS in the Deadwood/Flathead Formations will likely be greater than 10,000 mg/L and therefore would not be suitable as a USDW (Strata, 2011b). Monitoring of lixiviant-injection pressures and water quality of the injected brine are required by the UIC Class I Permit; thus, the potential impacts of the Ross Project's operation to ground-water quantity and quality in the deep aquifers would be SMALL."*

Comment: RP024-417

The commenter requested clarification on the DSEIS's statement in Section 4.5.1.1 that "the analysis of impacts to ground water provided in the GEIS are applicable because the effects of the containment barrier wall (CBW) on shallow ground water are localized and the presence of the CBW would not affect the surrounding ground water." The commenter noted that this statement was inconsistent with the subsequent text in that section, which stated that "Construction of the CBW could impact the quantity of water in the shallow aquifer because the CBW would isolate the shallow aquifer at the Ross Project facility."

Response: *The commenter identified an apparent contradiction within DSEIS Section 4.5.1.1. The first statement referenced by the commenter has been revised in FSEIS Section 4.5.1.1 to read, "Although construction of the CBW during the Proposed Action is not part of the typical ISR design considered in the GEIS, the analysis of impacts to ground water provided in the GEIS are applicable because the effects of the CBW on shallow ground water are localized." The impacts referred to in the second statement are localized within the shallow aquifer.*

Comment: RP024-435

The commenter suggested that a statement be added to the SEIS in Section 4.5.1.2 that describes the reason that the deep-monitoring (DM) aquifer was not included in the Applicant's ground-water hydrologic model. The commenter stated that, as indicated in the Applicant's TR, Addendum 2.7-H, "the intervening shale between the two aquifers effectively isolates them from each other which means that any attempt to model the DM [deep-monitoring aquifer] would show negligible response to changes in the overlying OZ [ore-zone] aquifer."

Response: *The NRC staff acknowledges that the TR, Addendum 2.7-H, of Strata's license application described the Applicant's basis for its model (Strata, 2011b). However, the NRC staff does not agree that the suggested addition is necessary here, where the SEIS states that the Applicant used the top of the lower confining unit as the lower boundary in the model. No changes to the SEIS were made in response to this comment.*

Comment: RP024-437

The commenter noted that the statement, "The Applicant would continue geologic evaluation and hydrologic testing to characterize the integrity of the lower confining units, through observations of piezometric levels in the SM [shallow-monitoring] and DM [deep-monitoring] aquifers," does not indicate that the upper confining unit would also continue to be evaluated.

Response: *The NRC staff has revised the text in FSEIS Section 4.5.1.2 to indicate that the upper confining unit would also continue to be evaluated.*

Comment: RP024-464

The commenter referenced the statement in SEIS Section 4.5.1.4, "The Applicant's implementation of BMPs and SOPs for the plugging and abandonment of its own wells during decommissioning of the Proposed Action would reduce the likelihood of shallow-aquifer contamination." The commenter suggested modifying the statement as follows: "The Applicant's implementation of BMPs and SOPs for the plugging and abandonment of its own wells during decommissioning of the Proposed Action and historical holes during wellfield development would reduce the likelihood of shallow-aquifer contamination."

Response: *The NRC does not agree that the suggested modification is necessary. Since SEIS Section 4.5.1.4 discusses decommissioning, only activities that would occur during decommissioning are included in that Subsection. Information regarding the well plugging that would occur during construction is included in SEIS Section 4.5.1.1. No changes were made to the SEIS beyond the information provided in this response*.

Comment: RP024-649

The commenter requested that the NRC staff more clearly support the use of the 0 m [0 ft] elevation contour on the top of the Fox Hills Formation for the ground-water cumulative-impacts study area in DSEIS Section 5.7.2.

Response: *As noted in SEIS Section 5.7.2, the depths of the City of Gillette's wells that draw water from the Fox Hills Formation were used by the NRC staff to define the western edge of the ground-water study area used for the assessment of cumulative impacts. The Fox Hills aquifer is approximately 1,200 – 1,500 m [4,000 – 5,000 ft] deep and has an elevation of 0 m [0 ft] at the locations of the City of Gillette's wells. Information on the depth of the Fox Hills aquifer included in this response has been added to the FSEIS Section 5.7.2 to support the selection of the western edge of the cumulative-impacts study area.*

Comment: RP032-058

The commenter referenced the following statement from DSEIS Section 2.1.1.1: "The Applicant expects the production of ground water during operations and decommissioning of wells completed outside of the aquifer exempted for uranium recovery (Strata, 2011a). This ground water would be discharged under a temporary WYPDES Permit." The commenter asked: 1) How many wells, of what type, into which formations, are covered now under the terms of this "temporary permit?" 2) How many wells will be drilled and covered by this permit in the future; 3) How long is the term of the renewed permit? 4) Where and how is the ground water "discharged" under the terms of this permit?

Response: *The WYPDES Permit is a temporary permit that requires renewal each year, and every WYPDES Permit that the Applicant is issued expires December 31 of the year the permit is issued (WDEQ/WQD, 2011a). The Permit applies only to ground water from wells that have not been put into operation of a wellfield and have not received lixiviant. The Permit authorizes the discharge of waste water associated with well development and testing activities from the Ross Project, but it does not specify the number of wells nor the depths or locations from which ground water can be discharged. However, as described in SEIS Section 2.1.1, the Proposed Action would consist of 1,400 – 2,200 recovery and injection wells plus monitoring wells. The wells would primarily be completed in the ore zones of the Lower Lance and Upper Fox Hills aquifers, but some monitoring wells would be completed in the aquifers underlying and overlying the ore-zone aquifers. The location of discharge is restricted to six unnamed, ephemeral tributaries to the Little Missouri River within the Ross Project area's boundaries (WDEQ/WQD, 2011a). The Permit requires that discharges are performed in a manner so as to prevent erosion, scouring, or damage to stream banks, stream beds, or other "Waters of the State" at the point of discharge. In addition, the Permit requires that there shall be no deposition of substances in quantities that could result in significant aesthetic degradation or in degradation of habitat for aquatic life, plant life, or wildlife, or which could adversely affect public-water supplies or those intended for agricultural or industrial use. The NRC has included additional information in the description of the Project's liquid effluents in FSEIS Section 2.1.1.5 to provide the supplemental detail on the Applicant's temporary WPDES Permit, as requested by the commenter.*

Comment: RP032-065

The commenter referenced the DSEIS Section 2.4 statement, "During operations there would be a MODERATE impact to ore-zone aquifer's water quality due to excursions; however, with measures in place to detect and resolve the excursions, the impacts would be reduced. During aquifer restoration there would be a MODERATE impact to ore-zone-aquifer water quantity due to short-term drawdown (see SEIS Sections 4.5.1.2 and 4.5.1.3)." The commenter requested additional information on the following topics:

1) Regarding the DSEIS statement, "...however, with measures in place to detect and resolve excursions, the impacts would be reduced," the commenter asked the NRC to please quantify the meaning of "reduced" in this context—from MODERATE to what? The commenter asked if the statement means that the impacts on the ore-zone aquifer would be no longer be "MODERATE," and, thus, they would be "SMALL." The commenter also asked what "SMALL" means quantitatively in this context, expressed as a deviation from pre-licensing site-characterized levels.

2) Regarding the following statement in DSEIS Section 2.4: "During aquifer restoration there would be a MODERATE impact to ore-zone-aquifer water quantity to short-term drawdown...." the commenter asked that the possible range of time that the NRC associates with "short-term" drawdown of an aquifer be discussed, and why this length of time would impose only a "MODERATE" environmental impact on current and potential future users of the aquifer be explained. The commenter asked if a "restored" aquifer's failure to recharge fully after thirty years would be a "MODERATE" impact.

3) The commenter asserted that the NRC's conclusions in DSEIS Section 2.4 indicate nothing about water-quality impacts during and after restoration. Therefore, the commenter asked if there are no water-quality impacts arising from and/or enduring past the aquifer-restoration phase of the Ross Project.

4) The commenter stated that since it is well known that there *are* such lasting impacts, when expressed as prolonged deviations from pre-operational baseline levels for key constituents whose concentrations determine the relative human potability and other uses of ground water, the commenter asked that the NRC staff describe the deviations from baseline water-quality values expected at the Ross Project and potential satellite areas in the Lance District.

Response: *The statement referenced by the commenter is presented in Section 2.4 "Preliminary Recommendation" in the DSEIS. DSEIS Section 2.4 provided the NRC staff's preliminary recommendation regarding the Proposed Action, based on the findings in the DSEIS, and provided a detailed summary of the DSEIS findings. However, it should be noted that Section 2.4 of the FSEIS provides the NRC staff's final recommendation regarding the Proposed Action but does not include the detailed summary of the SEIS findings, which were the subject of this comment.*

1) As noted in DSEIS Section 2.4, the NRC staff's impact analyses to support the summary statement in DSEIS Section 2.4 were found in DSEIS Sections 4.5.1.2 and 4.5.1.3. As stated in DSEIS Section 4.5.1.2, "The short-term potential impacts of lixiviant excursions from uranium-recovery operation to the OZ aquifer outside the exempted area would be SMALL to MODERATE. Detection of excursions through the network of monitoring wells, followed by the Applicant's pumping of ground water to recover the excursion would reduce the long-term potential impacts to the OZ aquifer outside the exempted portion to SMALL." Therefore, the reduction of impacts of lixiviant excursions to the OZ aquifer outside of the exempted area discussed in DSEIS Section 2.4 is a reduction from MODERATE short-term impacts to SMALL long-term impacts. As explained in SEIS Section 4.1, SMALL is a standard used in this SEIS to describe environmental effects that are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource considered. Before aquifer restoration would be approved by the NRC, the Applicant would be required to correct ("recover") all excursions and meet ground-water protection standards within the wellfields.

2) The analysis to support the NRC staff's determination that during aquifer restoration there would be a MODERATE impact to ore-zone aquifer water quantity due to short-term drawdown is described in SEIS Sections 4.5.1.2 and 4.5.1.3. Short-term impacts are those that occur during operations and restoration, which is expected to be about six years. The hydrologic model of the ore-zone aquifer during the operation and aquifer-restoration phases predicted significant drawdowns in three wells within the Ross Project area. Minor drawdowns were predicted in wells outside the Project area but within approximately 3 km [2 mi] of the Project. (The hydrologic model was presented in Addendum 2.7-H of the Applicant's TR [Strata, 2011b].)

FSEIS Section 4.5.1.2 reports the quantitative results of the drawdown predicted by the hydrologic model and explains that the most significant drawdown at the completion of restoration predicted by the model occurs in the well that supplies water to a structure that is currently used by the Applicant as its Field Office for the Ross Project and provides water to livestock. SEIS Section 4.5.1.2 further describes that a major variable in the predicted drawdown is the use of the Merit oil-field water-supply wells. To minimize the drawdown of the ore-zone aquifer, as indicated by Draft Source and Byproduct Materials License Condition No. 10.19, wellfields would not be allowed south of the Little Missouri River until Merit's use of the oil-field water-supply wells have ceased or diminished to an acceptable level (NRC, 2014b). Because the significant drawdown is predicted to be within the Ross Project area, Draft License Condition No. 10.19 would minimize the drawdown. This information was added to FSEIS Section 4.5.1.2. The time required for the aquifer to fully recharge is not necessarily the determining factor in assessing the impacts. The availability of water for the public is a key factor in impact assessment. The NRC staff determined that the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE because the minor drawdown during operations and restoration in wells outside of the Project area would not affect the water available for public use, and because reversal of the drawdown would begin as soon as restoration is completed.

3) The commenter is correct that the NRC staff's summary in DSEIS Section 2.4 did not specifically address water-quality impacts during aquifer restoration. DSEIS Section 2.4 stated "Potential adverse impacts to all environmental resource areas are expected to be SMALL, with the exception of… ." DSEIS Section 2.4 went on to provide a detailed summary of impacts that were expected to be greater than SMALL (i.e. MODERATE and LARGE impacts). As described in SEIS Sections 4.5.1.3 and 4.5.1.4, the water-quality impacts during and after aquifer restoration would be SMALL. Therefore, a detailed summary of the water-quality impacts during and after aquifer restoration was not provided in DSEIS Section 2.4.

4) The commenter asked that the NRC staff describe the deviations from baseline water-quality values expected at the Ross Project and potential satellite areas in the Lance District. As described in the response to Comment No. RP032-004, compliance with the regulations found in 10 CFR 40 Appendix A Criterion 5(B) would ensure that there are no deviations from Commission-approved post-licensing, pre-operational levels (baseline water quality) outside the exempted aquifer. Within the exempted aquifer, when restoration is complete, the water quality may deviate from the Commission-approved post-licensing, pre-operational levels but must meet water-quality numerical values given in Criterion 5(B)6 or an ACL for a given constituent. In response to Comment No. RP032-004, FSEIS Sections 2.1.1.2 and 4.5.1.2 have been revised to clarify these requirements and the associated process used by the NRC to determine ground-water-restoration compliance.

Comment: RP032-072

The commenter referenced the following statement in DSEIS Section 3.5.3: "Domestic wells are generally deeper than stock wells, ranging from 46 to 180 m [150 to 600 ft]. The limited information available on these wells has precluded a determination of which aquifer was supplying water to the domestic wells." The commenter stated that the DSEIS's inability to determine the aquifer tapped by the domestic wells seemed a little too convenient and thought that the domestic wells could easily include the Lance and Fox Hills Formations. The commenter asked for more information on the supply aquifers and water quality found in these domestic wells.

Response: *The depths of the water-supply wells within the 3-km [2-mi] buffer zone are found in the well-completion records at the Wyoming State Engineers Office (WSEO). No information on the stratigraphic unit or the aquifer tapped by these wells is included in the records on file at the WSEO. The question of whether the domestic wells tap water from the same aquifer as that proposed for uranium recovery is answered by a review of the depths of the wells compared to the depths of the proposed wellfields. As indicated in SEIS Section 2.1.1, the top of the ore zone is approximately 76 m [250 ft] deep at the eastern edge of the Project area and 200 m [650 ft] deep at the Project's western edge. The increasing depth to the ore zone from east to west across the Project area is due to the stratigraphic dip into the Powder River Basin (see SEIS Section 3.4, Geology and Soils for additional information on the geology of the Project area). The thickness of the ore zone ranges from 30 m to 55 m [100 to 180 ft].*

Based upon the depths of the water-supply wells, none of the domestic wells west of the Ross Project area (i.e., the downgradient flow direction) and its north-south projection are deep enough to intersect the unit in which the ore-zone aquifer is present, which is projected to be greater than 200 m [650 ft] deep on the western edge of the Project area. In other words, the domestic wells west of the Project area appear to tap ground water that is above the ore zone. East of the proposed Project area and its north-south projection (the upgradient flow direction), the wells that are identified as domestic are in the steeply dipping monocline section of the unit within which the ore-zone aquifer is located. The stratigraphic unit at the bottom of the wells cannot be estimated from the information that is available. North and south of the Ross Project area, there are no domestic wells sufficiently deep to intersect the top of the ore-zone aquifer. As described in SEIS Section 6.2.5, the Source and Byproduct Materials License would require that nearby water-supply wells within 2 km [approximately 1 mi] of an active uranium-recovery wellfield be monitored throughout the lifecycle of the Project. The locations of these water-supply wells (i.e., the 29 wells within 2 km [1 mi] that were monitored by the Applicant during its pre-licensing, site-characterization efforts) are shown in Figure 3.16 which has been added to this FSEIS. These wells will continue to be monitored during the lifecycle of the Project. The water quality of the water-supply wells is described in FSEIS Section 3.5.3. Appendix C, which contains all of the water-quality data submitted by the Applicant, has also been added to this FSEIS.

Comment: RP035-005

The commenter noted that the DSEIS stated in Section 4.5.1.2 the following: "Impacts from consumptive use of ground water from the ore zone would be minimized by cessation of water withdrawals by the Merit oil-field water-supply wells. The ground-water model simulated a single operational sequence of wellfield development, recovery, and aquifer restoration. Different operational approaches could be more effective in reducing impacts, and the Applicant proposes to investigate these as wellfield installation and testing progresses." The commenter stressed the importance of evaluating the range of impacts of consumptive ground-water use in the FSEIS. The commenter also recommended that the Record of Decision (ROD) include a requirement that "prior to operation, modeling that utilizes multiple operational wellfields is completed" as well as "a commitment to identifying and implementing mitigation measures that prevent excursions from concurrent operation of multiple wellfields."

Response: *The Applicant's ground-water hydrologic model and the results that were presented in DSEIS Sections 4.5.1.2 and 4.5.1.3 are adequate to support the impact assessments of water quantity in this SEIS. As discussed in the NRC's response to Comment No. RP032-065, the ground-water model of the ore-zone aquifer during the Project's operation and aquifer-*

restoration phases predicted significant drawdowns in three wells within the Ross Project area and minor drawdowns in wells outside the Project area but within 3 km [2 mi] of the Project. SEIS Section 4.5.1.2 noted that a major variable in the predicted drawdown is the use of the Merit oil-field water-supply wells. To minimize the drawdown of the ore-zone aquifer, as indicated by Condition No. 10.19 of the Draft Source and Byproduct Materials License, the Applicant would not install wellfields south of the Little Missouri River until Merit's use of its oil-field water-supply wells has ceased or diminished to an acceptable level (NRC, 2014b). The effects of Draft License Condition No. 10.19 would minimize the drawdown of the aquifer. In addition, as described in the NRC's response to Comment No. RP035-038, the ground-water dispute between Merit and the Applicant has been resolved by Strata's amending its Permit to Mine application with the WDEQ to specify: 1) that all activities conducted under that Permit would be conducted in a manner to avoid any impact on the quality and quantity of ground water available to Merit from the Fox Hills aquifer under Merit's ground-water permits issued by the WSEO and 2) if necessary, Strata would provide Merit with an alternative water source which is acceptable to Merit and which meets certain criteria (WWC, 2012).

Because reversal of the drawdown would begin as soon as aquifer restoration were to be completed, the NRC has determined that the potential impacts of the Proposed Action's aquifer-restoration phase to ground-water quantity of the confined aquifers would be SMALL to MODERATE. An analysis of the cumulative impacts of consumptive ground-water use is provided in SEIS Section 5.7; the analysis concluded that cumulative impacts to ground-water quantity in the Lance and Fox Hills aquifers would be SMALL.

The NRC staff reviewed the information provided by the Applicant and documented its findings in its SER (NRC, 2014a). SER Section 3.1.3.6 notes that the Applicant quantifies the impacts of the Ross Project in situ uranium-recovery activities based upon a maximum of 10 wellfield modules in operation at any one time during the Project's lifecycle (i.e., concurrent operation of multiple wellfields). The NRC staff found, as presented in SER Section 3.1.3.5, that the Applicant made commitments to protect against unwanted vertical and horizontal migration of fluids (i.e., lixiviant). The NRC staff also found, as presented in SER Section 3.1.3.4, that the Applicant provided an acceptable description of the instrumentation and monitoring that would prevent and correct spills, releases, and/or excursions (NRC, 2014a). Therefore, the NRC staff finds that the concern raised by the commenter has already been addressed and documented by the NRC staff in the Draft License and the SER; the addition of the commenter's suggested text is not warranted. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP035-006

The commenter noted that the DSEIS provided a good synopsis of the specific Project-phase environmental impacts. However, because the Project phases occur concurrently, the commenter stated that a full picture of surface- and ground-water environmental impacts at any one time at the Ross Project was difficult to understand. The commenter recommended adding a flow diagram or table that provides a water balance for each process/phase that would provide a more inclusive representation of the surface- and ground-water uses as well as the related impacts and mitigating measures.

Response: *Supplemental information has been added to FSEIS Section 4.5.1 regarding the ground-water balance throughout the Project. New Figures 4.2, 4.3, and 4.4 in the FSEIS illustrate the water balance during three Project periods: operation only, operation concurrent* *with aquifer restoration, and restoration only, respectively. In addition, FSEIS Table 4.9 has been revised to include water-balance and waste-disposal rates during the three periods in the four phases.*

Comment: RP035-011

The commenter asked how the collection of seepage within the CBW would affect downgradient ground water.

Response: *As described in Section 2.1.1.1 of the SEIS, the CBW is a low-permeability barrier that is designed to prevent grount water flow through the unconsolidated sediments into the area of the processing plant from the regional ground-water aquifer outside the CBW. The water levels north of the CBW would be maintained lower than the water levels outside the CBW by ongoing pumping. As described in SEIS Section 4.5.1, the change caused by the barrier would not result in significant changes to ground-water outside the CBW and are thus not considered an impact. As noted in the response to Comment No. RP024-417, the CBW would cause localized impacts to the shallow aquifer. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP035-013

The commenter requested information about other wells in the Lance District that are in the Deadwood and Flathead Formations, which are targeted for the UIC Class I injection wells at the Ross Project.

Response: *The UIC Class I Permit issued to the Applicant by WDEQ/WQD for deep-injection wells notes that there are no wells in the area of review that penetrate the confining units above the Deadwood and Flathead Formations (WDEQ/WQD, 2011b). The deep wells associated with the oil and gas industry are completed in the Minnelusa Formation. The top of the Deadwood and Flathead Formations are over 490 m [1,600 ft] below the bottom depth of the wells in the Minnelusa Formation. No changes were made to the SEIS beyond the information provided in this response.*

B.5.15.4 References

(US)EPA (U.S. Environmental Protection Agency). *Aquifer Exemption Approval, Strata Energy Corporation, Ross ISR Project, Upper and Lower Fox Hills-Ore Zone Aquifer, Crook County, WY*. Washington, DC: USEPA. May 15, 2013. ADAMS Accession No. ML13144A108.

(US)NRC (Nuclear Regulatory Commission). “Staff Technical Position, Alternate Concentration Limits for Title II Uranium Mills.” . Washington, DC: USNRC. 1996b. ADAMS Accession No. ML091420242.

(US)NRC, U.S. Department of Defense, U.S. Department of Energy, and U.S. Environmental Protection Agency. “Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM.” NUREG–1575. Washington, DC: USNRC. Rev. 1, 2000a/Updates, 2001.

(US)NRC. “Standard Review Plan for the Review of DOE Plans for Achieving Regulatory Compliance at Sites with Contaminated Ground Water under Title I of the Uranium Mill Tailings

Radiation Control Act (Draft for Comment).” NUREG–1724. Washington, DC: USNRC. 2000b. ADAMS Accession No. ML003731007.

(US)NRC. “Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report.” NUREG–1569. Washington, DC: USNRC. 2003a. ADAMS Accession No. ML032250177.

(US)NRC. “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978. Final Report. ” NUREG–1620. Washington, DC. USNRC: 2003c. ADAMS Accession No. ML031550569.

(US)NRC. “Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2.” NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. “NRC Regulatory Issue Summary 2009-05, Uranium Recovery Policy Regarding: (1) The Process for Scheduling License Reviews of Applications for New Uranium Recovery Facilities and (2) The Restoration of Groundwater at Licensed Uranium In Situ Recovery Facilities.” Washington, DC: USNRC. 2009c. ADAMS Accession No ML083510622

(US)NRC. “Staff Assessment of Ground Water Impacts from Previously Licensed In-Situ Uranium Recovery Facilities.” Memorandum from C. Miller to Chairman Jaczko, et al. Washington, DC: USNRC. July 10, 2009d. ADAMS Accession No. ML091770385.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. “Draft Source and Byproduct Materials License, No. SUA-1601.” Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

WDEQ/LQD (Wyoming Department of Environmental Quality/Land Quality Division). “Noncoal In Situ Mining,” *Rules and Regulations*, Chapter 11. Cheyenne, WY: WDEQ/LQD. 2005.

WDEQ/LQD. “Noncoal Mine Environmental Protection Performance Standards.” *Rules and Regulations*, Chapter 3. Cheyenne, WY: WDEQ/LQD. 2006.

WDEQ/WQD (WDEQ/Water Quality Division). *Authorization to Discharge Wastewater Associated with Pump Testing of Water Wells Under the Wyoming Pollutant Discharge Elimination System*. Authorization #WYG720229. Cheyenne, WY: WDEQ/WQD. March 2011a. ADAMS Accession No. ML13015A695.

WDEQ/WQD. *Strata Energy*, *Inc. – Ross Disposal Injection Wellfield*, *Final Permit 10-263*, *Class I Non-hazardous, Crook County*, *Wyoming*. Cheyenne, WY: WDEQ/WQD. April 2011b. ADAMS Accession No. ML111380015.

WWC Engineering (WWC). Ross ISR Project, Permit to Mine Application, TFN 5 5/217, Submittal of Mine Plan Replacement Page per the Joint Stipulation Resolving EQC Docket No. 12-4803. October 24, 2012. ADAMS Accession No. ML12299A040.

WWC. "RE: Info Request." Email to J. Moore, NRC, from B. Schiffer. Dated January 13, 2014. Gillette, WY: WWC. 2014c.

B.5.16 Surface-Water Resources

B.5.16.1 Impacts to Surface Drainages and Surface Waters

Comment: RP017-003

The commenter recommended that the FSEIS include a discussion of how the water would be stored or disposed of if the water quality did not meet the standards of the temporary WYPDES Permit that the Applicant would be required to possess during well development.

Response: *If the water quality does not meet the discharge standards of the WYPDES Permit, the Applicant would have to treat the water or dispose of the water in the UIC Class I deep-disposal wells that would be present at the Ross Project. The Applicant would manage the water that did not meet surface-discharge limits in a similar manner as it would manage any liquids produced from wells undergoing maintenance in active wellfields. For maintenance, ground water would be collected in a mobile storage tank parked at the well. The tank would then be moved to the CPP and the collected liquids would be emptied into the lined surface impoundments that would be located near the CPP, or they would be injected in a deep-disposal well (Strata, 2011b). As explained in the NRC's response to Comment No. RP032-015, water produced during well development and aquifer testing would likely meet Wyoming's WYPDES discharge standards. This is because the ground water discharged during the construction of the wells and initial testing of ground-water quality during pre-licensing, site-characterization efforts met the same Permit requirements and the same standards. No changes beyond those related to the specific description of the WYPDES Permit were made to the SEIS in response to this comment.*

Comment: RP017-021

The commenter noted that water-quality parameters to be analyzed by the Applicant during the Ross Project should include selenium and salinity in order to ensure that such constituents do not accumulate on the ground or get carried in overland flow in high concentrations that could impair surface waters. The commenter stated that this is particularly important for selenium, because the Ross Project is located in the upper Cretaceous Lance and Fox Hill Formations, which are high in selenium.

Response: *The WYPDES Permit No. WYG72022, issued by the WDEQ, does not contain an effluent limit for selenium; however the water quality data collected by the Applicant during pre-licensing, site-characterization indicate that dissolved selenium is generally less than the lowest standard (aquatic life chronic value) of 0.005 mg/L for total recoverable selenium. As described in the response to Comment No. RP017-002, only ground water in the deep aquifer below the ore zone consistently contains selenium at concentrations above the standard of 0.005 mg/L. In addition, as discussed in the NRC staff's response to Comment No. RP032-015, the Applicant's annually renewed WYPDES Permit requires that discharges are conducted in a manner to prevent erosion, scouring, or damage to stream banks, stream beds, or other "Waters of the State" at the point of discharge. In addition, the Permit requires that there shall be no deposition of substances in quantities which could result in significant aesthetic degradation or in degradation of habitat for aquatic life, plant life, or wildlife, or which could adversely affect public-water supplies or those intended for agricultural or industrial use (WDEQ/WQD, 2012). See also Comment Nos. RP017-003 and RP032-058 for additional information related to the Applicant's WYPDES Permit. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-411

The commenter recommended that the SEIS describe the BMPs proposed for the protection of water resources at the Ross Project in Section 4.5.1.

Response: *The staff has revised the text in FSEIS Section 4.5.1 to include the following at the end of the paragraph:*

> *These BMPs would include procedures for the Applicant to minimize surface-water impacts by limiting soil disturbance and compaction, diverting and controlling runoff, avoiding or promptly detecting and correcting accidental spills and leaks, and completing reclamation in a timely manner. Mitigation measures to minimize ground-water-quality impacts in the overlying and underlying aquifers include the Applicant's properly abandoning exploration and delineation drillholes, limiting over-penetration during drilling, employing onsite engineering/geologic supervision during well drilling and development, using proper well construction techniques, implementing an approved mechanical integrity testing (MIT) program, and the excursion monitoring program. Potential ground-water-quantity impacts in the ore zone would be mitigated by the Applicant's minimizing consumptive use (e.g., monitoring nearby stock and domestic wells, designing balanced wellfields, and minimizing the production bleed). Impacts to ground-water quality in the ore-zone aquifer would be mitigated by ground-water restoration, and excursion monitoring.*

Comment: RP024-419

The commenter referenced the following statement from DSEIS Section 4.5.1.2: "Ground water produced from monitoring and testing wells outside the exempt (ore-zone or OZ) aquifer would be discharged according to a temporary WYPDES Permit, comparable to the permit obtained by the Applicant for development of its monitoring wells installed in 2010. This water would either infiltrate into the ground or add to the surface water in the Little Missouri River." The commenter suggested describing the mitigation measures that the Applicant proposed to prevent discharge water from reaching surface waters in order to comply with its current temporary WYDES Permit. The Permit stipulates that "There shall be no deposition of substances in quantities which could result in significant aesthetic degradation, or degradation of habitat for aquatic life, plant life, or wildlife; or which could adversely affect public water supplies or those intended for agricultural or industrial uses."

Response: *The mitigation measures proposed by the Applicant in its surface-water pollution prevention plan were described in DSEIS Section 4.5.1.2, a few paragraphs after the statement referenced by the commenter. In response to this comment, three modifications have been made to the paragraph noted by the commenter. The modified paragraph in the FSEIS Section 4.5.1.2 now directs the reader to a discussion of WYPDES Permit No. WYG72022 in FSEIS Section 2.1.1.5. FSEIS Section 2.1.1.5 now explains that the WYPDES Permit does not allow degradation of habitat for aquatic life, plant life, and wildlife, nor does it allow discharges that would adversely affect public-water supplies or supplies intended for agricultural or industrial uses. The Section now notes that the mitigation measures proposed by the Applicant would ensure that habitat and water-supply degradation would not occur. See also response to Comment No. RP032-058 for a discussion of the temporary WYPDES Permit's renewal.*

Comment: RP024-421

The commenter noted that the Applicant would apply for and obtain an "Industrial General Permit for Storm Water Discharges" ("General Storm Water Permit") from the WDEQ/WQD prior to construction and operation. The commenter further explained that the only requirement associated with this type of permit is that the operator periodically inspect the BMPs and complete documentation of the required inspections. The commenter also stated that the General Storm Water Permit would not establish numeric effluent limits.

Response: *The text in FSEIS Section 4.5.1.2 has been revised, and the staff has included information on the requirements for a General Storm Water Permit.*

Comment: RP032-015

The commenter referenced the statement in DSEIS Section 2.1.1.1, "The Applicant expects that the water produced during well development would meet Wyoming's temporary Wyoming Pollution Discharge Elimination System (WYPDES) discharge standards, which would allow this water to be discharged directly to the ground surface (WDEQ/WQD, 2007)." The commenter asked the following questions: 1) What is the empirical basis for the Applicant's "expectation" and do the NRC and the EPA agree with the basis? 2) Would the WYPDES discharge standards be sufficiently protective so that the produced water would not cause any harm to wildlife, surface-water quality, or shallow aquifers if discharged directly to the ground surface? 3) Would the NRC staff describe the NRC's licensing requirement in the event that the water produced during well development does not meet WYPDES discharge standards? 4) Would the NRC staff describe any contingency plans and capabilities that would be required under the proposed license for the Applicant's safely disposing of the produced water from well development if the Applicant's expectation were proved to be incorrect?

Response: *1) The expectation that water produced during well development and testing would meet Wyoming's WYPDES discharge standards is based upon the fact that the ground water discharged during construction, installation, and initial testing of the wells prior to the license application's being submitted (i.e., during pre-licensing, site-characterization efforts) met all WYPDES Permit requirements. Effluent limits (i.e., discharge standards) contained in Strata's temporary WYPDES Permit apply to pH, total suspended solids, TDS, total uranium, and total recoverable radium-226. The pre-licensing water-quality samples collected from these* *monitoring wells also generally met the discharge standards in the WYPDES Permit (see Table 3.6 in SEIS Section 3.5.3 for pre-licensing, site-characterization water-quality data).*

2) The Applicant's annually renewed WYPDES Permit requires that discharges are conducted in a manner to prevent erosion, scouring, or damage to stream banks, stream beds, or other "Waters of the State" at the point of discharge. In addition, the Permit requires that there would be no deposition of substances in quantities which could result in significant aesthetic degradation or in the degradation of habitat related to aquatic life, plant life, or wildlife; moreover, the discharges cannot adversely affect public-water supplies or those intended for agricultural or industrial use (WDEQ/WQD, 2013). Thus, any surface discharges the Applicant might make after permitting would be limited to those that do not harm wildlife, surface waters, and shallow aquifers.

3) and 4) The NRC does not have authority over the water produced during well development; ground water that has not been affected by uranium-recovery activities (i.e. that has not come into contact with lixiviant) is not regulated by the NRC. If such water were not to meet WYPDES discharge standards, then the Applicant would need to develop a plan that would be compliant with its WYPDES Permit. The Applicant is responsible for managing ground water produced from the wells in a manner that meets the requirements of the WDEQ. The NRC staff's response to Comment No. RP017-003 discusses the actions proposed by the Applicant for disposal of ground water from wells outside of active wellfields that do not meet the discharge standards of its WYPDES Permit.

The NRC staff has revised the text in FSEIS Section 2.1.1.1 to address the commenter's questions by adding the supplemental information offered in this response. Also, please see the NRC's response to Comment No. RP032-058 for additional information regarding the Applicant's WYPDES Permit.

B.5.16.2 Wetlands

Comment: RP001-001

The commenter pointed out that an initial, pre-construction notification had been submitted to the U.S. Army Corps of Engineers (USACE) for the Ross ISR Project—Phase I, where Phase I includes construction of access roads, the CPP and other components of the Project facility, and monitoring wells. The commenter stated that due to the potential for the Ross Project to adversely affect historical and cultural resources, the USACE could not verify a Section 404 Nationwide Permit ("404 Permit") for construction in "Waters of the U.S." until such time as the NRC has completed its required evaluation of the impacts on historical and cultural resources in the 404 Permit's area of potential effects (APEs) as well as its required consultation process. The commenter also noted that compensatory mitigation for wetland losses through an approved mitigation plan would be required by a 404 Permit and that other aquatic-resource losses could require mitigation through a 404 Permit or in compliance with Executive Order No. 11990.

Response: *The text in FSEIS Section 3.5.2 has been modified to indicate that USACE cannot verify a 404 Permit until the NRC has completed its evaluation of impacts on historical and cultural resources in the 404 Permit's APE as well as its related consultation efforts.*

B.5.16.3 Miscellaneous Surface-Water Comments

Comment: RP024-271

The commenter suggested that the NRC staff revise the statement in DSEIS Section 3.5.1, “In addition to the permitted surface-water rights, there are at least 17 additional reservoirs within or adjacent to the Ross Project area, although none of these reservoirs was listed in the WSEO water-rights database, except for the Oshoto Reservoir (Strata, 2011a).” The commenter suggested that the discussion of Oshoto Reservoir be omitted, because the Reservoir *is* permitted, and that the discussion regarding reservoirs within and adjacent to the Ross Project area not listed in the WSEO water-rights database be clarified.

Response: *The NRC staff has revised the statement as noted by the commenter by deleting the following text: “except for the Oshoto Reservoir.”*

Comment: RP035-009

The commenter noted the following paragraph in SEIS Section 4.5.1.1:

> Potential impacts to the quantity of water in the shallow aquifers during construction of the Proposed Action would be caused by the quantity taken from the Oshoto Reservoir and the quantity involved in the installation of the CBW surrounding the facility (i.e., the CPP and surface impoundments). In the vicinity of the Oshoto Reservoir, the Reservoir stage (i.e., the volume of water it contains) and the shallow-aquifers’ water levels are closely related (Strata, 2012b). Although the Applicant anticipates an annual withdrawal of 4.6 ha-m/yr [37 ac-ft/yr] of water during construction, that volume is less than the permitted annual appropriation for the Oshoto Reservoir, 21 ha-m/yr [173 ac-ft/yr] (Strata, 2012b). Any changes in ground-water levels due to water usage from Oshoto Reservoir would be small and restricted to the area around the Reservoir.

The commenter recommended that the FSEIS provide additional information regarding the impacts to shallow ground water and the potential for associated impacts to wetlands and springs around Lake Oshoto in relation to its water use and Project construction.

Response: *The impact analysis presented in SEIS Section 4.5.1.1 was based upon the understanding that the small changes in water-levels would not affect the hydrologic balance of the Oshoto Reservoir. Because the Reservoir would continue to contain a significant depth of water, the weight of the water (i.e., the pressure of the water) would sustain infiltration and support springs that maintain wetlands associated with Oshoto Reservoir. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP035-028

The commenter noted that the Wyoming Water Development Commission (WWDC) publishes a northeastern Wyoming water-plan report that shows the Oshoto Reservoir’s maximum capacity to be 339 acre-feet. The commenter stated that the information disclosed on the maximum capacity of the Oshoto Reservoir appears to be the current, annual water-rights appropriation and not the maximum capacity as stated.

Response: *The NRC staff agrees with the information provided by the commenter, that the capacity of the Oshoto Reservoir is 42 ha-m [339 ac-ft]. The FSEIS Section 3.5.1 has been revised to reflect the maximum capacity of the Oshoto Reservoir as indicated by the WWDC.*

Comment: RP035-038

The commenter noted that it had learned that, during the license-application period, a water-rights issue has arisen with other users of appropriated water from Oshoto Reservoir. The WSEO reported that a water-rights dispute had been lodged for adjudication on behalf of an oil company requiring water from Oshoto Reservoir for its use in enhanced oil recovery (EOR) with water-flooding techniques. This commenter recommended that the FSEIS reassess any changes to cumulative impacts and mitigation measures resulting from the potential water-use conflict.

Response: *The dispute referrenced by the commenter was Merit's request for hearing before the Wyoming Quality Council on Strata's application for a Permit to Mine for the Ross Project. The request for hearing was based upon Merit's concern that the Ross Project would diminish the quantity available and degrade the quality of the water in the Fox Hills aquifer, the aquifer that is used by Merit for EOR. Merit's request for hearing expressed concern that surface water from the Oshoto Reservoir would not be a suitable replacement for ground water from the Fox Hills aquifer because of diminished water quality. The dispute was resolved by Strata's amending its Permit to Mine application, which has now been submitted to WDEQ. The amendments include: 1) that all activities governed by Strata's Permit to Mine would be conducted in a manner to avoid any impact on the quality and quantity of ground water available to Merit from the Fox Hills aquifer under Merit's ground-water permits issued by the WSEO and 2) if necessary, Strata would provide Merit with an alternative water source acceptable to Merit, one that meets certain criteria (WWC, 2012). No changes were made to the SEIS as a result of this comment beyond the information provided in this response.*

B.5.16.4 References

(US)ACE (U.S. Army Corps of Engineers). Letter from P. Wolken, U.S. Army Corps of Engineers, Omaha 34 District, Wyoming Regulatory Office, to T. Simpson, Strata Energy, Inc. December 9, 2010.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

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WWC Engineering (WWC). Ross ISR Project, *Permit to Mine Application, TFN 5 5/217, Submittal of Mine Plan Replacement Page per the Joint Stipulation Resolving EQC Docket No. 12-4803*. October 24, 2012. ADAMS Accession No. ML12299A040.

B.5.17 Ecology

B.5.17.1 General Ecology

Comment: RP003-005

The commenter noted the proximity of his/her home to the proposed Ross Project and the wildlife that visit, and expressed concern that the risks to his/her home, the neighbors' homes and the resident animals caused by the Project would exceed the value of the Project itself.

Response: *The SEIS has been prepared in accordance with the NRC guidance provided in NUREG–1748 (NRC, 2003b), and it is consistent with the NRC regulations at 10 CFR Part 51 that implement NEPA. The wildlife analyses are supported by sufficient technical bases, both tiered from the GEIS and based upon supplemental staff analyses. Section 7 of this SEIS provides an analysis of the costs and benefits of the Proposed Action and the Alternatives. No changes were made to the SEIS beyond the information provided in this response*.

Comment: RP017-002

The commenter recommended that the spill control BMPs that are discussed in FSEIS Sections 4.4.1.2 and 4.5.1.2 be made available to reviewing agencies and other reviewers to assist them in ensuring that the prescribed measures would protect fish and wildlife resources in the event of spills or leaks. The commenter opined that the SEIS stated that appropriate spill control BMPs would be defined in the final license, and it is these that should be available. The commenter also noted that high selenium concentrations could occur in waste water from ISR of uranium ore as uranium-bearing geologic formations are usually associated with seleniferous strata. Accidental releases and spills of uranium-bearing water can result in the ponding or pooling of this water, which could be ingested by local wildlife such as migratory birds, thus exposing the wildlife to uranium, other radionuclides, and selenium. Releases or spills of uranium-bearing water could also reach surface waters, which could impact aquatic organisms inhabiting the affected waters.

Response: *The mitigation measures and BMPs proposed by the Applicant to control impacts as a result of releases and spills were described in SEIS Sections 4.4.1.2 and 4.5.1. Currently, Draft License Condition No. 10.4 indicates that the Applicant would develop and implement written SOPs prior to uranium recovery operation for emergencies, potential accidents, and other unusual occurrences. These occurrences include significant damage to equipment or the facility, breaks in pipelines and spills, loss or theft of yellowcake or sealed sources, significant fires, and other natural disasters. The NRC staff reviewed the commitments by the Applicant to prepare a response plan for these emergencies, and it finds that the information is adequate because it meets the requirements of 10 CFR Part 20 and is consistent with current industry standard practices (NRC, 2014a).*

Regarding the commenter's concern about exposing local wildlife to selenium, the following factors apply: 1) the Applicant has committed to design features and operational practices to prevent and mitigate releases or spills of fluids potentially containing selenium (see FSEIS

Section 4.4.1.2); 2) the Applicant would be bound by WYPDES Permit No. WYG720229 to control discharge of ground water when drilling into the exempted aquifer (the Permit does not contain an effluent limit for selenium); 3) the Applicant has committed to reclaiming and restoring the mud pits it constructs during well and drillhole installation, usually within one construction season (see FSEIS Section 4.14.1.1); and 4) the 2010 water-quality data from the wells installed by the Applicant to characterize the ore-zone (OZ) aquifer and the aquifers above and below the OZ show that dissolved selenium was below 0.005 mg/L in all samples obtained from the aquifers above the OZ and in 22 of the 24 samples from the ore-zone aquifer. The dissolved selenium in the aquifer below the OZ ranged from less than 0.005 mg/L to 0.023 mg/L. Thus, no changes were made to the SEIS beyond the information provided in this response.

Comment: RP024-118

The commenter suggested that the NRC staff, to be consistent with Strata's license application, omit "wildlife and other intruders" from the following statement in Section DSEIS 2.1.1.1, Ross Project Wellfields: "The wellfields would be fenced to exclude livestock, wildlife, and other intruders."

Response: *The NRC agrees with the commenter. (See also Comment Nos. RP036-004, RP036-028, RP036-029, and RP036-034 which are also related to fencing.) The NRC staff has revised the text in FSEIS Section 2.1.1.1 as suggested by the commenter.*

Comment: RP024-474

The commenter questioned whether an increased risk of soil erosion would be relevant to the potential impacts on the local ecology and suggested that the discussion in DSEIS 4.6.1.1 be omitted.

Response: *Increased soil erosion has the potential to result in higher sediment loading in surface-water bodies, which in turn could impact aquatic species. The NRC staff, however, has edited FSEIS Section 4.6.1.1 to clarify the discussion related to soil-erosion impacts.*

Comments: RP024-478; RP024-479; RP036-008; RP039-007; RP039-009

The commenters asked that the FSEIS discuss and clarify certain ecological information, including the wildlife and vegetation species identified in the Project area and along related transportation routes, the Powder River and Black Hills herd units for white-tailed deer, and the possible impacts to the ecology, particularly to protected species. One commenter suggested that elk would not be impacted because they were not observed during the wildlife surveys and the area is not considered crucial habitat or a migration corridor.

Response: *The species identified at the Ross Project are discussed in SEIS Section 3.6, and protected species are specifically discussed in SEIS Sections 3.6.1 and 3.6.1.4. No Federally listed threatened or endangered species have been identified in the Project area. Potential impacts to wildlife as a result of transportation activities are discussed in SEIS Sections 4.3, Transportation, and 4.6, Ecology. Measures to mitigate ecological impacts are also included in these two SEIS Sections. Given the mitigation measures described therein, the NRC staff concluded that impacts to wildlife and vegetation that result from all Project activities would be SMALL.*

The NRC agrees with the commenter, who correctly identified that the Ross Project is within the habitat of the Powder River and Black Hills white-tailed deer herd units. FSEIS Section 3.6.1.2 has been revised to make clear that the white-tailed deer-herd units might be present at the Ross Project area. With respect to the occurrence of elk in the Project area, as documented in SEIS Section 3.6.1.2, elk have *been recorded in the area by the Wyoming Game and Fish Department (WGFD). Therefore, it is appropriate to discuss potential impacts to this species, and SEIS Section.3.6.1.2,* ***Mammals****, does so.*

Comment: RP036-054

The commenter agreed with the SEIS's conclusion of minimal impact to aquatic resources.

Response: *The NRC acknowledges this comment. Due to the general nature of the comment, no changes were made to the SEIS beyond the information provided in this response.*

B.5.17.2 Impacts to Terrestrial Ecology and Wildlife

Comments: RP017-001

The commenters expressed concern with potential impacts to wildlife from elevated levels of selenium, other metals, salt and other chemicals in the liquids stored in the evaporation ponds.

Response: *The surface impoundments (i.e., evaporation ponds) would be fenced in a manner that would exclude wildlife access, with the exception of avian species. The NRC staff acknowledge the risk to avian species posed by surface impoundments as described in SEIS Section 4.6.1.2. The Applicant has proposed mitigation measures to reduce this risk, which led to the NRC determination that the potential impacts to avian species posed by the surface impoundments would be SMALL. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP017-008; RP017-023; RP036-002; RP036-025; RP036-031

The commenters requested additional discussion regarding impacts to bird species, including waterfowl. One commenter expressed concern about selenium concentrations in the waste water stored in the proposed surface impoundments at the Ross Project as well as the possibility that selenium bio-accumulation could occur in birds when they repeatedly alight on the impoundments. This comment was made in reference to Section 2.1.1.1 in the DSEIS.

Response: *As documented in the GEIS, the NRC staff has concluded that when BMPs, such as avian deterrents, are used during the management of surface impoundments, such as those proposed by the Applicant, the potential ecological impacts resulting from waste-water management in uncovered surface impoundments is SMALL. In addition, there have been no reported impacts to wildlife as a result of birds' landing, resting, and/or perching on impoundment surfaces or otherwise contacting the waste water in the surface impoundments at NRC-licensed uranium-recovery facilities (NRC, 2009b). As discussed in SEIS Section 4.6.1.2, the Applicant would use a radar-hazing system designed to reduce the birds' alighting on the impoundments. Therefore, the NRC staff concluded that the potential impact would be SMALL. In addition, although there is no straightforward exposure pathway that could result in significant biocentration by wildlife at the Ross Project, the small potential for selenium bioaccumulation as a result of accidental releases or spills at the Project is discussed in FSEIS Sections 4.4.1.2 and*

4.5.1. See also Comment No. RP017-002 for additional information regarding selenium bioaccumulation. No changes were made to the SEIS beyond the information provided in this response.

Comments: RP036-004; RP036-028; RP036-029; RP036-034

The commenter noted that Section 2.1.1.1 in the DSEIS indicated that the wellfields would be fenced to exclude livestock, wildlife, and other intruders and that the wellfields were described as consisting of approximately 40 ha [90 ac]. In one comment, the commenter inquired regarding the design of the fencing and whether wire fencing, which would exclude livestock and wildlife, or more flexible fencing was proposed by the Applicant. It was noted that wire fencing might not effectively exclude wildlife. In another comment, the commenter pointed out that SEIS Section 4.6.1.1 indicated the big-game movement would not be significantly impacted by the Ross Project. The commenter requested that the type and design of fencing intended for use at the Ross Project be discussed in the FSEIS and that the FSEIS address whether the fencing would be completely exclusionary or wildlife friendly. The commenter noted that a wildlife-friendly fencing design could consist of a four-strand design, with a smooth bottom wire at least 40 cm [16 in] off the ground, with barbed top wire no higher than approximately 110 cm [45 in] off the ground. Additionally, the commenter noted that WGFD suggestions regarding fencing are recommendations, not requirements.

Response: *As stated in Section 4.2.1.2 of the DSEIS, less than 12 percent of the Ross Project area would be fenced at any one time, and the area proposed for wellfields was identified as 65 ha [160 ac] in the license application. However, this entire area would not be engaged in uranium recovery at the same time (i.e., not all wellfields would be installed or operated at the same time; their development would be sequential). Twelve percent of the entire Ross Project area is approximately 83 ha [205 ac]. Thus, the NRC staff has assumed that there would be some areas where the exclusion of livestock, wildlife, and all other intruders would be necessary throughout the lifecycle of the Ross Project (e.g., due to safety, health, and security concerns, fencing around the surface impoundments and avian deterrents would be designed to prevent or deter intruders from accessing the impoundments). In its license application, the Applicant committed to working with WGFD on the fencing at the Ross Project. The license application stated that wildlife-friendly fencing would be used to allow big game and other wildlife to pass through as much of the Project area as possible. As discussed in the response to RP024-118, the SEIS has been revised to indicate that the wellfields would be fenced to allow wildlife passage. As a result of the Applicant's commitment to installing fencing that allows wildlife passage and to working with the WFGD, as stated in SEIS Section 4.6.1.1, the NRC staff concluded that the resulting impact to wildlife and big-game movement would be SMALL. Section 4.6.1.1 in the FSEIS has been revised to clarify that fencing, which would permit wildlife passage, would be used in as much of the Project area as possible and that the Applicant would work with WFGD on the fencing's design.*

Comment: RP036-026

Referring to Section 4.6.1 of the DSEIS, the commenter expressed concern about how wildlife would be affected by the noise that would be generated by the proposed Ross Project and the presence of humans. The commenter indicated that because the noise could be significant, the resulting impacts on wildlife should be evaluated in the FSEIS.

Response: *The NRC staff recognizes that there could be impacts on local wildlife due to Project noise and acknowledges that the increased presence of humans could also have impacts on nearby wildlife. These impacts were addressed in the DSEIS in Section 4.8.1.1, under "Noise" rather than "Ecology." The greatest noise levels would likely occur during the construction phase of the Ross Project, when the CPP, surface impoundments, and other structures would be constructed and the first wellfields would be installed and developed. It would be wildlife's natural reaction to avoid the area during this time, when humans and noise are present, and there are no obstacles to the wildlife's movement away from the proposed Project area. The NRC staff therefore finds that noise and human-presence impacts on wildlife would be SMALL. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP036-030

The commenter noted the following statement in the DSEIS, Section 4.6.1.1, Terrestrial Species, **Wildlife**: "Species that occur in the area have shown the ability to adapt to human disturbance in varying degrees, and each also has a high reproductive potential and tend[s] to re-occupy and adapt to altered or reclaimed areas quickly." The commenter requested that the scientific basis for this statement be cited or the statement be deleted in the FSEIS.

Response: *The NRC staff has revised FSEIS text in Section 4.6.1.1, Terrestrial Species,* ***Wildlife****, deleting the statement noted by the commenter.*

Comment: RP039-008

The commenter requested that the NRC staff consider impacts to native plant communities and any aquatic habitats, including wetlands and any other areas of water-saturated soils, if waste water application to land were to be considered by the Applicant. The commenter also asked that the NRC consider bio-concentration of pollution in animals and any impacts to the food chain (human or animal).

Response: *The Applicant did not include land application of waste water in its license application; thus, the NRC staff did not include any impact analyses of land application of waste water in Section 4 of the SEIS. No changes were made to the SEIS beyond the information provided in this response.*

B.5.17.3 Mitigation and Timing

Comments: RP017-004; RP017-022; RP036-039

The commenters noted that fencing the surface impoundments and using avian deterrents were proposed in DSEIS Section 4.6, but that the sides of the impoundments would be steep. Wildlife that find their way into the impoundments could find it difficult to escape. The commenters suggested that the impoundments be fitted with escape ramps to prevent wildlife fatalities.

Response: *The Applicant has committed to fencing the surface impoundments and using netting to deter birds from landing on the impoundment surfaces, which would reduce the likelihood of wildlife's accessing the impoundments. The Applicant has also committed to working with the WGFD on the fencing design. The NRC staff agrees that additional mitigation* *measures could be warranted should the proposed mitigation measures be shown to be insufficient after surface-impoundment construction and operation begins. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-660; RP024-727; RP032-010; RP032-011; RP036-001; RP036-023; RP036-024; RP036-035; RP036-038

The commenters submitted comments related to the mitigation requirements for impacts to ecological resources, including avian species, big game animals, small mammals and noxious weeds, and requested clarification of what mitigation measures would be required and what reporting would be necessary. In some cases, the commenters requested additional detail regarding specific mitigation measures. One commenter inquired as to whether or not adaptive mitigation would be implemented at the site.

Response: *The NRC would establish site-specific license conditions for the Ross Project, but only within the limits of its authority. In addition, State agencies and other Federal agencies would establish permit conditions for the proposed Ross Project based upon their statutory and regulatory authority. Mitigation measures related to ecological impacts are included in SEIS Section 4.6; the measures outlined include those requested by other agencies, as well as those required by the WDEQ/LQD permit. The details of many of those mitigation measures, beyond those required in this SEIS, will be included in plans required by other permits. For example, the control of weeds would include timely reseeding, monitoring for the presence of noxious weeds, and spraying as necessary. These measures are discussed in SEIS Sections 4.6.1 and 6.5.1. Additional details would be outlined in an approved WDEQ/LQD reclamation plan. As also outlined in SEIS Section 6.5.2.1, mitigation measures for the protection of wildlife will be evaluated on an annual basis, and changes recommended if necessary. Text in SEIS Sections 4.6.1 and 5.8.3 was edited to increase clarity with respect to ecological mitigation and survey reporting.*

B.5.17.4 Threatened and Endangered Species

Comments: RP017-006; RP017-009, RP024-659, RP036-009, RP036-010, RP036-016; RP036-053

The commenters clarified and updated information on the USFWS and WGFD lists related to threatened, endangered, and otherwise protected species. One commenter discussed its plans with respect to protected species, including Federally listed species and identified areas of the DSEIS that needed clarification with respect to the different species on the lists maintained by the State and Federal agencies. In addition, Wyoming noted that it had changed the name of the WGFD's list from "Species of Concern" to "Species of Greatest Conservation Need."

Response: *In response to these comments, the NRC staff revised the text in FSEIS Section 3.6.1.4, including Table 3.13, and in SEIS Section 5.8, to reflect the updated lists and plans with respect to protected species, including the Federally listed species. In addition, all references to the "Wyoming Species of Concern (WSOC)" list was changed to "Species of Greatest Conservation Need (SGCN)" throughout the FSEIS. Finally, the NRC staff clarified text in FSEIS Section 5.8.3 to state that, although the USFWS has designated the Greater sage-grouse as a "Candidate Species" under the ESA, since Wyoming issued EO 2011-5, the USFWS has endorsed the State's conservation strategy, when fully supported and implemented, as a means to prevent a listing decision.*

B.5.17.5 Sage-Grouse

Comments: RP024-481; RP024-482; RP036-013; RP036-015; RP036-033; RP036-036; RP036-056; RP036-011; RP036-012, RP036-014; RP036-052

The commenters requested that information on the two sage-grouse leks in the vicinity of the Ross Project area be updated from 2010 information, and that text be clarified regarding the status of these leks in accordance with the Wyoming Governor's 2011 Executive Order (EO) and the corresponding BLM guidelines.

Response: *The NRC staff has revised the text in FSEIS Section 3.6.1.4 (see Table 3.13) and FSEIS Section 4.6.1.1,* **Protected Species***, to update the information on the two sage-grouse leks in the vicinity of the Ross Project. The Ross Project, however, is not located in a sage-grouse core area. The revisions the NRC staff has made include data from 2011 and 2012 as well as a reference to the 2011 EO.*

B.5.17.6 Habitat Loss and Fragmentation

Comments: RP024-477; RP024-486; RP036-022

The commenters requested clarification of the revegetation requirements, specifically related to the type of seeds that will be used and the parties who will approve the seed mixture. One commenter added that a shrub component should be added to the revegetation plan to reestablish lost shrubland habitat.

Response*: For the revegetation plan, the NRC recognizes that sagebrush is not specifically included in the Applicant's proposed seed mixture as described in SEIS Section 4.6.1.1; however, WDEQ/LQD and the landowners approve the seed mixtures of native plants and grasses, which may vary in species composition. At the time of decommissioning, the Applicant would submit an updated reclamation plan for approval, following review and approval by appropriate State and Federal agencies. Further, as stated in SEIS Section 4.6.1.1, WDEQ/LQD has the authority to determine the final revegetation for all the land within the proposed Project area. FSEIS Section 4.6.1.1 was clarified to include approval of the seed mixtures by the landowners.*

Comments: RP036-017; RP036-021; RP036-027; RP036-032; RP036-047; RP036-048; RP036-049; RP036-050; RP036-051; RP039-010

The commenters expressed concern about the cumulative impacts to sagebrush shrubland due to activities in the Powder River Basin, and the resulting habitat fragmentation. One commenter had numerous comments regarding potential impacts to sagebrush shrubland, the sequencing of reclamation, and the time required for reestablishment of this vegetation community.

Response: *The NRC staff recognizes the difficulty in re-establishing sagebrush shrubland, as discussed in SEIS Section 4.6.1.1. The Applicant has developed a Reclamation Plan as part of its WDEQ/LQD permit, which includes specific methods to minimize impacts to sagebrush shrubland vegetation. Although this vegetation community accounts for approximately 22 percent of the total area of the Ross Project, the majority of impacts to vegetation will occur to upland grassland and hayfield areas (between 70 and 80 percent of the total disturbance will be* *within these vegetation communities). Therefore, it is anticipated that the total impact to sagebrush shrubland will be less than between 20 and 30 ha [49 to 74 ac]. Although the phasing of construction activities over time will reduce the amount of surface area disturbed, the NRC staff recognizes that given the years needed to reestablish sagebrush shrubland, the phasing alone will not be enough to mitigate the impacts. Therefore, the Applicant has committed to additional mitigation measures, as discussed in SEIS Section 4.6.1.1, which include minimizing disturbances in sagebrush shrubland. The NRC has clarified that all of the proposed mitigation measures would be required in order to reduce impacts to vegetation at the Project.*

The NRC has edited SEIS Section 5.8 to clarify that although reclamation has been conducted on one-half of the disturbed areas with the Powder River Basin, the vegetative communities may not yet be restored to functional habitat. Additionally, this section has been modified to recognize that although some vegetation communities could recover within five years of the initiation of restoration, it could take decades for the sagebrush shrubland community to recover, as discussed in SEIS Section 4.6.1.1. Additionally, SEIS Section 5.8.1.1 was revised to clarify the potential impacts to vegetation resulting from projects within the Powder River Basin. Based upon the information provided by the commenters, the cumulative impacts to vegetation was changed from SMALL to MODERATE.

B.5.17.7 Traffic and Noise Impacts

Comment: RP017-013

The commenter expressed concern over the potential negative impacts of Ross Project-related noise on wildlife receptors. Concern was also expressed that construction equipment, CPP equipment, and trucks could increase low frequency noise in and around Devils Tower as a result of Ross Project activities, thereby negatively impacting visitor experience. The commenter requested that the “cumulative effects” of noise sources that may be in operation simultaneously be addressed.

Response: *SEIS Section 4.6 discusses in detail potential impacts of Ross Project- generated dust and noise on the flora and fauna of the area. This discussion details potential impacts on wildlife. The NRC has also addressed the impact of noise on wildlife in its response to comments RP024-516, RP036-040, and RP036-041. The NRC has assessed the attenuation of noise with distance from a single or multiple sources on a multi-spectrum basis. The combined noise produced by multiple pieces of equipment (including trucks) in close proximity to one another was analyzed using standard charts for combining sound levels for equal and non-equal sources. Anticipated noise levels, even with predominant low frequency characteristics, will revert to ambient levels well before the 10 mile [52,800 ft] distant Devils Tower, due to attenuation of noise with distance.*

Sound propagation from point source(s) was estimated by the inverse distance law, i.e., that sound pressure levels decrease by (-) 6 decibels (dBs) per doubling of distance from the source. SEIS Table 4.5 provides estimated damping effects on noise levels of construction equipment using the inverse distance law to represent workers, the nearest residence from the Ross Project boundary, and the proposed CPP site. As stated in SEIS Section 4.8.1.1, noise levels are expected to be the greatest during construction. However, even with certain equipment such as impact wrenches, the primary locations of these noises would be at least 335 m [1,100 ft] from the nearest residence, and not expected to reach the 55 A-weighted *decibel (dBA) nuisance level. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP024-019; RP024-020; RP024-220

The commenter asked that a range of impacts (i.e., SMALL to MODERATE) be inserted in the discussion of the Ross Project's transportation impacts on local and county roads in the Executive Summary of the SEIS.

Response: *The NRC staff determined that the impacts to the local and county road network surrounding the Ross Project area would be MODERATE to LARGE during the construction, operation, and decommissioning phases of the Ross Project. With mitigation, however, these impacts would be ameliorated to SMALL to MODERATE. (Impacts to the Interstate highway system would be SMALL in all phases.) The "Transportation" section of the Executive Summary was revised to ensure that the magnitudes of the respective impacts are correctly stated. Table ExS.1 has also been revised to ensure clarity. Responses to similar comments are also included at Comments Nos. RP024-056, RP024-057, RP024-221, RP024-379, and RP024-472.*

Comment: RP024-509

The commenter suggested striking the statement, "As noted in GEIS Section 3.3.1, most ISR facilities are proposed for undeveloped rural areas at least 16 km [10 mi] from the nearest communities," because the nearest community is Moorcroft, approximately 35 km [22 mi] south of the Ross Project site.

Response: *The SEIS statement from the GEIS provides information about ISR facilities generally. As the commenter notes, however, the Ross Project site is more than twice as far (35 km [22 mi]) from the nearest community of Moorcroft. Accordingly, the NRC added text to FSEIS Section 4.8 to clarify the distances to the nearest communities.*

Comment: RP024-510

The commenter questioned whether the reference to DSEIS Figure 3.3 is correct, because it indicated that Figure 3.3 does not depict the residences near the Ross Project. The commenter suggested changing the reference to Figure 3.1, which depicts the four nearest residences to the Ross Project.

Response: *The NRC staff agrees with the commenter. The FSEIS has been revised in Section 3.2 to refer the reader to Figure 3.1.*

Comments: RP024-516; RP036-040; RP036-041

The commenters noted that SEIS Section 4.8 states that impacts to wildlife from noise would be small because wildlife would generally avoid areas where noise-generating activity is occurring. The commenters noted that although wildlife may avoid areas where disruptive construction or development noise is occurring, the SEIS should analyze avoidance as the impact, not the solution to the impact. Although noise may be temporary and may not entail the actual disturbance or long-term loss of habitat, it may constitute a short-term loss of habitat because the area of avoidance is unusable as a result of the noise conflict.

Response: *Impacts to wildlife from noise during construction would be temporary and of relatively short duration. The GEIS evaluated the potential impacts to wildlife as ranging from SMALL to MODERATE, depending on site specific conditions, including the availability of adjacent habitat and the presence of critical habitat. The amount of land impacted by the Ross Project (133 ha [280 ac]) is SMALL (see SEIS Section 4.2.1.1). Furthermore, the habitat within the Ross Project is not critical for any big-game species or migration corridors (see SEIS Section 4.6.1.1), and sage grouse have not been observed on the Ross Project site. There is adequate habitat adjacent to the site in the surrounding community, and the wildlife would return to the Project Area once the temporary noise activities had ceased. Finally, WGFD mitigation requirements would be implemented, as necessary, and as outlined in SEIS Section 4.6.1.1. Therefore, the overall impact to wildlife resulting from noise impacts would be SMALL. The SEIS was revised to reflect the information provided in this response.*

Comment: RP024-672

The commenter questioned whether an increase in truck noise identified in the cumulative impacts had been double counted.

Response: *The NRC has clarified Section 5.11, indicating that the increase in truck noise was based upon the maximum yellowcake production rate of 1.4 million kg/yr [3 million lb/yr], which includes IX resin delivery from the Barber satellite area to the Ross Project's CPP, and that truck noise would not greatly increase due to the operation of additional Lance District satellite areas during overlapping phases, because the approximate number of vehicles—400—has already been considered in SEIS Section 4.8.*

Comment: RP024-751

The commenter suggested that the NRC staff revise language in DSEIS Section 5.11 indicating that there could be some increase in noise because of the additional uranium-loaded resin shipments as such resin is shipped from potential satellite areas in the Lance District. The commenter indicated this statement seemed to be double counted because the previous statement in the same paragraph specifies that the total number of shipments described in the cumulative-impact analysis for noise presented in DSEIS Section 4.8 included “the truck delivery of uranium-loaded IX resins from the potential Barber satellite area to the Ross Project’s CPP.”

Response: *The NRC staff agrees that noise impacts could have been over-estimated. The noise levels discussed in DSEIS 4.8.1 were predicated upon the maximum yellowcake production rate of 1.4 million kg/yr [3 million lb/yr]. So, the next statement in the DSEIS, which suggested a potential increase in noise attributable to* additional *uranium-loaded resin trucks recovered at the Barber satellite area and trucked to the CPP, did indeed over-count the truck noise to and from the Ross Project area. The NRC staff has revised the arithmetic in the cumulative-impacts noise analysis in FSEIS Section 5.11 inasmuch as the maximum yellowcake production rate had already been evaluated in DSEIS Section 4.8.1. Therefore, the NRC has revised the analysis and subject paragraph for clarity, deleting the subject sentence.*

B.5.17.8 References

(US)NRC (Nuclear Regulatory Commission). "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

B.5.18 Meteorology, Climatology, and Air Quality

B.5.18.1 Impacts to Air Quality

B.5.18.1.1 GHG and Climate Change

Comment: RP005-002

The commenter expressed concern with increases in fugitive dust created by additional traffic and fugitive dust inhalation by animals and humans who would be most exposed to it. The commenter noted that in the DSEIS the NRC staff concluded, based on the road dust estimates, that there is a potential for moderate dust emissions and impacts to the nearest residents. Therefore, short-term and intermittent air emissions may be visible to the residents near unpaved roads when vehicles travel on the roads. The commenter stated that the mitigation measures discussed in DSEIS Section 4.7.1.1 and in the Air Quality Permit to Construct issued by the WDEQ, and to which the Applicant has committed, should reduce but not eliminate Ross Project-related road dust, as well as minimize dust from pre-existing normal traffic levels.

Response: *Based on the road dust estimates, the NRC concluded that there is a potential of moderate dust emissions and impacts to the nearest residents when trucks are passing. Therefore, short-term and intermittent visible air emissions are possible to the residents near unpaved roads when vehicles (particularly trucks) travel on them. The mitigation measures discussed in Section 4.7.1.1 and in the Air Quality Permit to Construct issued by the*

WDEQ, and to which the Applicant has committed, should reduce but not eliminate Ross Project-related road dust, as well as minimize dust from pre-existing normal traffic levels. These mitigation steps include, but are not limited to, setting and enforcing appropriate speed limits, using chemical dust suppressants, encouraging employee carpooling, regular and unannounced WDEQ/AQD inspections, and twice-daily visual monitoring for effectiveness of duct control on access roads. A statement has been added to Section 4.7.1.1 regarding fugitive-dust mitigation measures to which the Applicant has committed for the nearest residences in its Air Quality Permit.

Comment: RP024-491

The commenter requested that greenhouse gas emissions from the Proposed Action be included.

Response: *Greenhouse-gas emissions are discussed as a cumulative impact in SEIS Section 5.10.2, and the discussion includes an estimation of the CO_2 emissions resulting from the project (Table 5.6). No changes were made to the SEIS beyond the information provided in this response.*

B.5.18.2 Impacts to Devils Tower National Monument

Comment: RP015-005

The commenter stated that the proximity of the project to Devils Tower threatens the economics of the region and the health and welfare of visitors to the National Monument due to contamination, dust, noise, and truck traffic.

Response: *The NRC acknowledges the uniqueness and value of Devils Tower. The analyses in the SEIS show that no impacts on the health and welfare of its visitors would occur due to contamination, dust, noise, and truck traffic. These analyses included identification of the predominant and high speed-wind event dispersion direction as to the south-southeast, combined with the channeling effects of the regional landscape (SEIS Section 4.7).*

GEIS Section 4.2.6 determined that uranium-recovery facilities are not, in general, major air-emission sources, and that potential air-quality impacts of an ISR facility are small (NRC 2009b), if three conditions were met at a specific facility. These included particle and gaseous emissions being within regulatory limits, National Ambient Air Quality Standards (NAAQS) compliance for regional air quality, and that the facility would not be classified as a major source under New Source Review or Title V air-quality permit programs (SEIS Section 4.7.1). The Ross Project meets these three conditions.

The Ross Project will be subject to the Wyoming Air Quality Standards and Regulations (WAQSR), Chapter 3, Section 2(f) regulating fugitive dusts from point sources and to the WDEQ/AQD regulations on general fugitive-dust emissions. In the Ross Project Air Quality Permit Application, requirements for BMPs and Best Available Control Technology (BACT) to mitigate fugitive dust and gaseous air emissions are described (WDEQ/AQD, 2011). These emissions would be limited in duration depending on the Project phase, as explained in SEIS Sections 4.7.1.1 through 4.7.1.4 and quantified in SEIS Table 4.5.

Two studies are cited in SEIS Section 4.7.1.1 that reported deposition rates of mechanically-generated fugitive (road) dusts, finding that concentrations decline substantially with 110 – 150 m [330 – 490 ft] from the road due to gravitational setting rates, vertical mixing, transport times and impacting nearby obstacles (e.g., vegetation). The studies conclude that there is a higher probability that mechanically generated particles, such as those generated by vehicles, are removed from the atmosphere close to their sources than windblown dusts. One of these studies also examines the settling rates of windblown fugitive dusts, concluding that PM_{10} particles are deposited at a rate that is about an order of magnitude greater than $PM_{2.5}$. The studies indicate that the majority of fugitive dust impacts would not extend beyond the 80-km [50-mi] radius around the Ross Project area.

Wind erosion is predicted to generate much less fugitive dust from exposed areas than vehicle use on unpaved roads (SEIS Table 4.5). However, stability class information (a measure of atmospheric turbulence) collected from the Ross Project meteorological station (Strata, 2011a) indicated that the class distributions were predominantly neutral (SEIS Section 4.7.l).

Relative to noise, the GEIS indicates that 300 m [1,000 ft] is the distance outside of which noise from construction would return to the usual conditions (SEIS Section 4.8). GEIS (Section 4.4.7.1) stated that potential noise impacts would be greatest during construction (NRC, 2009b). Such noise would not exceed the 24-hour average sound-energy guideline of 70 dBA or the daytime average of 55 dBA, the level EPA identified as protective against interference of receptor activities and receptor annoyance (EPA, 1978). Table 4.6 in SEIS Section 4.8.1.1, shows how the noise level of heavy equipment falls to background at 760 m [2,500 ft] from the source. At 16 km [10 mi] distance, Devils Tower will not experience any noise from the Ross Project. Thru-truck traffic should not create noticeable additional noise at Devils Tower, due to paved roads and the attenuation of noise over distance. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP017-018

The commenter expressed concern that fugitive dust from the Ross Project site might reach a 80-km [50-mi] radius of the project site, including Devils Tower. The commenter recommends adaptive management of fugitive dust minimization measures.

Response: *In its Air Quality Permit Application, the Applicant elaborates on adaptive dust management, committing to BACT and BMPs to control fugitive dust at the source. An important component of adaptive management is visual observation on at least an hourly basis to monitor air quality in the Ross Project area and on a twice-daily basis along the primary access routes (see SEIS Section 4.7.1.1). In addition, regular inspections by WDEQ/AQD would be conducted. Other fugitive dust management techniques include, but are not limited to, roadway evaluation and improvement systems, leeward placement of stockpiles (where hills are available), prompt restoration of disturbed areas, application of water to exposed soils, chemical dust suppressants, speed limits, etc. Roadway-evaluation systems have been adopted as part of the MOU with Crook County (Strata and Crook County, 2011d). The performance-related approach is flexible in that provisions can be implemented quickly. Fugitive dust from the CPP has been estimated to be very small when BACT controls are applied. SEIS Section 4.7.1 presents data from two studies of the settling distances and transport times of near-road fugitive dust (Countess et al., 2001). These data suggest that fugitive dust will not be deposited near Devils Tower. No changes were made to the SEIS beyond the information provided in this response.*

B.5.18.3 Miscellaneous Meteorology, Climatology, and Air Quality Comments

Comment: RP024-190

The commenter suggested that the discussion of the non-radioactive particulate and gaseous emissions in DSEIS Section 2.1.1.5, Airborne Emissions, *Non-Radioactive Emissions*, be revised to be consistent with the Applicant's ER at Section 4.6.1.

Response: *The discussion in the DSEIS deliberately did not include some of the smaller sources of non-radioactive particulate and gaseous emissions that are inventoried in the license application because Section 2 is a broad overview of the Proposed Action, less detailed than the impact analyses in Section 4 of the SEIS. Nonetheless, the NRC has revised the text in Section 2.0 to highlight the smaller sources identified by the commenter.*

Comments: RP024-306; RP024-307; RP024-308; RP024-309

The commenter requested that the NRC staff clarify the speeds of the wind, the direction of the wind (as measured at the Ross Project area), and the period of record for the wind measurements depicted by the wind roses in DSEIS Figures 3.17 and 3.18.

Response: *The text in FSEIS Section 3.7.1, which discusses the information conveyed by the subject figures, has been edited to clarify the results of wind monitoring at the Project area, including the discussion of the prevailing wind speeds, direction, and the pertinent records kept.*

Comment: RP024-492

The commenter stated that the statement in DSEIS Section 4.7 that "combustion emission and fugitive dust emissions from the Ross Project would be moved by the highest wind speeds to the south-southeast" is inconsistent with the Ross Project wind patterns. The commenter stated that the predominant wind direction at the Ross Project area is from the south and that, therefore, combustion engine and fugitive dust emissions would be moved to the "north-northwest."

Response: *The prevailing wind direction at the site is southerly, except in May, when southeast winds prevail. Despite the southerly winds, the SEIS statement that the highest wind speeds tend to occur from the north-northwest is accurate. Therefore, no changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-493

The commenter noted that the text in DSEIS Section 4.7 regarding "unwanted vapor and gaseous emissions" was unclear, as was, in the opinion of the commenter, much of text regarding fugitive dust. The commenter recommended eliminating this text from that particular subsection (i.e., that Section's introduction).

Response: *The NRC staff agrees to a point; however, fugitive dust* is *a significant air pollutant. The intent of the discussion was to compare the significance of fugitive dust to other pollutants relative to other examples. Nevertheless, the potential confusion introduced by the* *original wording is acknowledged. The text in FSEIS Section 4.7 retains the identification of fugitive dust as a significant air pollutant, but it has been revised for more clarity.*

Comment: RP024-500

The commenter requested that Table 4.5, under "[Non-Radioactive Emissions Summary] Construction Equipment and Truck Tailpipe Emissions," be revised to include all of the transportation-related emissions detailed by the Applicant in its responses to the NRC's RAIs on the license application (Strata, 2012a).

Response: *The NRC has added the information requested by the commenter to FSEIS Table 4.5.*

Comment: RP032-052

The commenter asked for a calculation of the CO_2 equivalent emissions for the project, per pound of yellowcake. The commenter asked that the calculation include all sources of electricity and fossil-fueled consumption for the life of the Ross Project.

Response: *As documented in Section 5.10.2 of the SEIS, the maximum annual CO_2 equivalent emissions for operations at the facility is 11,872 t [13,087 T]. The production of yellowcake is anticipated to be a maximum of 3,000,000 pounds per year, resulting in an estimated 8.7 pounds of CO_2 equivalent emissions per pound of yellowcake. This number only accounts for the emissions resulting from on-site plant operations, and does not include emissions from power plants providing electricity to the facility. Due to the interstate nature of the electrical grid, the actual source of the electricity for the plant is unknown, and therefore the CO_2 emissions for the electricity to be supplied to the plant cannot be calculated. No changes were made to the SEIS as a result of this comment.*

Comment: RP039-019

The commenter asked that impacts from truck traffic, dust, and noise be minimized.

Response: *The commenter's concerns are addressed in the responses to Comment Nos. RP016-005, RP017-012, RP017-013 RP017-018, and RP024-495.*

B.5.18.4 References

Countess, R., W. Barnard, C. Claiborn, D. Gillette, D. Latimer, T. Pace, and J. Watson. "Methodology for Estimating Fugitive Windblown and Mechanically Resuspended Road Dust Emissions Applicable for Regional Air Quality Modeling" in *10th International Emission Inventory Conference Proceedings*. Westlake Village, CA: Countess Environmental. May 2001. ADAMS Accession No. ML13022A448.

(US)EPA (Environmental Protection Agency). "Protective Noise Levels: Condensed Version of EPA Levels Document." EPA Report No. 550/9-79-100. ML13015A552. Washington DC: EPA. November 1978.

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices.* Docket No. 40-09091. Gillette, WY: Strata. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Air Quality Permit Application for Ross In-Situ Uranium Recovery Project*. Prepared for Strata Energy, Inc. Sheridan, WY: Inter-Mountain Laboratories, IML Air Science. 2011c. ADAMS Accession No. ML11222A060.

Strata and Crook County. *Memorandum of Understanding for Improvement and Maintenance of Crook County Roads Providing Access to the Ross ISR Project.* Sundance, WY: Crook County. April 6, 2011d. ADAMS Accession No. ML111170303.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

WDEQ/AQD (Wyoming Department of Environmental Quality/Air Quality Division). *Permit to Construct, Air Quality Permit #12198*. Cheyenne, WY: WDEQ/AQD. 2011. September 13, 2011. ADAMS Accession No. ML112770430.

B.5.19 Historical and Cultural Resources

B.5.19.1 Potential Impacts to Cultural, Historical, and Sacred Places

Comments: RP024-041; RP024-042; RP024-058; RP024-085; RP024-086; RP024-222; RP024-322; RP024-522; RP024-523; RP024-524; RP024-525; RP024-527; RP024-529; RP024-532; RP024-534; RP024-536; RP024-537; RP024-538; RP024-539; RP024-540; RP024-542; RP024-680; RP024-681; RP024-682; RP024-683; RP024-684; RP024-689; RP024-690; RP024-691; RP024-692; RP024-693; RP024-694

The commenter requested several revisions to the SEIS text within the sections on Historical, Cultural, and Paleontological Resources. The suggested revisions included justifying the statement that potential impacts to historical and cultural resources would be SMALL to LARGE, changing "eligible properties" to "potentially eligible properties," and clarifying the consultation status and level of interest of certain Tribes. The commenter also recommended clarifying the information regarding the status of the traditional cultural properties (TCPs) survey and existing disturbance within the project area that could adversely effect these sites, and including more information on the possible outcomes of Section 106 consultation and the possible development of mitigation measures to avoid or minimize adverse effects.

Response: *The NRC and the BLM staffs' Section 106 consultation activities for the proposed undertaking have continued since publication of the DSEIS. These activities have required significant revisions to SEIS discussions related to Section 106 consultation activities and historical, cultural, and paleontological resources. Many of these FSEIS revisions occur in sections of the DSEIS that the commenter addressed in its comments. When revising the text* *to reflect the new information obtained through the post-DSEIS Section 106 activities, the NRC staff considered these comments.*

Comment: RP024-535

The commenter suggested changing the word “mitigated” to “resolved” to be consistent with Section 106 consultation process.

Response: ***“****Mitigation,” as used in an EIS, means avoidance, minimization (to limit the degree or magnitude of an action), rectification (to repair, rehabilitate, or restore), reduction, or elimination of potential impacts over time; it can also mean compensation. Mitigation with respect of NHPA also means the resolution of specific adverse effects to a historical and/or cultural property. Thus, “mitigation” is the proper word that the NRC intended to use. No changes were made to the SEIS beyond the information presented in this response.*

Comment: RP037-001

The commenter brought to the attention of the NRC staff the concerns and frustrations of its Tribal Historic Preservation Office (THPO). A second letter was attached to the comment letter, one of which was written to the Advisory Council on Historic Properties (ACHP) and which discussed not only the Ross Project, but other ISR projects as well.

Response: *While many of the comments submitted by the commenter were not within the scope of this SEIS, which concerns only the proposed Ross Project, readers are invited to read the letter attached to the comment letter, which was dated March 20, 2013, at ADAMS Accession No. ML13196A371. Moreover, readers can access ACHP’s related letter to the NRC of May 3, 2013 (ADAMS Accession No. ML13196A368) as well as NRC’s response letter to the ACHP dated August 2, 2013 (ADAMS Accession No. ML13197A139).*

B.5.19.2 Miscellaneous Historic and Cultural Comments

Comment: RP024-316

The commenter stated that the original text in DSEIS Section 3.9 was factually incorrect and does not contribute to an understanding of historical and cultural properties at the Ross Project area.

Response: *The original text in the SEIS makes four relevant points. First, the text refers to the broad categories of property types that may be considered historic properties, including: sites, buildings, structures, districts or objects. Prehistoric archaeological sites considered potentially eligible for the National Register of Historic Places (NRHP) under Criterion D of 36 CFR Part 60.4 occur within the Ross Project area.*

Second, the SEIS text referred to the 1992 Amendments to Section 101 of the NHPA, which explicitly added TCPs as a property type that could be considered eligible for listing on the NRHP. TCP site and district properties eligible for listing on the NRHP under Criterion A do occur within the Ross Project area. Third, the text cited the four NRHP criteria for evaluation cited in 36 CFR Part 60.4; however, two errors occurred in the text: 1) the four criteria should be identified as Criteria “a – d”, rather than “1 – 4,” and 2) “under Criterion 4(d),” that the DSEIS *text read as "yield or be likely to yield important information." The correct citation for Criterion (d) is, "has yielded or may yield information significant to prehistory or history."*

Fourth, the DSEIS text referred to assessements of site integrity as a requirement of the NRHP site-evaluation process. This part of the text is not clear, nor does it contribute to an understanding of historic properties in the Ross Project area. To clarify the information presented in the FSEIS text, the commenter recommended replacing the original text with the following text passage: "Historic properties are resources eligible for or listed on the National Register of Historic Places. To be eligible for listing, resources must exhibit integrity of setting, location, design, materials, feeling and association. Once integrity is established, a resource is evaluated for criteria of eligibility as defined in 36 CFR Part 60.4, of which it must meet at least one criterion. These criteria include: 1) association with significant events in the past, 2) association with the lives of persons significant in the past, 3) embodiments of distinctive characteristics of type, period, or construction, or 4) yield or be likely to yield important information."

The NRC agrees that the text change recommended by the commenter provides increased clarity and is more descriptive of the historic properties in the Ross Project area. However, the incorporation of the important points cited in the DSEIS text is also necessary to provide the most complete picture of the occurrence and significance of potential historic and cultural properties in the Ross Project area. Therefore, a new, combined text passage has been inserted to replace the text in FSEIS Section 3.9.

Comment: RP024-319

The commenter suggested revising "additional shovel tests" in SEIS Section 3.9.2 to include all of the additional work completed by the Applicant.

Response: *The FSEIS has been revised in Section 3.9 to include a description of the additional work completed by the Applicant.*

Comment: RP024-321; RP024-675

The commenter suggested the NRC be consistent in its description of the APE for the Ross Project. The APE was defined in DSEIS Section 3.9 as "…the Ross Project site boundary and its immediate environs, which may be impacted by the Ross Project construction, operation, aquifer restoration, and decommissioning activities." This differed from the description in DSEIS Section 5.12, which stated that the APE "includes the Ross Project's boundaries as well as the area established for potential effects to TCPs."

Response: *The NRC staff agrees and has ensured that its references to the APE, as defined in the first quotation, are consistent in the discussions in FSEIS Sections 3.9 and 5.12.*

B.5.20 Visual and Scenic Resources

B.5.20.1 Light Pollution Concerns

Comment: RP017-012

The commenter expressed concern about the cumulative impacts related to light pollution at the Ross Project, air pollution (including fugitive dust), and visual and scenic impacts, particularly if potential satellite areas in the Lance District (including the proposed Kendrick, Richards, and Barber areas) would be under construction and/or operation in conjunction with the Ross Project area.

Response: *The construction, operation, aquifer restoration and decommissioning of the Lance District (Kendrick, Richards, and Barber areas) would be developed in sequence after the construction of the Ross Project facility (e.g., CPP and the surface impoundments) has been completed and its operation initiated. If other satellite areas were to be developed within the Lance District, then the Applicant would be required to submit to the NRC a license-amendment application. In that application, the Applicant would be required to evaluate light and air pollution as consequences of its expansion in the Lance District.*

SEIS Sections 4.9 and 4.13 consider the cumulative impacts of the Ross Project on local air quality as well as on visual and scenic resources (including light pollution in general). As noted in SEIS Section 4.10.1.1, prior to the actual construction of the Ross Project, monitoring for potential light pollution would be conducted at eight sites around the Project area. Based upon the results of this pre-construction evaluation, a light-pollution monitoring plan would be prepared by the Applicant. This plan would finalize the locations for both continuous and intermittent light sources; in addition, it would provide a schedule for periodic checks on sky brightness during the construction and operation of the Ross Project to ensure worker safety and to measure, and to mitigate if necessary, obtrusive light emanating from the Proposed Action (Strata, 2012a). Please see the NRC staff's responses to Comment Nos. RP035-015 and RP035-042 for further information on the potential cumulative impacts to air quality as a result of the Ross Project, and please refer to the other comments and responses in this Section B.5.20 of Appendix B. No changes were made to the SEIS beyond the information provided in this response.

Comment: RP017-014

The commenter recommended that all mitigation strategies listed in DSEIS Section 4.10.1.1 be extended to include all components of the Ross Project, including the CCP, wellfields, roads, and structures. The commenter also recommended that these mitigation strategies be extended to the operation and aquifer-restoration phases of the Project.

Response: *The NRC staff agrees with the commenter's recommendations. It has revised the text to clarify that the mitigation strategies noted in FSEIS Section 4.10.1.1 would be applied to all components of the Project, including the CPP, wellfields, roads, and structures, and that they would be continued during the operation and aquifer-restoration phases, until the area has been reclaimed and restored.*

Comments: RP017-015; RP017-016; RP039-017; RP042-001

One commenter recommended a few additional actions in order to better address and mitigate artificial lighting. The discussion in the DSEIS focused on the glare of light in the direct vicinity of the CPP. However, the commenter noted that light pollution could also occur from "sky glow," which has broader environmental implications. Sky glow (also known as "artificial sky glow," "light domes," or "fugitive light") is the brightening of the night sky from human-caused light scattered in the atmosphere. This glow can greatly detract from the overall darkness of the night sky and can inhibit people's ability to view celestial objects in the night sky. In a remote and dark environment, impacts can be detected at distances over 160 km [100 mi]. The commenter was pleased that the Applicant would address light pollution by conducting baseline monitoring for potential light pollution at eight sites near the Project area. The commenter indicated support for the Applicant's proposal to prepare a light-pollution monitoring plan and the multiple mitigation measures proposed. The commenter encouraged the highest level of light-pollution mitigation possible, and requested the opportunity to cooperate on the final light-pollution monitoring plan and the mitigation measures to be used at the Ross Project, based upon the information obtained during pre-construction, baseline monitoring. Because the night sky is such a valuable resource at Devils Tower, and to ensure that the resource is protected, the commenter requested the Applicant conduct or sponsor light-pollution and night-sky monitoring at Devils Tower in addition to the proposed eight sites, or in substitution for one or more of the currently proposed sites. The commenter stated that the Applicant or the NRC should contact the commenter to identify optimum monitoring locations and protocols to reflect potential impacts on the night sky and the visitor experience. Two other commenters recommended adequately minimizing light pollution and other industrial impacts to landowners in the Oshoto area and to Devils Tower.

Response: *The first commenter's suggestions will be available for review by the Applicant in the FSEIS. As noted in SEIS Section 4.10.1, the respective impact analysis yielded the result that the visual and scenic impacts of the Ross Project would be SMALL throughout its lifecycle. Moreover, as outlined in SEIS Section 4.10.1.1, the Applicant would mitigate light-pollution impacts by designing lighting plans with an emphasis on the minimum lighting requirements for operation, safety, and security purposes; using light sources of minimum intensity (as measured in lumens) necessary to accomplish the light's purpose; specifying lighting fixtures that direct light only where it is needed (i.e., shine down, not out or up) in conjunction with shielding that further directs the light towards the respective work area; turning lights off when not needed at proposed intermittent light locations either manually, with timers, or occupancy sensors; adjusting the type of lights used so that the light waves emitted are those that are less likely to cause light-pollution problems such as those attendant with high-pressure sodium lamps; fitting building windows with shutters, where appropriate, to block light emissions, including the CPP and other buildings; using natural and/or in situ screens to reduce perceptible light (i.e., locating buildings and other facility components to take advantage of the natural topography and any trees; and evaluating the results of the light-pollution monitoring to ensure that, as necessary, the mitigation measures suggested previously have been implemented successfully (Strata, 2012a). No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP017-024

The commenter noted that, while the light- and noise-pollution impacts of the Ross Project were discussed in the DSEIS with respect to nearby residences, Devils Tower is also sensitive to the effects of anthropogenic light and noise and should be included in the analysis.

Response: *Visual impacts to receptors at Devils Tower are discussed in FSEIS Section 4.10.1.1. The NRC staff has added supplemental text to the FSEIS in Sections 4.8, Noise, and 4.10, Visual and Scenic Resources, to further describe the impacts of anthropogenic light and noise at Devils Tower.*

B.5.20.2 Visual Impacts

Comment: RP017-017

The commenter noted that daytime visual impacts are a concern for Devils Tower. The main feature of the Monument is the 264-m [867-ft] rock monolith, Devils Tower. The rock formation is sacred to many Native American tribes and climbed by 5,000 to 6,000 rock climbers a year.

Response: *Daytime visual impacts are discussed in SEIS Section 4.10.1. Mitigation to reduce daytime visual impacts can be found in SEIS Section 4.10.1.1. The fact that the Tower is sacred to many Native American tribes is discussed in SEIS Section 3.9.1.2. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP017-019; RP024-547

One commenter stated that the viewshed-impact analysis in the DSEIS with respect to Devils Tower shows that visitors at ground level would not be able to see the CPP. However, the commenter noted that climbers on Devils Tower would be able to see the CPP and that there may impact to the visitor experience to climbers since few structures are visible from the Tower. Another commenter noted that pictures were taken by the NPS with a telephoto lens from the top of Devils Tower in September 2011 (see ADAMS Acession No. ML11320A307). The Devils Tower viewshed analysis concluded that the Ross Project would not be visible from the base of Devils Tower or from the Visitor’s Center, but that the Project area could be visible to climbers scaling the Tower.

Response: *The NRC staff does not use photos taken with a telephoto lens in its visual-impact analyses. The NRC staff evaluates visual impacts from the perspective of the human eye. Text in FSEIS Section 4.10.1.1 has been revised to clarify that it is unlikely that the Ross Project area could be visible to climbers scaling the tower due to the distance between the Project area and the Tower.*

Comment: RP017-020

The commenter indicated support for the multiple visual-impact mitigation measures proposed by the Applicant, including painting some of the infrastructure to match the surrounding environment, planting trees, and using the local topography and landscape to create a visual buffer. The commenter added that impacts to visual and scenic resources during Project operation are considered “SMALL” (i.e., not detectable) in the SEIS. However, given that climbers may be able to see the CPP and lights from the summit of Devils Tower, unless mitigated, the commenter indicated that those impacts would be “MODERATE” (i.e., sufficient to alter noticeably).

Response: *The NRC has determined that, with the mitigation measures committed to by the Applicant, as detailed in SEIS Section 4.10.1.1, the impacts to visual and scenic resources in the APE as a result of the CPP’s presence and its lighting during all of the Ross Project’s* *phases would be SMALL. In particular, given the BLM's management class of the Ross Project area, even nearby observers would experience only SMALL impacts, although the four nearest residences to the Project could experience SMALL to MODERATE impacts during the construction phase but these impacts would lessen during the operation phase of the Project to SMALL. During the day, climbers at the top of Devils Tower would not be able to see the Project, even the CPP, due to the camouflaging efforts committed to by the Applicant (e.g., paint colors); conversely, during the dark of night, such climbers might be able to see the lights of the Project. However, no climbing is permitted after dark at Devils Tower. No changes were made to the SEIS beyond the information presented in this response.*

Comment: RP024-545

The commenter noted the statement in DSEIS Section 4.10 that, "The Applicant would mitigate visual and scenic impacts related to fugitive dust by wetting the soil and using chemical dust suppressants, as necessary, when clearing and grading activities are underway as well as by establishing diminished speed limits for vehicle traffic…." The commenter suggested revising the statement to: "[The Applicant's] using chemical dust suppressants, as necessary, when clearing and grading activities are underway and on roads as well as…."

Response: *The NRC staff agrees that the subject statement could be stated more clearly. The NRC staff notes, however, a number of management practices the Applicant could exercise to suppress fugitive dust are presented in detail in SEIS Section 4.7. The statement has been revised per the commenter's suggestion in FSEIS Section 4.10.*

Comment: RP039-012

The commenter requested that the FSEIS fully discuss the visual quality of the area, impacts, and mitigation.

Response: *The visual and scenic resources in the Ross Project area, which are discussed in SEIS Section 3.10; the impacts to visual and scenic resources from the three proposed alternatives, which are discussed in SEIS Section 4.10; and the cumulative impacts related to Project-area visual and scenic resources, which are described in SEIS Section 5.13, are fully described and discussed in the SEIS. Further, the mitigation measures for visual and scenic resources impacts are described in SEIS Section 4.10.1. No changes were made to the SEIS beyond the information provided in this response.*

B.5.20.3 References

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

B.5.21 Socioeconomics

Comment: RP016-007

The commenter stated that the anticipated one-percent increase in the demand for health and social services as a result of an anticipated one-percent increase in local population well under-represented the true impact on local emergency services.

Response: *Increases in the demand for health and social services based upon increases in the local-area population are consistent with standard planning practices for these types of services. As noted in SEIS Section 4.11.1.1, accident rates (and the ensuing need for emergency services) are not expected to be different than those of other types of similar industrial facilities. The Applicant has represented itself to be committed to maintaining emergency-response personnel on staff and would train local emergency responders in preparing and responding to potential emergencies. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP016-008

The commenter noted that the increase in the workforce, distance of travel on two-lane gravel roads, extreme drought conditions in the region, and the amount of drill-rig activity and construction work in vegetated areas, would all make the potential for accidents and fires extremely high compared to the current state of the community prior to the Applicant's uranium-recovery operation. Since Crook County is staffed entirely by all-volunteer firefighters, the commenter proposed that the Applicant be required to have trained emergency-response personnel on staff, to work with local responders on preparing and responding to potential environmental, safety, and health emergencies, and to be required to have a firefighting unit available and staff trained to respond at all times.

Response: *The NRC's Ross Project SER, Section 7.3.6, determined that the Project-related fire hazard would be minimal and that the Applicant's commitments to further reduce the risk would make an onsite firefighting unit unnecessary. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-331

The commenter suggested revising SEIS Section 3.11.2 so that it would discuss median household income, which would be similar to previous SEISs completed for the Moore Ranch and Nichols Ranch Projects.

Response: *The purpose of the SEIS's providing a per-capita-personal-income measure, rather than a median household-income measure, was so that the total personal-income value was easily calculated for the region of influence (ROI), based upon population levels. The total personal-income value is the metric against which Project changes were measured regardless of whether a per-capita measure or a household measure were to be used. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-696

The commenter requested clarification on the sources the NRC staff used to evaluate the cumulative impacts for employment and population increases. For example, the commenter noted that the SEIS stated that “2,080 jobs” would be created if the other potential uranium-recovery projects in the 80-km [50-mi] area were at peak construction employment concurrently with the Ross Project. However, the commenter noted that, as indicated in SEIS Section 4.11, the Ross Project would employ 200 people during construction and an additional 140 indirect jobs could be generated. Therefore, the commenter stated that during construction the Ross Project and four other potential uranium-recovery projects could create “1,000 jobs” with the potential for an additional “700 indirect jobs.” Similarly, the commenter noted that the SEIS stated that “the additional operation-phase population would increase the projected six-county population in 2027 to 24,348 residents.” However, as the commenter noted, SEIS Section 4.11 stated that the employment base in the ROI (Crook and Campbell counties) was approximately 28,000 workers.

Response: *The 2,080 construction-worker estimate reflected not only uranium-recovery projects within 80 km [50 mi] of the Ross Project area, but it also included other uranium-recovery projects within the six-county region composed of Crook, Campbell, Weston, Sheridan, Johnson, and Converse Counties. This area is consistent with the geographic scope of the BLM's* Report for the Powder River Basin Coal Review Cumulative Social and Economic Effects *and is also consistent with the rest of the socioeconomics cumulative-impact analysis.*

The other, similar projects include the potential Aladdin, Elkhorn, Hauber, and Alzada uranium-recovery projects; the Smith Ranch, Willow Creek, Nichols Ranch, Moore Ranch, and Reno Creek uranium-recovery projects; the Ross Project itself; and the workforce associated with wellfield construction at the satellite areas of Ross Amendment Area 1, Kendrick, Richards, and Barber. The NRC staff assumed that the construction of the potential satellite areas would require 20 workers at each location, and approximately 200 workers at each of the other projects; thus, the peak construction workforce would total 2,080 workers. There is an error in SEIS Section 5.14 in reference to these projects all located within 80 km [50 mi] of the Ross Project. The NRC has corrected the SEIS text in Section 5.14 to reflect the impacts were assessed over the six-County region, rather than within 80 km [50 mi] of the Ross Project.

Comment: RP032-062

The commenter noted that the SEIS, in its discussion of the eliminated alternative of conventional mining and milling to extract uranium at the Ross Project, stated that “the uranium ore in the Lance District is low-grade and located at nearly the maximum depth for surface mining to practically recover uranium from an open pit.” The commenter asked that the NRC define "low-grade.” The commenter also asked that the NRC provide an analysis to show that the environmental impacts of developing the uranium within the Lance District is worth the socioeconomic benefits in light of the alternative to mine from other locations. Specifically, the commenter noted that mining uranium from the Athabasca Basin would cause significantly fewer environmental impacts per ton of U_30_8 product extracted. The commenter also asked if the Applicant’s mining the potential satellites within the Lance District could threaten the future use of wells in the area as a source of drinking water.

Response: *Uranium ore is defined as “low-grade” when it contains a small percentage (e.g., 0.01 to 0.25 percent) of uranium oxides. SEIS Section 7, “Cost-Benefit Analysis,” provides an* *examination of the costs and benefits of the Proposed Action and the Alternatives. The discussion of costs and benefits followed the NRC guidance presented in NUREG–1748 (NRC, 2003b). NRC guidance does not provide for the NRC's evaluation of the costs and benefits of the Proposed Action against those of an eliminated alternative (e.g., an operator's use of conventional mining to recover uranium from another location). This SEIS has been prepared to evaluate the environmental impacts of the NRC's decision to either grant or deny a license to construct and operate a uranium-recovery facility and wellfields at the proposed Ross Project area. If the Ross Project were to be licensed and Strata were to submit an application to amend its Source and Byproduct Materials License to include one or more of the potential satellite areas, the NRC would prepare a NEPA document at that time to evaluate the environmental impacts of granting or denying the license amendment. That NEPA document would include an analysis of impacts to water resources, at that time. No changes were made to the SEIS beyond in the information in this response.*

Comment: RP041-016

The commenter stated that Federal uranium would be mined under the "1872 General Mining Law" at the Ross Project and its potential satellite areas, but the SEIS did not disclose the lack of royalties related to the production of Federal minerals. Therefore, the commenter asked that the FSEIS disclose that the mining of Federal uranium reserves would not produce royalties to federal or state governments.

Response: *The discussion of royalty payments in the SEIS referred only to Wyoming royalties, which are authorized by State statute. All royalty revenues in the SEIS referred to these state-authorized royalties. No changes were made to the SEIS beyond in the information in this response.*

B.5.21.1 References

(US)NRC (Nuclear Regulatory Commission). "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming, Materials License No. SUA-1601, Docket No. 040-09091, Strata Energy, Inc." Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

B.5.22 Public and Occupational Health

B.5.22.1 Impacts to Members of the General Public

Comment: RP003-004

The commenter expressed concern regarding historical mining operations (including a mine in Colorado) that involved radioactive materials and stated that these operations caused unexplained illness and mortality to individuals as well as left the properties in that area with no value. The commenter also feared that there would be contamination that occurs as a result of the Ross Project.

Response: *In its role as a regulatory agency, the NRC regulates the radiological aspects of uranium-related projects to ensure public and occupational health and safety as well as the protection of the environment. As part of its licensing process, and to ensure public and occupational health and safety, the NRC's SER includes an analysis of the Applicant's proposed compliance with the applicable requirements and objectives set forth in 10 CFR Parts 20, "Standards for Protection Against Radiation," and 40, "Domestic Licensing of Source Material," in addition to 10 CFR Part 40, Appendix A, "Criteria Relating to the Operation of Uranium Mills and the Disposition of Tailings or Wastes Produced by the Extraction or Concentration of Source Material from Ores Processed Primarily for their Source Material Content" (NRC, 2014a). No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP035-018

The commenter noted that the DSEIS references a document containing information on the estimated radon released from the proposed facility, but that the estimate is not included in the DSEIS. The commenter recommended that the FSEIS include this radon-release estimate so that the public and decision makers can clearly understand whether there is a potential radon impact to public health.

Response: *The commenter does not provide a citation for the DSEIS section where the "document" is referenced. However, it appears that commenter was referring to SEIS Section 4.13.1.2, which discussed the impacts of a radon release due to pregnant-lixiviant and loaded-resin releases. The document referenced in this SEIS Section is the GEIS (NRC, 2009b), which references NUREG/CR-6733 (Mackin, 2001). NUREG/CR-6733, Table 4-5, indicated that the assumed activity concentration of radon used for the pregnant-lixiviant and loaded-resin spill scenarios was* 3.0×10^4 *Bq/L [*8.00×10^5 *pCi/L]. This activity concentration was provided in Section 4.13.1.2 of the DSEIS along with the estimated resulting radiation dose to a worker of 0.0013 Sv [1,300 mrem] and dose to a member of the public of less than 1 mSv [100 mrem]. No changes were made to the SEIS beyond the information provided in this response.*

B.5.22.2 Impacts to Occupational Workers

Comment: RP024-354

The commenter requested clarification on the radiation-exposure ranges and units presented in Table 3.21 of the DSEIS. The commenter indicated that these values seemed erroneously high.

Response: *The units of radiation exposure measured by the thermo-luminescent dosimeters (TLDs) during pre-licensing, site-characterization environmental studies of the Applicant were incorrectly listed in the DSEIS. Table 3.21 has been corrected in the FSEIS.*

Comments: RP032-034

The commenter asked where the off-gases generated in the yellowcake dryer would be vented and what constituents would be contained in these off gases. The commenter also asked if there would be an incremental risk to workers or the public as a result of the Ross Project.

Response: *The off-gases from the yellowcake dryer, including particulates, were reviewed by the NRC in its SER (NRC, 2014a). All such releases, which would exit the CPP from a stack only after gas filtration and scrubbing, have been determined to be ALARA. Please refer to the NRC's SER for further information. No changes were made to the SEIS beyond the information provided in this response.*

B.5.22.3 References

Mackin, P.C., D. Daruwalla, J. Winterle, M. Smith, and D.A. Pickett. "A Baseline Risk-Informed Performance-Based Approach for In Situ Leach Uranium Extraction Licensees." NUREG/CR–6733. Washington, DC: USNRC. September 2001. ADAMS Accession No. ML011860093.

(US)NRC. "Environmental Review Guidance for Licensing Actions Associated with NMSS Programs." NUREG–1748. Washington, DC: USNRC. 2003b. ADAMS Accession No. ML032450279.

(US)NRC. "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming." Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

B.5.23 Waste Management

B.5.23.1 Waste Treatment and Disposal Methods

Comments: RP017-011; RP032-055

One commenter noted the statement in DSEIS Section 2.1.1.5, "WDEQ has approved a UIC Class I Permit for up to five wells to be installed in the Deadwood and Flathead Formations (Permit No. 10-263) (WDEQ/WQD, 2011b). The applicant expects the capacity of each of the five Class I wells to range between 132.5 – 302.8 L/min [35 – 80 gal/min]." A commenter noted that the capacity of a disposal well is expressed as a flow-rate, not as a limit on the total amount of liquid wastes injected and asked the following questions: 1) What determines the actual amount of liquid waste that each deep-disposal well can accommodate, and how is this limit expressed; 2) Is there a limitation imposed on the maximum injection pressure, or on the resulting water pressure in the deep formation that is receiving the waste, and what is this limit for the Ross Project and for potential projects developed in the Lance District; and 3) Would all deep-disposal wells associated with uranium yellowcake produced pursuant to the proposed license be targeted in the same formations (Deadwood and Flathead) as targeted by the five deep-disposal wells permitted for the "Ross Project?" In addition, a commenter requested that the total estimated volume of liquid for deep-well injection that would be disposed in the Class I UIC wells be included in the SEIS.

Response: *The UIC Class I wells proposed by the Applicant and the corresponding UIC Permit for these wells that the Applicant has received from WDEQ/WQD are discussed in FSEIS Sections 2.1.1.5 and 4.5.1.2. The UIC Class I Permit limits the pressure rather than volume of liquid disposed in the disposal wells. The Permit sets a maximum limit on the injection pressure*

(2,570 psi) and sets a range for the annulus pressure (200 – 800 psi). Injection at pressures less than the injection limit ensures that the capacity of the target aquifer (Deadwood and Flathead Formations) is not exceeded. The UIC Permit requires that the pressures as well as injection rate and volume are monitored and submitted to the WDEQ. In addition, the UIC Permit requires pressure fall-off tests to be conducted; these tests will provide data so that the Applicant can calculate aquifer properties to determine safe pressures. It is likely that any other UIC Class I wells in the Lance District would also target the Deadwood and Flathead Formations because the geology is the same throughout the Lance District. The pressure limitations and the testing and monitoring requirements set by the UIC Class I Permit has been added to the FSEIS in Section 2.1.1.5 as a result of this comment. As described in Section 4.5.1 and 4.14.1, the estimated rates of disposal of liquid in the UIC Class wells are given in Figures 4.2, 4.3, and 4.4 and Table 4.10 in the FSEIS. The rate of liquid disposed in the wells ranges from 0.2 m^3/min [62 gal/min] during operations without concurrent restoration to 0.9 m^3/min [227 gal/min] during operations with concurrent restoration. The total volume of liquid disposed in the wells would be determined by the estimated rates of disposal multiplied by the duration of the project activities.

Comment: RP024-205

The commenter indicated that byproduct material would not be generated during the construction phase of the Ross Project. During the other phases of the Project's lifecycle, when byproduct material would be generated, such material would be stored onsite in a designated area and then shipped offsite for disposal.

Response: *The NRC staff acknowledges that the commenter is correct, and SEIS Section 2.1.1.5 has been revised accordingly as a result of this comment.*

Comments: RP024-401; RP024-402

The commenter noted lack of clarity regarding the environmental impacts to aquifers that would be used for deep-well injection.

Response: *The NRC staff has revised the text in SEIS Section 4.4.1.3, which now indicates that aquifer restoration would not result in the removal of any of the rock matrix or structure of the OZ; therefore, no significant matrix compression or ground subsidence would be expected as a result of deep-well injection of waste fluids.*

Comment: RP024-431

The commenter agreed with the conclusion described in SEIS Section 4.5.1.2, that the potential impacts to ground-water quality of the shallow aquifer would be SMALL. However, the commenter suggested that the conclusion could be strengthened by the NRC's including a discussion of the Applicant's commitment to install additional shallow aquifer wells and to monitor them on a quarterly basis, as indicated by License Condition 11.5 of the Draft Source and Byproduct Materials License.

Response: *The NRC staff has revised the text in FSEIS Section 4.5.1.2 to include a reference to the Applicant's additional shallow aquifer well installation and ground-water monitoring implementation.*

Comment: RP024-569

The commenter highlighted that the Applicant's executed agreement(s) with a byproduct material disposal facility would be required prior to the commencement of uranium recovery operation, not prior to the NRC's licensing of the Ross Project.

Response: *The commenter is correct; the Applicant must submit to the NRC fully executed agreement(s) with the disposal facilities to which it would convey Ross Project byproduct material prior to uranium recovery activities commencing. The text in FSEIS Sections 2.1.1.5 and 4.14.1 has been revised to clarify this requirement.*

Comment: RP032-021

The commenter stated that, in addition to the information provided in Figure 2.4 of the DSEIS, the SEIS should include a supplemental map indicating the number, the locations, and the required capacities of all UIC Class I deep-disposal wells and the corresponding target aquifer(s) that would be required in the event that the potential satellite areas in the Lance District are developed (as shown in DSEIS Figure 2.6.) In addition, the commenter asked that any currently planned and reasonably foreseeable uranium recovery operations in the Lance District that are not reflected in Figure 2.6 be included on the supplemental map. The commenter also requested that the FSEIS include another map(s) indicating the number of proposed locations and corresponding capacities of all UIC Class I deep-disposal wells and the respective target aquifer(s) that would be used by the Applicant to dispose of wastes generated during the operation of the Ross Project CPP over its entire reasonably foreseeable lifetime. The commenter requested that a scientifically and technically adequate discussion of the cumulative environmental impacts of uranium recovery waste disposed via deep well injection be included in the FSEIS. Finally, the commenter requested that the FSEIS include all the information related to Applicant's UIC Class I Permit No. 10-263, dated April 4, 2011, that was requested in the scoping comments letter submitted to the NRC by the EPA, Region 8 (EPA, 2011).

Response: *Figure 2.4, which is found in FSEIS Section 2.1.1.1, provides a map indicating the locations of the five UIC Class I deep-disposal wells proposed by the Applicant for the Ross Project, which have already been permitted by the WDEQ/WQD (WDEQ/WQD, 2013). The NRC staff contacted the WDEQ to obtain information regarding the status of any permit applications that might have been submitted by the Applicant for additional UIC Class I wells within the Lance District. No such permit applications have been submitted to the WDEQ. Therefore, the NRC staff cannot include in this SEIS a map of the locations or the number of these wells. However, FSEIS Section 5.17.1 does provide an analysis of the cumulative impacts of liquid waste disposal via the five UIC Class I wells. This analysis considers the disposal of liquid waste in wells that could be developed for future projects near the proposed Ross Project and estimates the total number of wells that would be developed.*

The scoping comments submitted by the EPA via a letter dated December 29, 2011 (EPA, 2011), were considered during the development of the DSEIS, and the information requested by the commenter to be included is provided throughout the FSEIS. For example, in the FSEIS Sections 2.1.1.5 and 4.5.1.2, a description of the Class I Permit (UIC Class I Permit No. 10-263) is provided, including the number and locations of the wells permitted by the WDEQ, the permitted injection geologic formation, the pressure limitations, and the monitoring requirements associated with the UIC Permit. In addition, FSEIS Section 3.4.1.2. provides data on the depths *of the formations targeted by the Class I wells, the thickness of the rock between them, and USDW above the Class I wells. Similar information on UIC Class I Permit for the deep-disposal wells is provided in the NRC's response to Comment Nos. 017-011 and RP032-055. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-023

The commenter referred to the statements in DSEIS Section 2.1.1.1 that describe the construction of the deep-disposal wells: "The Applicant proposes that each well location would consist of a 76 m x 76 m [250 ft x 250 ft] pad with a storage tank (Strata, 2011b; Strata, 2012b). Surface equipment for the deep-disposal wells would include storage tanks, pumps, filtration systems, instrumentation and control systems, and equipment for injection of process chemicals (Strata, 2011b)." Based upon these statements the commenter noted that 76 m x 76 m [250 ft x 250 ft] is equivalent to an area of 0.58 ha [1.43 ac] and the UIC Class I Permit for the Ross Project would allow up to five deep-disposal wells, so that approximately 3 ha [7 ac] (not including associated service roads and pipelines) of the Ross Project would be industrialized by the construction and operation of the deep-disposal wells. Based upon that area and nature of the disturbance, the commenter submitted several questions:

1) Were the land use impacts of the maximum number of deep-disposal wells at the Ross Project, and any planned and reasonably foreseeable disposal wells required for the development of the Lance District, included in the DSEIS's estimate of land area disturbed by uranium recovery activities?

2) How and when would the concrete or gravel pads surrounding the deep-disposal wells be reclaimed?

3) What would be the licensed disposal capacity of liquid wastes for each UIC-permitted Class I well, and what would be the total licensed disposal capacity of the five permitted wells mentioned in the SEIS for the Ross Project?

4) If five such deep-disposal wells have been permitted for wastes generated at the Ross Project, how many additional deep-disposal wells, with what disposal capacities, targeting which formations, would be required in connection with processing of pregnant lixiviant and/or loaded resin from the following potential satellite areas that would utilize the Ross Project's CPP: the Ross Amendment Area 1, Kendrick, Richards, and Barber satellite areas?

5) Please provide a table containing the above information, and when construction, operation, and abandonment of each disposal well would be planned or could reasonably be expected to occur.

6) Please provide a map showing the planned or reasonably foreseeable locations of the disposal wells described in 4) and 5) above.

7) How many additional deep-disposal wells, targeting which formations, at which locations, would be required to dispose of the wastes from processing loaded resin from the following potential uranium recovery projects within 80 km [50 mi] of the Ross Project's CPP: the Aladdin, Elkhorn, Hauber, and Alzada projects?

Response:

1) The land use impacts of the area disturbed by the maximum number of deep-disposal wells at the Ross Project are presented in Section 4.2.1.1 and in Table 4.1 of the FSEIS. The impacts are generally the same as those for all other disturbed portions of the Ross Project area. However, as a result of this comment, the NRC staff has corrected the area calculations of the 76 m x 76 m [250 ft x 250 ft] pads that would be constructed at the site of each deep-disposal well. Changes have been made in Table 4.1 in the FSEIS as follows: The "Area Impacted by Proposed Action" at "Deep-Injection Wells" has been changed from 2 ha [5 ac] to 3 ha [7 ac]; the "Total Area Impacted in the Year Preceding Proposed Action Operation" at "Deep-Injection Wells" has been changed from ~113 ha [280 ac] to ~114 ha [282 ac]. The correction of the area impacted by the pads at the sites of five deep-disposal wells has been updated throughout the FSEIS and in the response to Comment No. RP032-079.

2) Section 2.1.1.4 of the FSEIS describes the abandonment of the UIC Class I deep-disposal wells that would be accomplished according to the DP that would be prepared by the Applicant and approved by the NRC, as indicated in the Draft Source and Byproduct Materials License Condition No. 10.3 (NRC, 2014b). In the license application, the Applicant represented that surface disturbance associated with deep-disposal well infrastructure would remain for the life of the Ross Project (Strata. 2011b). DSEIS Section 2.1.1.4 reiterated the commitment by the Applicant that, at the completion of decommissioning, the entire Project area would be reclaimed and restored for unrestricted use. Section 2.1.1.4 of the FSEIS has been modified by the NRC staff to add the pads associated with the deep-disposal wells to the list of features that would be surveyed for radioactive contamination by the Applicant during decommissioning activities, then disposed of appropriately or released for unrestricted use.

3) As discussed in the NRC staff's responses to Comment Nos. RP017-011 and RP032-055, the liquids injected into deep-disposal wells would be limited on the basis of pressure, rather than volume. These comments also asked for information regarding the permitted disposal capacity of the deep-disposal wells; the reader is referred to the license application for a UIC Class I Permit included as Addendum 2.4-A in the Technical Report (Strata, 2011b) and the UIC Class I Permit issued to the Applicant by the WDEQ/WQD, (WDEQ/WQD, 2011b). No changes were made to the SEIS beyond the information provided in this response.

4) The application for the UIC Permit for Class I deep-disposal wells at the Ross Project specifies that the five wells could be installed to serve the uranium recovery facility (i.e., CPP) for the life of the Project (Strata, 2011b). In addition, the Applicant performed computer modeling for a 20-year lifecycle for the deep-disposal wells to determine the maximum required capacity (Strata, 2011b). The model was based upon the assumption that the Ross Project CPP would process uranium from the other potential satellite areas within the Lance District discussed in the FSEIS that are identified by the commenter. It was anticipated that the five deep-disposal wells currently permitted for the Project would be sufficient; however, as noted in Section 5.17.1.1 of the FSEIS, if a remote IX-only facility were to be constructed within the Lance District, an additional deep-disposal well may be located at a satellite project.

5) and 6) As discussed in 4) above, it has been anticipated that the five currently permitted UIC Class I deep-disposal wells would serve the waste management needs of the Project throughout its lifecycle. The Applicant's UIC Class I Permit from WDEQ/WQD, identified above, is summarized in FSEIS Section 2.1.1.4, which includes information on the depths and targeted formations. The UIC Permit does not specify the locations of the deep-disposal wells beyond *the section of land designated for each well; construction of the five deep-disposal wells are permitted within Sections 13, 18, and 19, which covers most of the Project area. Figure 2.4 in the FSEIS depicts the approximate locations anticipated by the Applicant for the UIC Class I wells. If additional deep-disposal wells within the Lance District were to be proposed by the Applicant, a permit application would be required to be submitted to the WDEQ/WQD and then a permit issued.*

7) Section 5.17.1.1 of the FSEIS presents the assumptions used by the NRC staff in its analysis of cumulative impacts of multiple UIC Class I wells at each of the potential uranium recovery projects identified in the SEIS, within 80 km [50 mi] of the Ross Project. The analysis projected that three Class I UIC wells would be needed for each future project potentially developed outside of the Lance District. Based upon available information, as presented in SEIS Section 5.2.1.1, the uranium reserves at these projects appear to be much less than in the areas of potential Lance District projects, which, as noted above, would require five deep-disposal wells. Therefore, three UIC Class I wells for each of the other potential projects represents a reasonable, but conservative, estimate.

Comment: RP032-056

The commenter noted a statement in DSEIS Section 2.1.1.5, “Net annual evaporation of brine in the surface impoundments would be 5.3 L/min-ac [1.4 gal/min-ac] which would reduce the volume of brine injected in the disposal wells (Strata, 2011b).” The commenter asked that the NRC staff provide the total quantity and percentage of total produced brine that would be disposed via evaporation, and the amounts of radon or other hazardous gases that might be released via evaporation from the surface impoundments.

Response: *The evaporation of brine stored in the surface impoundments is described in the FSEIS Section 4.14.1 and Table 4.10. In response to Comment No. RP035-006, Table 4.10 has been revised to clarify the amounts of brine estimated to be lost by evaporation during the three periods of the operation and aquifer restoration: operation only, operation concurrent with restoration, and restoration only. See the response to Comment No. RP035-012 for a discussion of the emission of radon from the surface impoundments. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-063

The commenter referenced the statement in SEIS Section 2.2.3, "The Applicant has estimated that the 2.5 ha [6.3 ac] available for evaporation in the Proposed Action would provide 33 L/min [8.8 gal/min] of average annual evaporation. Linear extrapolation suggests that 65 ha [160 ac] is the minimum surface area required for evaporation of all brine and other byproduct waste generated at the CPP." The commenter asked: a) how was the proposed surface area of 6.3 acres for the CPP surface impoundments determined; b) why was not a larger or smaller acreage proposed; and c) what environmental and operational factors were considered.

Response: *FSEIS Section* 2.2.3 *assesses evaporation as an alternative method for disposal of liquid byproduct material. In the Proposed Action, the surface impoundments would be constructed for management of brine and liquid byproduct material with only incidental evaporation. The size of the impoundments was determined by the Applicant as part of its proposed design. In response to Comment No. 035-006, an error in the DSEIS was recognized, and the size of the impoundments proposed at the Ross Project has been revised in the FSEIS* *to 4.0 ha [9.9 ac], which is the area of the liquid when the impoundments are at their full operating capacity (Strata, 2011b). As an alternative, if all liquid disposal was achieved by evaporation rather than deep-well injection, the Applicant estimated that an area of surface impoundments required for evaporation of all byproduct liquid material plus an operational reserve capacity would exceed 80 ha [200 ac] (Strata, 2011a). Because 80 ha [200 ac] was determined to be the required size of surface impoundments for managing brine disposal completely by evaporation, smaller or larger areas were not considered as additional alternatives.   Environmental and operational factors other than size that affect the rate of evaporation are described in the subsequent paragraph in FSEIS Section 2.2.3. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP035-004; RP035-039

The commenter recommended that, given the relatively shallow ground water in the Ross Project area and the potential for contaminants to migrate into the ground water, more protective waste management options should be considered for drilling wastes (e.g., muds and other fluids) than unlined mud pits (e.g., storage tanks and reuse of fluids for drilling). The commenter also stated that, although the drilling fluids and muds are managed under a temporary WYPDES permit, it is important that the FSEIS describe the potential for environmental impacts associated with these wastes, including the level of radioactivity and metals in the drilling fluids and mud.

Response: *As stated in Section 4.13.1.1.2.2 of the Applicant's license application, drilling for ore-body exploration and delineation, site characterization, and uranium recovery operation at the Ross Project generates drilling fluids and muds (Strata, 2011a). These wastes are classified as TENORM; they are defined by EPA as "[n]aturally occurring radioactive materials that have been concentrated or exposed to the accessible environment as a result of human activities such as manufacturing, mineral extraction, or water processing" (EPA, 2008). Drilling wastes have been and would be collected and disposed of by the Applicant in onsite excavated pits, or mud pits, that are dug for this specific purpose pursuant to the various EPA regulations governing TENORM, such as those in 40 CFR Part 192. (These pits have been excavated and used during the Applicant's preconstruction activities, which do not require an NRC license.) The pits would be allowed to evaporate and dry, and then the dried pits are reclaimed according to WDEQ/LQD requirements, usually within one construction season. WDEQ has extensive experience in managing potential impacts from mud pits as they are a standard component of exploration for natural resources and this experience would be reflected in the requirements included in the Permit to Mine. TENORM ground water produced during pre-operational activities would be discharged under a temporary WYPDES permit as discussed in the NRC staff's responses to Comment Nos. RP032-058 and RP024-419.*

The NRC staff, in its SER, discussed the potential human health and environmental considerations associated with the mud pits (NRC, 2014a). SER Section 4.2.3.1 states:

> TENORM liquid waste includes drilling fluid and 'native' ground water generated during construction and development of monitoring, recovery and injection wells, and ground water generated during sample collection and aquifer testing of wells. The staff finds that the types of liquid wastes as identified by the Applicant for the Ross Project are consistent with staff's experience at operating ISR facilities. Furthermore, because effluent control systems at those facilities for those types of liquid wastes have been shown to be protective of human health

> and the environment, staff has reasonable assurance that the Applicant will design, construct, and operate similarly effective systems. Therefore, the Applicant's descriptions meet acceptance Criterion (1) of Section 4.2.3 and Criterion (13) of Section 6.1.3 of the Standard Review Plan.

In addition, SEIS Section 4.5.1.1, Ground Water, Shallow Aquifers, *provided the NRC staff's analysis of water quality impacts to the shallow aquifer due to drilling fluids. As noted in the last paragraph of that SEIS section:*

> Potential water quality impacts to the shallow aquifer that could occur during construction include spills or leaks from construction equipment and the introduction of drilling fluids. The potential for the shallow ground water to be impacted by drilling fluids and muds is minimal because of the small volume of fluids used, and because the fluids would be contained within a mud pit in accordance with WDEQ/LQD and EPA requirements. Impacts to ground water during well drilling would be further limited by the nature of the bentonite or polymer-based drilling additives in the drilling fluids. These additives are designed to limit infiltration in an aquifer (i.e., to a few inches) and to isolate the drillhole from the surrounding geologic materials via a wall-cake or veneer of drilling fluid filtrate, further diminishing the potential for impacts. Thus, the potential impacts of the Proposed Action's construction to ground-water quality in the shallow aquifers would be SMALL.

No changes were made to the SEIS beyond the information provided in this response.

Comment: RP036-003

The commenter noted that the Proposed Action includes two, double-lined surface impoundments, or "retention ponds" as the commenter identified them, that would encompass a total area of 6.5 ha [16 ac] and would be used to manage liquid waste water in the Ross Project area, and that Section 2.1.1.1 of the DSEIS described the size of the impoundments as approximately twice the upper range of typical surface impoundment sizes described in the GEIS. The commenter requested an explanation of the need for impoundments that exceed the size of typical impoundments for this type of operation.

Response: *The commenter identified an error in the SEIS that has been corrected. The size of typical impoundments described in the GEIS, which range from 0.04 to 2.5 ha [0.1 to 6.2 ac], are for individual impoundments. Facilities may have multiple impoundments. As stated in DSEIS Section 2.1.1.1, the entire area of the impoundments at the Ross Project area would be approximately 6.5 ha [16 ac]. The design would include two individual impoundments. The surface area of the waste water that would be contained in the two impoundments when they are filled to maximum capacity would be 1.3 ha [3.3 ac] and 4.0 ha [9.9 ac] (Strata, 2011b). The average size of the two impoundments proposed for the Ross Project is consistent with the upper range of the typical impoundments described in the GEIS. The text has been revised in the FSEIS Section 2.1.1.1 as well as Table 8.1 in the FSEIS to correct the error.*

B.5.23.2 Regulation of Wastes and Disposal Methods

Comment: RP024-570

The commenter suggested revising “NRC-Regulated Wastes” and “Non-NRC-Regulated Wastes” throughout the SEIS to “AEA-Regulated Wastes” and “Non-AEA-Regulated Wastes,” respectively.

Response: *The NRC only has jurisdiction over NRC-regulated wastes. Therefore, the text as written in the SEIS is an appropriately narrow construction of the category. No changes were made to the SEIS beyond the information provided in this response.*

B.5.23.3 Scope of the Assessment of Waste Management Impacts

Comment: RP032-054

The commenter noted that DSEIS Section 2.1.1.5 stated the following: “The composition and quantities of liquid waste from Ross Project processes related to uranium recovery are similar to those ranges provided in Table 2.7-3 of the GEIS (NRC, 2009a).” The commenter stated that the NRC staff’s attempt to quantify the output of liquid wastes from the Ross Project, by indicating that it is “similar to a range” provided in another document conveys no useful information and fails to comply with NEPA, which requires that important environmental parameters be quantified wherever possible. Therefore, the commenter asked that the NRC staff provide: 1) estimates of the total quantity and composition of liquid waste requiring deep well disposal from the Ross Project and all future projects in connection with future use of the Ross Project CPP and 2) the number, planned locations, target aquifers, and required capacities of all deep-disposal wells that would be created by potential future development in the Lance District.

Response: *The relationship of the Ross Project SEIS to the GEIS is described in SEIS Sections 1.1 and 1.4.1. As noted, the SEIS is a supplement to the GEIS. The GEIS provided a starting point for the NRC’s NEPA analyses of ISR facilities located within the regions evaluated in the GEIS. The Ross Project SEIS tiers from and incorporates by reference from the GEIS relevant information, findings, and conclusions concerning potential environmental impacts. The extent to which the NRC staff incorporated GEIS impact conclusions depended on how closely the Applicant’s proposed facility, wellfields, activities, and conditions at the proposed Ross Project paralleled the reference facility description, activities, regional conditions, and information or conclusions in the GEIS. The NRC’s determinations regarding environmental impacts and the extent to which GEIS impact conclusions were incorporated by reference are described throughout FSEIS Section 4.*

The DSEIS statement quoted by the commenter was provided in the opening paragraph of the “<u>Liquid Effluents</u>” subsection of DSEIS Section 2.1.1.5. However, the opening paragraph of Section 2.1.1.5 directs the reader to SEIS Section 4.14, which contains a more detailed discussion on liquid effluents associated with the Ross Project. The types of liquid wastes and byproduct material that would be disposed of via deep-disposal wells at the Ross Project, based upon information provided by the Applicant, is predominantly waste water, excess permeate during brief periods of concomitant operation and aquifer restoration, and brine. The quantities of the types of liquid wastes disposed during different phases of the Ross Project are presented in FSEIS Table 4.10.

The Proposed Action analyzed in this FSEIS is the Ross Project, and not the "Lance District Project." Therefore, the direct impacts of the activities related to any potential Lance District development projects are only analyzed in this document to the extent that they are applicable to the cumulative impact analyses for the Proposed Action. The cumulative impacts of liquid effluent disposal by deep-well injection that includes potential development in the Lance District as a reasonable foreseeable future action are discussed in FSEIS Section 5.17.1.1. The NRC's staff responses to Comment Nos. RP032-002, RP032-067, and RP041-009 describe the environmental-review process that the NRC would follow if the Applicant were to submit a license amendment application to the NRC to expand its operation into any of the satellite areas.

Comment: RP041-017

The commenter noted that the DSEIS did not disclose the environmental impacts related to "11e.(2)" (e.g., byproduct) material disposal. Further, the commenter reiterated that the DSEIS lacked any discussion of impacts related to 11e.(2) material disposal for either the Ross Project or for future satellite areas, and noted that a disposal facility was not identified for disposal. The commenter indicated that this type of analysis must be performed prior to the NRC's decision, not after the Source and Byproduct Materials License is issued. The commenter expressed that the SEIS should, at the very least, list potential disposal facilities as well as the impacts related to each in the range of alternatives described and analyzed in the SEIS.

Response: *Table 4.10 in SEIS Section 4.14.1.1 indicates the types of wastes that would be generated at the Ross Project as well as the facilities where the different waste streams would be disposed. (The Table includes solid-phase "byproduct" waste, however, rather than "11e.(2)" waste; see Comment No. RP024-067 for related information.) All wastes, except the liquid wastes that are disposed of via deep-well injection (see SEIS Section 4.14.1.1) or in the mud pits discussed in the response to Comment No. RP032-049, would be disposed of offsite and not in or on the Ross Project area. DSEIS Section 5.17.2 discussed the NRC staff's assumption that all of the waste disposal facilities that would accept and dispose of Ross Project byproduct material and other wastes would have been properly licensed or permitted. This would ensure that all environmental impacts related to such waste disposal will have been evaluated by the licensing and/or permitting agency. License Condition 12.5 of the Draft Source and Byproduct Materials License for the proposed Ross Project would require that the Applicant submit all disposal agreements for byproduct material (and, consequently, it would identify the respective disposal facilities) to the NRC.*

B.5.23.4 References

(US)EPA (Environmental Protection Agency). *EPA Scoping Comments for Proposed Ross Uranium In-Situ Recovery Project, Crook County, WY*. Washington, DC: USEPA. Dec 29, 2011. ADAMS Accession No. ML12067A042.

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities, Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. *Safety Evaluation Report for the Strata Energy, Inc. Ross ISR Project, Crook County, Wyoming*. Washington, DC: USNRC. 2014a. ADAMS Accession No. ML14002A107.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Technical Report, Volumes 1 and 2 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012b. ADAMS Accession Nos. ML121020357 and ML121020361.

WDEQ/WQD (Wyoming Department of Environmental Quality/Water Quality Division). *Authorization to Discharge Wastewater Associated with Pump Testing of Water Wells Under the Wyoming Pollutant Discharge Elimination System*. Authorization #WYG720229. Cheyenne, WY: WDEQ/WQD. 2011a. ADAMS Accession No. ML13015A695.

WDEQ/WQD. *Strata Energy*, *Inc. – Ross Disposal Injection Wellfield*, *Final Permit 10-263*, *Class I Non-hazardous, Crook County*, *Wyoming*. Cheyenne, WY: WDEQ/WQD. 2011b. ADAMS Accession No. ML111380015.

WDEQ/WQD. *Authorization Associated with Ground Water Well Pump Testing and Development. Well Pump Test for Uranium Wells Under the Wyoming Pollutant Discharge Elimination System*. WYG720229. February 2013. ADAMS Accession No. ML13015A695.

B.5.24 Cumulative Impacts

B.5.24.1 Scope of Cumulative-Impact Analyses

Comments: RP011-005; RP013-004; RP014-005; RP016-011; RP019-005; RP023-003; RP033-003; RP039-016; RP040-005; RP041-011; RP043-003

The commenters stated that the NRC should take a look at the cumulative impacts from the entire project (i.e., the entire Lance District), not just the Ross Project. Multiple commenters noted that cumulative impacts to water quality and quantity should be analyzed in the SEIS. The commenters expressed concern regarding risk of pollution to air and water, pollution from dust and light, and traffic. One of the commenters also stated that the NRC should assess the impacts of the potential drawdown of water and the likelihood of leaks and excursions from drillholes. The commenter also expressed concern that the proposed Ross Project could potentially prevent livestock grazing and recreation in and around the area of Oshoto and Devils Tower.

Response: *The NRC staff described cumulative impacts to and from the Lance District throughout FSEIS Section 5. The FSEIS also specifically discusses cumulative impacts to water quality and air quality in Sections 5.7 and 5.9, respectively. Impacts to water resources and air quality from the Proposed Action can be found in FSEIS Sections 4.5 and 4.7, respectively. Please see also the NRC staff's response to Comment No. RP011-006 regarding the potential for drawdown. Leaks and excursions from improperly abandoned drillholes are discussed in Comment No. RP007-001. Grazing and recreation impacts are discussed in the FSEIS in Section 4.2.1. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP011-006; RP013-003; RP014-003; RP019-003; RP023-002; RP025-003; RP030-003; RP039-014; RP042-003; RP043-004

The commenters asked the NRC staff to consider fully that the "in situ [uranium-recovery] leach process" uses a high volume of water, which has the potential to drawdown surrounding aquifers. These aquifers provide the area's drinking water for humans and livestock. Other commenters noted that the proposed Ross Project area suffers from drought. Some commenters stated that potential for aquifer depletion could include the Madison-Formation aquifer, which supplies water to many municipalities in Wyoming, South Dakota, and Montana.

Response: *The short- and long-term drawdown impacts on the surrounding aquifers are addressed by the NRC staff in FSEIS Section 4.5.1. FSEIS Section 6.2.5 describes the Applicant's proposed monitoring program that includes measuring water levels in wells within, above, and below the ore-zone (i.e., the production zone) aquifers that could be affected by the proposed Ross Project. The conservative regional impact analysis, based upon ground-water modeling by the Applicant, predicts a minor reduction in the available head in wells used for stock, domestic, and industrial use. Although these effects would be localized and short-lived, the Applicant would commit to provide an alternative source of water of equal or better quantity and quality, subject to Wyoming water-statute requirements, in the event that aquifer-restoration operations prevent the full use of a well (Strata, 2011a). FSEIS Section 4.5.1.2 describes 1) the wells in which the water level is predicted by the model to be impacted by the Proposed Action and 2) the proposed mitigation measures. The duration of the mitigation measures throughout the operation phase of the Project are described in FSEIS Sections 4.5.1.2 and 4.5.1.3. Also, please see the NRC's response to Comment Nos. RP032-039, and RP032-065 regarding the potential for ground-water drawdown. As described in the response to Comment Nos. RP015-003; RP026-001; RP026-002; RP028-002, impacts to the Madison aquifer are highly unlikely. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-677

The commenter suggested a revision to the statement that the land-use cumulative-impacts analysis timeframe begins in 2013. This suggestion was made due to the fact that previous land-use activities, such as agricultural production and human-infrastructure construction (e.g., road installation) have occcurred historically.

Response: *The NRC staff agrees with the commenter that agricultural use and preconstruction activities started before 2013, with the majority of the preconstruction activities having been* *accomplished since 2009. To the best of the NRC's knowledge, current and historical land use has been ranching as well as some oil- and gas-production activities since the 1950s. In addition, the preconstruction activities that the Applicant could accomplish prior to the Ross Project's licensing, including those that the DSEIS evaluated, were assumed to include road and building construction as well as pipeline and utilities installation. The evaluation of these preconstruction activities has been incorporated into the SEIS as part of Alternative 2, No Action, as was defined in SEIS Section 2.1.2. Within the cumulative-impact analysis, SEIS Section 5, all preconstruction activities are assumed to have been completed, and they therefore represent "past actions." The cumulative-impact timeframe's beginning in 2013 remains the same in the FSEIS, because that is the year that the Ross Project was estimated to begin major Project construction. The NRC has revised the text in SEIS Section 5.3.2 as a result of this comment, clarifying the timeframe's basis.*

Comment: RP029-004

The commenter asserted that Strata has plans not for a single mine but for a series of mines and that the impacts of each of these mines would be cumulative and would result in polluted ground water, polluted topsoil, ground-water depletion, and health impacts on residents and livestock.

Response: *The NRC's responses to Comment Nos. RP032-002, RP032-067, and RP041-009 set forth the basis for this Ross Project SEIS and describe the environmental-review process the NRC would follow if Strata were to submit a license-amendment application to the NRC to expand its operation into any satellite areas, including those in the Lance District. The cumulative impacts of future development within the Lance District are assessed in Section 5 of the FSEIS. Specifically, impacts to soils, ground water, and health are addressed in FSEIS Sections 5.6, 5.7 and 5.16, respectively.*

Comment: RP032-024

The commenter asked what fraction of the Applicant's reasonably foreseeable mining activities in Wyoming involve development within the Lance District and what fraction of the Lance District activities are already planned and included in the business plan of the Applicant. The commenter also asked that the SEIS provide the most recently updated schedule for development of the Lance District development planned by the Applicant or any other applicant for an NRC license. The commenter asked that the SEIS include a detailed map showing the cumulative extent of the planned and contemplated wellfield areas to be mined and enclosed by fences in the course of Lance District development that would utilize the proposed CPP to be licensed pursuant to the Ross Project. The commenter also asked that the SEIS discuss when specific geographic areas will be mined, and to what extent the schedule overlaps that of the Ross Project.

Response: *As discussed in SEIS Section 5.2, the reasonably foreseeable activities considered in this SEIS are those that, due to their location and timing with respect to the Ross Project, could result in cumulative impacts when considered with the proposed Ross Project. Potential activities identified by the Applicant that are considered to be reasonably foreseeable within the context of the cumulative impacts assessment in this SEIS are those ISR-related activities within the Lance District. The NRC staff considered as reasonably foreseeable those potential satellite projects shown in FSEIS Figure 2.2: Ross Amendment Area 1, Kendrick, Richards, and Barber. The general locations of each of these areas is shown in SEIS Figure 2.2, however the* *specific locations for wellfields that may be developed within these areas is not currently available. The development schedule of the proposed Ross Project and the potential Lance District satellites is shown in SEIS Figure 2.6. The NRC is not aware that any other company is considering submitting a license application to construct and operate an ISR facility within the Lance District. The NRC is also not aware of what future activities the Applicant includes in its business plan for the Lance District beyond the information contained in the Applicant's license application, which is the subject of this SEIS. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-068

The commenter requested that the discussion of the land use for minerals and energy in DSEIS Section 3.2.3 include all of the "potential projects" planned for the Lance District by Strata's corporate parent, Peninsula Energy, Ltd.

Response: *The NRC has moved the listing of potential, future mineral and energy projects around the Ross Project to Section 5.2 of the FSEIS, which is the appropriate section for discussion of past, present, and reasonably foreseeable future events that are considered in the NRC's evalution of cumulative effects. In addition to the potential ISR projects listed in Section 3.2.3 of the DSEIS, FSEIS Section 5.2 includes the potential ISR projects in the Lance District.*

Comment: RP032-069

The commenter asked that the NRC staff provide the compliant Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves ("the JORC Code") uranium-resource estimates for "recoverable uranium" in the area encompassed by the potential Lance District.

Response: *The revised JORC Code-compliant resource estimate is 24.4 million kg [53.7 million lb]* U_3O_8 *(as of January 23, 2013) (Infomine, 2013).*

Comment: RP032-082

The commenter referenced the following statement in the DSEIS: "Several industries presently conduct activities in and near Crook County, activities which could have environmental impacts that, when combined with those of the Ross Project, could be greater than the individual impacts of the Ross Project." The commenter stated that because these additional activities include similar uranium recovery projects, as well as other activities known to impact environmental systems (e.g. oil and gas recovery), it should be assumed that the Proposed Action is necessarily smaller than the sum of all impacts due to external activities, as opposed to ambiguously representing the proposed action as potentially inconsequential within the context of cumulative impacts analysis.

Response: *The subject statement was found in DSEIS Section 5.2.1, in the paragraph introducing the discussion of present and reasonably foreseeable future actions within the geographic area used for cumulative-impact analyses. The cumulative-impact analyses for the resource areas addressed in this SEIS are provided in SEIS Sections 5.4 – 5.17. For each resource area, the NRC staff has determined the incremental contribution of the impact of the Proposed Action (defined as SMALL, MODERATE, or LARGE) to the overall cumulative impact* *to the resource area. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-086

The commenter questioned the assumptions underlying the calculation of the area of soil disturbance at the proposed Lance District satellite areas for purposes of cumulative-impact analysis.

Response: *As discusssed in SEIS Section 5.2.2.1, the Applicant indicates that the lixiviant from the wellfields at the Ross Amendment Area 1 and Kendrick satellite would be piped to and from the Ross CPP. The Applicant expected to construct an IX facility at the Barber satellite area to manage lixiviant and recover uranium from the lixiviant onto resin (Strata, 2012a). The Applicant noted that the wellfields at the Richards satellite area could be piped so that lixiviant is delivered to either the Ross CPP or the Barber IX plant. Since none of the potential Lance District satellite areas would have a CPP, the area of soil disturbance would be smaller at each than at the Ross Project. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP032-087

The commenter inquired to what extent the cumulative geology-impacts analysis would change if it were to consider successive (or replacement) operational capacity versus concurrent operations in the potential Lance District satellite areas. The commenter also asked for justification for the conclusion in the DSEIS that there would be a SMALL impact as a result of drilling, plugging, and abandonment of drillholes for either of these operational scenarios.

Response: *The NRC staff's analysis of the cumulative impacts to geology and soils is provided in SEIS Section 5.6. The analysis considered the timing of the potential development of the satellite areas as shown in Figure 2.6. The distinction between successive versus concurrent is not relevant to the schedule shown in Figure 2.6. The NRC staff determined that the cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area would be SMALL. The soil disturbance associated with the Ross Project area and the other satellite areas in the Lance District would be limited to approximately 5 percent of the approximately 9,000-ha [22,200-ac] Lance District with 95 percent of the area remaining undisturbed. This disturbance to geology and soils would be dispersed throughout the Lance District. Also, the NRC notes that reclamation and restoration of the areas will be required by the Applicant's Source and Byproduct Materials License, where the NRC must approve the related plan(s) (e.g., DP or RAP). No changes to the SEIS were made beyond the information included in this response.*

Comment: RP032-088

The commenter referenced the SEIS Section 5.7.1 statement, "The geographic area for the evaluation of surface-water cumulative impacts has been defined as the Little Missouri River Basin, from the Ross Project downstream to the Wyoming/Montana border (see Figure 3.10 in SEIS Section 3.4.2)." The commenter asked: 1) Does limiting the geographic area of study to the upper reaches of the Little Missouri River Basin preclude or unnecessarily limit the scope of study on impacts that could be experienced beyond this area of data collection and monitoring? 2) What additional watersheds would be impacted by future potential uranium-recovery projects in the Lance District? 3) What would be the cumulative demands on water resources from future projects within the Lance District in conjunction with all other reasonably foreseeable sources of water consumption and/or water-quality degradation in the same area?

Response: *Limiting cumulative surface-water impacts to the area of Little Missouri River Basin, from the Ross Project downstream to the Wyoming/Montana border is appropriate since activities outside the Basin would not impact surface-water flows inside the Basin. Three of the four potential satellite areas in the Lance District would be located in the Belle Fourche River Basin and impacts to that Basin would not be additive to the impacts in the Little Missouri River Basin. A sentence was inserted in Section 5.7.1 to clarify the location of the potential satellite areas in the Lance District. Further information on the surface-water hydrology of the potential satellite areas or projects in the Lance District is not available.*

Comment: RP032-089

The commenter asked the following questions regarding SEIS Section 5.17: 1) What methodology was used to determine the 20-year timeframe for evaluating the cumulative impacts of deep-well injection of liquid wastes and why was a longer timeframe not employed? 2) What analysis has been performed specific to the formations existing in the Ross Project area that studied the potential for migration of liquid wastes and the associated timelines for this migration and/or transformation into acceptable forms?

Response: *The 20-year timeframe used in the DSEIS for evaluating the cumulative impacts of deep-well injection of liquid wastes is a conservative duration sufficient to include: 1) 14 years from construction through decommissioning of the Proposed Action; 2) the requirement of the UIC Class I Permit issued by WDEQ/WQD for the injection wells that the wells are plugged and abandoned within six months after waste injection ceases; and 3) five years for the land surface reclamation to be complete. The NRC has revised the FSEIS Section 5.17.1 to clearly define the timeframe for its assessment of the cumulative impacts of deep-well injection for the duration of the Ross Project. Because the time for surface reclamation is covered under the cumulative impacts of soil discussed in SEIS Section 5.6, it is not included in the revised timeframe for the cumulative effects analysis of deep-well injection.*

Sections 4.5.1.3 and 5.7.2 establish that 10 CFR Part 40, Appendix A, Criterion 5B(5) requires the ground-water quality within the exempted aquifer to meet standards that ensure that ground water outside of the exempted aquifer is protected. The NRC requires the Applicant to demonstrate through hydrologic studies, to the satisfaction of the NRC, that water outside the exempted aquifer is not impacted before the restoration of a wellfield would be approved. In addition, as described in SEIS Section 5.7.2, there are no impacts to water quality from the Nubeth research and development project formerly conducted in the Ross Project area between 1978 – 1983. Also, as discussed in SEIS Section 5.7.2, due to the natural geochemical conditions of the aquifer outside the exempted portion of the ore-zone aquifer that would be subject to uranium-recovery activities, elements such as uranium, vanadium, and arsenic would naturally change geochemical form and become solid minerals. Clarifying text has been added to SEIS Section 5.7.2, Ground-Water Quality, as well as in SEIS Section 5.17.1 in response to this comment.

Comment: RP032-090

The commenter noted the statement in DSEIS Section 5.17.1.2, "Given that the potential impacts from deep-well injection are localized, generally 0.4 km [0.25 mi], the cumulative impacts of disposal of liquid byproduct wastes would be SMALL, to which the Ross Project would contribute only a SMALL incremental impact" and asked the following questions: 1) The commenter asked whether the NRC would describe why only using the physical geographic footprint (approximately 0.4 km [0.25] around each well) in relation to the overall Ross Project area is appropriate for the NRC's assessing the cumulative impacts of 17 deep-injection wells within the Ross Project area and potential satellite areas and questioned the NRC staff's conclusion that the cumulative impacts are SMALL. 2) What data are available regarding the failure rates and historical performance of deep-well waste storage, particularly in industrial activities similar to ISR? Do these data, when incorporated into the Ross Project cumulative-impact analysis over the entire Project's lifecycle, still allow for the conclusion that these impacts are SMALL?

Response: *The determination that potential impacts from deep-well injection are localized, generally 0.4 km [0.25 mi] as used in the cumulative-impact analysis was misinterpreted by the commenter as the physical geographic footprint around each well. The 0.4 km [0.25 mi] is the radius within the Deadwood/Flathead aquifer around the well at the point of injection in which potential impacts may occur. As described in SEIS Section 5.17.1.1, the minumum potential-impact radius of 0.4 km [0.25 mi] was developed by the EPA as the area of review (EPA, 2001). EPA has defined an "area of review" for a Class I well as the zone of endangering influence around the well, or the radius at which pressure due to injection may cause the migration of the injected wastes and/or poor-quality water in the target formation into an underground drinking water source EPA allows the area of review to be determined by either a fixed radius or mathematical computation. When a fixed radius is used, the area of review for Class I nonhazardous wells must be, at a minimum, 0.4 km [0.25 mi] unless specified as greater by State regulations. Although the Applicant used 0.4 km [0.25 mi] as the area of review, the estimated area of influence calculated by Strata in its application to WDEQ for a Class I UIC permit was less than 0.4 km [0.25 mi] so the minimum radius prescribed by EPA is appropriate (Strata, 2011b). Section 5.17.1.1 was modified in the FSEIS to clarify the information provided in this response.*

NRC does not have information on failure rates and historical performance of deep-well waste storage. The scope of this SEIS does not include analysis of information from other industrial activities. As discussed is Sections 2.1.1.5 and 4.4.1.2 and in the response to Comment Nos. RP017-011 and RP032-055, the UIC Class I permit from the WDEQ sets a maximum limit on the injection pressure (2,570 psi) and sets a range for the annulus pressure (200 to 800 psi). Injection at pressures less than the injection limit ensures that the capacity of the target aquifers (Deadwood and Flathead) is not exceeded and that potential impacts do not extend beyond the area of review as defined by EPA.

Comment: RP035-015

The commenter asked that power plants be considered in the air-quality cumulative-impacts discussion in SEIS Section 5.9 to augment the existing discussion of mining actvities as well as oil- and gas-production facilities.

Response: *The NRC recognizes that there are several coal-fired and natural-gas power plants within the air-quality cumulative-impacts study area. Thus, the NRC has augmented the related discussion in SEIS Section 5.9 as suggested. Coal-fired power plants, particularly older plants with limited pollution controls, emit far more pollution than natural-gas-fired power plants. Several of the older coal-fired power plants in Wyoming are currently the subject of EPA actions to compel the plants' upgrading with more contemporary pollution controls that would reduce* CO_2 *and other emissions. However, only the Wyodak power plant, which is near Gillette, is within the air-quality cumulative-impacts study area and has not been upgraded to contemporary standards. Wyodak is a significant emitter of* CO_2 *(> 2.7 million T/yr [> 3 million t/yr]) and other hazardous air pollutants (HAPs).*

The other coal-fired power plants within the air-quality cumulative-impacts study area emit much less pollution due to advanced controls. The newest power plant, the Dry Fork Station, 11 km [7 mi] north of Gillette, is a natural-gas-fired plant with advanced pollution controls, or BACT. Both Neil Simpson (near Gillette) and Ben French (near Rapid City) produce power using both natural-gas and coal. The Black Hills Corporation, however, has announced the closure of the 22-megawatt Unit 1 at the Neil Simpson power plant (as well as the older coal-fired Osage plant, which is outside of the study area) in March 2014. Two Elk, a waste-coal power plant proposed in the mid-1990s in northeast Wyoming, has yet to be financed or built. The future development of coal-fired power plants within the study area, and across the country, would be subject to stringent pollution controls, if they were to be built. Marion Loomis, the Executive Director of the Wyoming Mining Association, has predicted that many older plants will be shut down throughout the United States within the next ten years and that some will be converted to natural gas (Wyoming Star Tribune, 8/8/2012). Therefore, new coal- or natural-gas-fired power plants without *advanced pollution controls (i.e., BACT) were not included in the air-quality cumulative-impacts analysis. Per this comment, the FSEIS has been revised in Section 5.9 to include this information regarding power-plant cumulative impacts.*

Comment: RP035-042

The commenter noted that the DSEIS utilizes information from 2003 and 2005 to disclose mining, and oil and gas (including coal bed methane) development. The commenter stated that there has been growth in oil and gas development since 2005 and recommended that updated oil and gas information be included in the Final EIS cumulative air impacts discussion.

Response: *As noted in SEIS Section 5.9, BLM evaluations of potential air quality impacts from future coal and CBM mining and oil and gas production in the Powder River Basin include recent cumulative air quality impacts to support increased coal production. Emissions data were acquired for the base year of 2004 for* NO_2, SO_2, $PM_{2.5}$ *and* PM_{10}, *and then modeled to 2020. Updated models were not found. Given the distance to the Ross Project site, small differences in models, if available, would not likely change the designation of SMALL impacts. No changes were made to the SEIS beyond the information provided in this response.*

Comments: RP041-014; RP043-001

One commenter stated that the NRC does not disclose the consequences of minimal inspections and enforcement related to ISR projects in Wyoming, including the Ross Project, as the NRC does not have an office in Wyoming and does not have adequate staff to inspect uranium-recovery operations. Because of this, the commenter stated that the SEIS needs to describe how inspection and enforcement actions would take place at the Ross Project and

whether current NRC staff levels would be sufficient to fully inspect the Applicant's ISR facility and enforce the findings of those inspections. This point, the same commenter stated, would be especially important because NRC's environmental-impact conclusions rely on effective BMPs and mitigation measures. The commenter added that few fines have been levied over the years at uranium-recovery facilities in Wyoming, even though these facilities have routine license violations including excursions, spills, and leaks. The commenter stated that this history does not give the public much confidence in NRC's inspection and enforcement actions.
Another commenter stated that the Ross Project area is even more likely to have problems because of the thousands of old drillholes there.

Response: *As a matter of practice, the NRC expects from its licensees compliance with regulatory requirements and license conditions. When the NRC evaluates potential environmental impacts of such a facility, consequently, the NRC staff explicitly employs this assumption. As described in GEIS Section 1.7.1, the NRC staff would conduct periodic inspections of the Ross Project to determine compliance with applicable regulatory requirements, license conditions, and approved procedures (NRC, 2009b). Potential violations and allegations would be evaluated and addressed through the appropriate NRC enforcement or allegation programs. Enforcement actions can result in fines, corrective actions, or injunctive relief to address regulatory-requirement violations. No change was made to the SEIS beyond the information provided in this response.*

B.5.24.2 Onsite Excavated Pits

Comment: RP032-049

The commenter asked if the mud pits that the Applicant would use to dispose of well-drilling fluids would be subject to the applicable cleanup criteria in the Applicant's DP or RAP, what standards would be applied to the mud pits in these plans to determine whether they present long-term radiological and chemical impacts if left in place, and what the Applicant's NRC-approved DP would require for cleanup of the pits. The commenter also asked if some or all of the mud pits would qualify for a determination that they cannot economically meet the criteria for cleanup. If a radiation survey documents that some or all mud-pits would have long-term adverse environmental impacts, and some or all of these mud pits qualify for a determination that they cannot economically meet the criteria for cleanup, the commenter asked what steps would be taken to mitigate their environmental risks. The commenter asked that the NRC briefly summarize and provide detailed citations to technical literature demonstrating that the cumulative impacts of many thousands of mud pits would not present an elevated risk of environmental consequences.

Response: *As stated in Section 2.1.1.4 of the SEIS, the mud pits used for the disposal of drilling fluids and muds during the installation of wells would be specifically included in the Applicant's pre-decommissioning radiation surveys that would be conducted to identify those areas where decontamination would be required to meet applicable cleanup criteria or where the applicable cleanup criteria could not be economically met. The Ross Project area could be released for unrestricted use in conformance with the radiation-dose criteria for unrestricted release in 10 CFR Part 40, Appendix A. Please see NRC's staff response to Comment No. RP032-051 for additional discussion on the radiation surveys and soil removal if necessary that would be conducted on the mud pits according the approved DP.*

SEIS Section 5.6 discusses the cumulative impacts to geology and soils associated with the Ross Project. As stated, the NRC staff has determined that the cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area would be SMALL. The soil disturbance associated with the Ross Project area and the other potential satellite areas in the Lance District would be limited to approximately 5 percent of the approximately 9,000-ha [22,200-ac] Lance District with 95 percent of the area remaining undisturbed. This disturbance to geology and soils would be dispersed throughout the Lance District and site restoration would be required. The proposed Ross Project would have a SMALL incremental impact on the SMALL cumulative impacts to geology and soils in the geology and soils cumulative-impacts study area. The literature referenced by the NRC staff in its assessment of cumulative impacts is listed in Section 5.18, "References."

B.5.24.3 Past, Present, and Reasonably Foreseeable Future Actions

Comment: RP032-029

The commenter referenced the SEIS Section 2.1.1.2 statement, "To specifically avoid the injection restriction problems that plagued the Nubeth operation, the Applicant has proposed several improvements to well-design, well development, and filtration (Strata 2011a; Strata, 2011b)." The commenter requested additional information on improvements to well design, well development, and filtration-system design proposed by the Applicant. Specifically, the commenter asked the NRC to: 1) describe the injection-restriction problems that plagued the Nubeth operation; 2) describe the specific primary purpose and function of each improvement to well design, well development, and filtration-system design proposed by the Applicant; 3) discuss which improvements are directed primarily or exclusively at increasing uranium-production efficiency, and which are directed primarily or exclusively to improving safety and reducing the risk of environmental impacts; 4) explain which improvements, if any, did the NRC assume that it would accept and incorporate into its Source and Byproduct Materials License for the purposes of the SEIS analyses; and 5) describe how these improvements, taken individually and together, affect the risk of environmental impacts as a result of the Ross Project and the potential satellite areas in the Lance District (NRC, 2014b).

Response: *As noted in SEIS Section 2.1.1, the Applicant attributed previous issues with plugging of the aquifer and subsequent injection restrictions to the buildup of fine particles and organic material in the Nubeth wellfield. As discussed in SEIS Section 2.1.1.1, the Applicant has indicated that improvements to the well design, well development, and filtration-system design would be used at the proposed Project to avoid the injection restrictions that Nubeth encountered (Strata, 2011a). Examples of the improvements in filtration, which are frequently used today as compared to the time that Nubeth was operating, include filters that exclude smaller, finer particles and also filter cartridges that provide a larger surface areas as well as more contemporary well-purging techniques instead of the earlier technique of "air lifting" during the development of injection and recovery wells. The Applicant's avoiding injection restrictions would be necessary to maintain predictable hydrologic connectivity between injection and recovery wells. Predictable hydrologic connectivity is necessary to realize efficient uranium recovery as well as to ensure the recovery of injected lixiviant, which in turn would minimize environmental impacts. The SEIS assumed properly operating uranium-recovery wellfields. As described in the response to Comment RP032-027, controls on injection pressure imposed by the WDEQ/LQD's Permit to Mine would detect injection restrictions and require cessation of injection in the affected wells. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP035-007

The commenter noted the DSEIS discussed the "undesirable plugging of the aquifer" that occurred during the Nubeth research and development operation in DSEIS 2.1.1. The commenter stated that there is no explanation of why the aquifer became plugged or what this means in terms of the operation or environmental impacts. The commenter requests that, in order to provide reassurance that the situation that caused the plugging of the aquifer is understood and would be avoided for the proposed Ross Project, the FSEIS include lessons learned from the failure of the Nubeth research and development operation.

Response: *The Nubeth operation is discussed in DSEIS Section 2.1.1. On page 2-11 of the DSEIS, the cause for the plugging of the aquifer is provided as being due to the build-up of fine particles. The DSEIS also explains what this means in terms of the operation when it states, on page 2-11, that the plugging of the aquifer restricted injection rates, which eventually led to the Nubeth operation's premature shutdown. It is outside of the scope of this SEIS to evaluate the environmental impacts of the Nubeth operation. However, the environmental impacts of the Nubeth operation are considered in the cumulative-impacts analyses for the Ross Project in Section 5 when applicable. FSEIS Section 2.1.1 has been revised to provide additional information regarding the NRC staff's understanding of the cause of the plugging of the aquifer that occurred during the Nubeth operation. FSEIS Section 2.1.1.1 has also been revised to note the Applicant's commitment to incorporate improved well-construction designs and well-development techniques in order to minimize the potential for the Nubeth operation's injectivity problems to re-occur at the Ross Project.*

Comment: RP036-043

The commenter referenced the following statement in DSEIS Section 5.2.1.1, "Most of Wyoming's current oil production is from old oil fields with declining production and the level of exploration drilling to discover new fields has been low." The commenter indicated that the information included in the DSEIS on oil production was outdated and inaccurate and that conventional oil and gas exploration and production of deep rock units has been on the rise, particularly in the Powder River Basin, with hundreds, if not thousands, of wells predicted to be developed over the next few years. The commenter recommended that the NRC staff contact the Buffalo, Casper, and Newcastle BLM Field Offices for more current information and then correct and revise the respective cumulative-impacts analysis to reflect current energy-development predictions.

Response: *Data on the production of oil and gas in Crook and Campbell Counties posted by the Wyoming Oil and Gas Conservation Commission (WOGCC) [at www.wogcc.state.wy.us] support the conclusions presented in the 2005 BLM study that is referenced in SEIS Section 5.2.1.1. In Crook County, the production of oil and gas has declined from its peaks in 1985 – 1990 until about 2007, from which time the production has remained approximately constant. In Campbell County, gas production has declined steadily since its peak in 2001 – 2005, and oil production has declined since approximately 1992, despite slight increases in 2010. The BLM's Wyoming State Office's "White Paper on Hydraulic Fracturing," dated July 2013, includes shallow CBM wells and the Niobrara Shale as likely targets for hydraulic fracturing technology [see http://www.blm.gov/wy/st/en/ info/NEPA/documents/og-ea/2014/febr.html]. According to the WOGCC, Crook County does not produce CBM nor has it seen any development in the Niobrara Shale that is occurring of southeastern Wyoming. Of all of the BLM Districts in*

Wyoming, projected water use for hydraulic fracturing is the lowest in the Newcastle District, which includes Crook Country. The NRC revised the text in FSEIS Section 5.2.1.1 to include the more recent information on oil and gas development in Crook County that is provided in this response.

B.5.24.4 References

Infomine. At http://www.infomine.com/index/pr/pb275839.pdf (as of December 12, 2013). ADAMS Accession No. ML13346A632.

(US)BLM (Bureau of Land Management). "Hydraulic Fracturing White Paper," Appendix G of *BLM Environmental Assessment, High Plains District Portion of the February 2014 Lease Sale*. WY-070-EA-13-180. 2013. At http://www.blm.gov/wy/st/en/info/NEPA/documents/og-ea/2014/febr.html.

(US)EPA (Environmental Protection Agency). *Class I Underground Injection Control Program: Study of the Risks Associated with Class I Underground Injection Wells*. EPA 816-R-01-007. Washington, DC: EPA, Office of Water. 2001. ADAMS Accession No. ML13015A557.

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, Technical Report, Volumes 1 through 6 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2011b. ADAMS Accession Nos. ML110130333, ML110130335, ML110130314, ML110130316, ML110130320, and ML110130327.

Strata. *Ross ISR Project USNRC License Application, Crook County, Wyoming, RAI Question and Answer Responses, Environmental Report, Volume 1 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata. 2012a. ADAMS Accession No. ML121030465.

WOGCC (Wyoming Oil and Gas Conservation Commission). "Statistics by County." At http://wogcc.state.wy.us/urecordsMenu.cfm?Skip='Y'&oops=#oops# (as of August 23, 2013).

Wyoming Star Tribune. August 8, 2012. At http://trib.com (as of September 11, 2013).

B.5.25 Impact Conclusions

Comments: RP020-007; RP024-432

The commenters referenced the following SEIS Section 4.5.1.2 statement, “The most significant estimated drawdown occurs in the Wesley No. TW02 well located in the SWSW Section 8, Township 53 North, Range 67 West, with 10.2 m [33.3 ft] of drawdown or 42.4 percent of the available head under Scenario 2 at the end of aquifer restoration.” One commenter noted that additional factors should be considered during the NRC staff’s evaluation of this impact. The commenter pointed out these factors and then indicated they should be discussed in the SEIS:

1) As described in the license application, the well is located along the Little Missouri River floodplain, immediately adjacent to the no-flow boundary of the ground-water model. Hence the presence of the no-flow boundary may conservatively bias the estimated drawdown.

2) Water levels in the Wesley well fluctuated between 4.5 – 6.7 m [15 – 22 ft] during the year monitoring was conducted. In addition, the ground-water model incorporated the lowest water level, which added conservatism to the analysis.

3) Given the limited use by Strata’s Field Office personnel and livestock (primarily several horses), the moderate reduction in available head should not materially decrease the yield from the well (Strata, 2011b).

Another commenter inquired about the general impacts to ground-water quantity and the mitigation measures that would assist in preserving water quantity.

Response: *The NRC agrees that additional information pertaining to water-quantity impacts would be useful. Therefore, the NRC staff has revised the text in SEIS Section 4.5.1.2 to indicate that the estimated drawdown is a result of the ground-water model’s execution, which in turn incorporated conservative assumptions. The text has also been revised to indicate that this well (i.e., the Wesley well) has very limited use.*

Comment: RP024-002

The commenter recommended that the NRC staff use the word “potential” when the SEIS discusses the possible impacts or effects which had been identified during the staff’s evaluation of the proposed Ross Project. The commenter noted that the NRC staff evaluated possible impacts or effects, and these impacts may or may not result from the construction, operation, aquifer restoration, and decommissioning phases of the Ross Project.

Response: *The NRC staff agrees that the word “potential” should be used as often as appropriate in a discussion of the impacts of the Ross Project and/or other proposed projects. As a result of this comment, the NRC inserted the word “potential” into the FSEIS, where and as often as it was appropriate.*

Comment: RP024-463

The commenter referenced a statement in SEIS Section 4.5.1.4, “After uranium-recovery operation is complete, unidentified, improperly abandoned wells (i.e., from previous subsurface explorations not associated with the Applicant or its operations) could continue to impact aquifers above the ore-zone and adjacent aquifers by providing hydrologic connections between aquifers." The commenter requested that the NRC staff clarify its discussion of impacts to shallow aquifers and noted that the impacts described seem highly unlikely given that the pre-licensing water levels in the ore-zone aquifer are below the lowest portion of the shallow-aquifer system.

Response: *The NRC staff agrees with the commenter's assertion that the impact to shallow aquifers is highly unlikely. The statement identified by the commenter has been deleted from SEIS Section 4.5.1.4.*

Comments: RP024-533; RP024-741

The commenter requested justification for the statement that potential impacts to historical and cultural resources would be "SMALL to LARGE," as discussed in SEIS Section 4.9.1.1. In addition, the commenter asked for a similar justification for "The Unavoidable Adverse Environmental Impacts and Short-Term Impacts and Uses of the Environment" in Table 8.1 which state that the potential historical, cultural, and paleontological impacts from the Proposed Action would be "SMALL to LARGE."

Response: *The Section 106 consultation process, which includes assessments of impacts to historical and cultural properties, is currently ongoing; thus, not all impacts to historical and cultural resources are known or can be characterized at this time. Nevertheless, potential adverse impacts to a historical and cultural site(s) would be LARGE during the construction phase of the Ross Project, for example, if such a site were to be disturbed by a backhoe or an excavator. The impacts of the Project's construction could result in damage to the physical integrity of historical and cultural site(s) so severe that the values upon which the site(s) achieved NRHP significance are lost (i.e., they are LARGE as defined in SEIS Sections 2.3, 4.1, and 5.3.2). The standard mitigation measure, which would reduce or eliminate such adverse impacts, is avoidance of the site(s) altogether. No changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-541

The commenter expressed agreement with the DSEIS's conclusion that the potential historical and cultural impacts under the No-Action Alternative would be SMALL; however, the commenter suggested that it might be important to also state that, under the No-Action Alternative, no new historical and cultural resources would be discovered and identified; thus, archaeologists would not gain any additional or new knowledge about ancient cultures.

Response: *The NRC staff has revised SEIS Section 4.9.2 as the commenter suggested. Cultural-resource inventories have already occurred within the Ross Project area. Therefore, any new knowledge that has been gained by way of these already-accomplished inventories would be recorded under any of the three Alternatives, including the No-Action Alternative. However, inadvertent discoveries that could occur during the Proposed Action or Alternative 3 would likely be reported and recorded, because the two Alternatives entail Federal and State involvement and the framework of the NHPA. Inadvertent discoveries would be less likely to occur under the No-Action Alternative. This would be because no systematic protocol would be established to discover, identify, characterize, and/or record such new knowledge, artifacts, or historical and cultural resources. Thus, there would be fewer discoveries and less knowledge gained and recorded about ancient cultures under the No-Action Alternative.*

Comments: RP027-002; RP032-009; RP035-001; RP040-007

The commenters stated that, throughout the DSEIS, many of the environmental impacts were assessed as “MODERATE to LARGE,” but then these impacts were mitigated due to the Applicant’s proposed use of BMPs. One commenter noted that the DSEIS didn’t provide any specifics about what would be done, and when. Other commenters noted that BMPs may not be adhered to during the Ross Project, but the DSEIS nevertheless relied upon them and the assumption that the Applicant would adhere to them as well as assumed that the Applicant would immediately remedy problems that arise. Some commenters asserted that BMPs do not work and suggested that new practices be developed. If new, workable BMPs were not developed, then one commenter stated that new licenses for ISR projects should not, in good conscience, be issued by the NRC. Another commenter noted that the DSEIS relies on permitting requirements to minimize the potential impacts of the Proposed Action. That commenter suggested that, to help ensure that the required protection and mitigation measures are understood by the public, regulatory agencies, the Applicant, and the pertinent decision makers, the FSEIS and ROD should document the specific requirements that pertain to air quality and underground injection of liquids as well as specify the required BMPs that are applicable to the Ross Project.

Response: *The NRC staff’s analyses described in Section 4 of the SEIS determined the potential for MODERATE to LARGE unmitigated impacts in only three instances: Transportation impacts due to significantly higher volumes of traffic on local and county roads during all phases of the Ross Project (SEIS Section 4.3); water-resource impacts to shallow ground waters as a result of spills and pipeline leaks (SEIS Section 4.5.1.2) during all phases of the Project; and impacts to ground water from excursions (SEIS Section 4.5.1.2). Except for the transportation impacts, the potential MODERATE to LARGE impacts to ground water would be mitigated by conditions that would appear in the final license (see the current Draft Source and Byproduct Materials License being developed for the Ross Project) and the requirements of the permits Strata already holds (e.g., UIC Class I and WDEQ’s Permit to Mine), all of which require the use of BMPs on the part of the Applicant.*

BMPs have been used historically at all uranium-recovery facilities, and BMPs that have been shown to avoid or to reduce potential environmental impacts would be implemented at the Ross Project. The commenters do not provide any evidence for the claim that BMPs do not work. The NRC staff, in an SEIS, may rely on the mitigation measures that an Applicant includes in its license application (i.e., that the Applicant commits to) or that are conditions of its finalized source and byproduct materials license if it were to be issued by the NRC as a result of the Applicant’s license application. In the case of BMPs, the Applicant’s entire license application, and thus the proposed BMPs included therein, would be subject to Condition No. 9.2 in the (currently Draft) License (NRC, 2014b). This Draft License Condition mandates that “The Licensee shall conduct operations in accordance with the commitments, representations, and statements contained in the [Applicant’s] license application.” Therefore, the NRC staff can reasonably rely on these mitigation measures in formulating a reasoned prediction of the environmental impacts of the Ross Project as proposed.

Additionally, if a Source and Byproduct Materials License were to be granted, the Ross Project facility would be routinely inspected by NRC staff and other State and Federal agencies for compliance with the respective requirements, license conditions, and/or permit stipulations. If any violations of NRC requirements or License Conditions are identified in an NRC inspection, the NRC staff may issue a written notice of violation and, in certain circumstances, may require *payment of a civil penalty, injunctive relief, and/or corrective actions or may seek criminal penalties. Such inspections provide a mechanism for the NRC staff to determine that systems are being operated properly and any mitigation responses are timely. The NRC staff also has a process for members of the public to report allegations of violations to the agency through an email or a telephone hotline. Additional information on the allegation process can be accessed through the NRC website (www.nrc.gov). No change was made to the SEIS beyond the information provided in this response.*

Comment: RP041-007

The commenter indicated that the NRC fails to disclose the scope of the Ross Project, specifically the number of wells and wellfields. The commenter requested that the NRC disclose the size of the proposed action and analyze it in the SEIS. Specifically, the commenter asked how many wells and wellfields are included in the impact analyses.

Response: *FSEIS Section 2.1.1 describes the Proposed Action and states that the Ross Project would host 15 – 25 wellfield modules and would consist of a total of 1,400 – 2,200 recovery and injection wells (Strata, 2011a). Groups of wells (referred to as "wellfield modules") within a given wellfield would be connected with pipelines to a central collection facility called a "wellfield-module building," or a "header house." The wellfields would be surrounded by a perimeter-ring of monitoring wells. Additional wells to monitor the overlying and underlying aquifers would also be installed within the wellfields. The density of monitoring wells is described in Section 2.1.1.1 of the FSEIS and discussed in responses to Comments 032-019; 032-031; 032-036; and 032-041. These numbers of wells, wellfield modules, and wellfields are used consistently for the impact analyses in Section 4 of the FSEIS. In response to this comment, minor modifications were added to the referenced statements in Section 2.1.1 for text clarity.*

Comment: RP043-002

The commenter noted that the estimated size of the Ross Project varied throughout the DSEIS and asked how large the Project would be. The commenter also asked whether the impacts assessed as "SMALL" were so assessed as a result of the small number of wells that were used by the NRC staff to calculate the respective impacts.

Response: *Table 2.1 in SEIS Section 2.1 provides information on the total size of the Ross Project area (in hectares and in acres) as well as the total area of disturbance during the complete lifecycle of the Project. Figures 2.1, 2.4, and 2.5 in SEIS Sections 2.1 and 2.1.1 also illustrate the location of the Ross Project area and the proposed layout of the Project's facility and wellfields. The areas presented in Table 2.1 as well as the detailed areal estimates for specific Project activities, such as roads and other infrastructure as well as the CPP and the surface impoundments, are provided in SEIS Section 2.1.1 and used throughout the SEIS to assess impacts. SEIS Sections 4 and 5 consider all aspects of the proposed project, which includes the number of wells included in the Proposed Action in its evaluation of impacts. No changes were made to the SEIS beyond the information provided in this response.*

B.5.25.1 References

(US)NRC (Nuclear Regulatory Commission). "Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2." NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601." Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

Strata (Strata Energy, Inc.). *Ross ISR Project USNRC License Application, Crook County, Wyoming, Environmental Report, Volumes 1, 2 and 3 with Appendices*. Docket No. 40-09091. Gillette, WY: Strata Energy, Inc. 2011a. ADAMS Accession Nos. ML110130342, ML110130344, and ML110130348.

B.5.26 Mitigation Measures

Comment: RP024-005

The commenter stated that the mitigation measures described in the DSEIS were sometimes unclear, and the commenter suggested that pertinent mitigation measures be described separately from the respective potential impacts. The commenter also noted that it is important to state that the Applicant's proposed mitigation measures, in most cases, have been previously approved for other ISR facilities and projects. The commenter suggested that the Ross Project SEIS cite NUREG–1910 and its other supplements (i.e., other SEISs).

Response: *The NRC staff understands that a discussion of mitigation measures, separate from the potential impacts, could be beneficial and could allow SEIS readers to examine the individual mitigation measures all in one section. However, for this SEIS, the NRC staff chose to present the descriptions of mitigation measures together with the related potential impacts because mitigation measures informed the NRC staff's determination of impact magnitudes. This format provided a more clear and concise document overall. The commenter did not provide any specific examples of where the mitigation measures described in the DSEIS are unclear or where additional citations to the GEIS or the other SEISs would be helpful. Nonetheless, when the NRC staff prepared the FSEIS, the staff identified areas where the document could be enhanced as suggested by commenter; these sections were revised as appropriate.*

B.5.27 Environmental Justice

Comment: RP039-006

The commenter pointed out that Devils Tower is a sacred place for Native American Tribes. The commenter requested that special attention be paid to Native American treaty, cultural, historical, and religious concerns and asked that Devils Tower be considered an environmental-justice issue.

Response: *The NRC acknowledges that Devils Tower is sacred to Native Americans and that Tribal cultural traditions and religious beliefs should be honored. One of the principles of environmental justice is to meaningfully involve* all *people, regardless of race, color, national origin, or income, in the environmental issues that concern them. Observing this principle, the*

NRC staff has consulted with interested Tribes; the NRC staff have hosted formal, onsite consultation meetings on September 12 – 13 and November 2 – 3, 2011. As part of these consultation activities, several Tribes have identified the cultural importance of Devils Tower (also known as Bear Lodge). The Tribes have noted that Devils Tower continues to be a part of the Tribal cultural landscape vis-à-vis the Ross Project. Devils Tower was identified as such during the Tribal field surveys conducted by interested Tribes in May and June 2013, assisted by the NRC staff. No changes were made to the SEIS beyond the information provided in this response.

B.5.28 Editorial

B.5.28.1 Grammar and Typography Editorial

Comment: RP024-003

The commenter noted that the SEIS was inconsistent in its use of "would" versus "will," the latter of which is the correct term in the vast majority of cases.

Response: *The NRC staff disagrees that the word "will" is the appropriate verb tense for the SEIS. The outcome of the NEPA process is not known with absolute certainty until the process is complete and the EPA has rated the SEIS "satisfactory." Until then, the majority of the actions described in the SEIS are conditional (i.e., will not occur until the EPA has issued its opinion and the NRC staff has issued a Source and Byproduct Materials License to Strata) (NRC, 2014b). Thus, the SEIS uses "would" in almost all cases and, thus, no changes were made to the SEIS beyond the information provided in this response.*

Comment: RP024-067

The commenter noted that inconsistencies existed in the DSEIS's nomenclature use in discussing the actual license that would be issued by the NRC in response to Strata's license application. The commenter suggested using the term "Source and 11e.(2) Byproduct Material License" throughout the SEIS (NRC, 2014b).

Response: *The NRC staff agrees that various descriptors have been used in the SEIS to describe the license for which Strata submitted a license application. As discussed in the response to Comment RP024-004, the descriptor "11e.(2)" has not been used in the SEIS's final text. The NRC staff has used the plural structure (i.e., Materials) because the proposed License would govern both source material and byproduct material, where the latter is only for byproduct material, which would be generated during onsite uranium-recovery operations. In some cases, the descriptor might be different, if justified within the respective and specific context (e.g., the title for 10 CFR Part 40 remains "Domestic Licensing of Source Material" and has not been changed). The NRC staff has revised the SEIS so that the descriptor, "Source and Byproduct Materials License," is consistently used throughout the document.*

Comments: RP024-029; RP024-032; RP024-034; RP024-043; RP024-045; RP024-053; RP024-076; RP024-077; RP024-078; RP024-081; RP024-083; RP024-087; RP024-108; RP024-120; RP024-144; RP024-149; RP024-167; RP024-183; RP024-203; RP024-208; RP024-212; RP024-238; RP024-239; RP024-275; RP024-277; RP024-283; RP024-301; RP024-302; RP024-303; RP024-317; RP024-325; RP024-334; RP024-335; RP024-362;

RP024-365; RP024-368; RP024-370; RP024-382; RP024-393; RP024-398; RP024-405; RP024-408; RP024-409; RP024-426; RP024-428; RP024-456; RP024-476; RP024-480; RP024-484; RP024-485; RP024-489; RP024-498; RP024-508; RP024-512; RP024-513; RP024-514; RP024-515; RP024-531; RP024-549; RP024-571; RP024-574; RP024-580; RP024-595; RP024-596; RP024-597; RP024-599; RP024-601; RP024-603; RP024-608; RP024-615; RP024-627; RP024-635; RP024-640; RP024-645; RP024-646; RP024-654; RP024-657; RP024-658; RP024-661; RP024-662; RP024-663; RP024-664; RP024-665; RP024-666; RP024-668; RP024-697; RP024-702; RP024-704; RP024-705; RP024-706; RP024-710; RP024-718; RP024-728; RP024-729; RP024-730; RP024-731; RP024-735; RP035-030; RP035-031

Several commenters suggested corrections for typographical or grammatical errors in the SEIS.

Response: *The NRC staff verified all such changes and/or corrections for accuracy. When determined to be appropriate, the NRC staff incorporated such changes and/or corrections into the SEIS.*

B.5.28.2 Technical Editorial

Comments: RP017-005; RP017-007; RP024-006; RP024-007; RP024-008; RP024-009; RP024-010; RP024-011; RP024-012; RP024-014; RP024-015; RP024-016; RP024-017; RP024-018; RP024-021; RP024-022; RP024-023; RP024-026; RP024-027; RP024-028; RP024-033; RP024-036; RP024-038; RP024-039; RP024-044; RP024-046; RP024-047; RP024-048; RP024-049; RP024-050; RP024-051; RP024-052; RP024-055; RP024-059; RP024-060; RP024-061; RP024-062; RP024-063; RP024-064; RP024-065; RP024-069; RP024-070; RP024-073; RP024-075; RP024-079; RP024-082; RP024-089; RP024-090; RP024-091; RP024-092; RP024-093; RP024-094; RP024-095; RP024-097; RP024-098; RP024-099; RP024-101; RP024-102; RP024-103; RP024-104; RP024-106; RP024-109; RP024-110; RP024-111; RP024-113; RP024-114; RP024-116; RP024-117; RP024-119; RP024-121; RP024-122; RP024-123; RP024-124; RP024-125; RP024-126; RP024-127; RP024-128; RP024-129; RP024-130; RP024-131; RP024-136; RP024-137; RP024-138; RP024-139; RP024-145; RP024-147; RP024-148; RP024-150; RP024-151; RP024-153; RP024-154; RP024-155; RP024-156; RP024-157; RP024-158; RP024-164; RP024-174; RP024-178; RP024-179; RP024-185; RP024-186; RP024-187; RP024-188; RP024-189; RP024-193; RP024-195; RP024-196; RP024-197; RP024-198; RP024-200; RP024-201; RP024-204; RP024-207; RP024-213; RP024-214; RP024-215; RP024-217; RP024-219; RP024-223; RP024-224; RP024-225; RP024-226; RP024-227; RP024-228; RP024-229; RP024-230; RP024-231; RP024-232; RP024-233; RP024-234; RP024-235; RP024-236; RP024-237; RP024-241; RP024-242; RP024-243; RP024-244; RP024-245; RP024-246; RP024-249; RP024-250; RP024-251; RP024-252; RP024-253; RP024-255; RP024-256; RP024-257; RP024-258; RP024-259; RP024-260; RP024-261; RP024-262; RP024-263; RP024-264; RP024-265; RP024-266; RP024-267; RP024-268; RP024-269; RP024-270; RP024-272; RP024-273; RP024-274; RP024-276; RP024-278; RP024-279; RP024-280; RP024-281; RP024-282; RP024-284; RP024-285; RP024-286; RP024-287; RP024-288; RP024-289; RP024-290; RP024-291; RP024-292; RP024-294; RP024-295; RP024-296; RP024-297; RP024-298; RP024-299; RP024-300; RP024-304; RP024-310; RP024-311; RP024-312; RP024-313; RP024-314; RP024-315; RP024-318; RP024-320; RP024-323; RP024-324; RP024-326; RP024-327; RP024-328; RP024-329; RP024-330; RP024-332; RP024-333; RP024-336; RP024-337; RP024-339; RP024-340; RP024-341; RP024-342; RP024-343; RP024-344; RP024-345; RP024-346; RP024-347; RP024-348; RP024-349;

RP024-350; RP024-351; RP024-352; RP024-353; RP024-355; RP024-356; RP024-357; RP024-358; RP024-359; RP024-360; RP024-361; RP024-363; RP024-364; RP024-369; RP024-371; RP024-373; RP024-374; RP024-377; RP024-378; RP024-383; RP024-385; RP024-386; RP024-387; RP024-388; RP024-389; RP024-390; RP024-391; RP024-392; RP024-394; RP024-395; RP024-396; RP024-397; RP024-399; RP024-400; RP024-403; RP024-404; RP024-406; RP024-407; RP024-410; RP024-412; RP024-413; RP024-414; RP024-415; RP024-416; RP024-418; RP024-420; RP024-422; RP024-423; RP024-424; RP024-427; RP024-429; RP024-430; RP024-436; RP024-438; RP024-439; RP024-440; RP024-441; RP024-442; RP024-444; RP024-445; RP024-446; RP024-448; RP024-449; RP024-450; RP024-451; RP024-452; RP024-453; RP024-454; RP024-455; RP024-457; RP024-458; RP024-459; RP024-460; RP024-461; RP024-462; RP024-465; RP024-466; RP024-467; RP024-468; RP024-469; RP024-471; RP024-473; RP024-475; RP024-483; RP024-490; RP024-494; RP024-496; RP024-497; RP024-499; RP024-501; RP024-502; RP024-503; RP024-504; RP024-505; RP024-506; RP024-507; RP024-511; RP024-519; RP024-520; RP024-521; RP024-526; RP024-528; RP024-543; RP024-544; RP024-546; RP024-548; RP024-550; RP024-551; RP024-552; RP024-553; RP024-554; RP024-555; RP024-556; RP024-557; RP024-558; RP024-559; RP024-560; RP024-561; RP024-562; RP024-563; RP024-564; RP024-565; RP024-566; RP024-567; RP024-572; RP024-573; RP024-575; RP024-576; RP024-577; RP024-578; RP024-581; RP024-582; RP024-583; RP024-584; RP024-586; RP024-587; RP024-588; RP024-589; RP024-590; RP024-591; RP024-592; RP024-593; RP024-594; RP024-600; RP024-602; RP024-604; RP024-605; RP024-606; RP024-607; RP024-609; RP024-610; RP024-611; RP024-612; RP024-613; RP024-614; RP024-616; RP024-617; RP024-618; RP024-619; RP024-620; RP024-621; RP024-622; RP024-623; RP024-624; RP024-625; RP024-626; RP024-628; RP024-629; RP024-630; RP024-631; RP024-632; RP024-633; RP024-634; RP024-636; RP024-637; RP024-638; RP024-641; RP024-642; RP024-643; RP024-644; RP024-647; RP024-648; RP024-650; RP024-651; RP024-653; RP024-655; RP024-656; RP024-667; RP024-669; RP024-670; RP024-671; RP024-673; RP024-674; RP024-676; RP024-678; RP024-679; RP024-685; RP024-686; RP024-687; RP024-688; RP024-695; RP024-698; RP024-699; RP024-700; RP024-701; RP024-707; RP024-708; RP024-709; RP024-711; RP024-712; RP024-713; RP024-714; RP024-715; RP024-716; RP024-717; RP024-719; RP024-720; RP024-721; RP024-722; RP024-723; RP024-724; RP024-725; RP024-726; RP024-732; RP024-733; RP024-734; RP024-737; RP024-738; RP024-739; RP024-740; RP024-742; RP024-743; RP024-744; RP024-745; RP024-746; RP024-747; RP024-748; RP024-750; RP024-159; RP032-050; RP032-057; RP032-073; RP032-074; RP032-075; RP032-076; RP032-083; RP034-003; RP035-002; RP035-003; RP035-014; RP035-016; RP035-019; RP035-020; RP035-021; RP035-023; RP035-024; RP035-025; RP035-026; RP035-029; RP035-032; RP035-033; RP035-036; RP035-040; RP036-005; RP036-007; RP036-042

Several commenters suggested changes to the SEIS text to correct inaccuracies (such as inaccuracies in the NRC staff's incorporating information from the Strata's license application) and inconsistencies (such as inconsistencies with the Draft Source and Byproduct Materials License conditions) or proposed text to clarify and/or supplement information in the SEIS (such as additions or revisions to the SEIS text that would shed more light on the SEIS's analyses, conclusions, and recommendations) (NRC, 2014b).

Response: *The NRC staff verified for accuracy all proposed changes and suggestions and, when determined to be appropriate, the NRC incorporated such changes and additions into the SEIS.*

B.5.28.3 References

(US)NRC. "Draft Source and Byproduct Materials License, No. SUA-1601" Washington, DC: USNRC. 2014b. ADAMS Accession No. ML14002A111.

APPENDIX B1
ALTERNATE CONCENTRATION LIMITS

In-situ uranium recovery (ISR) facilities operate by an operator's first extracting uranium from specific areas called wellfields. After uranium recovery has ended, the ground water in the wellfields contain constituents that were mobilized by the lixiviant. Licensees shall commence aquifer restoration in each wellfield soon after the uranium recovery operations end (NRC, 2009d). Aquifer-restoration criteria for the site-specific post-licensing, pre-operational constituents are determined either for each individual well or as a wellfield average.

United States (U.S.). Nuclear Regulatory Commission (NRC) licensees are required to return water quality parameters to the standards in 10 CFR Part 40, Appendix A, Criterion 5B(5). As stated in the regulations: "5B(5)-At the point of compliance, the concentration of a hazardous constituent must not exceed—(a) The Commission approved background [in this SEIS, "post-licensing, pre-operational"] concentration of that constituent in the groundwater; (b) The respective value given in the table in paragraph 5C if the constituent is listed in the table and if the background [in this SEIS, "post-licensing, pre-operational"] level of the constituent is below the value listed; or (c) An alternate concentration limit (ACL) is established by the Commission."

For an ACL to be considered by the Commission, a licensee must submit a license amendment application to request an ACL. In this ACL license amendment request, the licensee must provide the basis for any proposed limits including consideration of practicable corrective actions that limits are as low as reasonably achievable (ALARA), and information on the factors the Commission must consider. The NRC will establish a site-specific ACL for a hazardous constituent as provided in paragraph 5B(5) if the NRC finds the proposed limit as ALARA, after considering practicable corrective actions, and determining that the constituent will not pose a substantial present or potential hazard to human health or the environment as long as the ACL is not exceeded.

To determine if the ACL does not pose a potential hazard to human health or the environment, NRC performs three risk assessments (NRC, 2003a). The first is a hazard assessment which evaluates the radiological dose and toxicity of the constituents in question and the risk to human health and environment. The second is an exposure assessment to examine the existing distribution of hazardous constituents, as well as potential sources for future releases and the potential consequences associated with the human and environmental exposure to the hazardous constituents. The last assessment is a corrective action assessment which evaluates 1) all applicant proposed corrective actions; 2) the technical feasibility of each proposed corrective actions; 3) the costs and benefits associated with each proposed corrective action; and 4) the preferred corrective action to achieve the hazardous constituent concentration which is protective of human health and the environment.

To perform these assessments, the NRC staff uses a rigorous review process. Licensees must provide a comprehensive ACL amendment that addresses surface-water and ground-water quality and expected impacts on human health and the environment. Such information required in an amendment request pursuant to 10 CFR Part 40, Appendix A, Criterion 5B(6) includes the following factors:

- Potential adverse effects on ground-water quality, considering the following:
  - The physical and chemical characteristics of the waste in the licensed site including its potential for migration
  - The hydrogeologic characteristics of the facility and surrounding land
  - The quantity of ground water and the direction of ground-water flow
  - The proximity and withdrawal rates of ground-water users
  - The current and future uses of ground water in the area
  - The existing quality of ground water, including other sources of contamination and their cumulative impact on the ground-water quality
  - The potential for health risks caused by human exposure to waste constituents
  - The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
  - The persistence and permanence of the potential adverse effects.
- Potential adverse effects on hydraulically connected surface water quality, considering the following:
  - The volume and physical and chemical characteristics of the waste in the licensed site
  - The hydrogeologic characteristics of the facility and surrounding land
  - The quantity and quality of ground water, and the direction of ground-water flow
  - The patterns of rainfall in the region
  - The proximity of the licensed site to surface waters
  - The current and future uses of surface waters in the area and any water quality standards established for those surface waters
  - The existing quality of surface water including other sources of contamination and the cumulative impact on surface water quality
  - The potential for health risks caused by human exposure to waste constituents
  - The potential damage to wildlife, crops, vegetation, and physical structures caused by exposure to waste constituents
  - The persistence and permanence of the potential adverse effects.

Although State “class of use” standards are not recognized in the NRC’s regulations as restoration standards, these standards can be considered as one factor in evaluating ACL requests for uranium-recovery facilities located in Wyoming. Furthermore, in considering ACL requests, the Commission places particular importance on protecting underground sources of drinking water (USDWs). The use of modeling and additional ground-water monitoring may be necessary to show that ACLs in ISR wellfields would not adversely impact USDWs. It must be demonstrated that the licensee has attempted to restore hazardous constituents in ground water to post-licensing, pre-operational values or an MCL—whichever level is higher.

Before an ISR licensee is allowed to extract uranium, the EPA under 40 CFR Part 146.4 and in accordance with the SDWA must issue an aquifer exemption covering the portion of the aquifer in which the uranium-bearing rock is located. The EPA cannot exempt the portion of the aquifer unless it is found that “it does not currently serve as a source of drinking water” and “cannot now and will not in the future serve as a source of drinking water.” Due to these criteria, only impacts outside of the exempted aquifer are evaluated. In most cases, the water in aquifers adjacent to the uranium OZs does not meet drinking water standards. The Commission will not approve an ACL if it will impact any adjacent USDWs. Therefore, the impact of granting an ACL request is SMALL.

Further guidance for the NRC’s evaluation of ACLs for uranium-recovery facilities is currently being developed for a revision of NUREG–1569 (NRC, 2003a). Existing guidance for the NRC’s review of ACLs for conventional mills can be found in NUREG–1620, Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of UMTRCA (NRC, 2003c).

B1.1 References

(US)NRC. “Standard Review Plan for In Situ Leach Uranium Extraction License Applications, Final Report.” NUREG–1569. Washington, DC: USNRC. 2003a. ADAMS Accession No. ML032250177.

(US)NRC. “Standard Review Plan for the Review of a Reclamation Plan for Mill Tailings Sites Under Title II of the Uranium Mill Tailings Radiation Control Act of 1978. Final Report. ” NUREG–1620. Washington, DC: USNRC. ADAMS Accession No. ML031550569.

(US)NRC. “Generic Environmental Impact Statement for In-Situ Leach Uranium Milling Facilities. Volumes 1 and 2.” NUREG–1910. Washington, DC: USNRC. 2009b. ADAMS Accession Nos. ML091480244 and ML091480188.

APPENDIX C
WATER-QUALITY DATA

Water-Quality Data

Sample Results

Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		12-18SA	12-18SA	12-18SA	12-18SA	12-18SA	12-18SA	12-18SA	12-18SA	12-18SM	12-18SM
Sample Date		3/23/10	6/5/10	8/11/10	10/4/10	2/15/11	6/17/11	9/12/11	11/8/11	3/11/10	6/18/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	201	303	151	290	286	299	299	202	531	528
Ammonia	mg/L	0.4	0.3	0.5	0.4	0.4	0.3	-0.1	0.2	-0.1	-0.1
Fluoride	mg/L	0.2	0.2	0.1	0.2	0.1	0.2	0.2	0.2	2.1	1.7
Laboratory conductivity	µmhos/cm	729	829	554	835	795	690	897	711	1420	1440
Laboratory pH	s.u.	9.2	8.4	9.8	8.2	8.1	8.3	8.4	8.6	8.8	8.8
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	500	550	370	490	560	540	540	420	970	980
Calcium	mg/L	20	43	3	46	54	53	54	26	3	3
Magnesium	mg/L	22	31	13	33	33	35	33	24	1	1
Potassium	mg/L	22	16	20	16	16	16	17	20	8	5
Sodium	mg/L	101	97	89	84	90	89	88	78	341	328
Bicarbonate	mg/L	172	352	84	354	349	361	361	218	577	578
Carbonate	mg/L	36	8	49	-5	-5	-5	-5	14	35	33
Chloride	mg/L	12	12	24	11	13	14	14	14	5	3
Sulfate	mg/L	163	142	94	130	157	143	146	124	236	218
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	0.18	0.3	0.28	0.08	-0.05	-0.05	-0.05
Iron, total	mg/L	0.33	0.34	0.42	0.37	0.41	1.12	1.02	0.32	0.09	0.06
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.04	0.06	0.03	0.08	0.07	0.13	0.15	0.04	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	0.06	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.008	-0.005	-0.005
Silver, dissolved	mg/L			0.006	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	0.003	-0.001	-0.001	-0.001	-0.001	-0.0003	-0.0003	0.0008	-0.001	-0.001
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	0.0013			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Lead 210, suspended	pCi/L		-1	-1			-1	1.1			-1
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	0.28	0.24	0.2	0.4	0.3	0.2	0.3	-0.2	-0.2	0.24
Ra-226, suspended	pCi/L		0.24	-0.2			-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	-1	1	-1	1.8	1	-1	1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	-2	2.7	-2	4	-2	-2	-3	-2	-2	2.1
Gross Beta	pCi/L	15.8	13	13.5	11.2	13.1	12.5	10.1	17.6	3.3	-6.8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detection limit (e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	12-18SM	12-18SM	12-18SM	12-18SM	12-18SM	12-18SM	12-18OZ	12-18OZ	12-18OZ	12-18OZ
	Sample Date	8/10/10	10/6/10	2/15/11	6/17/11	9/8/11	10/23/11	3/10/10	6/18/10	7/22/10	10/6/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	532	534	534	532	530	528	531	541	533	545
Ammonia	mg/L	0.2	0.4	0.3	0.1	0.2	0.2	0.3	0.2	0.4	0.6
Fluoride	mg/L	1.9	2.1	1.9	2	1.5	2	1.1	1.2	0.9	1.2
Laboratory conductivity	µmhos/cm	1430	1450	1350	1200	1520	1580	1900	1640	2160	1700
Laboratory pH	s.u.	8.7	8.8	8.8	8.8	8.8	8.8	8.6	8.6	8.6	8.7
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	980	970	990	970	940	940	1340	1140	1490	1140
Calcium	mg/L	3	3	3	3	3	2	6	4	7	4
Magnesium	mg/L	1	1	1	1	1	1	2	1	2	1
Potassium	mg/L	6	6	4	4	4	4	5	4	4	4
Sodium	mg/L	354	371	374	371	374	385	438	416	516	368
Bicarbonate	mg/L	598	573	593	579	590	583	607	624	603	601
Carbonate	mg/L	25	38	28	34	28	30	20	18	24	31
Chloride	mg/L	3	4	4	5	4	4	7	4	6	4
Sulfate	mg/L	212	216	242	221	206	213	480	295	543	320
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	0.05	-0.05	0.06	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.07	0.06	0.29	0.6	0.07	0.91	0.07	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	0.004	-0.003	-0.003	-0.003	0.011	-0.003			-0.003	-0.003
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	-0.0003	-0.0003	-0.0003	0.07	0.033	0.069	0.033
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003			-0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	-1			4.83	4.89	
Lead 210, suspended	pCi/L	-1			-1	1.1			1.7	1.87	
Polonium 210, dissolved	pCi/L	-1			-1	-1			22.9	22.2	
Polonium 210, suspended	pCi/L	-1			-1	-1			35	17.2	
Ra-226, dissolved	pCi/L	-0.2	0.2	-0.2	-0.2	-0.2	-0.2	8.16	5	12.01	5.8
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	2.27	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	0.4			-0.2	-0.2	
Gross Alpha	pCi/L	-2	-2	-5	-2	-5	-3	222	157.5	177	93.9
Gross Beta	pCi/L	-3	9.4	-8	-4	-7	-5	26.5	24.1	43.2	21.7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	12-18OZ	12-18OZ	12-18OZ	12-18OZ	12-18DM	12-18DM	12-18DM	12-18DM	12-18DM	12-18DM
	Sample Date	2/15/11	6/8/11	9/8/11	10/23/11	3/10/10	6/18/10	8/10/10	10/6/10	2/15/11	6/17/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	552	550	538	543	466	415	418	411	426	406
Ammonia	mg/L	0.4	-0.1	0.3	-0.1	2.4	1.4	0.9	0.6	0.7	0.5
Fluoride	mg/L	1.1	1.3	1.2	0.9	1	0.9	1	1.2	1	1.2
Laboratory conductivity	µmhos/cm	1550	1420	1740	1800	2400	2290	2150	2180	2080	1740
Laboratory pH	s.u.	8.7	8.8	8.7	8.7	11.5	11.2	10	9.7	9.5	9.4
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1150	1090	1090	1050	1140	1190	1260	1240	1290	1260
Calcium	mg/L	4	4	3	3	8	3	1	1	2	2
Magnesium	mg/L	1	1	1	1	-1	-1	-1	-1	-1	-1
Potassium	mg/L	4	4	3	4	39	31	23	16	15	13
Sodium	mg/L	453	421	444	434	427	405	470	476	541	521
Bicarbonate	mg/L	626	594	609	610	-5	-5	159	256	324	336
Carbonate	mg/L	24	38	23	26	171	200	172	121	96	78
Chloride	mg/L	4	5	5	6	376	362	395	402	513	508
Sulfate	mg/L	337	297	322	294	30	37	29	28	25	29
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	0.6	0.5	0.3	0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	0.007	0.008	0.007	0.005	0.009	0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.5	0.6	0.6	0.6	0.4	0.5	0.7	0.7	0.8	0.8
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	-0.05	-0.05	-0.05	-0.05	0.15	0.06	0.05	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	0.06	0.04	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	0.012	0.017	0.013	0.008	0.02	0.015
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.031	0.0268	0.0146	0.0205	-0.001	-0.001	-0.001	-0.001	-0.001	-0.0003
Uranium, suspended	mg/L		-0.0003	-0.0003			-0.001	-0.001			-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		4.2	8.7			-1	-1			-1
Lead 210, suspended	pCi/L		1.6	1.5			-1	-1			-1
Polonium 210, dissolved	pCi/L		6.5	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		7.9	25.1			-1	-1			-1
Ra-226, dissolved	pCi/L	5.2	5.3	4.7	3.8	0.28	0.22	-0.2	0.4	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	1.4	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	64.1	20.7	76.6	66.7	4.7	3.2	-2	-2	-5	-4
Gross Beta	pCi/L	14.4	10.7	20	13.8	24.1	18.8	12	11.8	-8	-8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	12-18DM	12-18DM	14-18SA	14-18SA	14-18SA	14-18SA	14-18SA	14-18SA	14-18SA	14-18SA
	Sample Date	9/8/11	10/23/11	3/24/10	6/5/10	7/22/10	10/4/10	2/18/11	6/17/11	9/12/11	11/8/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	419	441	453	471	463	478	289	329	476	221
Ammonia	mg/L	0.5	0.1	-0.1	-0.1	0.1	0.2	0.1	-0.1	-0.1	0.2
Fluoride	mg/L	1.2	1.2	0.4	0.4	0.4	0.4	0.3	0.4	0.3	0.4
Laboratory conductivity	µmhos/cm	2290	2390	1690	1750	1800	1860	1460	1280	1940	1580
Laboratory pH	s.u.	9.3	9	9.3	8.6	8.5	8.4	10.2	9.4	8.6	11
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1240	1240	1160	1230	1200	1220	1010	1070	1160	820
Calcium	mg/L	2	3	14	17	18	22	6	7	22	2
Magnesium	mg/L	-1	-1	8	9	10	12	2	7	13	-1
Potassium	mg/L	12	11	17	11	11	13	19	14	12	18
Sodium	mg/L	530	557	393	361	391	400	335	347	416	306
Bicarbonate	mg/L	379	438	368	526	544	572	94	273	552	-5
Carbonate	mg/L	65	50	91	24	10	5	127	64	14	83
Chloride	mg/L	476	484	80	86	68	67	68	77	84	68
Sulfate	mg/L	23	15	314	343	315	327	311	327	347	303
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.6
Arsenic, dissolved	mg/L	0.007	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.9	0.8	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	0.09	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	-0.05	-0.05	0.1	0.14	0.14	0.15	0.11	0.16	0.21	0.17
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	0.02	0.04	0.04	0.07	-0.02	0.02	0.06	0.05
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	0.03	-0.02	-0.02	-0.02	0.07	0.03	-0.02	0.04
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.023	0.006	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	0.005	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	-0.0003	-0.0003	0.007	0.007	0.007	0.007	0.0011	0.0046	0.0067	0.0003
Uranium, suspended	mg/L	-0.0003			-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	0.04	0.03	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	-1			-1	1.4	
Lead 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	0.27	0.26	0.5	-0.2	-0.2	0.3	0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	1.4	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	-4	-3	5.1	7.4	7.33	13.8	-4	4.2	-6	-3
Gross Beta	pCi/L	-7	-8	12.1	5.9	5.99	7.9	13.7	10.6	-8	13.1

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	14-18SM	14-18SM	14-18SM	14-18SM	14-18SM	14-18SM	14-18SM	14-18SM	14-18OZ	14-18OZ
	Sample Date	3/29/10	6/16/10	7/24/10	10/12/10	2/22/11	6/7/11	8/18/11	10/22/11	3/25/10	6/16/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	551	556	581	582	581	583	579	579	471	493
Ammonia	mg/L	-0.1	-0.1	0.1	0.2	0.1	-0.1	-0.1	-0.1	0.4	0.5
Fluoride	mg/L	1.6	1.5	1.6	1.5	1.6	1.6	1.5	1.6	0.5	0.4
Laboratory conductivity	µmhos/cm	1480	1520	1560	1560	1470	1400	1710	1720	2620	2810
Laboratory pH	s.u.	9.2	9.1	8.9	9	9	8.8	9	8.8	8.9	8.6
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1020	1040	1010	1000	1050	1110	1060	1030	2020	2070
Calcium	mg/L	2	2	2	2	2	2	1	2	5	7
Magnesium	mg/L	-1	-1	1	1	1	1	-1	1	2	3
Potassium	mg/L	6	8	7	8	7	7	6	6	17	11
Sodium	mg/L	350	352	373	360	412	399	412	416	624	639
Bicarbonate	mg/L	526	566	603	599	597	622	597	628	478	556
Carbonate	mg/L	72	55	52	54	55	44	54	39	48	23
Chloride	mg/L	4	3	2	2	3	3	4	4	10	10
Sulfate	mg/L	232	241	238	230	241	227	283	234	897	859
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	-0.1
Arsenic, dissolved	mg/L	0.012	0.009	0.007	0.005	-0.005	0.008	0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.5	0.5	0.6	0.5	0.6	0.5	0.6	0.4	0.4
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.69	-0.05
Iron, total	mg/L	0.06	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	3.38	0.33
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.06	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	-0.001	0.0008	0.0007	0.0006	-0.0003	0.096	0.109
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.01
Lead 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Lead 210, suspended	pCi/L		-1	-1			-1	-1			1.18
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			1.79
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			1.05
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	0.4	-0.2	-0.2	-0.2	2.31	3.74
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			0.28
Ra-228, dissolved	pCi/L	-1	1.29	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	2.8	3.1	-3.5	11.2	-5	-2	-6	-5	173	191
Gross Beta	pCi/L	7.2	7	-6.8	12.4	-8	4.4	-8	-7	40.2	37.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	14-18OZ	14-18OZ	14-18OZ	14-18OZ	14-18OZ	14-18OZ	14-18DM	14-18DM	14-18DM	14-18DM
	Sample Date	7/14/10	10/11/10	2/22/11	6/6/11	9/6/11	10/22/11	3/29/10	6/16/10	7/24/10	10/12/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	520	518	510	526	509	525	439	422	416	422
Ammonia	mg/L	0.6	0.6	0.5	0.5	0.3	-0.1	0.6	0.4	0.5	0.5
Fluoride	mg/L	0.5	0.4	0.5	0.5	0.4	0.4	1.1	1.1	1.2	1.1
Laboratory conductivity	µmhos/cm	2780	2730	2550	2300	2890	2980	2030	2170	2190	2150
Laboratory pH	s.u.	8.6	8.6	8.6	8.5	8.7	8.6	10	9.5	9	9.2
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1980	1930	2050	1980	1980	1900	1220	1260	1220	1240
Calcium	mg/L	8	9	9	10	11	10	2	2	3	3
Magnesium	mg/L	3	3	3	3	3	3	-1	-1	-1	-1
Potassium	mg/L	7	6	7	7	7	6	34	22	15	13
Sodium	mg/L	644	600	668	696	718	653	460	447	468	454
Bicarbonate	mg/L	591	593	584	614	567	585	188	337	399	391
Carbonate	mg/L	21	19	19	13	26	27	171	87	54	61
Chloride	mg/L	10	9	11	10	11	11	449	392	437	438
Sulfate	mg/L	937	826	870	854	823	820	23	4	1	-1
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.008	0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.5	0.4	0.5	0.5	0.4	0.6	0.7	0.8	0.9
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	-0.05	-0.05
Iron, total	mg/L	0.1	0.52	0.12	-0.05	0.08	-0.05	2.92	0.72	0.33	0.15
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	0.03	-0.02	-0.02	0.02	-0.02	0.05	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.014	0.012	0.012	0.01
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003
Uranium, dissolved	mg/L	0.109	0.085	0.0757	0.0992	0.106	0.104	-0.001	-0.001	-0.001	-0.001
Uranium, suspended	mg/L	0.003			-0.0003	-0.0003			0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	0.02	0.01
Lead 210, dissolved	pCi/L	1.79			1.3	13.6			1.1	-1	
Lead 210, suspended	pCi/L	1.04			2.6	2			-1	-1	
Polonium 210, dissolved	pCi/L	5.04			1.5	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			2.7	-1			-1	-1	
Ra-226, dissolved	pCi/L	4.03	4.9	5.1	3.3	4.8	3.7	0.35	0.21	-0.2	0.4
Ra-226, suspended	pCi/L	4.24			-0.2	0.4			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	1.56
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	0.95			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	165.3	183	131	158	161	188	13.7	2.1	-3.1	28.3
Gross Beta	pCi/L	39.6	27.6	16.3	34.6	36	46.8	32.3	17.2	8.24	41

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

	Sample Results										
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		14-18DM	14-18DM	14-18DM	14-18DM	21-19SA	21-19SA	21-19SA	21-19SA	21-19SA	21-19SA
Sample Date		2/22/11	6/7/11	8/18/11	10/22/11	3/24/10	6/18/10	7/22/10	10/4/10	2/18/11	6/17/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	414	411	404	405	374	374	367	399	390	374
Ammonia	mg/L	0.5	0.4	0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	1.2	1.1	1.1	1.3	0.4	0.4	0.3	0.4	0.4	0.8
Laboratory conductivity	µmhos/cm	2040	1900	2320	2350	911	937	968	974	901	853
Laboratory pH	s.u.	9.3	9.1	9.1	8.9	8.2	8.2	8.1	8.2	8.1	8.2
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	1.1	-0.1	1	0.3	-0.1	-0.1
Total Dissolved Solids	mg/L	1260	1270	1240	1150	620	640	620	610	640	680
Calcium	mg/L	3	3	3	3	31	26	36	30	27	37
Magnesium	mg/L	-1	-1	-1	-1	13	11	15	13	11	16
Potassium	mg/L	12	11	9	9	7	9	7	8	8	8
Sodium	mg/L	513	544	542	529	160	171	165	177	200	192
Bicarbonate	mg/L	366	383	396	427	456	456	447	487	476	457
Carbonate	mg/L	68	58	48	33	-5	-5	-5	-5	-5	-5
Chloride	mg/L	513	528	526	508	19	17	18	17	22	28
Sulfate	mg/L	-1	-1	-1	-1	112	107	118	91	99	131
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	0.007	0.009	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.8	0.8	0.8	0.8	-0.1	0.1	0.1	0.1	0.1	0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	0.66	-0.05
Iron, total	mg/L	0.08	-0.05	0.07	-0.05	0.08	5.68	0.16	0.37	2.78	7.87
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	0.19	0.36	0.18	0.2	0.19	0.16
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.016	0.026	0.028	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0006	-0.0003	-0.0003	-0.0003	0.007	0.004	0.006	0.005	0.0026	0.004
Uranium, suspended	mg/L		-0.0003	-0.0003			-0.001	-0.001			-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	0.02	-0.01	0.02	1.32	0.09	-0.01	0.05	0.05
Lead 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Lead 210, suspended	pCi/L		-1	-1			-1	-1			1.4
Polonium 210, dissolved	pCi/L		-1	1.3			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	0.7	-0.2	-0.2	-0.2	0.41	0.24	0.23	0.3	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			0.24	-0.2			0.2
Ra-228, dissolved	pCi/L	-1	1	-1	1.7	-1	-1	-1	1.2	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	-4	-4	-6	-4	6.5	6.4	6.16	6.7	5.1	3.3
Gross Beta	pCi/L	7.2	-7	-7	-7	7.4	10	6.99	5.3	-7	7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	21-19SA	21-19SA	21-19SM	21-19SM	21-19SM	21-19SM	21-19SM	21-19SM	21-19SM	21-19SM
	Sample Date	9/12/11	11/8/11	3/25/10	5/19/10	8/5/10	10/14/10	2/23/11	5/7/11	9/6/11	10/20/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	369	311	572	602	647	633	685	628	622	619
Ammonia	mg/L	-0.1	-0.1	-0.1	0.2	1.1	0.6	0.3	0.1	-0.1	0.2
Fluoride	mg/L	0.3	0.5	1	1	1.1	1.1	1.1	1	1.1	1.2
Laboratory conductivity	µmhos/cm	1130	1010	1770	1970	2000	1960	1940	1740	1680	2070
Laboratory pH	s.u.	8.4	8.4	9.6	9.3	9.9	9.6	9.9	9.4	9.1	8.9
Nitrate/Nitrite	mg/L	0.3	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	680	590	1270	1330	1310	1300	1340	1310	1270	1270
Calcium	mg/L	37	20	2	2	1	1	1	1	1	1
Magnesium	mg/L	15	11	-1	-1	-1	-1	-1	-1	1	1
Potassium	mg/L	9	7	32	31	47	37	43	28	20	19
Sodium	mg/L	204	188	426	439	451	447	491	480	516	510
Bicarbonate	mg/L	440	361	399	532	347	491	365	560	634	643
Carbonate	mg/L	-5	9	146	99	218	138	231	101	61	56
Chloride	mg/L	34	31	3	8	3	2	3	4	4	4
Sulfate	mg/L	134	141	383	396	336	335	350	366	342	359
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	0.023	0.009	0.009	0.006	-0.005	0.006	0.006	0.006
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.1	0.1	0.2	0.5	0.6	0.6	0.6	0.6	0.6	0.6
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	0.11	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	3.65	3.3	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.09	0.05	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.006
Silver, dissolved	mg/L	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0049	0.0017	0.003	0.003	0.004	0.003	0.0021	0.0012	0.0006	0.0005
Uranium, suspended	mg/L	-0.0003			-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.04	-0.01	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	1.1			-1	-1			-1	1.5	
Lead 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	0.4	-0.2	-0.2	-0.2	-0.2	-0.2	3.7	-0.2	-0.2	0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	5.1	-3	3.1	5.4	6.6	12.2	-5	-3	-6	-4
Gross Beta	pCi/L	6.4	5.2	22.2	19	29.8	42.5	22.9	12.6	12.5	14.2

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Parameter**	Units	Sample Results									
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		21-19OZ	21-19OZ	21-19OZ	21-19OZ	21-19OZ	21-19OZ	21-19OZ	21-19OZ	21-19DM	21-19DM
Sample Date		3/25/10	5/19/10	7/16/10	10/11/10	2/23/11	5/7/11	8/17/11	10/20/11	3/24/10	5/19/10
Alkalinity (as CaCO3)	mg/L	529	520	529	535	537	532	523	527	408	413
Ammonia	mg/L	0.3	0.5	0.4	0.5	0.4	0.4	0.3	0.5	0.6	0.5
Fluoride	mg/L	0.5	0.5	0.5	0.4	0.5	0.4	0.4	0.4	1.2	1.1
Laboratory conductivity	µmhos/cm	2190	2370	2280	2300	2200	2040	2540	2540	2000	2150
Laboratory pH	s.u.	8.7	8.6	8.5	8.6	8.6	8.7	8.7	8.7	9.7	9.4
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1600	1670	1620	1590	1680	1640	1620	1630	1200	1250
Calcium	mg/L	6	7	7	7	7	7	7	7	2	3
Magnesium	mg/L	2	2	2	2	2	2	2	2	-1	-1
Potassium	mg/L	5	6	5	6	5	6	5	5	23	21
Sodium	mg/L	537	531	574	516	618	602	598	577	463	522
Bicarbonate	mg/L	586	603	609	615	585	588	586	589	246	338
Carbonate	mg/L	29	16	18	19	35	30	26	26	124	82
Chloride	mg/L	7	9	8	7	9	9	9	10	473	535
Sulfate	mg/L	634	678	667	605	639	650	650	623	11	4
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.2
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.006	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.7	0.8
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.06	0.1
Iron, total	mg/L	0.18	0.07	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.73	0.87
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.03
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.014	0.014
Silver, dissolved	mg/L			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	0.017	0.008	0.024	0.005	0.005	0.0055	0.0071	0.0061	-0.001	-0.001
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	-0.01	0.02	0.01
Lead 210, dissolved	pCi/L		-1	1.35			-1	1.9			1.16
Lead 210, suspended	pCi/L		-1	32.2			-1	1.5			1.25
Polonium 210, dissolved	pCi/L		-1	3.74			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	25.4			1.3	-1			-1
Ra-226, dissolved	pCi/L	0.89	0.93	0.71	0.8	0.7	0.7	0.6	0.9	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			0.24
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	33.5	19	47.7	18.4	-5	13.8	11.7	11.2	-2	2.3
Gross Beta	pCi/L	9.2	9.1	17.1	7.1	-7	-7	8.1	-8	16.2	13

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	21-19DM	21-19DM	21-19DM	21-19DM	21-19DM	21-19DM	34-18SM	34-18SM	34-18SM	34-18SM
	Sample Date	8/5/10	10/14/10	2/23/11	5/7/11	9/6/11	10/20/11	3/17/10	5/18/10	8/4/10	10/11/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	429	431	414	413	409	413	521	486	484	458
Ammonia	mg/L	0.2	0.9	0.3	0.3	0.3	0.5	1.9	1.4	1.2	1
Fluoride	mg/L	1.2	1.2	1.2	1.1	1.2	1.1	1.4	1.3	1.2	0.9
Laboratory conductivity	µmhos/cm	2130	2170	2040	1920	2240	2340	2240	2190	2070	1800
Laboratory pH	s.u.	9.2	9.1	8.9	8.9	8.8	8.7	11.6	11.5	11.4	10.5
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1240	1250	1270	1220	1200	1240	1040	1100	1060	1140
Calcium	mg/L	3	3	3	4	4	4	2	1	1	-1
Magnesium	mg/L	-1	-1	-1	1	1	-1	-1	-1	-1	-1
Potassium	mg/L	17	14	11	10	8	8	31	28	26	20
Sodium	mg/L	467	449	516	509	496	538	359	342	360	383
Bicarbonate	mg/L	398	426	433	445	455	460	-5	-5	-5	51
Carbonate	mg/L	62	49	36	29	22	22	168	173	189	250
Chloride	mg/L	425	438	530	555	501	504	6	5	4	3
Sulfate	mg/L	2	-1	-1	-1	-1	-1	293	295	304	367
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	0.005	0.007	-0.005	0.009	0.011	0.012	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.8	0.9	0.8	0.8	0.8	0.9	0.2	0.2	0.3	0.4
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.17	0.09	0.05	0.14	0.11	0.08	0.07	0.12	0.11	0.07
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	0.03	0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.009	0.013	0.018	0.021	0.025	0.007	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003			0.004	-0.003
Uranium, dissolved	mg/L	-0.001	-0.001	-0.0003	-0.0003	0.0005	-0.0003	-0.001	-0.001	-0.001	-0.001
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003			-0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	0.03	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Lead 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	1.3	-1	2.2	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	3.53	4.5	-5	-4	-6	-6	-2	-2	-3.5	-2
Gross Beta	pCi/L	8.33	9.2	-8	7	-8	-8	18.7	17.3	16.5	11

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	34-18SM	34-18SM	34-18SM	34-18SM	34-18OZ	34-18OZ	34-18OZ	34-18OZ	34-18OZ	34-18OZ
	Sample Date	2/16/11	5/6/11	8/17/11	10/19/11	3/29/10	5/18/10	7/13/10	10/7/10	2/16/11	4/29/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	558	559	540	537	496	485	497	504	507	502
Ammonia	mg/L	0.5	0.3	-0.1	-0.1	0.4	0.4	0.4	0.7	0.5	0.3
Fluoride	mg/L	0.9	0.9	1.1	1.1	0.6	0.6	0.5	0.6	0.5	0.5
Laboratory conductivity	µmhos/cm	1890	1720	2120	2080	2070	2220	2260	2230	2070	2090
Laboratory pH	s.u.	9.9	9.7	9.6	9.4	9	8.7	8.4	8.7	8.6	8.6
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1300	1330	1310	1310	1530	1560	1620	1560	1540	1560
Calcium	mg/L	1	2	1	2	4	6	6	6	7	8
Magnesium	mg/L	-1	1	1	-1	2	2	2	2	2	3
Potassium	mg/L	21	18	15	15	8	6	5	6	7	6
Sodium	mg/L	486	477	507	520	542	486	557	481	580	581
Bicarbonate	mg/L	299	408	438	429	499	540	591	559	587	571
Carbonate	mg/L	188	135	114	111	52	26	8	28	15	21
Chloride	mg/L	3	4	5	5	8	8	8	6	7	7
Sulfate	mg/L	418	433	458	410	606	670	593	578	631	647
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.5	0.5	0.5	0.4	0.4	0.5	0.4	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.12	0.13	0.1	0.25	1.02	0.1	-0.05	-0.05	-0.05	0.15
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	0.009	-0.005	-0.005	-0.005	0.009	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0009	0.0007	0.0008	0.0011	0.062	0.059	0.046	0.041	0.0427	0.0378
Uranium, suspended	mg/L		-0.0003	-0.0003			-0.001	-0.001			-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	-0.01
Lead 210, dissolved	pCi/L		-1	-1			1.88	3.02			3.1
Lead 210, suspended	pCi/L		-1	-1			3.88	1.66			5.8
Polonium 210, dissolved	pCi/L		-1	-1			4.77	8.73			5.6
Polonium 210, suspended	pCi/L		-1	-1			13.38	6.93			26.6
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	5.97	9.06	9.68	8.8	9.8	10
Ra-226, suspended	pCi/L		-0.2	-0.2			0.49	-0.2			0.6
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	-4	-4	-6	-6	175.7	111.1	76	93.8	78.6	90
Gross Beta	pCi/L	13.2	10.4	8.4	-8	43.1	35.2	23.9	26.7	17.7	15.3

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	34-18OZ	34-18OZ	34-18DM	34-18DM	34-18DM	34-18DM	34-18DM	34-18DM	34-18DM	34-18DM
	Sample Date	8/16/11	10/19/11	3/17/10	5/18/10	8/4/10	10/11/10	2/16/11	5/6/11	8/17/11	10/19/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	500	507	498	336	360	427	444	458	453	455
Ammonia	mg/L	0.3	0.2	3.9	0.9	1.8	0.6	0.4	0.4	0.3	-0.1
Fluoride	mg/L	0.6	0.5	1.2	1.1	1.2	1	1	1.1	1.3	1.1
Laboratory conductivity	µmhos/cm	2380	2430	2170	2040	1980	2210	2130	2010	2500	2530
Laboratory pH	s.u.	8.7	8.7	11.7	10	10	9.3	9.1	9.1	8.9	8.8
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1530	1540	870	1160	1110	1300	1320	1320	1310	1540
Calcium	mg/L	7	6	4	2	2	2	2	3	2	3
Magnesium	mg/L	2	2	-1	-1	-1	-1	-1	1	-1	1
Potassium	mg/L	5	6	44	21	21	15	15	12	11	10
Sodium	mg/L	562	568	302	473	405	452	498	554	556	540
Bicarbonate	mg/L	564	561	-5	133	134	374	429	453	481	488
Carbonate	mg/L	21	28	128	137	150	72	56	52	35	33
Chloride	mg/L	7	8	139	523	371	422	526	576	575	547
Sulfate	mg/L	661	591	29	12	15	6	4	-1	1	1
Aluminum, dissolved	mg/L	-0.1	-0.1	0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	0.007	0.007	0.008	-0.005	0.006	0.005	0.008	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.5	0.5	0.3	0.5	0.6	0.8	0.9	1	0.9	1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	0.07	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	-0.05	-0.05	0.39	0.11	0.29	-0.05	-0.05	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	0.05	0.02	0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	0.008	0.009	0.006	0.01	0.022	0.023	0.029	0.007
Silver, dissolved	mg/L	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0419	0.0355	-0.001	0.003	-0.001	-0.001	-0.0003	-0.0003	-0.0003	-0.0003
Uranium, suspended	mg/L	-0.0003			-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	0.09	0.02	-0.01	0.04	0.01	-0.01	0.02	-0.01
Lead 210, dissolved	pCi/L	1.8			-1	-1			-1	-1	
Lead 210, suspended	pCi/L	9.1			-1	-1			-1	-1	
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	8.3	12.1	-0.2	-0.2	-0.2	0.3	-0.2	0.2	-0.2	0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	1.1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	97.5	105	-2	-2	-3.5	3.1	-4	-4	-4	-5
Gross Beta	pCi/L	23.2	25.1	32.6	13.1	10.1	6.6	-7	-7	-8	-8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	34-7SA	34-7SA	34-7SA	34-7SA	34-7SA	34-7SA	34-7SA	34-7SA	34-7SM	34-7SM
	Sample Date	3/25/10	6/5/10	7/22/10	10/4/10	2/15/11	6/17/11	9/12/11	11/8/11	3/30/10	5/20/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	497	511	531	506	435	396	342	365	595	628
Ammonia	mg/L	-0.1	-0.1	-0.1	0.4	0.6	0.6	0.4	0.3	-0.1	0.2
Fluoride	mg/L	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.9	1
Laboratory conductivity	µmhos/cm	1160	1200	1270	1190	1010	882	1080	1020	1650	1840
Laboratory pH	s.u.	9.1	9.1	9.1	10	10.3	10.2	10.4	10.6	9.4	9
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	770	810	820	690	640	580	580	540	1150	1200
Calcium	mg/L	2	2	2	3	4	2	2	2	1	2
Magnesium	mg/L	-1	1	2	2	2	-1	2	-1	-1	1
Potassium	mg/L	10	11	11	13	9	7	7	7	14	13
Sodium	mg/L	274	266	299	259	256	234	232	213	426	417
Bicarbonate	mg/L	484	516	513	223	126	124	77	-5	508	631
Carbonate	mg/L	60	53	66	193	199	177	168	218	107	66
Chloride	mg/L	3	3	2	2	2	3	3	3	4	7
Sulfate	mg/L	134	133	137	98	95	90	124	84	312	312
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.016	0.011
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.4	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	0.07	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	-0.05	-0.05	-0.05	0.15	0.06	0.8	0.6	0.88	0.8	0.11
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.03	0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	0.0005	-0.0003	-0.0003	-0.001	0.001
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		-1	-1			-1	-1			1.34
Lead 210, suspended	pCi/L		-1	-1			-1	-1			-1
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.21	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			0.28
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	-2	3.8	2.65	2.4	-2	-2	-3	-3	4.7	6.2
Gross Beta	pCi/L	7.6	7.7	7.27	7.1	6.2	4.1	4.6	5.4	8.7	10.3

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	34-7SM	34-7SM	34-7SM	34-7SM	34-7SM	34-7SM	34-7OZ	34-7OZ	34-7OZ	34-7OZ
	Sample Date	8/10/10	10/13/10	2/14/11	6/8/11	9/7/11	10/24/11	3/30/10	5/20/10	7/8/10	10/13/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	647	658	672	677	683	685	532	522	556	568
Ammonia	mg/L	0.2	0.5	0.3	-0.1	-0.1	0.3	0.4	0.5	0.5	0.8
Fluoride	mg/L	0.9	0.9	0.8	1.1	1	1	0.4	0.5	0.4	0.4
Laboratory conductivity	µmhos/cm	1800	1830	1730	1620	1980	2040	2130	2290	2250	2190
Laboratory pH	s.u.	9	8.9	8.8	8.8	8.8	8.8	8.7	8.7	8.4	8.8
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1240	1260	1280	1280	1210	1260	1590	1590	1640	1550
Calcium	mg/L	2	2	3	3	3	2	4	5	6	6
Magnesium	mg/L	1	1	2	2	2	1	2	2	3	2
Potassium	mg/L	10	10	8	8	7	12	7	12	5	8
Sodium	mg/L	426	431	478	499	477	508	533	520	546	512
Bicarbonate	mg/L	674	682	731	731	752	725	590	587	662	624
Carbonate	mg/L	57	60	43	47	40	55	29	24	8	34
Chloride	mg/L	3	3	4	4	4	4	5	5	4	4
Sulfate	mg/L	298	300	307	306	272	303	590	644	563	512
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.009	0.008	0.009	0.008	-0.005	0.008	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.6	0.6	0.5	0.7	0.6	0.6	0.4	0.4	0.4	0.4
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	0.05	0.06	0.21	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.08	0.06	0.12	0.18	0.12	35	0.09	0.1	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.02	0.02	-0.02	-0.02	0.02	0.88	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.008	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003
Uranium, dissolved	mg/L	0.002	0.001	0.002	0.001	0.0005	0.0012	0.041	0.038	0.044	0.028
Uranium, suspended	mg/L	-0.001			-0.0003	0.0004			-0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	5.2			1.17	-1	
Lead 210, suspended	pCi/L	-1			1	-1			1.94	1.44	
Polonium 210, dissolved	pCi/L	-1			-1	1.9			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	0.3	0.3	1.38	0.94	2.35	1.5
Ra-226, suspended	pCi/L	-0.2			-0.2	0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	4.1	10.1	4.9	-2	-7	-6	69.1	46.1	56.8	48.1
Gross Beta	pCi/L	5.8	9.7	-7	-3	13.6	319	16.6	18.3	13.3	9.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results

Parameter**	Units	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		34-7OZ	34-7OZ	34-7OZ	34-7OZ	34-7DM	34-7DM	34-7DM	34-7DM	34-7DM	34-7DM
Sample Date		2/14/11	6/7/11	9/7/11	10/24/11	3/30/10	5/20/10	8/10/10	10/13/10	2/14/11	6/8/11
Alkalinity (as CaCO3)	mg/L	580	593	584	586	463	449	547	447	605	422
Ammonia	mg/L	0.5	0.4	0.2	0.3	0.8	1.8	2.4	1.5	2.9	1.5
Fluoride	mg/L	0.4	0.6	0.4	0.4	0.9	1.1	0.9	0.9	0.8	1.2
Laboratory conductivity	µmhos/cm	2040	1820	2250	2400	2740	3080	3220	3100	3390	2680
Laboratory pH	s.u.	8.8	8.8	8.8	8.8	10	10.1	10.8	9.9	11.1	9.7
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1550	1500	1450	1470	1600	1760	1900	1860	2130	1990
Calcium	mg/L	6	5	5	5	3	2	3	2	6	2
Magnesium	mg/L	2	2	2	2	2	-1	-1	-1	-1	-1
Potassium	mg/L	11	9	8	8	32	23	36	22	37	19
Sodium	mg/L	560	535	555	582	686	722	688	645	807	709
Bicarbonate	mg/L	632	634	642	629	168	143	-5	208	-5	247
Carbonate	mg/L	37	44	34	43	195	199	312	166	324	132
Chloride	mg/L	5	5	7	7	699	818	539	640	638	759
Sulfate	mg/L	541	506	498	496	75	71	146	123	234	143
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	0.1	-0.1	0.1	0.4
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	0.014	0.009	0.008	0.007	0.008	0.008
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.4	0.4	0.4	0.8	0.9	0.8	1	0.8	0.9
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	0.21	0.08	0.1	0.1	0.18
Iron, total	mg/L	-0.05	-0.05	-0.05	-0.05	1.02	1.81	10.2	2.22	3.75	6.29
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.15	0.02	0.05	0.08
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	0.017	0.023	0.016	0.014	0.025	0.024
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.03	0.0272	0.0298	0.0282	0.001	0.002	-0.001	-0.001	-0.001	0.0004
Uranium, suspended	mg/L		-0.0003	-0.0003			-0.001	-0.001			0.0006
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		1.5	4.9			-1	-1			-1
Lead 210, suspended	pCi/L		-1	-1			-1	1			1.2
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	1.1	0.9	1	0.9	-0.2	-0.2	-0.2	-0.2	0.2	0.3
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	0.5			0.8
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	1.1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	0.325			0.3
Gross Alpha	pCi/L	43.3	26	54.1	62.2	3.5	4.4	20	10.5	-5	-2
Gross Beta	pCi/L	14.3	4.4	16	9.3	19.4	10.5	28	16.3	12.6	3.1

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data											
		Sample Results									
	Sample Type*	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
	Sample Station Name	34-7DM	34-7DM	42-19SM	42-19SM	42-19SM	42-19SM	42-19SM	42-19SM	42-19SM	42-19SM
	Sample Date	9/7/11	10/24/11	3/16/10	5/18/10	8/4/10	10/5/10	2/17/11	5/6/11	8/4/11	10/18/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	421	404	420	282	303	319	386	430	470	518
Ammonia	mg/L	1	1	2.8	1.4	1.2	0.8	0.4	0.4	0.3	0.4
Fluoride	mg/L	1	1	1.6	1.5	1.5	1.4	1.2	1.1	1.4	0.9
Laboratory conductivity	µmhos/cm	3330	3370	1690	1540	1580	1620	1760	1760	2110	2160
Laboratory pH	s.u.	9.9	9.5	11.5	10.8	10.6	10.3	10.2	10	9.9	9.5
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1840	1820	830	970	990	1040	1200	1300	1330	1350
Calcium	mg/L	2	2	3	1	1	1	1	1	1	2
Magnesium	mg/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Potassium	mg/L	32	21	17	11	10	11	11	13	13	15
Sodium	mg/L	779	718	275	325	342	323	447	440	490	542
Bicarbonate	mg/L	205	267	-5	-5	12	64	123	222	296	393
Carbonate	mg/L	152	111	137	152	175	160	171	149	136	118
Chloride	mg/L	696	731	7	5	4	4	8	5	6	5
Sulfate	mg/L	152	118	179	405	371	414	462	469	574	457
Aluminum, dissolved	mg/L	0.4	0.3	0.2	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.01	-0.005	0.007	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	1	0.9	0.3	0.4	0.4	0.4	0.8	0.4	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.4	0.1	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	23.3	3.02	0.66	0.11	0.16	-0.05	0.08	-0.05	0.05	0.08
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.37	0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	0.05	0.03	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.03	0.006	-0.005	-0.005	-0.005	-0.005	0.017	-0.005	-0.005	0.005
Silver, dissolved	mg/L	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0004	0.0004	-0.001	-0.001	-0.001	-0.001	-0.0003	-0.0003	-0.0003	-0.0003
Uranium, suspended	mg/L	-0.0003			-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	0.01	-0.01	0.02	-0.01
Lead 210, dissolved	pCi/L	-1			-1	-1			1.8	1.5	
Lead 210, suspended	pCi/L	-1			-1	-1			-1	1.4	
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1	-1	
Polonium 210, suspended	pCi/L	-1			-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	-0.2	0.2	-0.2	-0.2	0.21	-0.2	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	1.6	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	-7	-14	-2	-2	2.78	2.8	-5	-3	-4	5.2
Gross Beta	pCi/L	-10	-20	10.8	6.8	6.9	6	-7	-8	5.9	9

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Parameter**	Units	Sample Results									
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19DM	42-19DM
Sample Date		3/11/10	5/17/10	7/10/10	10/5/10	2/17/11	5/6/11	8/4/11	10/18/11	3/16/10	5/17/10
Alkalinity (as CaCO3)	mg/L	477	474	480	480	487	478	473	471	481	352
Ammonia	mg/L	0.3	0.3	0.5	0.4	0.5	0.3	0.4	0.4	2.5	2.1
Fluoride	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	1.2	1.6
Laboratory conductivity	µmhos/cm	2080	1850	2200	2130	2000	1570	2340	2280	2000	1600
Laboratory pH	s.u.	8.6	8.8	8.7	8.7	8.6	8.8	8.7	8.6	11.5	10.9
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1500	1520	1650	1500	1500	1660	1500	1490	940	960
Calcium	mg/L	6	6	6	7	7	5	7	7	5	4
Magnesium	mg/L	2	2	2	3	3	2	3	2	-1	-1
Potassium	mg/L	6	6	5	7	6	6	5	5	48	27
Sodium	mg/L	499	532	547	541	537	442	541	540	315	369
Bicarbonate	mg/L	539	519	543	533	556	522	537	537	-5	-5
Carbonate	mg/L	21	29	21	26	19	30	20	18	160	195
Chloride	mg/L	5	4	3	3	4	4	5	5	182	326
Sulfate	mg/L	638	640	595	600	598	399	602	575	42	30
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.4	0.2
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.01	0.01
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	-0.05	-0.05
Iron, total	mg/L	0.11	0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	0.21	0.36
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.06	0.03
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.008	-0.005
Silver, dissolved	mg/L			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	0.011	0.01	0.01	0.009	0.009	0.0113	0.0096	0.0093	-0.001	-0.001
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.01	-0.01	0.04	-0.01
Lead 210, dissolved	pCi/L		-1	1.4			1.5	3			-1
Lead 210, suspended	pCi/L		1.35	1.86			1.9	2.2			-1
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	1.38	1.36	1.46	1.4	1.4	0.7	1.4	1.2	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	1.6	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	19.4	15.4	18.7	19.6	13.7	24.8	18.3	20.4	-2	-2
Gross Beta	pCi/L	4.2	9.8	8.54	13.4	7.9	-7	-7	11.2	34.3	19.7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

	Sample Results										
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Domestic	GW Domestic	GW Domestic	GW Domestic
Sample Station Name		42-19DM	42-19DM	42-19DM	42-19DM	42-19DM	42-19DM	CSWELL01	CSWELL01	CSWELL01	CSWELL01
Sample Date		8/4/10	10/5/10	2/17/11	5/6/11	8/3/11	10/18/11	8/6/09	10/23/09	1/22/10	5/13/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	386	443	431	445	443	452	792	633	633	637
Ammonia	mg/L	0.6	0.4	0.4	0.4	0.4	0.5	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	1.4	1.4	1.3	1.2	1.5	1.2	0.4	0.3	0.3	0.4
Laboratory conductivity	µmhos/cm	1920	2040	1920	1880	2260	2240	2560	1880	1550	1930
Laboratory pH	s.u.	9.6	9.3	9.3	9.2	9.1	9	8.3	8.4	8.4	8.4
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.4	0.1	-0.1	0.6
Total Dissolved Solids	mg/L	1080	1170	1140	1260	1230	1210	1920	1340	1030	1610
Calcium	mg/L	2	2	3	3	3	3	39	16	9	29
Magnesium	mg/L	-1	-1	-1	-1	-1	-1	30	12	6	19
Potassium	mg/L	11	10	11	11	10	11	14	9	8	11
Sodium	mg/L	390	480	489	477	508	535	574	444	393	527
Bicarbonate	mg/L	282	389	388	430	445	462	931	758	748	760
Carbonate	mg/L	93	74	67	56	47	44	18	7	12	9
Chloride	mg/L	345	385	451	477	463	452	6	3	2	6
Sulfate	mg/L	9	7	5	3	3	2	688	368	224	558
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.006	-0.005	-0.005	0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.7	0.8	0.8	0.8	0.9	0.9	0.4	0.4	0.3	0.4
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.31	-0.05	0.1	0.06	0.1	-0.05	-0.05	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	-0.02	-0.02	0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.012	0.01	0.017	0.017	0.017	0.007	0.006	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003				
Uranium, dissolved	mg/L	-0.001	-0.001	-0.0003	-0.0003	-0.0003	-0.0003	0.014	0.008	0.004	0.015
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003					-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.04	0.02	0.04	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	1.2			-1		-1
Lead 210, suspended	pCi/L	-1			-1	1.5					-1
Polonium 210, dissolved	pCi/L	-1			-1	-1			-1		-1
Polonium 210, suspended	pCi/L	-1			-1	-1					-1
Ra-226, dissolved	pCi/L	-0.2	-0.2	0.2	-0.2	-0.2	-0.2	0.86	-0.2	0.38	0.5
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2					-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	1.66	1.44	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2		-0.2
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2					-0.2
Gross Alpha	pCi/L	-3.5	-2	-3	-4	-3	-4	18.3	16.3	7.2	9.5
Gross Beta	pCi/L	-6.8	8.9	-7	-7	6.1	-7	11.3	12.4	-3.96	6.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results

Parameter**	Units	3/11/10	5/17/10	7/10/10	10/5/10	2/17/11	5/6/11	8/4/11	10/18/11	3/16/10	5/17/10
Sample Type*		GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring	GW Monitoring
Sample Station Name		42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19OZ	42-19DM	42-19DM
Alkalinity (as CaCO3)	mg/L	477	474	480	480	487	478	473	471	481	352
Ammonia	mg/L	0.3	0.3	0.5	0.4	0.5	0.3	0.4	0.4	2.5	2.1
Fluoride	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	1.2	1.6
Laboratory conductivity	µmhos/cm	2080	1850	2200	2130	2000	1570	2340	2280	2000	1600
Laboratory pH	s.u.	8.6	8.8	8.7	8.7	8.6	8.8	8.7	8.6	11.5	10.9
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1500	1520	1650	1500	1500	1660	1500	1490	940	960
Calcium	mg/L	6	6	6	7	7	5	7	7	5	4
Magnesium	mg/L	2	2	2	3	3	2	3	2	-1	-1
Potassium	mg/L	6	6	5	7	6	6	5	5	48	27
Sodium	mg/L	499	532	547	541	537	442	541	540	315	369
Bicarbonate	mg/L	539	519	543	533	556	522	537	537	-5	-5
Carbonate	mg/L	21	29	21	26	19	30	20	18	160	195
Chloride	mg/L	5	4	3	3	4	4	5	5	182	326
Sulfate	mg/L	638	640	595	600	598	399	602	575	42	30
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.4	0.2
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.01	0.01
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	-0.05	-0.05
Iron, total	mg/L	0.11	0.05	-0.05	-0.05	-0.05	-0.05	0.06	-0.05	0.21	0.36
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.06	0.03
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.008	-0.005
Silver, dissolved	mg/L			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003		
Uranium, dissolved	mg/L	0.011	0.01	0.01	0.009	0.009	0.0113	0.0096	0.0093	-0.001	-0.001
Uranium, suspended	mg/L		-0.001	-0.001			-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	-0.01	-0.01	0.04	-0.01
Lead 210, dissolved	pCi/L		-1	1.4			1.5	3			-1
Lead 210, suspended	pCi/L		1.35	1.86			1.9	2.2			-1
Polonium 210, dissolved	pCi/L		-1	-1			-1	-1			-1
Polonium 210, suspended	pCi/L		-1	-1			-1	-1			-1
Ra-226, dissolved	pCi/L	1.38	1.36	1.46	1.4	1.4	0.7	1.4	1.2	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	1.6	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Th-230, suspended	pCi/L		-0.2	-0.2			-0.2	-0.2			-0.2
Gross Alpha	pCi/L	19.4	15.4	18.7	19.6	13.7	24.8	18.3	20.4	-2	-2
Gross Beta	pCi/L	4.2	9.8	8.54	13.4	7.9	-7	-7	11.2	34.3	19.7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic
	Sample Station Name	CSWELL01	CSWELL01	CSWELL01	CSWELL01	CSWELL01	CSWELL01	DWWELL01	DWWELL01	DWWELL01	DWWELL01
	Sample Date	7/22/10	10/4/10	2/10/11	5/16/11	8/18/11	11/21/11	8/27/09	10/21/09	1/22/10	5/13/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	642	646	641	673	456	644	647	589	597	586
Ammonia	mg/L	-0.1	0.1	0.1	-0.1	0.5	-0.1	1.2	0.6	0.4	0.4
Fluoride	mg/L	0.3	0.3	0.3	0.4	0.3	0.3	0.7	0.7	0.6	0.6
Laboratory conductivity	µmhos/cm	2600	2100	1550	2600	2200	2480	2690	2560	2500	2210
Laboratory pH	s.u.	8.3	8.4	8.4	8.3	8.7	8.5	8.4	8.5	8.4	8.4
Nitrate/Nitrite	mg/L	0.9	0.5	-0.1	1.2	-0.1	0.7	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1920	1430	1150	2520	1480	1830	1880	1780	1820	1820
Calcium	mg/L	43	22	10	62	35	39	16	16	16	17
Magnesium	mg/L	33	18	6	50	23	30	6	6	6	6
Potassium	mg/L	12	12	8	16	14	12	11	12	12	12
Sodium	mg/L	570	459	414	700	471	501	629	665	610	624
Bicarbonate	mg/L	772	763	759	821	504	737	774	682	710	689
Carbonate	mg/L	5	12	11	-5	26	24	8	18	9	13
Chloride	mg/L	7	4	3	14	3	13	16	8	7	11
Sulfate	mg/L	723	460	244	1110	644	680	690	794	689	727
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4	0.4	0.3	0.5	0.4	0.4	0.6	0.6	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	1.96	0.21	0.58	0.66
Iron, total	mg/L	-0.05	-0.05	-0.05	0.07	-0.05	-0.05	5.02	2.73	1.84	1.73
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	0.04	-0.02	-0.02	0.07	0.05	0.04	0.03
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.009	0.007	-0.005	0.019	-0.005	0.006	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	0.005	-0.003	-0.003				
Uranium, dissolved	mg/L	0.02	0.011	0.004	0.0317	0.0041	0.014	-0.001	-0.001	-0.001	-0.001
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003					-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			-1	1.3					-1
Lead 210, suspended	pCi/L	-1			-1	-1					1.78
Polonium 210, dissolved	pCi/L	-1			-1	-1					-1
Polonium 210, suspended	pCi/L	-1			-1	-1					9.2
Ra-226, dissolved	pCi/L	0.49	0.4	0.2	0.8	0.4	0.4	0.35	-0.2	0.3	0.37
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2					-0.2
Ra-228, dissolved	pCi/L	-1	1.5	-1	-1	-1	1	-1	2.84	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2					-0.2
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2					-0.2
Gross Alpha	pCi/L	14.6	12.2	-5	23.9	-5	12.7	10.7	17.3	14.9	12
Gross Beta	pCi/L	13.2	4.3	-7	18.3	9.7	12.7	6.7	11.8	-10.2	10.5

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
Sample Type*		GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic
Sample Station Name		DWWELL01	DWWELL01	DWWELL01	DWWELL01	DWWELL01	DWWELL01	HBWELL05	HBWELL05	HBWELL05	HBWELL05
Sample Date		7/22/10	10/4/10	2/15/11	5/17/11	8/17/11	11/22/11	8/4/09	1/29/10	5/13/10	7/22/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	593	588	564	589	600	595	499	519	527	521
Ammonia	mg/L	0.4	0.6	0.5	0.4	0.3	0.4	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.6	0.6	0.5	0.5	0.5	0.6	0.3	0.3	0.3	0.2
Laboratory conductivity	µmhos/cm	2540	2540	2240	2080	2790	2520	1570	1520	1370	1610
Laboratory pH	s.u.	8.5	8.5	8.5	8.4	8.6	8.6	8.1	8	8	8.2
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	-0.1	0.2	-0.1
Total Dissolved Solids	mg/L	1820	1760	1760	1780	1770	1460	1100	1090	1160	1160
Calcium	mg/L	17	15	15	15	16	14	87	87	79	90
Magnesium	mg/L	6	6	6	6	6	5	36	34	33	38
Potassium	mg/L	11	13	13	12	13	12	8	8	7	8
Sodium	mg/L	582	558	601	570	612	548	258	232	251	246
Bicarbonate	mg/L	697	690	657	699	685	673	609	633	642	635
Carbonate	mg/L	13	14	15	9	23	26	-5	-5	-5	-5
Chloride	mg/L	7	7	8	8	9	11	6	4	5	4
Sulfate	mg/L	691	663	666	662	711	667	327	355	381	378
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.5	0.5	0.4	0.4	0.5	0.4	0.2	0.2	0.2	0.2
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.88	0.9	0.54	0.48	0.22	0.19	0.49	1.55	1.17	0.82
Iron, total	mg/L	1.73	1.71	1.22	1.61	1.48	1.47	32.8	17	7.38	8.39
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.04	0.03	0.03	0.03	0.03	0.03	0.08	0.12	0.11	0.17
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.007	0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	0.004	-0.003	-0.003				-0.003
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	0.0009	0.0005	0.0005	0.015	0.011	0.01	0.013
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003				-0.001	-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			1	-1				-1	-1
Lead 210, suspended	pCi/L	1.21			1.4	1.8				1.56	-1
Polonium 210, dissolved	pCi/L	-1			-1	-1				-1	-1
Polonium 210, suspended	pCi/L	8.91			6.7	1.9				-1	-1
Ra-226, dissolved	pCi/L	0.21	0.4	0.3	0.3	0.3	0.4	0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	-0.2			-0.2	-0.2				-0.2	-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2				-0.2	-0.2
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2				-0.2	-0.2
Gross Alpha	pCi/L	12.6	11.7	5.2	3.3	-4	-6	7.1	11.8	7.5	11.3
Gross Beta	pCi/L	7.71	7.2	-8	7	8.5	9.7	7.2	10	6.4	8.77

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic
	Sample Station Name	HBWELL05	HBWELL05	HBWELL05	HBWELL05	HBWELL05	HBWELL06	P144030W	P144030W	P31770W	P31770W
	Sample Date	10/5/10	2/10/11	6/29/11	8/12/11	11/21/11	3/23/10	8/24/10	8/16/11	9/3/09	11/18/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	543	543	538	536	541	768	443	438	501	504
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.5	-0.1	-0.1	-0.1	
Fluoride	mg/L	0.2	0.3	0.3	0.3	0.3	2.5	0.1	0.2	0.3	0.3
Laboratory conductivity	µmhos/cm	1660	1530	1830	1820	1620	1410	846	934	2510	2550
Laboratory pH	s.u.	8.1	8	8	8.3	8.2	8.5	8	8.2	8.2	8.2
Nitrate/Nitrite	mg/L	-0.1	-0.1	0.3	-0.1	0.7	-0.1	-0.1	-0.1	0.6	
Total Dissolved Solids	mg/L	1100	1220	1190	1200	1040	960	520	510	1800	1920
Calcium	mg/L	79	89	97	83	93	3	49	45	57	56
Magnesium	mg/L	36	38	44	34	37	2	25	23	25	23
Potassium	mg/L	8	9	12	10	9	3	16	16	14	12
Sodium	mg/L	229	268	288	294	271	397	113	121	593	514
Bicarbonate	mg/L	662	662	657	653	660	886	541	534	612	615
Carbonate	mg/L	-5	-5	-5	-5	-5	25	-5	-5	-5	-5
Chloride	mg/L	4	4	6	5	6	46	1	2	21	21
Sulfate	mg/L	367	383	409	392	370	25	56	55	842	853
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	
Boron, dissolved	mg/L	0.2	0.2	0.2	-0.1	0.2	0.5	-0.1	-0.1	0.3	
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	
Iron, dissolved	mg/L	0.17	0.35	0.47	0.29	0.39	-0.05	0.08	0.33	0.9	
Iron, total	mg/L	2.4	8.02	9.37	47.6	21.3	0.1	0.13	0.38	0.91	
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	
Manganese, total	mg/L	0.15	0.15	0.08	0.09	0.07	0.08	0.08	0.08	0.15	
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	
Selenium, dissolved	mg/L	0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.006	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003		-0.003	-0.003		
Uranium, dissolved	mg/L	0.013	0.013	0.0106	0.0108	0.0119	-0.001	0.024	0.0274	0.017	0.015
Uranium, suspended	mg/L			-0.0003	0.0029			-0.001	-0.0003		
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	
Zinc, dissolved	mg/L	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.02	
Lead 210, dissolved	pCi/L			1.4	1			-1	1.3		
Lead 210, suspended	pCi/L			1.7	6.8			-1	-1		
Polonium 210, dissolved	pCi/L			-1	-1			-1	-1		
Polonium 210, suspended	pCi/L			-1	1.5			-1	-1		
Ra-226, dissolved	pCi/L	0.2	0.3	-0.2	0.2	0.2	0.27	0.8	0.9	0.32	
Ra-226, suspended	pCi/L			-0.2	1.2			-0.2	-0.2		
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	
Th-230, dissolved	pCi/L			-0.2	-0.2			-0.2	-0.2		
Th-230, suspended	pCi/L			-0.2	-0.2			-0.2	-0.2		
Gross Alpha	pCi/L	12.7	7.7	9.6	10	9.2	-2	23.9	20.4	7.8	36.8
Gross Beta	pCi/L	7.2	-8	12.1	7.4	8	3.6	23.8	17.2	12.9	17.1

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic (e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data											
		Sample Results									
	Sample Type*	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic
	Sample Station Name	P31770W	P42868W	P42868W	P42868W	P61006W	P61006W	P61006W	P61006W	P61006W	P78287W
	Sample Date	1/22/10	8/31/09	6/7/11	8/16/11	8/31/09	2/16/11	6/7/11	8/16/11	12/7/11	9/1/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	499	547	562	558	490	530	491	504	490	116
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	0.4
Fluoride	mg/L	0.3	0.3	0.3	0.2	0.1	0.2	0.1	0.1	0.1	1.1
Laboratory conductivity	µmhos/cm	2550	1250	1120	1370	1030	1180	880	1140	1010	841
Laboratory pH	s.u.	8.2	8.7	8.6	8.8	8.3	8.4	8.1	8.5	8.2	8
Nitrate/Nitrite	mg/L	1.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1890	810	810	790	660	840	640	650	650	580
Calcium	mg/L	74	2	3	2	18	18	18	15	18	22
Magnesium	mg/L	37	1	1	1	9	9	9	7	9	5
Potassium	mg/L	11	3	4	4	8	9	8	8	9	6
Sodium	mg/L	565	321	342	329	244	299	239	254	221	148
Bicarbonate	mg/L	609	616	651	623	578	636	599	590	597	142
Carbonate	mg/L	-5	25	17	29	9	5	-5	13	-5	-5
Chloride	mg/L	23	1	2	2	-1	3	1	2	2	6
Sulfate	mg/L	865	117	119	116	74	158	70	78	78	260
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	0.02	0.02	0.016	-0.005	-0.005	0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.5
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	0.09	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.05	-0.05	-0.05	0.08	0.16	0.13	0.4	0.16	0.18	0.14
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.04	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.12
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.006	-0.005	-0.005	-0.005	-0.005	-0.005	0.006	-0.005	-0.005	-0.005
Silver, dissolved	mg/L			-0.003	-0.003		-0.003	-0.003	-0.003	-0.003	
Uranium, dissolved	mg/L	0.071	-0.001	-0.0003	-0.0003	0.002	0.0019	0.0016	0.0021	0.0023	-0.001
Uranium, suspended	mg/L			-0.0003	-0.0003			-0.0003	-0.0003		
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.06	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L			-1	-1			-1	-1		
Lead 210, suspended	pCi/L			1.2	-1			-1	2.2		
Polonium 210, dissolved	pCi/L			-1	-1			-1	-1		
Polonium 210, suspended	pCi/L			-1	-1			-1	-1		
Ra-226, dissolved	pCi/L	0.43	-0.2	-0.2	-0.2	1.13	0.6	0.6	0.8	0.8	-0.2
Ra-226, suspended	pCi/L			-0.2	-0.2			-0.2	-0.2		
Ra-228, dissolved	pCi/L	-1	-1	1.8	-1	-1	-1	3.2	-1	-1	-1
Th-230, dissolved	pCi/L			-0.2	-0.2			-0.2	-0.2		
Th-230, suspended	pCi/L			-0.2	-0.2			-0.2	-0.2		
Gross Alpha	pCi/L	35.8	-2	-2	-2	4.8	6.9	5.2	7.4	-3	-2
Gross Beta	pCi/L	14.4	-3	-4	-4	3.6	10.3	5.3	7.3	10.1	4.1

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

	Sample Results										
	Sample Type*	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic
	Sample Station Name	TSWELL01	TW01	TW01	TW01	TW01	TW01	TW01	TW01	TW01	TW01
	Sample Date	10/22/09	7/29/09	1/23/10	5/14/10	7/21/10	10/5/10	2/10/11	5/5/11	8/11/11	11/21/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	587	836	684	668	685	689	687	683	688	686
Ammonia	mg/L	-0.1	-0.1	-0.1	0.2	0.2	0.2	0.2	0.1	-0.1	0.2
Fluoride	mg/L	0.4	1.2	1.2	1.2	1.2	1.2	1.2	1	1.1	1.2
Laboratory conductivity	µmhos/cm	1300	2000	2000	2150	2050	2020	1910	1770	2280	2010
Laboratory pH	s.u.	8.7	8.4	8.4	8.4	8.4	8.5	8.4	8.5	8.5	8.6
Nitrate/Nitrite	mg/L	0.1	-0.05	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	910	1350	1440	1380	1430	1360	1440	1390	1470	1410
Calcium	mg/L	4	9	8	9	9	8	9	9	15	8
Magnesium	mg/L	2	4	4	4	5	4	4	4	8	4
Potassium	mg/L	4	7	6	7	7	8	8	8	10	9
Sodium	mg/L	353	509	457	438	477	473	507	539	528	492
Bicarbonate	mg/L	666	935	815	798	810	793	823	796	807	772
Carbonate	mg/L	24	42	10	8	13	23	8	18	16	32
Chloride	mg/L	1	8	5	7	4	4	5	6	6	7
Sulfate	mg/L	122	331	393	379	392	375	377	400	426	341
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.1	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.3	0.59	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cadmium, dissolved	mg/L	-0.002	-0.0001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	0.001	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.03	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.22	0.04	0.08	-0.05	0.09	0.12	-0.05	0.07	0.18	0.11
Lead, dissolved	mg/L	-0.02	-0.002	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.02	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.012
Silver, dissolved	mg/L					-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.004	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.0003	-0.0003	-0.0003
Uranium, suspended	mg/L				-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	0.01	0.02	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L				-1	-1			-1	-1	
Lead 210, suspended	pCi/L				-1	-1			-1	1.3	
Polonium 210, dissolved	pCi/L				-1	-1			-1	-1	
Polonium 210, suspended	pCi/L				-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	0.46	-0.2	0.2	0.32	-0.2	0.3	-0.2	0.3	0.3	0.3
Ra-226, suspended	pCi/L				-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	1.17	-1	-1	-1	-1	-1	2.5	-1	-1	-1
Th-230, dissolved	pCi/L				-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L				-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	10.8	-2	-2	-2	-3.7	4.2	-4	-4	-4	4.8
Gross Beta	pCi/L	7.3	-3	-4.11	5.8	8.55	4.4	-7	-7	-7	-8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results											
Sample Type*		GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Domestic	GW Industrial
Sample Station Name		TW02	TW02	TW02	TW02	TW02	TW02	TW02	TW02	TW02	19XX18
Sample Date		7/29/09	10/21/09	1/23/10	5/13/10	7/21/10	10/5/10	2/10/11	5/4/11	8/12/11	8/6/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	646	654	621	613	630	632	631	627	617	656
Ammonia	mg/L	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.3	0.1	-0.1
Fluoride	mg/L	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.6	0.5
Laboratory conductivity	µmhos/cm	2190	2110	2110	1840	2170	2160	2010	1770	2310	2410
Laboratory pH	s.u.	8.3	8.5	8.3	8.3	8.3	8.4	8.3	8.4	8.5	8.5
Nitrate/Nitrite	mg/L	-0.05	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.5
Total Dissolved Solids	mg/L	1500	1450	1550	1500	1500	1490	1580	1510	1490	1730
Calcium	mg/L	19	19	24	26	26	24	26	25	26	7
Magnesium	mg/L	8	8	11	11	12	11	11	11	11	2
Potassium	mg/L	11	11	12	11	13	13	14	12	13	5
Sodium	mg/L	543	544	477	484	482	466	519	518	514	655
Bicarbonate	mg/L	780	762	757	742	754	755	769	734	716	746
Carbonate	mg/L	-5	18	-5	-5	8	8	-5	15	18	27
Chloride	mg/L	15	10	10	11	9	8	10	10	11	6
Sulfate	mg/L	576	481	513	502	498	467	506	500	496	646
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.1	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.52	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5
Cadmium, dissolved	mg/L	-0.0001	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	0.002	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.06	0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.11	0.22	0.13	-0.05	0.12	-0.05	-0.05	0.06	-0.05	-0.05
Lead, dissolved	mg/L	-0.002	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.02	0.02	0.03	0.03	0.03	0.03	0.02	0.02	0.03	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L					-0.003	-0.003	-0.003	-0.003	-0.003	
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	0.0004	-0.0003	0.086
Uranium, suspended	mg/L				-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.02	0.01	0.02	0.01	0.03	0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L				-1	-1			-1	1.2	
Lead 210, suspended	pCi/L				-1	-1			1.2	1	
Polonium 210, dissolved	pCi/L				-1	-1			-1	-1	
Polonium 210, suspended	pCi/L				-1	-1			-1	-1	
Ra-226, dissolved	pCi/L	0.45	0.31	0.49	0.49	0.41	1.1	0.4	0.6	0.4	39.5
Ra-226, suspended	pCi/L				-0.2	-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	1.54	-1	-1	-1	-1	1.3	-1	-1	-1
Th-230, dissolved	pCi/L				-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L				-0.2	-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	2.4	4.4	3.1	-2	4.61	3.1	-5	-4	6.6	227
Gross Beta	pCi/L	-3	11.7	8.6	6.6	10.4	9.2	-8	9.6	9.6	52.3

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

	Sample Results										
	Sample Type*	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial
	Sample Station Name	19XX18	19XX18	19XX18	19XX18	19XX18	19XX18	19XX18	19XX18	19XX18	19XX18
	Sample Date	10/21/09	1/21/10	1/22/10	5/14/10	7/9/10	10/4/10	2/16/11	5/6/11	9/7/11	11/22/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	659	555		521	531	534	567	536	537	536
Ammonia	mg/L	-0.1	0.2		-0.1	-0.1	-0.1	0.6	-0.1	-0.1	-0.1
Fluoride	mg/L	0.5	0.6		0.6	0.6	0.5	0.5	0.4	0.5	0.6
Laboratory conductivity	µmhos/cm	2360	2320		2390	2370	2390	2220	2010	2510	2420
Laboratory pH	s.u.	8.6	8.6		8.5	8.6	8.6	8.6	8.6	8.6	8.6
Nitrate/Nitrite	mg/L	0.5	0.1		0.5	0.5	0.5	-0.1	0.5	0.3	0.4
Total Dissolved Solids	mg/L	1660	1690		1690	1790	1660	1690	1720	1650	1710
Calcium	mg/L	7	8		8	7	7	7	8	6	7
Magnesium	mg/L	2	3		3	3	3	2	3	2	2
Potassium	mg/L	5	4		4	4	5	4	4	5	5
Sodium	mg/L	629	580		499	543	542	592	614	593	559
Bicarbonate	mg/L	770	639		605	610	609	655	607	622	597
Carbonate	mg/L	17	19		15	19	21	18	23	17	28
Chloride	mg/L	7	6		8	7	6	6	8	8	10
Sulfate	mg/L	685	616		663	664	639	617	680	608	625
Aluminum, dissolved	mg/L	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5		-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.5	0.5		0.5	0.4	0.5	0.4	0.5	0.5	0.4
Cadmium, dissolved	mg/L	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05		-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.14	-0.05		-0.05	-0.05	-0.05	0.08	-0.05	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Mercury	mg/L	-0.001	-0.001		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L					-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.085	0.074		0.089	0.087	0.078	0.0726	0.0779	0.0835	0.0837
Uranium, suspended	mg/L				-0.001	-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	2.41			3.04	6.13			3.9	13.4	
Lead 210, suspended	pCi/L				1.43	2.8			1.7	3.4	
Polonium 210, dissolved	pCi/L	-1			4.04	6.4			4	1.1	
Polonium 210, suspended	pCi/L				3.91	5.9			-1	5.1	
Ra-226, dissolved	pCi/L	47.23	37.3		43.7	39.4	42	31.1	37.1	35.6	37.5
Ra-226, suspended	pCi/L				0.31	0.28			-0.2	0.7	
Ra-228, dissolved	pCi/L	1.65	1.35		-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L				-0.2	-0.2			-0.2	0.2	
Gross Alpha	pCi/L	185.2	252		267	167.7	324	267	190	233	207
Gross Beta	pCi/L	39.7	75		65.7	54	81.4	116	57.9	72.1	53.2

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Industrial	GW Stock
	Sample Station Name	22X-19	22X-19	22X-19	22X-19	22X-19	22X-19	22X-19	22X-19	22X-19	CSWELL03
	Sample Date	1/21/10	1/22/10	5/14/10	7/9/10	10/4/10	2/17/11	5/6/11	9/7/11	11/22/11	10/23/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	467		462	471	472	475	475	469	470	327
Ammonia	mg/L	0.3		0.3	0.4	0.5	0.3	0.4	0.3	0.4	-0.1
Fluoride	mg/L	0.6		0.7	0.7	0.6	0.6	0.5	0.6	0.6	0.1
Laboratory conductivity	µmhos/cm	2030		1840	2070	2080	2010	1820	2180	2110	651
Laboratory pH	s.u.	8.6		8.6	8.6	8.7	8.6	8.7	8.7	8.7	8.2
Nitrate/Nitrite	mg/L	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1460		1440	1520	1420	1470	1450	1390	1450	430
Calcium	mg/L	6		6	6	5	6	6	5	6	28
Magnesium	mg/L	2		2	2	2	2	2	1	2	15
Potassium	mg/L	4		4	4	5	5	4	4	5	9
Sodium	mg/L	444		465	507	474	537	522	506	508	97
Bicarbonate	mg/L	528		520	547	523	527	523	515	515	399
Carbonate	mg/L	21		21	13	26	26	28	28	29	-5
Chloride	mg/L	10		13	10	10	13	13	11	15	4
Sulfate	mg/L	520		535	538	511	569	546	517	501	32
Aluminum, dissolved	mg/L	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5		-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.4		0.4	0.4	0.4	0.4	0.4	0.4	0.4	-0.1
Cadmium, dissolved	mg/L	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.06		-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.16
Iron, total	mg/L	0.07		0.05	0.06	-0.05	0.06	0.05	0.05	-0.05	3.62
Lead, dissolved	mg/L	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	0.08
Mercury	mg/L	-0.001		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L				-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	
Uranium, dissolved	mg/L	0.02		0.022	0.021	0.02	0.0213	0.02	0.016	0.0199	0.001
Uranium, suspended	mg/L			-0.001	-0.001			-0.0003	-0.0003		
Vanadium, dissolved	mg/L	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L			-1	-1			1.1	3		
Lead 210, suspended	pCi/L			1.21	1.46			-1	1.8		
Polonium 210, dissolved	pCi/L			-1	-1			-1	-1		
Polonium 210, suspended	pCi/L			-1	1.12			-1	-1		
Ra-226, dissolved	pCi/L	3.38		3.05	3.08	3.2	2.8	3.4	3.1	3.2	0.4
Ra-226, suspended	pCi/L			-0.2	-0.2			-0.2	-0.2		
Ra-228, dissolved	pCi/L	-1		-1	-1	1.4	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L			-0.2	-0.2			-0.2	-0.2		
Th-230, suspended	pCi/L			-0.2	-0.2			-0.2	-0.2		
Gross Alpha	pCi/L	46.3		45.3	38.5	47.9	42.6	40.3	48.2	30.1	-2
Gross Beta	pCi/L	7.3		9.3	12.3	12.2	-7	9.4	12	8.2	8.5

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results

Parameter**	Units	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
Sample Type*		GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
Sample Station Name		CSWELL03	CSWELL03	CSWELL03	CSWELL03	HBWELL01	HBWELL03	HBWELL03	HBWELL03	HBWELL03	HBWELL03
Sample Date		5/18/10	7/22/10	10/4/10	5/16/11	8/3/09	8/3/09	1/28/10	5/14/10	7/21/10	10/4/10
Alkalinity (as CaCO3)	mg/L	318	324	336	304	343	485	460	494	524	531
Ammonia	mg/L	0.3	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	0.2	0.3
Fluoride	mg/L	0.2	0.1	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Laboratory conductivity	µmhos/cm	543	617	654	542	732	1720	1520	1790	1800	1760
Laboratory pH	s.u.	8.4	8.1	8.2	8.3	8	8.2	8	8	8.1	8.1
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	1.6	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	390	380	370	370	440	1230	1140	1370	1310	1210
Calcium	mg/L	35	37	38	30	63	83	95	106	91	79
Magnesium	mg/L	18	19	20	17	47	52	55	56	52	44
Potassium	mg/L	9	9	9	9	14	16	14	17	17	20
Sodium	mg/L	76	74	82	86	26	248	178	238	267	275
Bicarbonate	mg/L	379	395	410	368	419	591	561	603	640	648
Carbonate	mg/L	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
Chloride	mg/L	3	3	3	6	6	15	9	13	11	8
Sulfate	mg/L	28	28	32	32	53	411	402	540	437	408
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.1	0.1	0.2	0.2
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.55	0.83	0.5	0.44	0.21	0.55	2.25	2.78	3.94	4.14
Iron, total	mg/L	1.3	1.51	3.94	5.19	0.8	2.33	4.76	3.86	7.22	6.42
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.34	0.32	0.32	0.21	-0.02	0.15	0.25	0.25	0.9	0.21
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.006	-0.005	-0.005	-0.005	0.006	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L		-0.003	-0.003	0.005					-0.003	-0.003
Uranium, dissolved	mg/L	0.001	0.001	-0.001	0.0017	0.01	0.006	0.005	0.006	0.004	0.002
Uranium, suspended	mg/L	-0.001	-0.001		-0.0003				-0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	0.01	-0.01	0.01	0.18	0.25	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1	-1		-1				-1	-1	
Lead 210, suspended	pCi/L	-1	-1		-1				1.21	-1	
Polonium 210, dissolved	pCi/L	-1	-1		-1				-1	-1	
Polonium 210, suspended	pCi/L	-1	-1		-1				-1	-1	
Ra-226, dissolved	pCi/L	0.3	0.34	0.4	0.3	0.27	0.87	0.85	1.03	0.77	0.8
Ra-226, suspended	pCi/L	-0.2	-0.2		-0.2				0.32	0.5	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	1.2	-1	1.2	-1	-1
Th-230, dissolved	pCi/L	-0.2	-0.2		-0.2				-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2	-0.2		-0.2				-0.2	-0.2	
Gross Alpha	pCi/L	2.5	5.53	3.5	2.9	5.8	8.8	7	7.1	8.73	10.1
Gross Beta	pCi/L	7.7	7.36	8.8	6.7	12.2	9.3	11.2	11.5	17.3	15.4

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
	Sample Station Name	HBWELL03	HBWELL03	HBWELL03	HBWELL03	HBWELL04	HBWELL04	HBWELL04	HBWELL04	HBWELL04	HBWELL04
	Sample Date	2/10/11	6/29/11	8/12/11	11/21/11	8/3/09	9/1/09	1/29/10	5/13/10	7/21/10	6/29/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	531	493	503	525	351		444	354	364	362
Ammonia	mg/L	0.2	-0.1	-0.1	0.2	-0.1		-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.3	0.3	0.3	0.3	0.2		0.2	0.2	0.2	0.1
Laboratory conductivity	µmhos/cm	1660	2030	1980	1740	1740	1730	1620	1640	1700	1820
Laboratory pH	s.u.	8	8	8.2	8.3	8	7.8	7.9	7.8	7.9	7.8
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	1.1		1.2	0.9	0.9	0.6
Total Dissolved Solids	mg/L	1360	1330	1350	1190	1420	1460	1380	1380	1370	1360
Calcium	mg/L	81	83	96	81	202		203	195	199	208
Magnesium	mg/L	41	52	50	41	60		62	58	64	66
Potassium	mg/L	20	17	19	21	7		7	7	7	8
Sodium	mg/L	305	315	294	292	133		141	117	123	136
Bicarbonate	mg/L	647	601	614	641	429		542	432	444	442
Carbonate	mg/L	-5	-5	-5	-5	-5		-5	-5	-5	-5
Chloride	mg/L	11	20	14	13	17		12	14	12	15
Sulfate	mg/L	433	508	490	424	597		654	591	583	585
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5		-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.2	0.1	0.1	-0.1		-0.1	-0.1	-0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	4.83	3.8	-0.05	5.89	-0.05		-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	4.31	5.69	5.22	9.34	0.95		0.92	0.46	0.07	1.21
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.2	0.23	0.25	0.23	0.08		0.08	0.07	0.07	0.09
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001		-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003					-0.003	-0.003
Uranium, dissolved	mg/L	0.002	0.004	0.0033	0.0018	0.034	0.039	0.033	0.034	0.033	0.029
Uranium, suspended	mg/L		-0.0003	-0.0003					-0.001	-0.001	-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.02	-0.01	-0.01	0.04	0.03		0.05	0.04	0.03	0.05
Lead 210, dissolved	pCi/L		1.3	-1					-1	-1	1.8
Lead 210, suspended	pCi/L		-1	1.1					1.8	-1	-1
Polonium 210, dissolved	pCi/L		-1	-1					-1	-1	-1
Polonium 210, suspended	pCi/L		-1	-1					-1	-1	-1
Ra-226, dissolved	pCi/L	0.7	0.5	0.5	0.6	0.28	0.45	0.31	0.31	0.52	0.2
Ra-226, suspended	pCi/L		0.4	0.2					-0.2	0.59	-0.2
Ra-228, dissolved	pCi/L	1.1	1.1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2					-0.2	-0.2	-0.2
Th-230, suspended	pCi/L		-0.2	-0.2					-0.2	-0.2	-0.2
Gross Alpha	pCi/L	-4	-5	5.6	-4	20.7	16.1	15.2	12.1	23	20.9
Gross Beta	pCi/L	12.5	16	13.4	18.2	7.9	11.2	9.1	11	17.4	9.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
	Sample Station Name	HBWELL04	HBWELL04	P17177W	P17177W	P17177W	P17177W	P17177W	P17177W	P17177W	P17177W
	Sample Date	8/12/11	11/21/11	8/27/09	11/18/09	8/11/10	10/6/10	3/1/11	5/17/11	8/17/11	12/6/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	361	365	339	415	331	320	313	326	322	306
Ammonia	mg/L	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.2	0.2	0.1	0.1	-0.1	0.1	0.1	0.1	-0.1	0.1
Laboratory conductivity	µmhos/cm	1800	1630	923	904	889	822	755	746	944	684
Laboratory pH	s.u.	8	8.1	7.8	7.9	8	8	8.1	7.9	8	7.9
Nitrate/Nitrite	mg/L	0.8	0.9	21.9		22.4	20	14.9	-0.1	16.3	0.2
Total Dissolved Solids	mg/L	1350	1260	610	580	590	530	500	580	550	440
Calcium	mg/L	201	189	115	117	108	100	91	103	98	60
Magnesium	mg/L	58	60	30	31	30	27	23	27	26	17
Potassium	mg/L	8	8	5	5	5	5	5	5	5	5
Sodium	mg/L	137	132	39	38	38	39	43	33	42	71
Bicarbonate	mg/L	441	445	414	507	404	391	382	398	395	373
Carbonate	mg/L	-5	-5	-5	-5	-5	-5	-5	-5	-5	-5
Chloride	mg/L	15	16	21	20	19	17	18	25	26	15
Sulfate	mg/L	587	576	46	41	40	45	45	41	39	55
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5		-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05		-0.05	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.87	0.53	0.11		-0.05	-0.05	-0.05	0.08	1.54	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.08	0.07	-0.02		-0.02	-0.02	-0.02	-0.02	0.13	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	0.005	-0.005	-0.005	0.01	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0291	0.0301	0.024	0.024	0.022	0.022	0.0214	0.0263	0.023	0.0189
Uranium, suspended	mg/L	-0.0003				-0.001			-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.07	0.02	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	1.2				-1			-1	-1	
Lead 210, suspended	pCi/L	-1				-1			-1	1.8	
Polonium 210, dissolved	pCi/L	-1				-1			-1	-1	
Polonium 210, suspended	pCi/L	-1				-1			-1	-1	
Ra-226, dissolved	pCi/L	0.3	0.3	-0.2		-0.2	0.3	-0.2	-0.2	0.2	-0.2
Ra-226, suspended	pCi/L	-0.2				-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	1.2	-1	-1		-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2				-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2				-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	19.6	16.6	19.5	12.1	16.8	15.7	17.1	12.9	11.6	5.8
Gross Beta	pCi/L	14.4	10.3	6.4	7.3	8.6	9.8	13.6	10	4.1	7.4

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results											
	Sample Type*	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
	Sample Station Name	P21128P	P21128P	P21128P	P22582P	P22582P	P22582P	P22582P	P50113W	P50113W	P50113W
	Sample Date	6/24/10	8/24/10	10/7/10	10/22/09	10/7/10	6/29/11	8/16/11	8/28/09	11/18/09	8/11/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	414	438	425	440	491	381	378	511	553	536
Ammonia	mg/L	-0.1	-0.1	0.1	-0.1	0.6	-0.1	-0.1	-0.1		0.5
Fluoride	mg/L	0.2	0.1	0.2	0.6	0.9	0.3	0.3	0.2	0.3	0.2
Laboratory conductivity	µmhos/cm	962	956	973	972	1120	895	881	1840	1710	1500
Laboratory pH	s.u.	8.4	8.4	8.5	8.6	8.7	8.5	8.4	8	8	8.1
Nitrate/Nitrite	mg/L	1.3	1.1	1.6	-0.1	-0.1	-0.1	-0.1	44.9		23.9
Total Dissolved Solids	mg/L	640	620	620	610	730	520	500	1320	1150	1060
Calcium	mg/L	19	13	20	12	6	24	24	120	111	97
Magnesium	mg/L	9	7	11	6	3	12	12	67	60	52
Potassium	mg/L	18	15	20	5	4	8	7	7	7	6
Sodium	mg/L	185	207	205	234	277	171	159	208	190	162
Bicarbonate	mg/L	491	514	492	500	536	443	448	624	675	654
Carbonate	mg/L	7	10	13	18	31	11	7	-5	-5	-5
Chloride	mg/L	3	2	3	4	2	6	6	63	48	36
Sulfate	mg/L	96	91	96	85	112	62	60	249	259	172
Aluminum, dissolved	mg/L	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005		-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5		-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	0.2	0.3	0.1	0.1	-0.1		-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Iron, dissolved	mg/L	0.1	-0.05	-0.05	-0.05	0.07	0.8	0.8	-0.05		-0.05
Iron, total	mg/L	5.81	16.5	0.13	0.22	0.11	1.32	1.57	-0.05		-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Manganese, total	mg/L	0.17	0.51	-0.02	-0.02	-0.02	0.05	0.04	0.07		0.44
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001		-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Selenium, dissolved	mg/L	0.127	0.103	0.165	-0.005	-0.005	-0.005	-0.005	0.042	0.026	0.05
Silver, dissolved	mg/L		-0.003	-0.003		-0.003	-0.003	-0.003			-0.003
Uranium, dissolved	mg/L	0.388	0.271	0.375	0.003	-0.001	0.0035	0.004	0.212	0.21	0.173
Uranium, suspended	mg/L	0.004	0.002				-0.0003	-0.0003			-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Lead 210, dissolved	pCi/L	1.76	17.4				1.6	1.1			2.1
Lead 210, suspended	pCi/L	1.26	1.8				-1	3.6			-1
Polonium 210, dissolved	pCi/L	-1	-1				-1	-1			-1
Polonium 210, suspended	pCi/L	-1	-1				-1	-1			-1
Ra-226, dissolved	pCi/L	0.21	0.3	0.3	-0.2	-0.2	-0.2	-0.2	0.6		0.5
Ra-226, suspended	pCi/L	0.91	0.7				-0.2	-0.2			-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	2.59	-1	1.6	-1	-1		-1
Th-230, dissolved	pCi/L	-0.58	-0.2				-0.2	-0.2			-0.2
Th-230, suspended	pCi/L	0.49	0.209				-0.2	-0.2			-0.2
Gross Alpha	pCi/L	239	178	224	2.7	2.8	3.3	3.9	87.3	90.4	78.6
Gross Beta	pCi/L	123.2	128	67.9	4.1	-3	5.9	4.7	40.7	37.3	40.1

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results		GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
Sample Station Name		P50113W	P50113W	P50113W	P50113W	P50113W	P50883W	P50883W	P50883W	P50883W	P61007W
Sample Date		10/6/10	3/1/11	5/17/11	8/17/11	12/6/11	8/24/10	10/7/10	6/29/11	8/16/11	8/31/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	534	535	534	527	524	296	340	348	342	537
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Laboratory conductivity	µmhos/cm	1640	1390	1260	1360	1660	588	686	775	753	1170
Laboratory pH	s.u.	8	8.3	7.9	8.1	7.8	8.1	8.2	8.4	8.3	8.8
Nitrate/Nitrite	mg/L	29	12.2	19.1	11.1	30.5	0.1	0.2	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1130	1050	1070	800	1220	370	430	430	410	720
Calcium	mg/L	94	94	90	81	118	33	44	46	45	3
Magnesium	mg/L	54	51	50	45	64	16	20	21	19	1
Potassium	mg/L	7	7	7	6	8	7	6	6	6	3
Sodium	mg/L	202	201	193	139	209	81	81	95	91	293
Bicarbonate	mg/L	652	653	652	642	639	361	414	409	411	591
Carbonate	mg/L	-5	-5	-5	-5	-5	-5	-5	8	-5	32
Chloride	mg/L	41	35	39	28	70	3	3	4	4	-1
Sulfate	mg/L	231	219	193	111	203	39	44	45	44	83
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.007
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	0.07	0.09	0.07	0.14	-0.05
Iron, total	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	1.6	0.23	8.94	7.71	0.17
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.42	0.6	0.37	0.39	0.5	0.05	0.02	0.11	0.09	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	0.03	0.024	0.027	0.023	0.022	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	
Uranium, dissolved	mg/L	0.189	0.191	0.207	0.174	0.181	0.025	0.028	0.0278	0.0325	0.001
Uranium, suspended	mg/L			-0.0003	-0.0003		-0.001		0.0003	0.0015	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	0.04	0.07	0.14	0.16	-0.01
Lead 210, dissolved	pCi/L			-1	2.2		-1		3.5	2.3	
Lead 210, suspended	pCi/L			1	1.4		-1		3.4	3.5	
Polonium 210, dissolved	pCi/L			-1	-1		-1		-1	-1	
Polonium 210, suspended	pCi/L			-1	-1		-1		1.2	-1	
Ra-226, dissolved	pCi/L	0.2	0.2	0.3	0.3	0.5	7.7	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L			-0.2	-0.2		-0.2		-0.2	-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	1.27	-1	-1	-1
Th-230, dissolved	pCi/L			-0.2	-0.2		-0.2		-0.2	-0.2	
Th-230, suspended	pCi/L			-0.2	-0.2		-0.2		-0.2	-0.2	
Gross Alpha	pCi/L	100	117	101	69.7	73.3	15.4	16.9	14.8	18.8	2.3
Gross Beta	pCi/L	38.1	51.9	40.7	27.1	33.1	10.1	6.4	12.3	13.1	-3

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results

Parameter**	Units	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
Sample Type*		GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
Sample Station Name		P61007W	P61007W	P61007W	P71108W	P71108W	P71108W	P71108W	P71108W	P71108W	P71108W
Sample Date		2/16/11	6/7/11	12/7/11	8/27/09	11/18/09	6/23/10	8/11/10	3/1/11	5/17/11	12/6/11
Alkalinity (as CaCO3)	mg/L	536	531	521	580	572	541	549	549	590	588
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Laboratory conductivity	µmhos/cm	1050	985	1110	2190	1930	1670	1660	1490	1600	1860
Laboratory pH	s.u.	8.6	8.5	8.5	8	7.9	8	8.1	8.3	8	7.9
Nitrate/Nitrite	mg/L	0.3	-0.1	0.3	0.6		0.2	0.2	0.1	0.2	0.3
Total Dissolved Solids	mg/L	730	720	720	1610	1460	1200	1160	1170	1460	1380
Calcium	mg/L	3	3	3	76	75	70	65	64	62	65
Magnesium	mg/L	1	1	2	98	79	71	66	56	67	68
Potassium	mg/L	3	3	5	9	9	9	9	9	9	10
Sodium	mg/L	293	295	280	381	328	230	242	252	329	346
Bicarbonate	mg/L	617	619	603	707	698	660	670	670	720	718
Carbonate	mg/L	18	15	16	-5	-5	-5	-5	-5	-5	-5
Chloride	mg/L	1	1	2	7	7	5	4	5	8	9
Sulfate	mg/L	83	81	86	679	601	387	377	321	516	498
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1		-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.006	0.008	-0.005	-0.005		-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5		-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.2	0.2	0.1		-0.1	-0.1	-0.1	0.1	0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002		-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05		-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	0.08	0.3	1.5	0.07		-0.05	-0.05	0.15	0.33	0.19
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	0.25		0.18	0.21	0.22	0.31	0.29
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001		-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01		-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	0.026	0.015	0.007	0.008	0.014	0.008	0.006
Silver, dissolved	mg/L	-0.003	-0.003	-0.003				-0.003	-0.003	0.039	-0.003
Uranium, dissolved	mg/L	0.0021	0.0041	0.0051	0.113	0.094	0.064	0.065	0.0639	0.097	0.0974
Uranium, suspended	mg/L		-0.0003				-0.001	-0.001		-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02		-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	0.03	-0.01	-0.01	0.03		0.03	0.02	0.06	0.03	0.06
Lead 210, dissolved	pCi/L		-1				-1	-1		-1	
Lead 210, suspended	pCi/L		-1				-1	-1		-1	
Polonium 210, dissolved	pCi/L		-1				-1	-1		-1	
Polonium 210, suspended	pCi/L		-1				-1	-1		-1	
Ra-226, dissolved	pCi/L	-0.2	1.4	0.3	-0.2		0.22	0.9	0.4	0.3	0.2
Ra-226, suspended	pCi/L		-0.2				-0.2	-0.2		-0.2	
Ra-228, dissolved	pCi/L	-1	-1	-1	-1		1.07	1.6	1.2	-1	-1
Th-230, dissolved	pCi/L		-0.2				-0.2	-0.2		-0.2	
Th-230, suspended	pCi/L		-0.2				-0.2	-0.2		-0.2	
Gross Alpha	pCi/L	2.8	5.2	3.9	57.7	59.2	40	37	37.9	50.2	54.4
Gross Beta	pCi/L	-4	-4	5	18.6	22.3	14.8	21.7	16.3	20.9	22.7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

	Sample Results										
	Sample Type*	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
	Sample Station Name	P84665W	P84665W	P84665W	P84665W	P84665W	P84665W	P84665W	SBWELL01	SBWELL01	SBWELL01
	Sample Date	8/28/09	8/11/10	10/6/10	3/1/11	5/17/11	8/17/11	12/6/11	8/27/09	11/18/09	6/23/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	406	412	412	420	471	464	455	531	533	531
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1
Fluoride	mg/L	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	-0.1	0.1
Laboratory conductivity	µmhos/cm	922	936	952	891	875	1120	1020	1170	1130	1140
Laboratory pH	s.u.	8	8.1	8	8.3	8	8.1	7.9	8.7	8.6	8.7
Nitrate/Nitrite	mg/L	0.9	2	2.4	1.4	1.1	0.6	2.1	-0.1		-0.1
Total Dissolved Solids	mg/L	590	650	620	700	690	650	690	740	740	750
Calcium	mg/L	74	81	79	95	88	88	88	1	2	2
Magnesium	mg/L	36	36	37	40	38	43	42	-1	-1	-1
Potassium	mg/L	5	5	6	6	5	6	8	2	3	3
Sodium	mg/L	76	83	75	81	83	87	88	313	268	272
Bicarbonate	mg/L	495	503	502	512	575	566	555	609	600	596
Carbonate	mg/L	-5	-5	-5	-5	-5	-5	-5	20	24	26
Chloride	mg/L	6	8	8	10	11	15	13	1	1	1
Sulfate	mg/L	98	107	107	108	109	108	119	96	102	95
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1		-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.007		0.007
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5		-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1		0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002		-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Iron, dissolved	mg/L	0.07	-0.05	-0.05	-0.05	-0.05	0.38	0.12	-0.05		-0.05
Iron, total	mg/L	3.75	0.07	0.09	0.09	0.11	2.8	1.84	-0.05		-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Manganese, total	mg/L	0.05	0.02	-0.02	-0.02	0.02	0.13	0.03	-0.02		-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001		-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01		-0.01
Selenium, dissolved	mg/L	0.009	0.007	-0.005	0.01	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L		-0.003	-0.003	-0.003	0.004	-0.003	-0.003			
Uranium, dissolved	mg/L	0.056	0.056	0.056	0.0612	0.0688	0.0617	0.0576	0.001	0.001	0.002
Uranium, suspended	mg/L		-0.001			-0.0003	0.0009				-0.001
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02		-0.02
Zinc, dissolved	mg/L	0.08	0.08	0.08	0.06	0.03	0.79	0.06	-0.01		-0.01
Lead 210, dissolved	pCi/L		-1			-1	4				1.04
Lead 210, suspended	pCi/L		-1			1.4	1.7				-1
Polonium 210, dissolved	pCi/L		-1			-1	-1				-1
Polonium 210, suspended	pCi/L		-1			-1	-1				-1
Ra-226, dissolved	pCi/L	0.33	0.3	0.4	0.5	0.3	0.7	0.5	-0.2		-0.2
Ra-226, suspended	pCi/L		-0.2			-0.2	-0.2				-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1		-1
Th-230, dissolved	pCi/L		-0.2			-0.2	-0.2				-0.2
Th-230, suspended	pCi/L		-0.2			-0.2	-0.2				-0.2
Gross Alpha	pCi/L	37.3	26.7	30.8	32.5	41.1	29.5	27.8	-2	2.5	2
Gross Beta	pCi/L	15.2	16	16.4	11	17.6	23	14.5	3.4	-3	-3.7

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock
	Sample Station Name	SBWELL01	SBWELL01	SBWELL01	SBWELL01	SBWELL01	SBWELL01	SBWELL02	SBWELL02	SBWELL02	SBWELL02
	Sample Date	8/11/10	10/6/10	3/1/11	5/17/11	8/17/11	12/6/11	6/23/10	8/11/10	10/6/10	5/17/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	532	535	537	536	524	527	390	387	488	481
Ammonia	mg/L	0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	0.2	0.2
Fluoride	mg/L	-0.1	0.1	-0.1	0.1	-0.1	-0.1	-0.1	-0.1	0.2	0.2
Laboratory conductivity	µmhos/cm	1140	1140	1120	1010	1240	1170	758	735	1010	858
Laboratory pH	s.u.	8.7	8.7	8.9	8.7	8.8	8.6	8.1	8.2	8.3	8.3
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.9	0.3	0.4	-0.1	-0.1
Total Dissolved Solids	mg/L	770	750	770	740	720	760	480	480	650	650
Calcium	mg/L	2	2	2	2	2	2	35	39	19	20
Magnesium	mg/L	-1	-1	-1	-1	-1	-1	23	26	11	11
Potassium	mg/L	3	3	3	3	3	3	15	16	12	12
Sodium	mg/L	274	288	307	307	281	279	106	98	205	219
Bicarbonate	mg/L	602	592	579	595	581	597	476	472	595	587
Carbonate	mg/L	23	30	38	29	29	23	-5	-5	-5	-5
Chloride	mg/L	1	-1	1	2	2	2	-1	1	1	-1
Sulfate	mg/L	96	94	92	93	94	98	40	37	78	80
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.006	0.007	0.006	0.007	0.008	0.007	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.1	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	-0.05	0.14	0.2	0.06	0.07
Iron, total	mg/L	-0.05	-0.05	-0.05	-0.05	-0.05	0.72	0.46	0.61	0.12	0.13
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	0.03	0.05	0.05	0.04	0.05
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	0.01	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	0.005	-0.003	-0.003		-0.003	-0.003	0.031
Uranium, dissolved	mg/L	-0.001	0.002	0.0014	0.0014	0.0014	0.0012	0.005	0.005	-0.001	0.0004
Uranium, suspended	mg/L	-0.001			-0.0003	-0.0003		-0.001	-0.001		-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	-1			1.2	-1		-1	-1		-1
Lead 210, suspended	pCi/L	1.5			-1	1.1		1.11	-1		-1
Polonium 210, dissolved	pCi/L	-1			-1	-1		-1	-1		-1
Polonium 210, suspended	pCi/L	-1			-1	-1		-1	-1		-1
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	0.21	0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	0.7			-0.2	-0.2		-0.2	7		-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	1.22	-1	-1
Th-230, dissolved	pCi/L	-0.2			-0.2	-0.2		-0.2	-0.2		-0.2
Th-230, suspended	pCi/L	-0.2			-0.2	-0.2		-0.2	-0.2		-0.2
Gross Alpha	pCi/L	3.4	2.8	-2	-2	-3	-3	4.1	3.89	2.7	-2
Gross Beta	pCi/L	-3	3.2	-4	-4	-4	-4	12.3	9.53	7.6	8.4

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

Sample Results											
Sample Type*		GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	GW Stock	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring
Sample Station Name		SBWELL02	SBWELL02	TWWELL03	TWWELL03	TWWELL03	TWWELL03	SW-1	SW-1	SW-1	SW-1
Sample Date		8/17/11	12/6/11	7/28/10	10/5/10	5/5/11	8/11/11	3/9/10	4/13/10	3/16/11	4/6/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	469	380	603	596	588	581	331	497	591	421
Ammonia	mg/L	0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1	-0.1	0.2	-0.1
Fluoride	mg/L	0.1	-0.1	1.3	1.5	1.2	1.5	0.2	0.2	0.3	0.1
Laboratory conductivity	µmhos/cm	1070	729	1440	1490	1350	1620	795	1110	1360	876
Laboratory pH	s.u.	8.3	8	8.8	8.7	8.8	8.8	8.2	8.7	8.3	8.5
Nitrate/Nitrite	mg/L	-0.1	0.9	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	-0.1
Total Dissolved Solids	mg/L	610	460	1000	970	990	970	580	790	980	640
Calcium	mg/L	21	36	2	3	3	3	17	37	26	24
Magnesium	mg/L	11	25	1	2	1	1	12	24	22	22
Potassium	mg/L	12	16	7	4	4	4	11	11	13	12
Sodium	mg/L	196	101	374	360	379	386	154	204	306	192
Bicarbonate	mg/L	566	464	664	657	642	635	404	542	721	490
Carbonate	mg/L	-5	-5	35	35	37	37	-5	32	-5	12
Chloride	mg/L	1	2	2	2	3	3	7	8	10	7
Sulfate	mg/L	79	39	201	195	207	198	98	147	178	102
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.1	0.6	0.5	0.5	0.5	-0.1	0.1	0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.11	0.35	-0.05	-0.05	-0.05	-0.05	0.33	0.08	0.32	-0.05
Iron, total	mg/L	0.16	0.55	-0.05	-0.05	-0.05	-0.05	0.95	0.37	0.88	0.24
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.05	0.06	-0.02	-0.02	-0.02	-0.02	0.17	0.05	0.27	0.04
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003
Uranium, dissolved	mg/L	0.0004	0.005	-0.001	-0.001	-0.0003	-0.0003	0.008	0.011	0.014	0.0093
Uranium, suspended	mg/L	-0.0003		-0.001		-0.0003	-0.0003				0.0017
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	1.1		-1		1.2	-1				-1
Lead 210, suspended	pCi/L	2.1		-1		-1	-1				-1
Polonium 210, dissolved	pCi/L	-1		-1		-1	-1				-1
Polonium 210, suspended	pCi/L	-1		-1		-1	-1				-1
Ra-226, dissolved	pCi/L	-0.2	0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	-0.2		-0.2		-0.2	-0.2				-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2		-0.2		-0.2	-0.2				-0.2
Th-230, suspended	pCi/L	-0.2		-0.2		-0.2	-0.2				-0.2
Gross Alpha	pCi/L	-2	3.7	-3.1	6.7	-2	-3	8.8	7.3	7	8.5
Gross Beta	pCi/L	10	13.3	-6.7	6.9	-4	-7	8.6	9.7	8.1	12

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring
	Sample Station Name	SW-1	SW-1	SW-1	SW-1	SW-2	SW-2	SW-2	SW-2	SW-2	SW-2
	Sample Date	5/4/11	5/23/11	6/8/11	8/11/11	3/9/10	4/13/10	3/16/11	4/6/11	5/4/11	5/23/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	471	319	462	559	118	600	133	332	558	235
Ammonia	mg/L	0.3	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1
Fluoride	mg/L	0.2	0.2	0.2	0.3	-0.1	0.3	-0.1	0.1	0.2	0.1
Laboratory conductivity	µmhos/cm	963	688	920	1300	283	1250	317	734	1060	654
Laboratory pH	s.u.	8.5	8.5	8.3	8.3	8.1	8.6	8.1	8.4	8.5	8.3
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	760	520	740	810	220	940	210	550	860	510
Calcium	mg/L	28	25	30	32	14	58	19	44	57	61
Magnesium	mg/L	24	19	24	28	6	29	7	19	28	23
Potassium	mg/L	11	9	9	12	6	7	9	10	8	11
Sodium	mg/L	222	132	192	250	37	216	42	120	225	72
Bicarbonate	mg/L	550	371	553	674	144	655	162	393	633	287
Carbonate	mg/L	12	9	5	-5	-5	38	-5	6	24	-5
Chloride	mg/L	8	5	7	10	3	10	2	5	9	29
Sulfate	mg/L	134	96	119	105	26	168	33	101	148	122
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	0.006	0.011	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.1	-0.1	0.1	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.1	0.08	0.19	0.2	0.26	0.14	0.12	0.12	0.09	0.08
Iron, total	mg/L	0.32	0.4	0.54	0.75	0.64	0.32	0.56	0.2	0.14	0.29
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.12	0.05	0.42	0.64	0.11	0.05	0.08	0.03	-0.02	0.04
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0102	0.0093	0.008	0.0044	0.003	0.02	0.0029	0.0131	0.013	0.0121
Uranium, suspended	mg/L	-0.001	-0.0003	-0.0003	-0.0003				-0.0003	-0.001	-0.0003
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	1.3	1.2	-1	1.9				1.4	1.1	-1
Lead 210, suspended	pCi/L	1.2	-1	1	-1				-1	-1	-1
Polonium 210, dissolved	pCi/L	-1	-1	-1	-1				-1	-1	-1
Polonium 210, suspended	pCi/L	-1	-1	-1	-1				-1	-1	-1
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	-0.2	-0.2	-0.2	-0.2				-0.2	-0.2	-0.2
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	1.3	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2				-0.2	-0.2	-0.2
Th-230, suspended	pCi/L	-0.2	-0.2	-0.2	-0.2				-0.2	-0.2	-0.2
Gross Alpha	pCi/L	10.5	5.9	5.1	3.3	4	7.9	2.5	8.6	5.7	6.5
Gross Beta	pCi/L	11.4	9.3	8.7	8.7	6	7.4	4.6	6.4	8.2	8.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

		Sample Results									
	Sample Type*	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Monitoring	SW Reservoir
	Sample Station Name	SW-2	SW-2	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	SW-3	CSRES02 (R-5)
	Sample Date	6/8/11	8/11/11	3/9/10	4/13/10	3/16/11	4/6/11	5/4/11	5/23/11	6/8/11	8/6/09
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	659	801	357	586	250	442	648	522	599	72
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1
Fluoride	mg/L	0.3	0.4	0.1	0.3	0.1	0.2	0.2	0.2	0.3	-0.1
Laboratory conductivity	µmhos/cm	1130	1930	794	1120	611	971	1140	993	1010	156
Laboratory pH	s.u.	8.5	8.5	8.3	8.8	8.4	8.7	8.4	8.7	8.4	7.5
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	970	1210	580	800	420	740	950	790	820	500
Calcium	mg/L	62	30	24	32	20	35	46	32	45	20
Magnesium	mg/L	32	18	25	35	18	35	44	41	42	4
Potassium	mg/L	8	9	10	11	7	13	9	10	9	14
Sodium	mg/L	264	380	129	196	89	181	250	210	212	3
Bicarbonate	mg/L	754	929	435	619	299	488	755	575	699	88
Carbonate	mg/L	25	24	-5	47	-5	25	17	30	15	-5
Chloride	mg/L	8	8	4	7	3	5	6	6	3	20
Sulfate	mg/L	118	206	92	102	82	149	149	192	89	-1
Aluminum, dissolved	mg/L	0.2	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.3
Arsenic, dissolved	mg/L	0.006	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.028
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.1	0.2	-0.1	0.1	-0.1	0.1	0.2	0.1	0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.11	0.07	0.34	0.07	0.18	0.11	0.26	0.1	0.48	8.32
Iron, total	mg/L	0.18	0.34	0.87	0.58	0.4	0.31	0.93	0.6	0.91	15.1
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.03	0.05	0.17	0.21	0.1	0.06	0.65	0.12	0.71	1.05
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003			-0.003	-0.003	-0.003	-0.003	-0.003	
Uranium, dissolved	mg/L	0.0036	0.0036	0.009	0.014	0.01	0.0239	0.0176	0.0152	0.0098	-0.001
Uranium, suspended	mg/L	-0.0003	-0.0003				-0.0003	-0.001	-0.0003	-0.0003	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.05
Lead 210, dissolved	pCi/L	-1	2				3.3	1.7	-1	-1	
Lead 210, suspended	pCi/L	-1	-1				-1	1.5	1.2	-1	
Polonium 210, dissolved	pCi/L	-1	-1				-1	-1	-1	-1	
Polonium 210, suspended	pCi/L	-1	-1				-1	-1	-1	-1	
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-2.7
Ra-226, suspended	pCi/L	-0.2	-0.2				-0.2	-0.2	-0.2	-0.2	
Ra-228, dissolved	pCi/L	1.7	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2	-0.2				-0.2	-0.2	-0.2	-0.2	
Th-230, suspended	pCi/L	-0.2	-0.2				-0.2	-0.2	-0.2	-0.2	
Gross Alpha	pCi/L	2.4	4.5	7.3	6	4.6	14.9	10.3	12.7	15	2.15
Gross Beta	pCi/L	4.7	9.4	11.2	9.8	5.2	9.9	10.3	9.5	12.4	16.8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir
	Sample Station Name	CSRES02 (R-5)	CSRES02 (R-5)	CSRES02 (R-5)	CSRES02 (R-5)	CSRES02 (R-5)	CSRES03 (R-3)	CSRES03 (R-3)	CSRES03 (R-3)	CSRES03 (R-3)	CSRES03 (R-3)
	Sample Date	10/23/09	5/18/10	8/10/10	5/16/11	8/18/11	8/6/09	10/23/09	5/20/10	8/10/10	10/4/10
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	47	113	147	39	45	117	164	136	154	346
Ammonia	mg/L	-0.1	5.6	4	-0.1	-0.1	-0.1	-0.1	-0.1	0.1	0.6
Fluoride	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	0.1
Laboratory conductivity	µmhos/cm	108	240	327	76	100	296	441	444	544	1000
Laboratory pH	s.u.	7.7	8.1	7.5	7.5	8.4	10	8.6	8.7	9.2	8.5
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	110	220	370	60	100	200	290	270	420	760
Calcium	mg/L	11	30	34	9	9	25	30	35	28	54
Magnesium	mg/L	2	5	7	2	3	8	14	13	12	26
Potassium	mg/L	9	17	23	6	10	9	13	8	14	29
Sodium	mg/L	-1	5	5	2	1	22	37	38	69	119
Bicarbonate	mg/L	58	138	179	47	54	56	190	149	106	398
Carbonate	mg/L	-5	-5	-5	-5	-5	43	5	9	41	12
Chloride	mg/L	3	6	9	1	1	3	5	3	5	9
Sulfate	mg/L	-1	3	1	-1	-1	32	48	81	111	169
Aluminum, dissolved	mg/L	0.2	1.4	0.2	0.4	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	0.005	0.021	-0.005	0.006	0.007	-0.005	-0.005	0.012	0.022
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.2	0.92	0.2	0.26	0.08	-0.05	-0.05	-0.05	-0.05	-0.05
Iron, total	mg/L	1.68	19.7	16.7	1.66	1.02	0.08	0.22	0.42	0.45	1.32
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.14	0.94	1.24	0.07	0.21	-0.02	0.07	0.03	0.06	1.12
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	0.006	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L			-0.003	0.004	-0.003				-0.003	-0.003
Uranium, dissolved	mg/L	-0.001	-0.001	-0.001	-0.0003	0.0033	-0.001	0.002	0.002	0.002	0.005
Uranium, suspended	mg/L		-0.001	-0.001		-0.0003			-0.001	-0.001	
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		-1	-1		1.3			-1	-1	
Lead 210, suspended	pCi/L		3.26	-1		1.6			-1	-1	
Polonium 210, dissolved	pCi/L		-1	-1		-1			-1	-1	
Polonium 210, suspended	pCi/L		-1	-1		-1			-1	-1	
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	0.46	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L		1.12	-0.2		-0.2			-0.2	-0.2	
Ra-228, dissolved	pCi/L	1.22	-1	-1	-1	-1	-1	1.52	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2		-0.2			-0.2	-0.2	
Th-230, suspended	pCi/L		0.28	-0.2		-0.2			-0.2	-0.2	
Gross Alpha	pCi/L	-2	3.85	7.4	-2	-2	-2	-2	3.4	2.5	11.1
Gross Beta	pCi/L	10.5	20.3	28.7	5.4	8.2	8.9	12.1	8.6	12.1	27.6

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data											
		Sample Results									
	Sample Type*	SW Reservoir	SW Reservoir	SW Reservoir	SW Oshoto R.	SW Oshoto R.	SW Oshoto R.	SW Oshoto R.	SW Oshoto R.	SW Oshoto R.	SW Oshoto R.
	Sample Station Name	CSRES03 (R-3)	CSRES03 (R-3)	CSRES04 (R-4)	HBRES04 (R-2)	HBRES04 (R-2)	HBRES04 (R-2)	HBRES04 (R-2)	HBRES04 (R-2)	HBRES04 (R-2)	HBRES04 (R-2)
	Sample Date	5/16/11	8/18/11	8/6/09	8/4/09	10/22/09	1/9/10	4/14/10	7/21/10	10/5/10	3/1/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	100	142	72	301	353	444	390	430	507	619
Ammonia	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.3	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	-0.1	-0.1	-0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Laboratory conductivity	µmhos/cm	282	368	143	713	791	969	827	965	1090	1260
Laboratory pH	s.u.	8.3	9.7	9.5	9.1	8.8	8.3	8.7	9.2	8.9	8.9
Nitrate/Nitrite	mg/L	0.9	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	220	280	100	460	520	680	560	640	730	920
Calcium	mg/L	31	24	16	20	20	29	24	15	16	27
Magnesium	mg/L	9	11	4	17	18	25	20	23	24	28
Potassium	mg/L	9	12	7	10	12	14	11	12	14	15
Sodium	mg/L	20	31	4	123	131	171	148	177	226	263
Bicarbonate	mg/L	122	97	64	292	385	539	429	347	520	668
Carbonate	mg/L	-5	37	11	37	23	-5	23	88	49	43
Chloride	mg/L	2	4	-1	8	8	9	8	7	8	12
Sulfate	mg/L	61	36	3	66	70	95	79	97	96	114
Aluminum, dissolved	mg/L	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	0.01	0.009	0.01	0.006	-0.005	-0.005	0.008	0.007	0.007
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	0.1	-0.1	-0.1	0.1	0.1	0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.07	-0.05	0.1	-0.05	-0.05	0.06	-0.05	-0.05	-0.05	0.1
Iron, total	mg/L	0.54	-0.05	0.46	0.12	0.14	0.1	0.25	0.07	0.13	0.4
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	-0.02	0.03	0.04	0.08	0.05	0.16	0.04	0.03	0.07	0.19
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	0.009
Silver, dissolved	mg/L	0.003	-0.003						-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.001	0.0009	-0.001	0.006	0.006	0.007	0.007	0.009	0.008	0.0107
Uranium, suspended	mg/L		-0.0003						-0.001		
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		1.6						-1		
Lead 210, suspended	pCi/L		-1						-1		
Polonium 210, dissolved	pCi/L		-1						-1		
Polonium 210, suspended	pCi/L		-1						-1		
Ra-226, dissolved	pCi/L	-0.2	-0.2	0.2	-0.2	-0.2	-0.2	0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2						-0.2		
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	1.1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2						-0.2		
Th-230, suspended	pCi/L		-0.2						-0.2		
Gross Alpha	pCi/L	-2	-2	-2	5.1	9.1	5.5	3.1	7.34	9.5	5
Gross Beta	pCi/L	7.9	9.3	6.9	8.1	22.9	12.7	11.3	11.5	13	10.8

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

Water-Quality Data

		Sample Results									
	Sample Type*	SW Oshoto R.	SW Oshoto R.	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir
	Sample Station Name	HBRES04 (R-2)	HBRES04 (R-2)	P15507S (R-10)	P15507S (R-10)	P15507S (R-10)	P15507S (R-10)	P15507S (R-10)	P15508S (R-8)	P15508S (R-8)	P15508S (R-8)
	Sample Date	4/6/11	8/11/11	5/5/10	8/24/10	10/5/10	5/5/11	8/16/11	10/5/10	5/5/11	8/16/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	423	374	639	1210	1700	573	1070	1220	594	856
Ammonia	mg/L	-0.1	-0.1	0.2	0.2	0.1	-0.1	0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.1	0.2	0.3	0.5	0.7	0.2	0.4	0.5	0.2	0.4
Laboratory conductivity	µmhos/cm	869	954	1220	2010	2910	1150	1900	2130	1130	1720
Laboratory pH	s.u.	8.6	9	8.9	9.2	9.9	8.8	9.3	9.4	8.8	9.5
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	630	580	970	1510	2320	940	1340	1560	930	1090
Calcium	mg/L	22	17	43	16	10	42	19	13	35	15
Magnesium	mg/L	22	22	46	42	43	48	56	36	43	44
Potassium	mg/L	11	10	11	31	27	10	57	16	10	22
Sodium	mg/L	180	166	212	467	739	236	368	494	238	370
Bicarbonate	mg/L	484	372	635	1130	965	608	964	1030	636	706
Carbonate	mg/L	16	42	71	169	548	45	167	226	44	166
Chloride	mg/L	7	9	7	12	21	8	19	8	6	11
Sulfate	mg/L	94	94	163	54	84	199	19	90	177	86
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	0.009	0.006	0.016	0.052	0.005	0.043	0.015	-0.005	0.018
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	-0.1	0.2	0.1	0.3	0.4	0.1	0.3	0.2	0.1	0.2
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	-0.05	-0.05	0.08	0.13	0.06	-0.05	0.14	0.08	0.06	0.14
Iron, total	mg/L	0.47	0.07	1.14	6.28	1.06	0.26	1.43	1.3	0.88	0.55
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.08	0.07	0.11	0.34	0.12	0.03	0.16	0.09	0.06	0.08
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	0.06	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003		-0.003	-0.003	-0.003	-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.0087	0.0072	0.019	0.021	0.087	0.0416	0.0193	0.027	0.0212	0.0145
Uranium, suspended	mg/L	-0.0003	-0.0003	-0.001	0.003						
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	0.03	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	0.03	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L	1.8	1.7	1.46	-1						
Lead 210, suspended	pCi/L	-1	1	1.55	-1						
Polonium 210, dissolved	pCi/L	-1	-1	-1	-1						
Polonium 210, suspended	pCi/L	-1	-1	-1	-1						
Ra-226, dissolved	pCi/L	-0.2	-0.2	0.31	-0.2	-0.2	-0.2	0.3	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L	-0.2	-0.2	-0.2	0.3						
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2						
Th-230, suspended	pCi/L	-0.2	-0.2	0.28	0.46						
Gross Alpha	pCi/L	7.5	5.4	13.6	27.3	48.7	10.8	11.7	15	10.2	9.5
Gross Beta	pCi/L	4.9	7.1	12.9	44.4	48.5	11.5	49.4	20	10.6	21.4

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

		Water-Quality Data									
		Sample Results									
	Sample Type*	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir
	Sample Station Name	P17592S (R-6)	P17592S (R-6)	P17592S (R-6)	TSRES01 (R-7)	TWRES01 (R-1)	TWRES01 (R-1)	TWRES01 (R-1)	TWRES01 (R-1)	TWRES01 (R-1)	TWRES01 (R-1)
	Sample Date	10/5/10	5/5/11	8/17/11	10/22/09	9/1/09	10/22/09	6/23/10	7/22/10	10/5/10	5/5/11
Parameter**	Units										
Alkalinity (as CaCO3)	mg/L	1090	553	556	1080	64	95	55	59	116	44
Ammonia	mg/L	0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Fluoride	mg/L	0.5	0.2	0.3	0.3	0.1	0.1	-0.1	0.1	0.2	-0.1
Laboratory conductivity	µmhos/cm	2270	1080	1250	2000	146	213	129	133	231	92
Laboratory pH	s.u.	9	8.6	9.4	8.6	8.8	8	9.2	8.7	8.5	8.2
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	1710	890	800	1360	110	120	100	100	170	80
Calcium	mg/L	18	55	12	41	13	19	12	11	21	9
Magnesium	mg/L	33	28	22	60	3	5	3	3	5	2
Potassium	mg/L	18	9	5	24	10	12	9	10	14	6
Sodium	mg/L	515	230	246	440	7	9	7	8	15	4
Bicarbonate	mg/L	1080	628	456	1190	71	116	49	68	137	53
Carbonate	mg/L	123	23	109	66	-5	-5	9	-5	-5	-5
Chloride	mg/L	20	10	9	10	1	4	-1	-1	2	-1
Sulfate	mg/L	224	160	90	136	4	8	5	5	4	5
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	0.2	-0.1	-0.1	-0.1	-0.1
Arsenic, dissolved	mg/L	0.013	-0.005	0.011	0.005	0.006	-0.005	-0.005	0.006	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	0.1	0.1	0.3	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.18	0.07	-0.05	0.07	0.34	0.18	0.2	0.35	-0.05	0.05
Iron, total	mg/L	0.77	0.21	0.18	1.95	0.78	2.62	0.43	0.64	1.35	0.13
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.08	-0.02	0.14	0.25	0.03	0.12	0.02	0.03	0.07	-0.02
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	0.005	0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003	-0.003	-0.003					-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	0.02	0.0161	0.0023	0.028	-0.001	-0.001	-0.001	-0.001	0.001	-0.0003
Uranium, suspended	mg/L							-0.001	-0.001		
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L							1.29	-1		
Lead 210, suspended	pCi/L							-1	-1		
Polonium 210, dissolved	pCi/L							-1	-1		
Polonium 210, suspended	pCi/L							-1	-1		
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	0.29	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L							-0.2	-0.2		
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	1.25	1.34	-1	-1	-1	-1
Th-230, dissolved	pCi/L							-0.2	-0.2		
Th-230, suspended	pCi/L							-0.2	-0.2		
Gross Alpha	pCi/L	16.3	7	3.2	23	-2	2.25	-2	3.55	2.5	-2
Gross Beta	pCi/L	20	6.8	5.2	31.4	8.7	13.1	9.3	9.26	14.3	5.2

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

		Water-Quality Data					
		Sample Results					
	Sample Type*	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir	SW Reservoir
	Sample Station Name	TWRES01 (R-1)	TWRES02 (R-11)	TWRES02 (R-11)	TWRES02 (R-11)	TWRES02 (R-11)	TWRES02 (R-11)
	Sample Date	8/11/11	5/21/10	7/22/10	10/5/10	5/5/11	8/11/11
Parameter**	Units						
Alkalinity (as CaCO3)	mg/L	69	183	107	732	235	323
Ammonia	mg/L	-0.1	-0.1	-0.1	0.1	-0.1	-0.1
Fluoride	mg/L	-0.1	0.1	-0.1	1.7	0.2	0.5
Laboratory conductivity	µmhos/cm	155	397	273	1870	477	801
Laboratory pH	s.u.	9	8.6	9.8	10	8.5	9.4
Nitrate/Nitrite	mg/L	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Total Dissolved Solids	mg/L	90	250	210	1190	360	470
Calcium	mg/L	14	38	14	5	37	10
Magnesium	mg/L	4	18	10	5	15	15
Potassium	mg/L	7	5	5	5	4	6
Sodium	mg/L	7	24	26	427	60	153
Bicarbonate	mg/L	73	209	51	363	272	280
Carbonate	mg/L	5	7	39	261	8	56
Chloride	mg/L	-1	2	2	3	3	4
Sulfate	mg/L	4	28	27	235	54	70
Aluminum, dissolved	mg/L	-0.1	-0.1	-0.1	1.5	-0.1	-0.1
Arsenic, dissolved	mg/L	-0.005	-0.005	0.007	-0.005	-0.005	-0.005
Barium, dissolved	mg/L	-0.5	-0.5	-0.5	-0.5	-0.5	-0.5
Boron, dissolved	mg/L	0.2	-0.1	-0.1	0.6	-0.1	0.2
Cadmium, dissolved	mg/L	-0.002	-0.002	-0.002	-0.002	-0.002	-0.002
Chromium, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Copper, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Iron, dissolved	mg/L	0.9	-0.05	-0.05	0.8	-0.05	-0.05
Iron, total	mg/L	0.61	0.37	0.06	1.29	-0.05	-0.05
Lead, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Manganese, total	mg/L	0.04	0.03	0.03	0.03	-0.02	0.06
Mercury	mg/L	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
Molybdenum, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Nickel, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Selenium, dissolved	mg/L	-0.005	-0.005	-0.005	-0.005	-0.005	-0.005
Silver, dissolved	mg/L	-0.003		-0.003	-0.003	-0.003	-0.003
Uranium, dissolved	mg/L	-0.0003	0.006	0.003	0.002	0.005	0.0012
Uranium, suspended	mg/L		-0.001	-0.001			
Vanadium, dissolved	mg/L	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Zinc, dissolved	mg/L	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
Lead 210, dissolved	pCi/L		-1	-1			
Lead 210, suspended	pCi/L		-1	-1			
Polonium 210, dissolved	pCi/L		-1	-1			
Polonium 210, suspended	pCi/L		-1	-1			
Ra-226, dissolved	pCi/L	-0.2	-0.2	-0.2	-0.2	-0.2	-0.2
Ra-226, suspended	pCi/L		-0.2	-0.2			
Ra-228, dissolved	pCi/L	-1	-1	-1	-1	-1	-1
Th-230, dissolved	pCi/L		-0.2	-0.2			
Th-230, suspended	pCi/L		-0.2	-0.2			
Gross Alpha	pCi/L	-2	5.6	3.61	4.8	3.3	-2
Gross Beta	pCi/L	6	11.6	5.99	3.9	5.2	4.9

Notes:

*Water Type
GW=Ground water
SW=Surface water

**Negative number indicates value of less than detectic
(e.g., -0.01 is <0.01)

***Blank cells indicate that no data were reported.

APPENDIX D
VISUAL-IMPACTS ANALYSIS

APPENDIX D: VISUAL IMPACTS ANALYSIS

Scenic Quality Inventory Point B-1

Photograph from Scenic Quality Inventory Point C-1 to North

Table D.1 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	Low rolling hills, foothills, or flat valley bottoms or few or no interesting landscape features.	1
Vegetation	Some variety of vegetation, but only one or two major types.	3
Water	Present/Little Missouri River and the Oshoto Reservoir are occasionally visible.	1
Color	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add variety, but are very discordant and promote strong disharmony.	-2
	TOTAL SCORE =	**7**

Scenic Quality Inventory Point B-2

Photograph from Scenic Quality Inventory Point B-2 to East

Table D.2 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops; or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers.	5
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns.	5
Water	Present, but not noticeable.	0
Color	Some intensity or variety in colors and contrast of the soil, rock, and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery greatly enhances visual quality (Devils Tower).	5
Scarcity	One of a kind, or unusually memorable, or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing.	5
Cultural Modifications	Modifications add little or no visual variety to the area, and introduce no discordant elements.	0
	TOTAL SCORE =	**23**

Scenic Quality Inventory Point B-3

Photograph from Scenic Quality Inventory Point B-3 to South

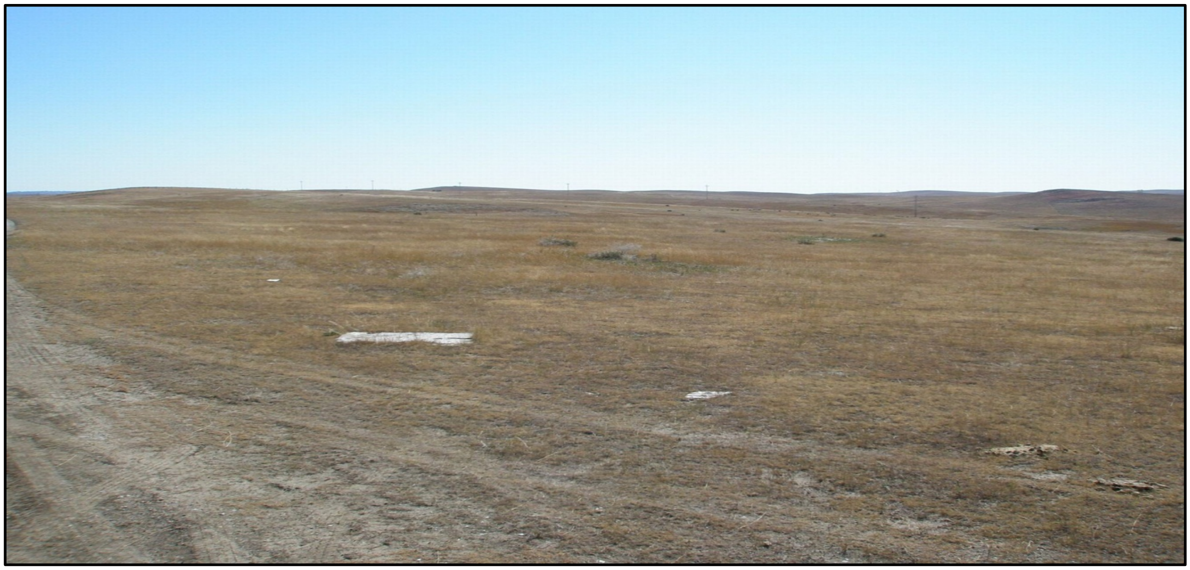

Table D.3 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.	1
Vegetation	Little or no variety or contrast in vegetation.	1
Water	Present, but not noticeable.	0
Color	Subtle color variations, contrast, or interest; generally mute tones.	1
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add little or no visual variety to the area and introduce no discordant elements.	0
	TOTAL SCORE =	**4**

Scenic Quality Inventory Point B-4

Photograph from Scenic Quality Inventory Point B-4 to South

Table D.4 Scenic Quality Inventory and Evaluation		
Key Factor	**Rating Criteria**	**Score**
Landform	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features.	1
Vegetation	Some variety of vegetation, but only one or two major types.	3
Water	Present, but not noticeable.	1
Color	Some intensity or variety in colors and contrast of the soil, rock and vegetation, but not a dominant scenic element.	3
Influence of Adjacent Scenery	Adjacent scenery has little or no influence on overall visual quality.	0
Scarcity	Interesting within its setting, but fairly common within the region.	1
Cultural Modifications	Modifications add variety but are discordant and promote disharmony.	-1
	TOTAL SCORE =	**8**

Table D.5
Scenic Quality
Inventory and Evaluation
Average of Four Views

Key Factor	Score
Landform	2.00
Vegetation	3.00
Water	0.50
Color	2.50
Influence of Adjacent Scenery	1.25
Scarcity	2.00
Cultural Modifications	-0.75
AVERAGE =	**10.50**

APPENDIX E
DRAFT ROSS PROJECT
PROGRAMMATIC AGREEMENT

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PROGRAMMATIC AGREEMENT AMONG THE U.S. NUCLEAR REGULATORY COMMISSION, THE ADVISORY COUNCIL ON HISTORIC PRESERVATION, THE WYOMING STATE HISTORIC PRESERVATION OFFICE, THE BUREAU OF LAND MANAGEMENT–NEW CASTLE FIELD OFFICE, AND STRATA ENERGY, INC., REGARDING THE ROSS IN SITU URANIUM RECOVERY PROJECT IN CROOK COUNTY, WYOMING

WHEREAS, this Programmatic Agreement (PA or "Agreement") addresses the federal undertaking (Undertaking) regarding the issuance of a license for the Ross In Situ Uranium Recovery (ISR) Project (Ross Project) pursuant to the U.S. Nuclear Regulatory Commission's (NRC) authority under the Atomic Energy Act of 1954 (AEA), 42 U.S.C. §§ 2011 *et. seq.* for purposes of NRC's compliance with Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. §§ 470 *et. seq.*; and

WHEREAS, on January 4, 2011, Strata Energy, Inc. (Strata) submitted to the NRC for review and approval a new source and byproduct materials license for an ISR project at the Ross Project site located in Crook County, Wyoming; and

WHEREAS, the U.S. Department of the Interior, Bureau of Land Management (BLM), Newcastle, Wyoming Field Office received from Strata on January 21, 2011, a Plan of Operations for the Ross Project for review and approval which requires compliance with Section 106 of NHPA for the Undertaking as defined at 36 CFR § 800.16(y) and pursuant to BLM's authority under the Mining Law of 1872, 30 U.S.C. §§ 22-54 and the Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701-1784; and

WHEREAS, for the purposes of the Undertaking, the NRC is the lead Federal agency for compliance with Section 106 on behalf of the BLM Newcastle Field Office (36 CFR § 800.2(a)(2)) by letter dated November 21, 2011 and is the primary contact for all parties to this PA and Indian Tribes except as noted elsewhere in this document; and

WHEREAS, upon issuance of a license and approval of a mine plan, the Undertaking would use ISR technology to extract uranium and would process the extracted uranium into yellowcake at the Ross Project site, which consists of 1,721 acres (696 ha) located approximately 38 km (24 mi) north of Moorcroft on County Route 68 in Crook County, Wyoming (in portions of Sections 7, 17, 18, and 19, Township 53 North, Range 67 West and portions of Sections 12, 13, and 24, Township 53 North, Range 68 West), as shown in Appendix A; and

WHEREAS, the NRC, by letter dated August 19, 2011, initiated Section 106 consultation with the Wyoming State Historic Preservation Office (WYSHPO); and

WHEREAS, the NRC, in consultation with WYSHPO as provided in 36 CFR § 800.4(a) and 36 CFR § 800.16(d), established the area of potential effects (APE) for the Undertaking as the area at the Ross Project site and its immediate environs, which may be impacted by activities associated with the construction and operation of the proposed facility. The direct APE is comprised of the areas within the Ross Project boundary that may be directly affected by physical ground disturbance and construction of the Ross Project, and the indirect APE is comprised of the area within three miles of the Ross Project boundary wherein potential visual and audible effects to historic properties may occur, as described in Appendix A; and

WHEREAS, the Phase I area, shown in Figure 3 of Appendix A, encompasses all areas within the direct APE where Strata's physical ground disturbance and construction of the Ross Project is currently proposed to occur; and

WHEREAS, identification of cultural properties has been completed for the Undertaking, including background research of the existing records and Class III and Tribal field surveys within the APE, as described in Appendix B; and

WHEREAS, the NRC has made determinations of eligibility for the National Register of Historic Places (NRHP) for two historic properties within the APE (48CK1603 and 48CK2083) and WYSHPO has concurred with these findings; as described in Appendix B; and

WHEREAS, the NRC has yet to make determinations of eligibility for the NRHP for 32 unevaluated cultural properties within the APE as shown in Table 1-D and Table 3 of Appendix B; and

WHEREAS, effects on all historic properties within the APE cannot be fully determined prior to approval of the Undertaking (36 CFR § 800.14(b)(1)(ii)); and

WHEREAS, the NRC has determined that a phased process for compliance with Section 106 of NHPA is appropriate for the Undertaking, as specifically permitted under 36 CFR § 800.4(b)(2), such that completion of the evaluation of historic properties, determinations of effect on historic properties, and consultation concerning measures to avoid, minimize, or mitigate any adverse effects will be carried out in phases, as set forth in this PA; and

WHEREAS, by letter dated April 17, 2013, Strata has submitted an Additional Testing Plan to the NRC to test the two unevaluated sites (48CK2076 and 48CK2073) that are located within the Phase I area for NRHP eligibility and to test the two eligible sites (48CK1603 and 48CK2083) that are located within the Phase I area for effects; and

WHEREAS, the NRC is coordinating with the BLM to review Strata's Additional Testing Plan and, if accepted by the NRC in consultation with WYSHPO, the Additional Testing Plan will be implemented as necessary; and

WHEREAS, the NRC, by letter dated February 9, 2011, invited the following Indian Tribes to participate in Section 106 consultation for the Ross Project: The Apache Tribe of Oklahoma; The Blackfeet Tribe; The Cheyenne and Arapaho Tribes of Oklahoma; The Cheyenne River Sioux Tribe; The Confederated Salish and Kootenai Tribe; The Crow Tribe; The Crow Creek Sioux Tribe; The Eastern Shoshone Tribe; The Flandreau Santee Sioux Tribe; The Fort Belknap Community; The Fort Peck Assiniboine and Sioux Tribes; The Kiowa Indian Tribe of Oklahoma; The Lower Brule Sioux Tribe; The Northern Arapaho Tribe; The Northern Cheyenne Tribe; The Oglala Sioux Tribe; The Rosebud Sioux Tribe; The Santee Sioux Tribe of Nebraska; The

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Sisseton-Wahpeton Sioux Tribe; The Spirit Lake Tribe; The Standing Rock Sioux Tribe, The Three Affiliated Tribes; The Turtle Mountain Band of Chippewa Indians; and the Yankton Sioux Tribe; and

WHEREAS, the following twenty-one tribes are the Ross Project Consulting Tribes: The Blackfeet Tribe; The Cheyenne and Arapaho Tribes of Oklahoma; The Cheyenne River Sioux Tribe; The Confederated Salish and Kootenai Tribe; The Crow Tribe; The Crow Creek Sioux Tribe; The Eastern Shoshone Tribe; The Flandreau Santee Sioux Tribe; The Fort Belknap Community; The Fort Peck Assiniboine and Sioux Tribes; The Lower Brule Sioux Tribe; The Northern Arapaho Tribe; The Northern Cheyenne Tribe; The Oglala Sioux Tribe; The Rosebud Sioux Tribe; The Santee Sioux Tribe of Nebraska; The Sisseton-Wahpeton Sioux Tribe; The Standing Rock Sioux Tribe, The Three Affiliated Tribes; The Turtle Mountain Band of Chippewa Indians; and the Yankton Sioux Tribe; and

WHEREAS, the applicable requirements of NHPA, the American Indian Religious Freedom Act, 42 U.S.C. 1996 *et. seq.*, the Native American Graves Protection and Repatriation Act, 25 U.S.C. 3001 *et. seq.* and 43 CFR § 10 (NAGPRA), and the Archaeological Resources Protection Act, 16 U.S.C 1979 *et. seq.* (ARPA) have been considered in this Agreement and this Agreement does not waive the responsibilities of the Signatories and Invited Signatory under these Acts and regulations; and

WHEREAS, in accordance with 36 CFR § 800.6(a)(1)(i)(C), the NRC, by letter dated September 19, 2013, has invited the Advisory Council on Historic Preservation (ACHP or "Council") to participate in Section 106 consultation and development of this PA and the Council, by letter dated October 28, 2013, accepted the invitation and is a Signatory; and

WHEREAS, the NRC, by letters dated September 19, 2013, invited each of the Ross Project Consulting Tribes to participate in the development of this PA and representatives from The Cheyenne and Arapaho Tribes of Oklahoma, The Cheyenne River Sioux Tribe, The Chippewa Cree Tribe, The Fort Peck Assiniboine and Sioux Tribes, and The Northern Cheyenne Tribe, participated; and

WHEREAS, each of the Ross Project Consulting Tribes will be invited to sign the PA as a Concurring Party; and

WHEREAS, the NRC, by letter dated September 19, 2013, invited the Crook County Museum District and the Alliance for Historic Wyoming, to participate in the development of this PA, and no response was received; and

WHEREAS, by email dated November 8, 2013, the National Park Service—Devils Tower National Monument informed the NRC that it would like to be involved with the development of the PA and subsequently participated in the development of this PA; and

WHEREAS, Strata has participated in the development of this PA, shall implement the Undertaking in accordance with this PA, and will be invited to sign the PA as an Invited Signatory; and

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WHEREAS, the NRC, WYSHPO, ACHP, BLM, and Strata are collectively hereafter called "Signatories;" and

WHEREAS, the Signatories, Invited Signatory, and Concurring Parties are collectively referred to as the "Parties"; and

WHEREAS, the refusal of any Invited Signatory or Invited Concurring Party to sign this PA does not invalidate the PA;

NOW, THEREFORE, the NRC, WYSHPO, ACHP, and BLM agree that the Undertaking shall be implemented in accordance with the following stipulations in order to take into account the effects of the Undertaking on historic properties.

STIPULATIONS

A. GENERAL STIPULATIONS

1. The NRC will require as a condition of any license issued to Strata, and the BLM will require as a condition of approval of Strata's Plan of Operations, that Strata complies with all stipulations and other provisions in this PA.
2. Strata shall fund all required fieldwork, analysis, reporting, curation, and mitigation necessary to comply with this PA.
3. The NRC will ensure that all work undertaken to satisfy the terms of this PA, including all cultural resource inventory reports and documentation, meets the Secretary of the Interior's Standards for Archaeology and Historic Preservation (48 FR 44716-42), WYSHPO standards, and ACHP guidance on archaeology found at www.achp.gov/archguide.
4. Strata shall have a qualified archaeologist, as defined in the Secretary of Interior's Professional Qualifications and Standards (48 FR 22716), conduct recordation and testing, prepare testing reports, conduct data recovery, and prepare data recovery reports whenever these activities are required.
5. Strata shall direct all of its employees, contractors, subcontractors, inspectors, monitors, and any authorized additional parties involved in the Ross Project not to search for, retrieve, deface, or impact historic and prehistoric materials (e.g., archaeological materials such as, arrowheads, pottery sherds, petroglyphs) and ensure that they receive training regarding the sensitivity of all historic and cultural resources, both Native American and non-Native American. Strata shall cooperate with the NRC, BLM and the WYSHPO to ensure compliance with ARPA of 1979 as amended (16 U.S.C 470) and NAGPRA (25 U.S.C. 3001) on public lands, and with Wyoming Statute § 36-1-115 on state lands.
6. The NRC will continue to consult with the representatives of the Ross Project Consulting Tribes throughout the implementation of the PA. The Ross Project Consulting Tribes will be invited to participate in the determinations of eligibility for the unevaluated properties, the determination of effect to historic properties, and the development of any plans to avoid, minimize, or mitigate adverse effects to historic properties. Any information

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provided by the Ross Project Consulting Tribes on sites of traditional religious and cultural importance will remain confidential to the greatest extent permitted by law.

7. For each Ross Project Phase, all cultural resources that may be affected by that stage of the Undertaking will be evaluated by the NRC in consultation with the Parties and Ross Project Consulting Tribes pursuant to 36 CFR § 800.4(c)(1) if not previously evaluated.

8. Strata shall provide to the BLM Newcastle Field Office point of contact copies of all reports required to be provided to the NRC pursuant to the PA. The BLM shall review all reports concurrently with the NRC. The NRC will develop schedules and coordinate with the BLM when fulfilling the NRC's PA responsibilities The NRC may designate the BLM staff as the local point of contact to address unanticipated discoveries or other tasks as needed.

B. CONTINUING DETERMINATIONS OF ELIGIBILITY

1. Testing Phase I Area Properties for NRHP Eligibility

   a. Strata shall complete recordation and evaluation of 48CK2087, 48CK2229, 48CK2230, and 48CK2231 (see Table 1-A of Appendix B) and prepare a report on this inventory. If any of these sites are located within the Phase I area of the Ross Project, then Strata shall submit a Supplement to the Additional Testing Plan to the NRC to include those sites.

   b. Upon receipt of Strata's Supplement to the Additional Testing Plan, the NRC and BLM will review the plan and request any corrections or modifications from Strata within 30 days of receipt. If no Supplement to the Additional Testing Plan is necessary, the NRC in coordination with BLM will review the existing plan and request any corrections or modifications from Strata within 30 days following notification that a Supplement is not required. During review of the testing plan, the NRC will consult with Strata concerning whether any sites or portions of sites may be avoided. If avoidance is possible, the testing plan shall be revised to include a map and documentation to support this avoidance.

   c. The NRC will then distribute the Additional Testing Plan to the Parties (excluding WYSHPO) and Ross Project Consulting Tribes for a 30 day review and comment period. The NRC will consider any comments received in writing from the Parties or the Ross Project Consulting Tribes within the specified review period.

   d. The NRC will then submit the final Additional Testing Plan to the WYSHPO for a 30 day review and concurrence. Copies of this correspondence will be sent to the other Parties and Ross Project Consulting Tribes.

   e. If the WYSHPO concurs with the NRC's final Additional Testing Plan or fails to respond within 30 days, the NRC will notify Strata in writing that it may proceed with the final Additional Testing Plan.

   f. The NRC will consult to resolve any comments or objections regarding the final Additional Testing Plan received in writing from the WYSHPO within the 30 day review period. If a dispute arises, it will be resolved in accordance with Stipulation I (Dispute Resolution).

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2. Testing New Phase Area Unevaluated Properties for NRHP Eligibility

   a. Strata shall not conduct ground disturbance activities beyond the boundaries of the Phase I area (see Appendix A, Figure 3) without first notifying the NRC and fulfilling the relevant requirements set forth in this Agreement.

   b. If ground disturbance activities will occur beyond the boundaries of the Phase I area, then, consistent with the phased process for Section 106 compliance under this PA, Strata shall submit a Notice of Intent (NOI) to the NRC. The NOI shall state Strata's intent to prepare a plan for testing the eligibility of any unevaluated properties within the New Phase area or the NOI shall demonstrate that all the previously identified properties within the New Phase area will be avoided by Strata. The NOI shall be submitted at least three months prior to the testing plan's proposed submission date so that the NRC and BLM can appropriately allocate staff resources to the extent possible, acknowledging that additional time may be necessary in the event that NRC and BLM staff resources are limited due to conditions beyond the staff's control. If the NOI demonstrates that all the previously identified properties within the New Phase area will be avoided by Strata and the NRC staff, in coordination with BLM, agree, the NRC will notify Strata within 120 days of receipt of the NOI that it may proceed with its proposed activities.

   c. Strata's NOI shall include a description of the area of ground disturbance activities for the New Phase. Strata shall delineate the New Phase area with township/section/range, GPS data points, GIS map, or other land survey techniques such that the New Phase area can be reproducibly defined and illustrated with appropriate graphic materials and sufficient documentation to enable any reviewer to readily understand its scope and basis.

   d. Upon receipt of Strata's testing plan, the NRC in coordination with the BLM will review the plan and request any corrections or modifications from Strata within 30 days of receipt.

   e. Prior to accepting Strata's testing plan, the NRC will consult with Strata to determine if the unevaluated properties can be avoided in the proposed project phase. If any properties in the original testing plan can be avoided, Strata shall submit a revised testing plan, including a map and sufficient documentation to support this avoidance determination.

   f. The NRC will distribute the revised testing plan to the Parties (excluding WYSHPO) and Ross Project Consulting Tribes for a 30 day review and comment period. The NRC will consider any comments received in writing within the specified review period.

   g. The NRC will then submit the final testing plan to the WYSHPO for a 30 day review and concurrence, copying the other Parties and Ross Project Consulting Tribes on this correspondence.

   h. If the WYSHPO concurs with the NRC's final testing plan or fails to respond within 30 days, the NRC will notify Strata in writing that it may proceed with the testing plan.

   i. The NRC will consult to resolve any comments or objections received in writing from WYSHPO within the 30 day review period regarding the final testing plan. If a

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dispute arises, it will be resolved in accordance with Stipulation I (Dispute Resolution).

3. Determination of Eligibility

   a. In accordance with an approved final testing plan from Sections B.1 or B.2, Strata shall evaluate and make NRHP eligibility recommendations for unevaluated properties.

   b. Upon receipt of Strata's eligibility recommendations, the NRC in coordination with BLM will review the recommendations and request any corrections or modifications from Strata within 30 days of receipt.

   c. The NRC will then distribute revised eligibility determinations to the Parties (excluding WYSHPO) and Ross Project Consulting Tribes for a 30 day review period. The NRC will consider any comments received in writing from the Parties and the Ross Project Consulting Tribes within the specified review period.

   d. The NRC will then provide its eligibility determinations to the WYSHPO for a 30 day review and concurrence, copying the other Parties and Ross Project Consulting Tribes on this correspondence. The NRC will consult to resolve any objections regarding eligibility determinations received from the WYSHPO or the Council in writing within the specified review period.

   e. If the WYSHPO concurs with the NRC's eligibility determinations, or if no written objections are received within the 30 day review period, the NRC's eligibility determinations are final.

   f. If the WYSHPO and NRC agree that a cultural resource is not eligible for the NRHP, no further review or consideration under this PA will be required for the cultural resource. If, after appropriate consultation, the WYSHPO and NRC agree that the property is eligible, then a determination of effect will be made in accordance with Stipulation C.

   g. In accordance with 36 CFR § 800.4(c)(2), if there is disagreement regarding eligibility between the NRC and the WYSHPO, and that disagreement cannot be resolved after further consultation, or if the ACHP so requests, the NRC will refer the property(ies) in question to the Keeper of the National Register and request a formal determination of eligibility. The Keeper's decision is final.

4. Sites of Traditional and Cultural Importance

   a. The NRC, in consultation with the WYSHPO, will make NRHP eligibility determinations and effects determinations for the 18 properties identified during the Tribal field survey (see Table 3 of Appendix B).

   b. The NRC will prepare a report documenting its eligibility determinations for the 18 properties and submit it to the WYSHPO for a 30 day review and concurrence, copying other Parties and the Ross Project Consulting Tribes on this correspondence.

   c. If the WYSHPO concurs with the NRC's eligibility determinations, or if the WYSHPO or Council do not object to the NRC's eligibility determinations within the 30 day review period, the NRC's eligibility determinations are final.

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- **d.** The NRC will consult to resolve any written objections from the WYSHPO or the Council received during the 30 day review period regarding eligibility determinations.
- **e.** For any unevaluated cultural resources that are of concern to the Ross Project Consulting Tribes, the NRC will conduct further consultation with Ross Project Consulting Tribes, and, if needed, schedule additional site visits in order to complete eligibility assessments.
- **f.** If the WYSHPO and NRC agree that a cultural resource is not eligible for the NRHP, no further review or consideration under this PA will be required for the cultural resource. If the WYSHPO and NRC agree that the property is eligible, then a determination of effect will be made in accordance with Stipulation C.
- **g.** In accordance with 36 CFR § 800.4(c)(2), if there is disagreement regarding eligibility between the NRC and the WYSHPO, and that disagreement cannot be resolved after further consultation, or if the ACHP so requests, the NRC will refer the property(ies) in question to the Keeper of the National Register and request a formal determination of eligibility. The Keeper's decision is final.

C. CONTINUING ASSESSMENT OF EFFECTS

1. The NRC, in consultation with the Parties and Ross Project Consulting Tribes will make determinations of the effects of the proposed Undertaking on the viewshed of historic properties within the three-mile indirect APE.
2. The NRC, in consultation with the Parties and Ross Project Consulting Tribes will make determinations of the visual and audible adverse effects of the proposed Undertaking of historic properties within the three-mile indirect APE of the Undertaking.
3. Testing Historic Properties for Direct Adverse Effects
   - **a.** Following eligibility determinations, if additional testing is needed to assess the effects of the proposed Project Phase on a historic property, Strata shall submit to the NRC a testing plan to determine the direct (i.e., physical disturbance) adverse effects to historic properties that cannot be avoided.
   - **b.** Upon receipt of Strata's testing plan, the NRC in coordination with the BLM will review the plan and request any corrections or modifications from Strata within 30 days of receipt.
   - **c.** Prior to accepting Strata's testing plan, the NRC will consult with Strata to determine if the historic properties can be avoided. If any historic properties in the testing plan can be avoided, Strata shall submit a revised testing plan, including a map and sufficient documentation to support this avoidance determination.
   - **d.** The NRC will distribute the revised testing plan to the Parties (excluding WYSHPO) and the Ross Project Consulting Tribes for a 30 day review period. The NRC will consider any comments received in writing within the specified review period.
   - **e.** The NRC will then distribute the final testing plan to the WYSHPO for a 30 day review and comment period, copying the other Parties and the Ross Project Consulting Tribes on this correspondence.

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- **f.** If the WYSHPO concurs with the NRC's final testing plan or fails to respond within 30 days, the NRC will notify Strata that it may proceed with the testing plan, and Strata shall submit the results of the testing to the NRC.
- **g.** The NRC will consult to resolve any comments or objections received in writing from the WYSHPO within the 30 day review period regarding the testing plan. If a dispute arises, it will be resolved in accordance with Stipulation I (Dispute Resolution).

4. Assessment of Effects

- **a.** Strata shall have a qualified archaeologist conduct the testing in accordance with the approved adverse effects testing plan from Stipulation C.3 and shall submit a report to the NRC that documents Strata's evaluation and recommendations, which the NRC may use in making determinations of effect on identified historic properties within the area of ground disturbance activities for each Ross Project phase.
- **b.** Upon receipt of Strata's recommended determinations of effect, the NRC in coordination with the BLM will review those determinations and request any corrections or modifications from Strata within 30 days of receipt.
- **c.** The NRC will then distribute its determinations of effect and the associated documentation [pursuant to 36 CFR §§ 800.5 and 800.6(a)(3)] to the Parties (excluding WYSHPO) and the Ross Project Consulting Tribes for a 30 day review period. The NRC will consider any comments received in writing within the specified review period.
- **d.** The NRC will then distribute the determinations of effect to the WYSHPO for a 30 day review period, copying the other Parties and the Ross Project Consulting Tribes on this correspondence.
- **e.** If the WYSHPO concurs with NRC's determinations of effect, or if no written objections are received from the Parties or the Ross Project Consulting Tribes within the 30 day review period, the effects determinations are final.
- **f.** The NRC will consult to resolve any written objections received from the Parties or the Ross Project Consulting Tribes regarding determinations of effect. If a dispute arises, it will be resolved in accordance with 36 CFR § 800.5(c)(2) or Stipulation I (Dispute Resolution).
- **g.** If any eligible properties will be adversely affected, plans to avoid, minimize, or mitigate the adverse effects will be developed in accordance with the Stipulation D of this PA.

D. AVOIDANCE, MINIMIZATION and MITIGATION of ADVERSE EFFECTS

1. Avoidance of Adverse Effects:

Once the assessment of adverse effects to a historic property has been finalized per Stipulation C, Strata shall notify the NRC within 30 days if it can avoid the historic property that would be adversely affected within the area of ground disturbance activities for each Ross Project Phase, including properties of traditional religious and cultural significance to the Tribes. Potential avoidance measures include, but are not limited to, relocating pipelines, roads, facilities, monitoring wells, and other disturbances.

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2. Development of Plan for the Minimization and Mitigation of Adverse Effects

   a. If the NRC determines adverse effects to historic properties within the area of ground disturbance activities for any Ross Project Phase cannot be avoided, for each Phase of the Undertaking, the NRC will consult with the Parties and Ross Project Consulting Tribes to identify those measures to be implemented by Strata to minimize and/or mitigate adverse effects to affected historic properties. A wide range of options to minimize and/or mitigate adverse effects shall be considered, including but not limited to the following:

      i. For historic properties that are archaeological in nature and significant for their research data potential (Eligibility Criterion D, National Register of Historic Places), the treatment measures may follow standard mitigation through data recovery. Mitigation plan(s) for data recovery shall include, at a minimum, a research design with provisions for data recovery and recordation, analysis, reporting, and curation of resulting collection and records, and shall be consistent with the *Secretary of Interior's Standards and Guidelines* (48 FR 44734-44737). Mitigation plan(s) must be consistent with easement and permit requirements of other agencies, when applicable. To the extent possible, mitigation plan(s) should group related sites or areas, so that treatment of related resources can be considered in context, and to minimize the burden of review and approval by agencies.

      ii. Mitigation plan(s) for those resources relating to properties eligible under Criteria A, B and C, or that are significant for values other than their potential research value, if warranted, shall specify approaches for treatment or mitigation of the property in accordance with the principles, standards, and guidelines appropriate to the resource. This may include, but not be limited to, use of such approaches as relocating the historic property, re-landscaping to reduce effects, public interpretation, ethnographic recordation, oral history, archival research, or prescribing use of a component or activity of this Undertaking in such a way as to minimize effects to historic properties or to those concerned about the effects of that component or activity. Methods of recordation and documentation described in the mitigation plan(s) shall conform with the *Secretary of the Interior's Standards for Architectural and Engineering Documentation* (48 FR 44730-44734) or other standards specified by NRC.

      iii. In lieu of standard mitigation approaches described above, mitigation plan(s) may adopt other alternative approaches to avoid, minimize or mitigate effects to historic properties, including, but not limited to, assisting in the development of Tribal historic preservation plans, developing detailed historic contexts for the region, developing educational materials, purchasing properties containing historic resources, or developing historic property management plans.

   b. The NRC shall consult with the Ross Project Consulting Tribes regarding minimization and/or mitigation of indirect effects to historic properties of traditional religious and cultural importance.

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c. Meetings and conference calls shall be scheduled as needed to develop mitigation measures for the Undertaking. Meetings and telephone conferences shall involve all or part of the Parties and Ross Project Consulting Tribes, as appropriate.

d. Following the development of measures to minimize and/or mitigate adverse effects, Strata shall prepare a Mitigation Plan. The Mitigation Plan shall identify minimization and/or mitigation measures to address the adverse effects of the Undertaking on each individual historic property.

i. The Mitigation Plan shall contain a map of all proposed effects for that Project Phase, a description of the effects on each historic property, and a description of the proposed treatment for each historic property.

ii. If monitoring by a qualified archaeologist and/or by Tribal monitors is part of the strategy for identifying and resolving adverse effects, the Mitigation Plan shall include a Monitoring Plan. The objective of monitoring is to protect extant sites from construction impacts, identify at the time of discovery any archaeological materials exposed during ground disturbance, and protect such resources from damage until the procedures for Discoveries per Stipulation E are implemented.

iii. If data recovery is part of the strategy for resolving adverse effects, the Mitigation Plan shall specify all details of the research design, field and laboratory work methodology (including mapping, geomorphological studies, controlled scientific excavation methods, analyses of data recovered, and photographic documentation), and report preparation.

e. The NRC in coordination with the BLM will review the Mitigation Plan developed by Strata and request any corrections or modifications within 30 days of receipt.

f. The NRC will distribute the Mitigation Plan to the Parties (excluding WYSHPO) and the Ross Project Consulting Tribes. The NRC will consider any comments received in writing from the Parties (excluding WYSHPO) and the Ross Project Consulting Tribes within the specified review period.

g. The NRC will then distribute the final Mitigation Plan to the WYSHPO for a 30 day review period, copying the other Parties, the Ross Project Consulting Tribes on this correspondence.

h. Upon final concurrence by the WYSHPO, or if WYSHPO fails to respond in writing within 30 days, and no other objections from the Parties or the Ross Project Consulting Tribes are received, the final Mitigation Plan will be appended to this PA.

i. The NRC will consult to resolve any written comments or objections received from the Parties and the Ross Project Consulting Tribes regarding the final Mitigation Plan within the WYSHPO's 30 day review period. If a dispute arises, it will be resolved in accordance with 36 CFR § 800.7 or Stipulation I (Dispute Resolution).

j. The NRC will notify the Parties and the Ross Project Consulting Tribes of the approval of any Mitigation Plan.

3. Implementation of Mitigation Plan

a. For any data recovery on BLM-administered lands, the archaeologist shall have a BLM Cultural Resource Use permit for Excavation and/or Removal.

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b. For data recovery on State lands, the archaeologist shall have an Authorization for Archaeological Investigations on State Lands.

c. Upon completion of data recovery fieldwork, Strata shall submit a data recovery report documenting implementation and results.

d. The NRC in coordination with the BLM will review the data recovery report developed by Strata and request any corrections or modifications within 30 days of receipt, allowing additional time if NRC/BLM fieldwork inspection is needed and is not feasible within the 30 day review period.

e. The NRC will then distribute the data recovery report or revised report to the Parties (excluding WYSHPO) and Ross Project Consulting Tribes for a 30 day review and comment period. The NRC will consider any written comments received from the Parties and the Ross Project Consulting Tribes.

f. The NRC will submit the final data recovery report to WYSHPO for a 30 day review and concurrence, copying the other Parties and Ross Project Consulting Tribes on this correspondence.

g. If the WYSHPO concurs with NRC's data recovery report or fails to respond within 30 days, the NRC shall notify Strata that the data recovery report is final. After such notification, Strata may proceed with implementation of that Phase of the Undertaking.

h. The NRC will consult to resolve any comments received in writing from the WYSHPO during the WYSHPO's 30 day review period. If a dispute arises, it will be resolved in accordance with Stipulation I (Dispute Resolution).

i. For other mitigation measures specified in the Mitigation Plan that result in a product or process that requires review and acceptance, the process of review and acceptance shall be specified in the Mitigation Plan. Strata shall not proceed with implementation of ground disturbance activities outside of the Project Phase area prior to completion of such review and acceptance.

E. Curation

a. BLM will ensure that curation of all records and other archaeological items resulting from identification and data recovery efforts on public (BLM) and State land is completed in accordance with 36 CFR § 79 and the provisions of 43 CFR § 10 (NAGPRA). All archaeological materials recovered from Federal and State land shall be curated at the University of Wyoming Archaeological Repository. Strata shall provide documentation of the curation of the materials to the NRC, BLM, and WYSHPO within 60 days of acceptance of the final cultural resource inventory report and/or data recovery report.

b. BLM will encourage private landowners to curate archaeological materials recovered from their lands in accordance with Federal curation policies. If private landowners agree to curate archaeological materials recovered from their lands, the curation shall be done in accordance with Federal curation policies. Materials from private lands to be returned to private landowners shall be maintained in accordance with 36 CFR § 79 until all necessary analysis has been completed. Strata shall provide

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documentation of the disposition of private collections to the NRC, BLM, and WYSHPO.

F. DISCOVERIES

1. Inadvertent Discoveries of Historic and Cultural Resources

a. If previously unknown cultural resources, including archaeological, are discovered during implementation of the Ross Project, or previously known properties will be affected in an unanticipated manner, all construction activities will cease within 150 feet of the area of discovery to avoid or minimize harm to the resource, and Strata shall immediately notify the NRC and the WYSHPO. Activity in the area will cease until NRC, in consultation with the Parties and Ross Project Consulting Tribes, can evaluate and, if necessary, authorize steps to mitigate impacts to the new discovery. Strata shall have any discovered materials evaluated for NRHP eligibility by a professional cultural resource specialist meeting the Secretary of Interior's Standards for Archaeology and History. Documentation of the discovery and evaluation will be promptly provided to the NRC in order for the NRC, in consultation with the WYSHPO, ACHP, BLM, and the Ross Project Consulting Tribes, to make a determination of eligibility and effect. Inadvertent discoveries may include artifacts, bone, features, or concentrations of these materials outside previously identified sites or in and adjacent to previously identified eligible and not eligible sites. Discoveries may also include stones and groups of stones that are out of place in their sedimentary contexts and may be parts of stone features. Discoveries may also include changes in soil color, texture, or content suspected to be of anthropic origin, such as burned soil, ash, or charcoal fragments.

b. If a cultural resource monitor or Tribal monitor is present, the monitor shall have the authority to temporarily halt construction operations within 150 feet of the find or exposed resource and shall flag or otherwise mark the area of avoidance. If a monitor is not present, Strata shall halt work and mark the location for avoidance.

c. Strata shall have a qualified archaeologist and, if needed, a Tribal monitor, inspect the area for additional resources, document the discovery, make recommendations concerning eligibility, and submit the findings to the NRC. The Parties and Ross Project Consulting Tribes shall consult to determine what data recovery or other mitigation may be needed.

d. Work may continue in other areas of the site; however, construction shall not resume in the area of discovery unless the NRC has issued a written Notice to Proceed.

e. Evaluation and mitigation will be carried out by NRC in consultation with the WYSHPO, Ross Project Consulting Tribes, BLM, ACHP, and Strata as expeditiously as possible in accordance with 36 CFR § 800.13(b).

2. Inadvertent Discoveries of Human Remains

a. In the event human remains are discovered on private land during implementation of the Ross Project, all work within 300 feet of the discovery will cease, the area will be secured, and Strata shall immediately contact NRC, who will notify the Crook County Sheriff's Office and Coroner's Office of the discovery per W.S. 7-4-104.

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b. Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on Federal land will be handled according to Section 3 of NAGPRA and its implementing regulations (43 CFR § 10). In the event that human remains are discovered on Federal land during implementation of the Ross Project, all work within 300 feet of the discovery will cease, the area will be secured, and BLM shall be contacted immediately. BLM will be responsible for compliance with the provisions of NAGPRA on Federal land. Native American human remains, funerary objects, sacred objects, or items of cultural patrimony found on state or private land will be handled in accordance with procedures agreed upon by the NRC and WYSHPO for State and private land. If non-Native American human remains are found on Federal land, Strata shall immediately notify the NRC and BLM and BLM will treat such remains in accordance with applicable law. The NRC, BLM, and Strata recognize that any human remains, funerary objects, sacred objects, or items of cultural patrimony encountered during construction should be treated with dignity and respect.

G. CONFIDENTIALITY OF CULTURAL RESOURCE DATA

Cultural resource data, including data concerning the location and nature of historic properties and properties of religious and cultural significance, will be treated as confidential by all Parties and any additional parties involved in the Ross Project, including but not limited to employees, contractors, and subcontractors of Strata. These data shall be protected from public disclosure to the greatest extent permitted by law, including conformance with Section 304 of the NHPA, as amended, Section 9 of the ARPA, and Executive Order No. 13007 on Indian Sacred Sites (Federal Register, Vol. 61 No. 104, May 24, 1996). Confidentiality concerns for properties that have traditional religious and cultural importance to the Ross Project Consulting Tribes will be respected and will remain confidential to the greatest extent permitted by law. Duplication or distribution of cultural resource data from BLM-managed lands by any Party requires written authorization from the BLM Newcastle Field Manager.

H. ANNUAL REPORT AND EVALUATION

1. On or before January 1 of each year, beginning in 2015, unless the Parties agree in writing that the terms of this PA have been fulfilled, Strata shall prepare and provide a letter report to the NRC detailing how the applicable terms of the PA are being implemented. Upon acceptance, Strata shall provide this annual report to the Parties and Ross Project Consulting Tribes. The Parties may provide comments on the report to Strata within 30 days of receipt, and Strata shall distribute all comments to the Parties.

2. Strata shall coordinate a meeting or conference call of the Parties and Ross Project Consulting Tribes, in coordination with the NRC, within 60 days after providing the annual report for the first five (5) years, and (if the PA is still in effect) every third year after that, unless the Parties agree to another timeframe. As appropriate, Parties may request a separate meeting to discuss the annual report. The purpose is to review implementation and achieved outcomes of the terms of this PA and to discuss the annual report, as needed.

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I. DISPUTE RESOLUTION

1. Any Signatory to this PA who objects to an action under this PA, or the implementation of the measures stipulated to in this PA, shall provide written notice to the NRC within 30 days of becoming aware of an action. The NRC will consult with the objecting Signatory to this PA to resolve the objection, unless otherwise specified in this document. If the NRC determines that the objection cannot be resolved, the NRC will forward all documentation relevant to the dispute to the ACHP as well as the other Parties and Ross Project Consulting Tribes, including NRC's proposed response to the objection. The objecting Signatory must provide reasons for, and a justification of, its objection at the time it initially submits its objection to the NRC. Within 30 days after receipt of all pertinent documentation, the ACHP shall either:
   a. Advise the NRC that the ACHP concurs with the NRC's proposed final decision, whereupon the NRC will respond accordingly;
   b. Provide the NRC with recommendations, which the NRC will take into account in reaching a final decision regarding the dispute; or
   c. Notify the NRC that it will comment within an additional 30 days, in accordance with 36 CFR § 800.7(c)(4). Any ACHP comment provided in the response to such a request will be taken into account, and responded to, by the NRC in accordance with 36 CFR § 800.7(c)(4) with reference to the subject of the dispute.
   d. Should the ACHP not exercise one of the above options within forty-five (45) days after receipt of all pertinent documentation, the NRC may proceed with its proposed response to the objection.
2. Any recommendation or comment provided by the ACHP will be understood to pertain only to the subject of the dispute. The responsibility to carry out all actions under this PA that are not the subject of the dispute shall remain unchanged.

J. AMENDMENT

Any Signatory to this PA may request that it be amended, whereupon the Signatories will consult to reach agreement. Such amendment shall be effective upon the signature of all Signatories to this PA, and the amendment shall be appended to the PA as an Appendix.

K. TERMINATION

1. Any Signatory to this PA may initiate termination by providing written notice to the other Signatories of their intent. After notification by the initiating Signatory, the remaining Signatories shall have 60 business days to consult to seek agreement on amendments or any other actions that would address the issues and avoid termination. If such consultation fails, the termination will go into effect at the end of the 60-day period, unless all the Signatories agree to a longer period.
2. In the event of termination, the Signatories will comply with any applicable requirements of 36 CFR §§ 800.4 through 800.6 with regard to the original Undertaking covered by this PA.

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L. DURATION OF AGREEMENT

This PA shall remain in effect for 20 years from its date of execution by the Signatories (last date of signature), or until completion of the work stipulated, whichever comes first, unless extended by agreement among the Signatories.

M. ANTI DEFICIENCY ACT

The stipulations of this Agreement are subject to the provisions of the Anti-Deficiency Act (31 U.S.C. §1341). If compliance with the Anti-Deficiency Act alters or impairs the NRC's ability to implement the stipulations of this Agreement, the NRC will consult in accordance with the amendment and termination procedures found in this Agreement.

N. GENERAL PROVISIONS

1. **Entirety of Agreement.** This PA, consisting of twenty (20) pages, represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations and agreements, whether written or oral, regarding compliance with Section 106 of NHPA.
2. **Prior Approval.** This PA shall not be binding upon any party unless this PA has been reduced to writing before performance begins as described under the terms of this PA, and unless the PA is approved as to form by the Wyoming Attorney General or his representative.
3. **Severability.** Should any portion of this PA be judicially determined to be illegal or unenforceable, the remainder of the PA shall continue in full force and effect, and any party may renegotiate the terms affected by the severance.
4. **Sovereign Immunity**. The State of Wyoming, the WYSHPO, the NRC, the BLM, the ACHP, and Ross Project Consulting Tribes do not waive their sovereign or governmental immunity by entering into this PA and each fully retains all immunities and defenses provided by law with respect to any action based on or occurring as a result of the PA.
5. **Indemnification.** Each Signatory to this PA shall assume the risk of any liability arising from its own conduct. Each Signatory agrees they are not obligated to insure, defend or indemnify the other Signatories to this PA.

Execution of this PA by the NRC, BLM, ACHP, WYSHPO, Strata, Ross Project Consulting Tribes, the submission of documentation and filing of this PA with the ACHP pursuant to 36 CFR § 800.6(b)(1)(iv) prior to the Signatories' approval of the Undertaking, and implementation of its terms, are evidence that the NRC has taken into account the effects of this Undertaking on historic properties and afforded the ACHP an opportunity to comment.

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SIGNATURES: In witness thereof, the Signatories to this PA through their duly authorized representatives have executed this PA on the days and dates set out below, and certify that they have read, understood, and agreed to the terms and conditions of this PA as set forth herein.

The effective date of this PA is the date of the last signature affixed to this page.

Federal Agencies

The U.S. Nuclear Regulatory Commission

____

NRC Official Date

The U.S. Department of the Interior, Bureau of Land Management, Newcastle Field Office

____

BLM Official Date

Wyoming State Historic Preservation Officer

____

Mary Hopkins, SHPO Date

Advisory Council on Historic Preservation

____

John M. Fowler, Executive Director Date

Strata Energy, Inc.

____

Name and title Date

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Approval as to Form:
Wyoming Attorney General's Office

S. Jane Caton, Date
Senior Assistant Attorney General

Concurring Parties:

Blackfeet Tribe

Name and title Date

Cheyenne and Arapaho Tribes

Name and title Date

Cheyenne River Sioux Tribe

Name and title Date

Confederated Salish and Kootenai Tribe

Name and title Date

Apsaalooke (Crow) Nation

Name and title Date

Crow Creek Sioux Tribe

Name and title Date

Eastern Shoshone Tribe

Name and title Date

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Flandreau-Santee Sioux Tribe

Name and title Date

Fort Belknap Community

Name and title Date

Fort Peck Assiniboine/Sioux

Name and title Date

Lower Brule Sioux Tribe

Name and title Date

Northern Arapaho Tribe

Name and title Date

Northern Cheyenne Tribe

Name and title Date

Oglala Sioux Tribe

Name and title Date

Rosebud Sioux Tribe

Name and title Date

Santee Sioux Tribe of Nebraska

Name and title Date

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Sisseton-Wahpeton Oyate Tribes

____
Name and title Date

Standing Rock Sioux Tribe

____
Name and title Date

Mandan, Hidatsa & Arikara Nation
Three Affiliated Tribes

____
Name and title Date

Turtle Mountain Band of Chippewa

____
Name and title Date

Yankton Sioux Tribe

____
Name and title Date

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Appendix A

Description of Undertaking and Area of Potential Effects

Undertaking

On January 4, 2011, Strata Energy, Inc. (Strata or the Applicant) submitted to the U.S. Nuclear Regulatory Commission (NRC) a license application to construct and operate the Ross Project, which is a proposed uranium in situ recovery (ISR) facility located in Oshoto, Crook County, Wyoming.

The Atomic Energy Act of 1954, as amended, authorizes the NRC to issue licenses, either as a general or specific license, to qualified applicants for the receipt, possession and use of byproduct and source materials resulting from the removal of uranium ore from its place of deposit in nature. An NRC specific license is issued to a commercial uranium or thorium ISR facility pursuant to NRC implementing regulations listed in Title 10 of the Code of Federal Regulations (10 CFR) Part 40.

On January 21, 2011, Strata submitted to the U.S. Department of the Interior, Bureau of Land Management (BLM), Newcastle, Wyoming Field Office a Plan of Operations for the Ross Project for review and approval.

The Mining Law of 1872, 30 U.S.C. §§ 22-54 authorizes the BLM to review and approve mining plans for use of Federal minerals and the Federal Land Policy and Management Act of 1976, 43 U.S.C. §§ 1701-1784 requires the BLM to manage all BLM-administered lands and minerals for multiple uses.

Ross Project Location and Proposed Activities

The proposed activities consist of constructing and operating an ISR facility at the Ross Project site located in Oshoto, Crook County, Wyoming. Strata is a U.S.-based corporation registered in Wyoming and a wholly owned subsidiary of Peninsula Energy Limited, an Australian registered company. Peninsula Energy is a publicly traded corporation on the Australian Securities Exchange. For this Undertaking, Strata is the Applicant.

As shown in Figure 1, Crook County is located in the northeastern corner of Wyoming, abutted by Montana to the north, South Dakota to the east, Weston County, Wyoming, to the south, and Campbell County, Wyoming to the west. The total area encompassed by Crook County is 2871 square miles. The nearest town to the project is Moorcroft, which is located approximately 22 miles south of the Ross Project. The closest community is Oshoto, which includes 11 residences located within 2 miles (mi) [3.2 kilometers (km)] of the project area. In addition to Moorcroft, the other nearest major urban centers include Sundance, Hulett, and Pine Haven, all of which are located in Wyoming. The largest population in those nearby urban centers is in Sundance with a 2010 population of 2602 persons (Strata, 2011).

As shown in Figure 2, the Ross Project comprises approximately 696 hectares (ha) [1,721 acres (ac)]. Surface ownership of land located within the Ross Project is as follows: private entities,

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553 ha [1367.2 ac]; State of Wyoming, 127 ha [314.1 ac]; and the Federal Government as administered by the BLM, 16 ha [40.0 ac]. Mineral rights are owned by the same entities as the surface rights; however, the distribution differs slightly from that of the surface ownership in that federal mineral rights ownership occurs in several quarter/quarter sections for which surface land is owned by private entities. The Ross Project includes parts of the following sections of the Public Land Survey System:

Section	Township	Range
7, 17, 18 & 19	53 North	67 West
12, 13 & 24	53 North	68 West

The proposed activities for the Ross Project include the construction of wellfields and a central processing plant (CPP) with ancillary equipment. The ancillary equipment includes underground piping from the wellfield to the CPP and from the CPP to the deep disposal wells, two to three dozen header houses, an administrative and warehouse/maintenance building, a chemical and equipment storage area, lined retention ponds, and deep disposal wells. Except for the wellfields, header houses, deep disposal wells and piping, most of the development is limited to a 50-acre area referred to as the “CPP area” within the project.

The Applicant proposes in situ recovery processes for this project. The ISR process involves extracting uranium from underground ore bodies without bringing the ore bodies to the surface by injecting a leaching solution through wells into underground ore bodies to dissolve the uranium. The leaching solution is recovered from the subsurface through the extraction wells and piped to the CPP through a system of underground piping. At the CPP, two generic processes produce the final product, which is referred to as yellowcake.

From the initial construction to final decommissioning, the Applicant-proposed timeline for the Ross Project is approximately 10 years; however, the Applicant also requests processing of uranium-rich resins derived from other ISR operations (either a future Strata facility or a facility operated by another licensee) or other entity (e.g., water treatment resins). The Applicant states that processing of resins outside sources could extend the life of the CPP to 20 years.

The Applicant proposes restoration of the production aquifer and stability monitoring. Restoration of portions of wellfields may occur simultaneously with operations (recovery of uranium) at other wellfields. After restoration is completed and approved by NRC staff, the wellfields will undergo decommissioning and reclamation by removing the piping and other ancillary equipment. Upon completion of operations, all surface facilities that were installed for the Ross Project will be decommissioned to allow unrestricted future use of the property. All equipment not fully decontaminated for unrestricted use will be disposed of at an NRC-licensed facility.

Ross Project Area of Potential Effects

As indicated in the NRC’s letters to the Wyoming State Historic Preservation Office and the Advisory Council on Historic Preservation, dated August 19, 2011, the Area of Potential Effects (APE) is the area at the Ross Project site and its immediate environs, which may be impacted by activities associated with the construction and operation of the proposed facility. The direct APE is comprised of the areas within the Ross Project boundary that may be directly affected by physical ground disturbance and construction of the Ross Project, including the Phase I area

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shown in Figure 3, and the indirect APE is comprised of the area within three (3) miles of the Ross Project boundary wherein potential visual and audible effects to historic properties may occur.

By letter dated August 27, 2012, Strata provided to the NRC the results of its analysis to identify and assess the potential visual effects to properties located within 3 miles of the Ross Project boundary. The NRC staff's initial review of this analysis will be incorporated into the NRC's *Tribal Field Survey and NRC's Eligibility Determination Report for the Ross In Situ Uranium Recovery Project.*

Reference:

Strata, 2011. Ross ISR Project USNRC License Application, Crook County, Wyoming, prepared by Strata Energy, Inc., Docket No. 040-09091. ADAMS Accession No. ML110120063, January 2011.

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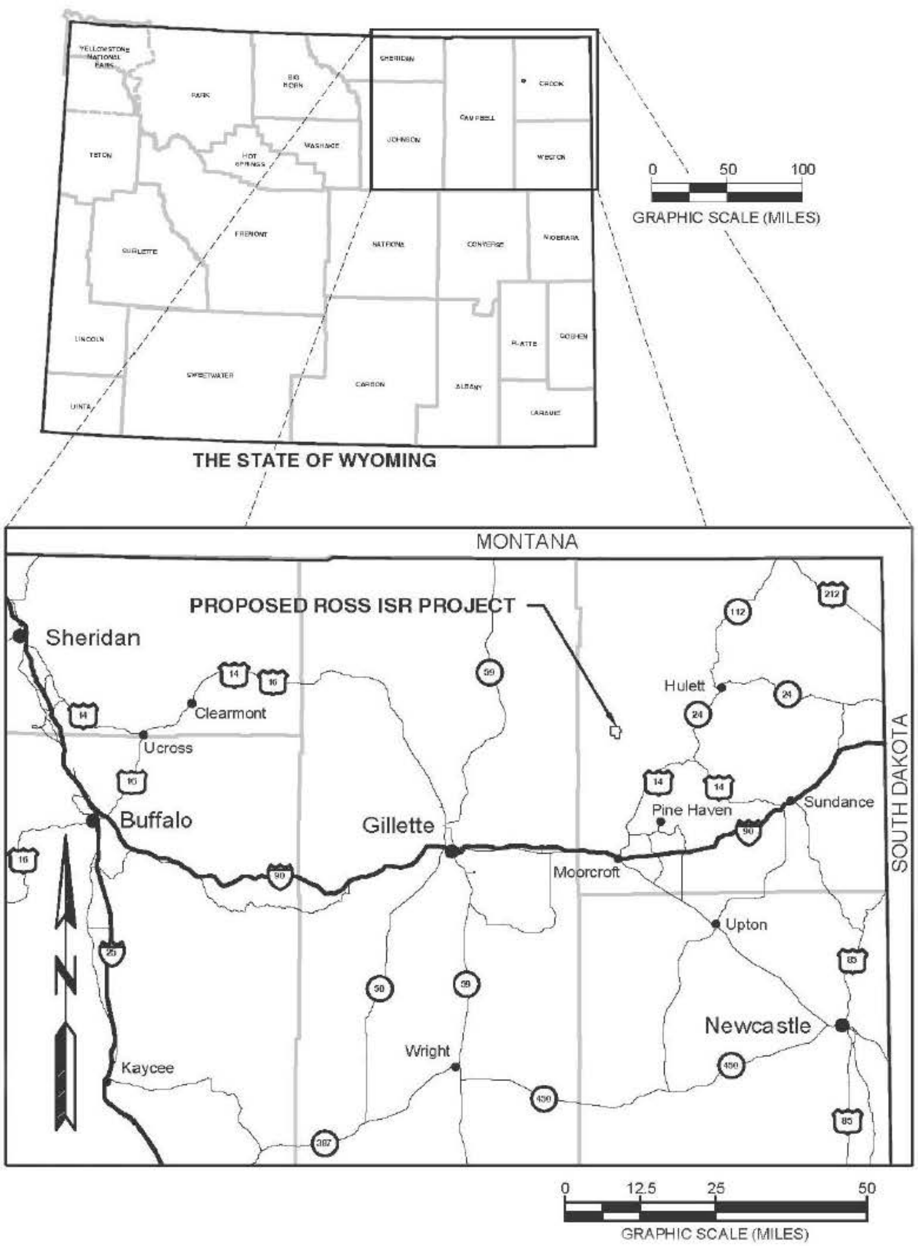

Figure 1 Ross Project Location Map
Source: Figure 1.4-1 of the Ross ISR Project USNRC License Application, Technical Report, Crook County, Wyoming, prepared by Strata Energy, Inc., Docket No. 040-09091. ADAMS Accession No. ML110120063, January 2011.

APPENDIX A TO THE PROGRAMMATIC AGREEMENT AMONG THE U.S. NUCLEAR REGULATORY COMMISSION, THE ADVISORY COUNCIL ON HISTORIC PRESERVATION, THE WYOMING STATE HISTORIC PRESERVATION OFFICE, THE BUREAU OF LAND MANAGEMENT-NEWCASTLE FIELD OFFICE AND STRATA ENERGY, INC. REGARDING THE ROSS IN-SITU URANIUM RECOVERY PROJECT IN CROOK COUNTY, WYOMING

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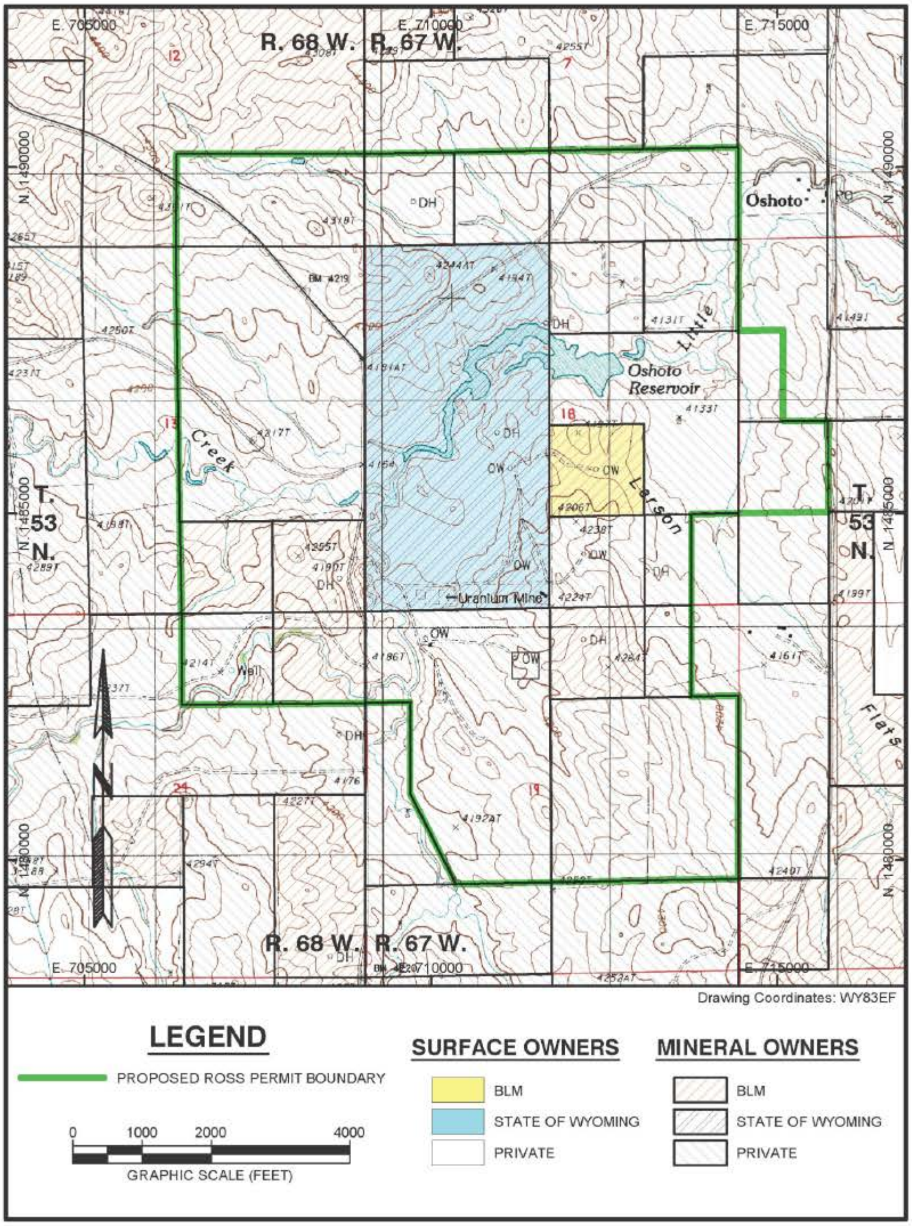

Figure 2 Ross Project License Boundary and Distribution of Land Ownership
Source: Figure 2.1-1 of the Ross ISR Project USNRC License Application, Technical Report, Crook County, Wyoming, prepared by Strata Energy, Inc., Docket No. 040-09091. ADAMS Accession No. ML110120063, January 2011.

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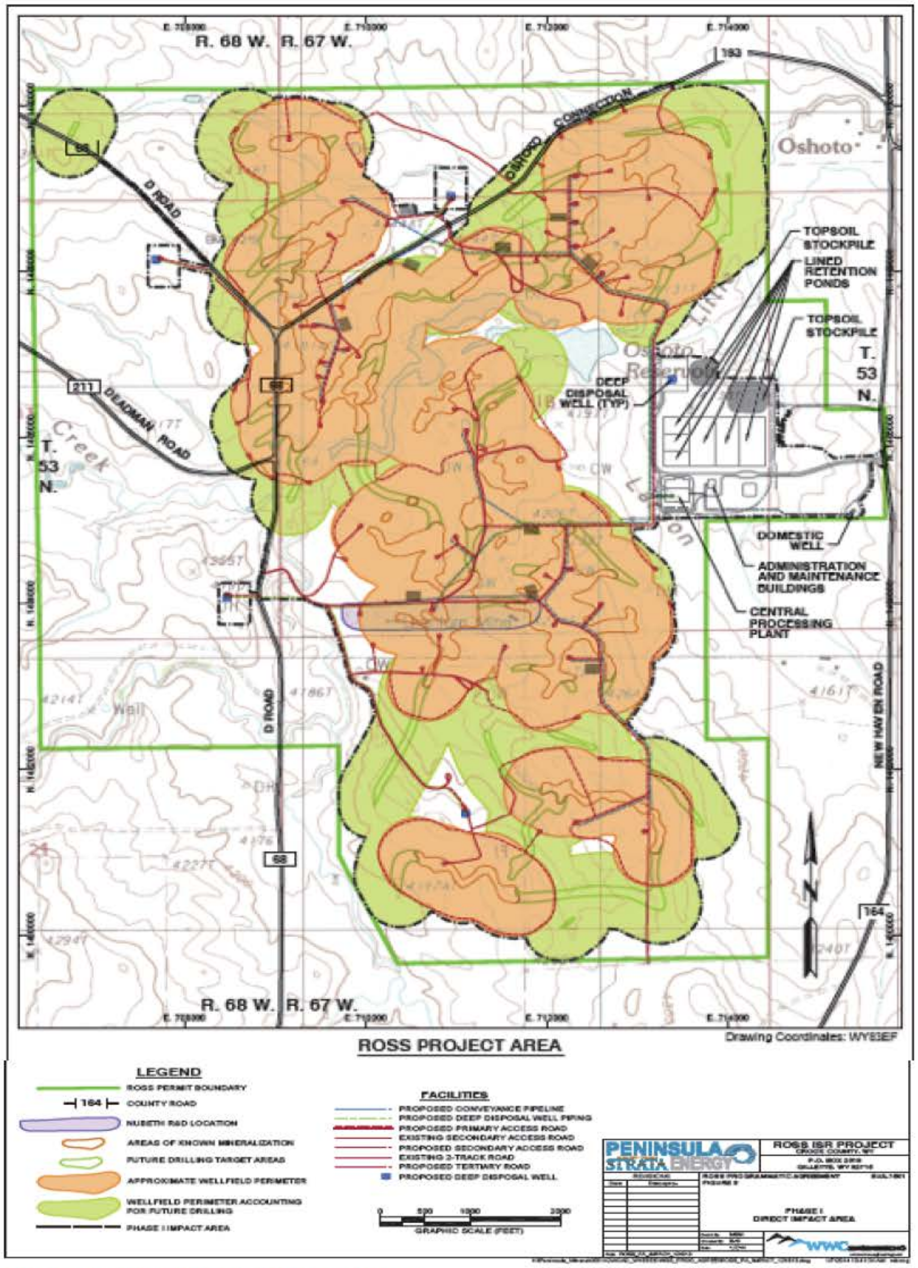

Figure 3 Ross Project Phase I Area

Source: Email to Johari Moore (NRC) from Ben Schiffer [WWC (Strata)]. Re: Request for Additional Information to Develop Draft Programmatic Agreement. Docket No. 040-09091. January 7, 2014.

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Appendix B

Ross Project Cultural Resource Inventories

Cultural Resource Inventory

A Class III Cultural Resource Inventory (Class III Inventory) was conducted in support of the Ross Project in April 2010 and July 2010. The Inventory included a pedestrian survey in transects of 30-m [102-ft] intervals throughout the Ross Project area. Subsurface exposures such as cut banks, anthills, rodent burrows, roads ruts, and cow tracks were examined. Shovel probes were placed at the discretion of the surveyors, primarily in locations where artifacts or features were located or where soil had accumulated. The Inventory focused on landforms where intact sites might be expected, such as intact, stable terraces and their margins, as well as areas of exposure. Site evaluations were not completed for all sites during this Inventory and sites were not assessed for project effect.

In November 2011, additional site evaluation field work was accomplished: A geophysical magnetometer survey was conducted at several sites, but it was found to be ineffective because of the nature of the soils. During the fieldwork 6 back-hoe trenches, approximately 27 test pits measuring 0.5 m x 0.5 m [1.6 ft x 1.6 ft], and approximately 44 test pits measuring 1.0 m x 1.0 m [3.3 ft x 3.3 ft] were excavated to further evaluate sites near areas where road construction and other impacts would be expected. The testing report for this fieldwork was submitted in 2012.

In preparation for the Class III Inventory, a records search was conducted for the Ross Project area in 2010; this search included the records of the Wyoming Cultural Records Office (WYCRO), the WYCRO online data base, and the BLM's Newcastle Field Office. The records search showed that, prior to the 2010 Class III Inventory, no substantial block inventory had been conducted in the Project area. Small-scale investigations, including two associated with power lines and buried telephone cables as well as a drilling-pad and access-road survey, had been conducted in the Ross Project area. One survey, an inventory for a linear buried telephone cable in Section 13, identified one prehistoric campsite, 48CK1603. This site was re-recorded during the 2011 fieldwork and determined to be eligible for the National Register of Historic Places despite damage from a county road that bisects the site.

Buildings and Structures

No buildings or structures eligible for the National Register of Historic Places (NRHP) or Wyoming State Register were identified within the Ross Project area. An earthen structure in the Ross Project area, the Oshoto Dam, did not meet the criteria for eligibility for listing in the NRHP (48 CFR Part 2157). The original dam has been rebuilt numerous times because of flood damage, most recently in 2005, and is considered to be essentially a reconstruction rather than the original dam.

Archaeological Sites

During the Applicant's initial Class III Inventory for the Ross Project, 24 new sites and 21 isolated finds were recorded. Twenty-three of the recorded sites are prehistoric camps, and one

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is a historic-period homestead. A number of sites produced projectile points that represent Middle Archaic, Late Archaic, and Late Prehistoric occupations. Twenty-one isolates were also recorded during the Inventory. All but two of these are prehistoric artifacts; the two historic isolates are trash scatters. In addition to the sites identified during the Class III Inventory, the potential exists for deeply buried sites to be found within the Ross Project area because of its propitious location near the headwaters of the Little Missouri River and the percentage of the Ross Project area that consists of deep alluvium.

As described in the Tribal Consultation section below, a Class III Inventory in the Ross Project area designed to identify and evaluate the NRHP significance of properties of religious and cultural significance to Tribes was performed by representatives of ten Tribes during May and June 2013. During the June Tribal field survey, additional archaeological content including bone and lithic artifacts was found at 48CK2087, a site identified in the cultural resource inventory as consisting only of a hill-top cairn. The new cultural finds at 48CK2087 extend the boundary of 48CK2087. Additionally, three new archaeological sites were found within the Ross Project Area: 48CK2229, 48CK2230, and 48CK2231.

The 27 sites along with previously identified 48CK1603 are listed in Table 1-A, Table 1-B, Table 1-C, and Table 1-D. Consultations on the eligibility determinations for these sites are documented in the following letters between the NRC and the Wyoming State Historic Preservation Office (WYSHPO): NRC letter to WYSHPO, dated March 8, 2013; WYSHPO letter to NRC, dated March 28, 2013; NRC letter to WYSHPO, dated September 20, 2013; WYSHPO letter to NRC, dated October 22, 2013.

Table 1-A. Summary of Ross Project Cultural Properties

Site Number	NRHP Eligibility
48CK1603	Eligible
48CK2070	Unevaluated
48CK2071	Not Eligible
48CK2072	Not Eligible
48CK2073	Unevaluated
48CK2074	Not Eligible
48CK2075	Unevaluated
48CK2076	Unevaluated
48CK2077	Not Eligible
48CK2078	Unevaluated
48CK2079	Unevaluated
48CK2080	Unevaluated
48CK2081	Unevaluated
48CK2082	Unevaluated
48CK2083	Eligible
48CK2084	Not Eligible
48CK2085	Unevaluated
48CK2086	Not Eligible
48CK2087	Unevaluated
48CK2088	Not Eligible
48CK2089	Unevaluated

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Site Number	NRHP Eligibility
48CK2090	Unevaluated
48CK2091	Unevaluated
48CK2092	Unevaluated
48CK2093	Not Eligible
48CK2229	Unevaluated
48CK2230	Unevaluated
48CK2231	Unevaluated

Table 1-B. Summary of NRHP Eligible Ross Project Cultural Properties

Site Number	NRHP Eligibility
48CK1603	Eligible
48CK2083	Eligible

Table 1-C. Summary of NRHP Not Eligible Ross Project Cultural Properties

Site Number	NRHP Eligibility
48CK2071	Not Eligible
48CK2072	Not Eligible
48CK2074	Not Eligible
48CK2077	Not Eligible
48CK2084	Not Eligible
48CK2086	Not Eligible
48CK2088	Not Eligible
48CK2093	Not Eligible

Table 1-D. Summary of Unevaluated Ross Project Cultural Properties

Site Number	NRHP Eligibility
48CK2070	Unevaluated
48CK2073	Unevaluated
48CK2075	Unevaluated
48CK2076	Unevaluated
48CK2078	Unevaluated
48CK2079	Unevaluated
48CK2080	Unevaluated
48CK2081	Unevaluated
48CK2082	Unevaluated
48CK2085	Unevaluated
48CK2087	Unevaluated
48CK2089	Unevaluated
48CK2090	Unevaluated

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Site Number	NRHP Eligibility
48CK2091	Unevaluated
48CK2092	Unevaluated
48CK2229	Unevaluated
48CK2230	Unevaluated
48CK2231	Unevaluated

Tribal Consultation

According to Executive Order (EO) No. 13175, *Consultation and Coordination with Indian Tribal Governments*, the NRC is encouraged to "promote government-to-government consultation and coordination with Federally-recognized Tribes that have a known or potential interest in existing licensed uranium-recovery facilities or applications for new facilities." The BLM is required to comply with this Order. Although the NRC, as an independent regulatory agency, is explicitly exempt from the Order, NRC remains committed to its spirit. The agency has demonstrated a commitment to achieving the Order's objectives by implementing a case-by-case approach to interactions with Native American Tribes. The NRC's case-by-case approach allows both the NRC and the Tribes to initiate outreach and communication with one another.

As part of its obligations under Section 106 of the NHPA and the regulations at 36 CFR 800.2(c)(2)(ii)(A), the NRC must provide Native American Tribes "a reasonable opportunity to identify its concerns about historic properties, advise on the identification and evaluation of historic properties and evaluation of historic properties, including those of religious and cultural importance, articulate its views on the undertaking's effects on such properties, and participate in the resolution of adverse effects." Tribes that have been identified as potentially having concerns about actions near Devils Tower were formally invited by the NRC staff, by letter dated February 9, 2011, to participate in the Section 106 consultation process for the proposed Ross Project (see Table 2). The NRC staff invited the Tribes to participate as consulting parties in the NHPA Section 106 process and sought their assistance in identifying Tribal historic sites and cultural resources that may be affected by the Undertaking.

Table 2. Tribes Invited to Participate in Section 106 Consultation for the Ross Project

1	Apache Tribe of Oklahoma[a]
2	Blackfeet
3	Cheyenne and Arapaho Tribes of Oklahoma
4	Cheyenne River Sioux
5	Chippewa Cree
6	Confederated Salish & Kootenai Tribes
7	Crow Tribe
8	Crow Creek Sioux Tribe
9	Eastern Shoshone Tribe
10	Flandreau Santee Sioux Tribe
11	Fort Belknap Community
12	Fort Peck Assiniboine and Sioux Tribes
13	Kiowa Tribe of Oklahoma[b]
14	Lower Brule Sioux Tribe

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15	Northern Arapaho Tribe
16	Northern Cheyenne Tribe
17	Oglala Sioux Tribe
18	Rosebud Sioux Tribe
19	Santee Sioux Tribe of Nebraska
20	Sisseton-Wahpeton Sioux Tribe
21	Spirit Lake Tribe[b]
22	Standing Rock Sioux Tribe
23	Three Affiliated Tribes
24	Turtle Mountain Band of Chippewa Indians
25	Yankton Sioux Tribe

[a]The Apache Tribe of Oklahoma notified the NRC by email dated August 19, 2011 that it did not wish to participate in consultation on the Ross Project.

[b]No response was received from the Kiowa Tribe of Oklahoma or the Spirit Lake Tribe.

Culturally Significant Locations

No Native American heritage, special interest, or sacred sites were previously formally identified or recorded to date that are in the Ross Project APE. The geographic position of the Project area between mountains considered sacred by various Native American cultures (the Big Horn Mountains to the west and the Black Hills including nearby Devils Tower to the east), however, creates the possibility that the Project area could have sites and locations of special religious or sacred significance to Native American groups.

Properties of Religious and Cultural Significance to Tribes

As required by Section 106 of the NHPA, the NRC requested information about places of cultural, religious, and traditional significance that could be affected by the Ross Project from various interested Tribes in order to complete government-to-government consultation efforts. Places of cultural, religious, and traditional significance that meet the NRHP criteria are included in the definition of Historic Property under 36 CFR Part 800.16(l)(1).

The NRC invited the Tribes listed in Table 2 (excluding The Apache Tribe of Oklahoma) to participate in a field survey of the Ross Project area under an “Open-Site approach” and a “Tribal Working Group” approach. A detailed description of the NRC’s efforts to provide an opportunity for Consulting Tribes to conduct a field survey of the Ross Project site is provided in the NRC’s letter to the Advisory Council on Historic Preservation (ACHP), dated August 14, 2013. A Class III Inventory in the Ross Project area designed to identify and evaluate the NRHP significance of properties of religious and cultural significance to Tribes was performed by representatives of six Tribes on May 13 – 16, 2013. The six Tribes participating in the May Tribal field survey included:

- Santee Sioux Tribe of Nebraska (Niobrara, Nebraska)
- Crow Creek Sioux Tribe (Fort Thompson, South Dakota)
- Rosebud Sioux Tribe (Rosebud, South Dakota)
- Yankton Sioux Tribe (Wagner, South Dakota)
- Northern Cheyenne Tribe (Lame Deer, Montana)

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- Turtle Mountain Band of Chippewa Indians (Belcourt, North Dakota)

A second Tribal field survey was performed by representatives of four Tribes on June 3 – 6, 2013. The four Tribes participating in the May Tribal field survey included:

- Cheyenne and Arapaho Tribes of Oklahoma (Concho, Oklahoma)
- Northern Arapaho Tribe (Fort Washakie, Wyoming)
- Fort Belknap Indian Community (Harlem, Montana)
- Eastern Shoshone Tribe (Fort Washakie, Wyoming)

The entire 696.46 [1,721-ac] Ross Project area was inventoried using current Class III-inventory methods during both Tribal field surveys. Crew members performed the surveys using transects spaced no greater than 30 meters (m) [100 ft]. Skirmish-line transects were walked across the Ross Project area, guided by GPS bearings in addition to natural and cultural features, and the transects were adjusted in direction when major obstacles, such as Oshoto Reservoir, were met. Because of the large numbers of personnel involved in the two surveys, radio communications were provided by Strata to Tribal leaders to facilitate survey communications and coordination. In most instances, a limited time was spent at previously recorded archaeological sites. To facilitate relocation and recording, newly discovered archaeological sites were located by a single GPS datum and briefly noted as to the site's general content and setting. Newly discovered prehistoric individual finds were also mapped and recorded during both surveys.

When properties of religious and cultural significance to Tribes were noted during the May Tribal field survey, the pedestrian survey was brought to a halt, and the find was recorded by the NRC archaeological consultant supporting the survey in consultation with leaders of the May Tribal crew. Properties of religious and cultural significance to Tribes noted during the June Tribal field survey were briefly identified as properties of religious and cultural significance to Tribes by the Tribal crew and plotted by GPS location. The survey then resumed. Once the walkover was completed, the June crew returned to the mapped properties and recorded them.

As a result of the May and June Tribal field surveys, 18 properties of religious and cultural significance to Tribes were located, recorded, and evaluated for NRHP eligibility in the Ross Project area (see Table 3). A *Tribal Field Survey Report* documenting these findings, based on the recommendations provided by the Northern Arapaho Tribe, the Cheyenne and Arapaho Tribes of Oklahoma, and the NRC archaeological consultants that supported the survey will be submitted to the Wyoming SHPO for review and comment. By letter dated August 27, 2012, Strata provided to the NRC the results of its analysis to identify and assess the potential visual effects to properties located within 3 miles of the Ross Project boundary. The NRC in coordination with the BLM will utilize this analysis and additional records search information to analyze indirect effects and will incorporate this analysis into the *Tribal Field Survey Report*.

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Table 3. Summary of Ross Project Properties of Religious and Cultural Significance to Tribes

Site Number	NRHP Eligibility
48CK2070	Unevaluated
48CK2080	Unevaluated
48CK2087	Unevaluated
48CK2089	Unevaluated
48CK2214	Unevaluated
48CK2215	Unevaluated
48CK2216	Unevaluated
48CK2217	Unevaluated
48CK2218	Unevaluated
48CK2219	Unevaluated
48CK2220	Unevaluated
48CK2221	Unevaluated
48CK2222	Unevaluated
48CK2223	Unevaluated
48CK2224	Unevaluated
48CK2225	Unevaluated
48CK2226	Unevaluated
48CK2227	Unevaluated

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U.S. NUCLEAR REGULATORY COMMISSION

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(See instructions on the reverse)

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10. SUPPLEMENTARY NOTES

11. ABSTRACT (200 words or less)

By a letter dated January 4, 2011, Strata Energy, Inc. (Strata or the "Applicant") submitted a license application to the Nuclear Regulatory Commission (NRC) for a new source and byproduct materials license for the proposed Ross Project. The Ross Project would be located in Crook County, Wyoming, which is in the Nebraska-South Dakota-Wyoming Uranium Milling Region identified in the NUREG-1910, Generic Environmental Impact Statement (GEIS) for In-Situ Leach Uranium Milling Facilities. The NRC staff prepared this Supplemental Environmental Impact Statement (SEIS) to evaluate the potential environmental impacts of the Applicant's proposal to construct, operate, conduct aquifer restoration, and decommission an in situ uranium-recovery facility at the Ross Project. This SEIS describes the environment that could be affected by the proposed Ross Project activities, estimates the potential environmental impacts resulting from the Proposed Action and two Alternatives, discusses the corresponding proposed mitigation measures, and describes the Applicant's environmental-monitoring program. The NRC staff evaluated site-specific data and information to determine whether the site characteristics and the Applicant's proposed activities were consistent with those evaluated in the GEIS. The NRC staff has incorporated public comments received on the Draft SEIS into this Final SEIS.

12. KEY WORDS/DESCRIPTORS (List words or phrases that will assist researchers in locating the report.)

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