U.S. Nuclear Regulatory Commission Request for Additional Information
Uranium One Americas Antelope and JAB Uranium Project Environmental Review of Application for a U.S. Nuclear Regulatory Commission Source Materials License

Uranium One Americas (Uranium One) submitted a source material license application on July 3, 2008, to the U.S. Nuclear Regulatory Commission (NRC) for the Antelope and JAB Uranium Project (Uranium One, 2008a, 2008b). This application, which included an environmental report (Uranium One, 2008c), is to allow Uranium One to conduct *in-situ* recovery (ISR) operations for uranium extraction at Antelope and JAB (a satellite to Antelope), both in Sweetwater County, Wyoming. Based on a review of the environmental report, the NRC staff offers the following Request for Additional Information (RAI). In this RAI, staff refers to the Antelope and JAB Uranium Project, which consists of the Antelope Unit and the JAB Unit. Each information request may refer collectively to Antelope and JAB Uranium Project or individually to the Antelope or JAB unit, and includes the basis and purpose for requesting the information. Information requests are organized by environmental resource area or review topic. All section numbers, figures and tables refer to Uranium One's environmental report, unless otherwise indicated.

Proposed Action RAI PA-1 Provide updated

plans for the proposed project.

The following updates are required:
1 The detailed land development plan for the proposed project, including a map showing the current well field layout, information on header houses and pipe laying for well lines and trunk lines.
2 The estimate of the number of injection, recovery, and monitoring wells that will be installed in the well fields.
3 The detailed plan for excursion monitoring at the well fields, including sampling frequency and estimates of porosity in the production aquifers.
4 The bases for estimating the initial surety amount (e.g., will the surety amount be the cost of constructing the facilities and well fields for the first year of operation?)

These updates are required to enable NRC staff to determine potential impacts from the proposed project based on the most current design information.

RAI PA-2 Clarify or confirm information provided in the

environmental report.
Several inconsistencies and missing information were observed in the description of the proposed action and the affected environment:

1. Discrepancy between the range of elevation in the Great Divide Basin stated in Sections 3.1.1 (6,900 to 7,400 feet above mean sea level) and 3.4.1.1 (6,398 to 9,980 feet above mean sea level).

2. Expected U_3O_8 production for the Antelope area.

3. Inconsistencies between the illustration in Figure 2.2-7 depicting central processing plant units and the process description in Section 2.3.1.3.

4. Technical details of screens to be used for injection, recovery, and monitoring wells consistent with the well construction materials specifications described in Section 2.2.6.1.

5. That the ion exchange vessels to be used at the JAB satellite plant will be sized at 500 cubic feet each, similar to those at the Antelope central processing plant.

6. The eluate storage volume and how many batches of eluate will stored before precipitation and drying begins.

7. Anticipated groundwater transfer flow rate.

8. Anticipated volumes of reductant and sodium hydroxide that would be used for groundwater treatment

This information is needed for a complete description of the proposed action and a consistent technical basis for determining the impacts of the proposed project.

RAI PA-3

Provide the current status of WDEQ, BLM, and Sweetwater County permits for the proposed project.

In Sections 1.5 and 2.2 through 2.6 of the ER, Uranium One acknowledges that all necessary WDEQ and BLM permits and approvals must be obtained prior to commencement of commercial production. However, there is no indication of a plan or schedule for obtaining these permits. This information is needed to update the status of permits and approvals for the proposed project.

RAI Climate-1

Provide extended climatic data for the following parameters: temperature, rainfall, snowfall, wind, and pan evaporation. The data sets should be representative of the Antelope and JAB areas and should cover periods comparable to the timespan of the proposed project.

The climatic data provided in Section 3.6 for the Seminole II Mining site covered a 5- year span, whereas the text indicates the data have been collected for about 15 years. Also, Table 3.6-1 indicates data records dating back to 1928 are available for some regional meteorological stations. This information is needed to address potential long-term climate variation.

RAI Land Use-1

Clarify the location of the Continental Divide National Scenic Trail relative to the proposed Antelope and JAB permit areas.

Table 3.1-2 of the environmental report indicates the Continental Divide National Scenic Trail is 1 mile from the license area while the text on page 3.1-3 states that the trail "comes within 2 miles of the northeast boundary of the Antelope site." This information is needed to ensure the affected environment is correctly and consistently described in the environmental report.

RAI Land Use-2

Provide additional state and county information on the land use plans for the parcels that are on or near the project areas.

The environmental report discusses land use planning for BLM lands but does not discuss land use planning for the State of Wyoming-managed lands. Also, there is no discussion of county zoning designations or potential changes to zoning that may be needed to implement the proposed project. Uranium One should clarify what the State of Wyoming land use plans and county zoning are for the parcels that are on or near the project or provide a basis for why the information is not pertinent to evaluating potential land use impacts. This information is needed to evaluate whether the proposed project conflicts with any current land use plans.

RAI Land Use-3

Clarify whether the proposed project will restrict public access to any existing roads, indicate where access would be restricted, and describe how such restrictions could potentially impact access to land for other uses.

Given the proposed project areas encompass local roads (e.g., Bairoil Road, Connector Road), NRC staff could not locate a description in the environmental report as to whether any existing road access would be restricted by proposed activities. If any road access will be restricted by the proposed project, Uranium One should identify these roads and indicate where access would be restricted and describe how such restrictions could potentially impact access to land for other use activities, such as grazing, recreation, or other resource extraction. Uranium One should also clarify whether the proposed access restrictions for well fields discussed in the environmental report would apply to humans in addition to livestock. If this information is already discussed in the environmental report, Uranium One should indicate where the information can be located. NRC staff needs this information to evaluate whether the proposed project will restrict access to other land uses on or around the proposed project areas.

RAI Land Use-4

Clarify whether any split estate status land ownership exists at the proposed project area and provide an updated figure that identifies the current status of private land ownership on areas where any construction activities would be located

If split estate land ownership in the project areas (e.g., well fields, facilities, roads), discuss whether any steps have been taken to identify and/or resolve potential conflicts with land

surface owners. Figure 1.2-3 in the environmental report indicates all the land in the proposed license area is managed by the BLM or the State of Wyoming. Section 7.3.3 of the environmental report discusses lease payments to local private landowners. Provide an updated figure that identifies private land holdings (surface and subsurface) in the proposed license areas or provide an additional description of the information provided and the current status of private land ownership on the areas of the project where construction activities are proposed. Because split estate land use situations are common in the State of Wyoming, NRC staff needs this information to evaluate whether the proposed project will generate use conflicts with existing land owners on or around the proposed project areas.

RAI Land Use-5

Verify the data on existing oil and gas leases in Table 3.1-2 of the environmental report is consistent with currently held permits and update as needed. Also, describe actions that have been taken to evaluate whether any potential land use conflicts are foreseeable with existing oil, gas, mineral, grazing or other leases or land uses that overlap with the proposed project areas.

The environmental report mentions a number of existing oil and gas leases that overlap the proposed project area. NRC staff identified some of these associated with the proposed Pappy Draw Coal Bed Methane Pilot Project, but Table 3.1-2 in the environmental report appears incomplete with respect to this project's leases as described in the final BLM environmental assessment for that project (see Figure 1-1 of BLM, 2008). Uranium One may provide an explanation for why providing such information would be otherwise impractical or unnecessary for evaluating potential land use impacts. Uranium One should also clarify what actions they have taken to evaluate whether any potential land use conflicts are foreseeable with existing oil, gas, mineral or other leases or land uses that overlap with the proposed project areas, and summarize the results of these evaluations including conflicts identified and actions taken to resolve these conflicts. Uranium One should clarify what actions or investigations, if any, it has taken to evaluate the potential interference with ISR operations from adjacent resource exploration or extraction activities and potential impacts of proposed land use restrictions (e.g., well field fencing) on existing grazing permittees, if any. The response should clearly identify whether the land proposed for siting the proposed project is currently being used for grazing or other economic activities. If such land use conflicts have not been identified or are not foreseen, Uranium One should provide the basis for that response (for example, activities will not overlap or intersect in their environmental impacts). The staff needs this information to evaluate potential land use conflicts with existing proposed activities on and in the vicinity of the proposed project areas.

RAI Land Use-6

Provide the technical basis for deriving the number of acres disturbed by the proposed project.

Table 3.3-2 of the environmental report, which is not described in detail, includes 2483 acres of soil disturbance area. However, Section 2.2.4 provides an estimate for affected land area of 1400 acres. The environmental report does not describe the meanings of these disturbance area estimates. This information is needed to correctly evaluate land use and other impacts.

Clarify whether the information used in the environmental report represent currently applicable BLM resource management planning information.

Grazing information in Section 3.1.2 of the environmental report is referenced to a 1986 BLM Resource Management Plan (BLM, 1986). The web reference for this document is out of date and the BLM website only provides the management plan from 1987. Clarify whether the information used in the environmental report is consistent with the information BLM is presently using for resource management planning and update the information if necessary. This information is needed to support evaluation of land use impacts to grazing activities.

RAI Transportation-1

Provide an estimate of the magnitude of construction related transportation activity (e.g., average daily traffic counts for trucked supply and equipment shipments

NRC staff could not locate any information in the environmental report that discusses the magnitude of construction related transportation activity for the proposed project. This information is needed to evaluate the potential transportation impacts from the proposed construction activities.

RAI Transportation-2

Clarify the estimated magnitude of the workforce needed for operations, and verify the *employee estimates other than for the construction, aquifer restoration, and* decommissioning phases.

NRC staff found different estimates for the proposed operations workforce in the environmental report. For example: (i) Section 4.10.3 indicates a maximum workforce of 180; (ii) Section 4.10.2 states 40 to 60 staff needed for operations; and (iii) Section 7.3.1 discusses 80 operational workers as a maximum. This information is required to evaluate the transportation impacts from the commuting workforce.

RAI Transportation-3

Provide additional details on local herding and grazing activities on the proposed project areas and along Bairoil Road, if any, that could potentially be impacted by proposed transportation activities

Section 3.1.2 of the environmental report mentions grazing as a local land use activity but does not provide sufficient detail to evaluate whether local grazing permittees or other land uses would be impacted by the proposed increased traffic on local access roads (e.g., incidental wildlife kills, forage palatability impacts from road dust). This information is required to evaluate the potential transportation impacts on grazing activities.

RAI Transportation-4

Provide a justification for the number of hazardous chemical shipments per day to the proposed project facilities. Also provide the approximate frequency of ammonia shipments if this chemical is to be used.

Section 4.2.2.3 of the environmental report describes an estimate of 4 operational supply shipments per day that are characterized as "bulk chemical, fuel, and supply deliveries." Other ISL facilities, have reported less than 1 chemical supply shipment per day (NRC, 2009). Uranium One should provide information that explains why the proposed project requires the increased level of shipping activity. In addition, because use of ammonia is suggested in Section 2.2.8.4 of the environmental report as a potential processing chemical option, Uranium One should provide the approximate frequency of ammonia shipments if this option was selected. This information is needed to evaluate the magnitude of hazardous material

RAI Geology-1

Provide a detailed fault location map with the locations of both the Antelope and JAB project areas and mineralized areas clearly identified. Also indicate the locations of fault(s) inferred from cross-sections and well logs which are not projected at the surface. Discuss the potential for these faults to act as flow pathways across aquifers.

Section 3.3.1 of the environmental report (Uranium One, 2008c) indicates there is at least one fault within the JAB project area. However, this fault location is not provided (see, for example, Figure 3.3-37). Section 3.3.6 presents an analysis of the seismicity of the area by focusing on surrounding towns, but does not provide data on the locations of faults in the immediate area. Because the environmental report does not provide sufficient data to fully interpret and evaluate the fault geology of the project area, NRC staff is unable to determine the impacts of faulting to lixiviant excursion control and groundwater quality.

RAI Geology-2

Provide a conceptual model for the relation between the strata underneath the Antelope and JAB areas. This map should include a regional cross-section linking both areas.

The subsurface nomenclature used in the environmental report differs between the Antelope and JAB areas. This information is required to compare and contrast the time equivalences, facies and stratigraphic hierarchy between both project areas.

RAI Geology-3

Provide an expanded discussion of the potential impacts to geology and soils for the proposed project. This discussion should clearly distinguish the impacts during the four phases of the project, i.e., construction, operation, aquifer restoration, and decommissioning.

Section 4.3.1 of the environmental report presents impacts to geology and soils for the entire proposed project. However, this section does not discuss the impacts during the four project phases. This information is needed to evaluate the bases for determining the stated impacts.

RAI Water-1

Provide a hydrography map of the Lost Creek watershed including its four subwatersheds and the Antelope and JAB permit boundaries.

Figures 3.4-3 through 3.4-6 present each subwatershed (Upper Lost Creek, Arapahoe Creek, Lower Lost Creek, and Osborne Draw) as a separate hydrography map, partially overlain by the permit boundaries. Thus, it is difficult to view the complete surface drainage of the Antelope and JAB project areas. This information is needed to evaluate the impacts to surface water resources from the proposed project.

RAI Water-2

Provide a site layout map showing the locations of surface discharges from the well fields, processing plants and other disturbed areas within the Antelope and JAB project areas.

Activities within the well fields, process plants, and along the pipeline courses and roads have the potential to increase the stormwater discharge and sediment loading to stream channels, wetlands, and ponds. However, the environmental report does not indicate which surface drainage feature would receive these discharges. This information is required to evaluate impacts to surface water resources.

RAI Water-3

In addition to information provided in response to RAI PA-2, indicate the locations of diversion ditches, culverts, pipe crossings, and utility crossings.

The environmental report does not provide sufficient information regarding location of proposed work in relation to surface drainage features. Specific locations are needed to determine impacts to surface water features.

RAI Water-4

Provide a detailed description of the deep well injection plan for the proposed project, including the strata into which injection is being proposed and the water quality and degree of isolation of those strata.

The environmental report indicates that liquid wastes (including produced water, restoration water, and reverse osmosis brine) will be disposed of by deep well injection. However, there is no clear discussion linking the deep well injection to aquifer restoration techniques and liquid waste handling processes This information is needed to perform a site-specific evaluation of the potential impacts of the proposed deep well injection of liquid wastes.

RAI Water-5

Provide distance-drawdown information for the proposed well fields. This information should include a contour map or a map showing the radius of influence for each pumping test conducted in the Antelope and JAB areas.

In addition, confirm whether any site-scale flow models have been developed based on aquifer parameters estimated from the pumping tests. If so, provide a figure showing predicted drawdowns for the proposed well fields, including the location of all planned well fields and permitted water wells completed in the production zone within the Antelope and JAB permit boundaries and the surrounding 3-mile buffer. The predictions represent conditions expected during operation and aquifer restoration. This information is required to evaluate potential impacts to existing groundwater rights within the vicinity of the proposed project

RAI Water-6

Discuss the implications of the results obtained from the pumping tests conducted in the Antelope and JAB areas on projected aquifer performance during the operation and aquifer restoration phases of the proposed project.

In particular, relate the estimated aquifer parameters to expected aquifer performance under higher net pumping rates (up to the production bleed of 30 gpm) and longer pumping durations. This information is required to evaluate potential impacts to groundwater resources.

RAI Wildlife-1

Provide information indicating the location of sage-grouse core breeding areas relative to the proposed Antelope and JAB permit areas. Consider referencing the Sage-Grouse Core Breeding Areas—Version 2 map published by the Wyoming Game and Fish Department.

The requested additional information is needed to verify that the project area is within the sage-grouse core breeding area. The requested additional information is necessary to complete the analysis of the potential impacts to sage-grouse.

RAI Wildlife-2

Provide information indicating the location of the proposed Antelope and JAB permit areas relative to Wyoming Game and Fish Department Terrestrial Crucial Priority Areas. Consider referencing maps presented in the Wyoming Game and Fish Department Strategic Habitat Plan of January 2009.

The requested additional information is needed to verify that the project area is within Terrestrial Crucial Priority Areas. The requested additional information is necessary to complete the analysis of the potential impacts to terrestrial wildlife.

RAI Wildlife-3

Provide all occupied sage-grouse leks and their perimeters within 2 miles of the permit boundaries recently recorded by the Wyoming Game and Fish Department. In addition, indicate 0.6 mile and 1.9 mile perimeters around each of the occupied leks.

New sage-grouse leks are discovered every year, and some leks are determined to be unoccupied. WGFD Stipulations for Development in Core Sage-Grouse Population Areas, including road locations and surface occupancy restrictions, may apply within the permit areas due to the location of leks within 2 miles of the perimeter of the permit areas. Therefore, the requested additional information is necessary to complete the analysis of the potential impacts to sage-grouse.

RAI Wildlife-4

Provide all written documentation from the Wyoming Game and Fish Department and U.S. Fish and Wildlife Service that addresses permitting requirements that may be imposed on Uranium One based on wildlife survey results.

The requested additional information is needed to verify that there are no site-specific requirements that WGFD and USFWS will impose on Uranium One as a result of the wildlife surveys conducted. The requested additional information is necessary to complete the analysis of the potential impacts to wildlife.

Provide a detailed description (including location) of overhead utility lines to be constructed. Describe the mitigation measures to reduce impacts to raptors.

The requested additional information is needed to verify where potential overhead power lines would be located. Overhead utility lines can provide perches for raptors and other species altering the natural relationships between birds and animals. The requested additional information is necessary to complete the analysis of the potential impacts to wildlife.

RAI Vegetation-1

Provide references to support the claim that invasive or noxious weeds were not documented in the permit area.

Section 3.5.5.1.9 mentions that no state designated weeds were encountered in the proposed project area. The United States Department of Agriculture Natural Resource Conservation Service (USDA NRCS) Invasive and Noxious Weeds List identifies 30 noxious weeds in Wyoming. However, Sweetwater County Weed and Pest may have other species of concern on the local level. Therefore, there is insufficient basis to conclude that there are no invasive or noxious weeds of concern to Sweetwater County Weed and Pest at the proposed project.

RAI Vegetation-2

Identify the species for the observed *Cirsium* specimens listed in Addendum 3.5-A.

Identification to the species level of these specimens is warranted because of the number of listed state noxious *Cirsium* species. Therefore, there is insufficient basis to conclude that the *Cirsium* specimen observed is not one that is listed as a noxious weed.

RAI Vegetation-3

Provide information on the species of noxious weeds observed at man-made water sources, including available data and references. Consider adding the weeds to the table in Addendum 3.5-A as a species observed but not sampled and revising Section 3.5.5.1.9, which states that no state designated weeds were encountered in the license area, and Section 3.5.5.3.2, which states "[n]oxious weed infestations were observed in areas where livestock concentrated at man-made water sources, though these infestations were not widespread."

Various sections in the environmental report present conflicting information that prevent NRC staff from concluding whether or not noxious weeds were observed at the project site.

RAI Vegetation-4

Identify the species for the observed *Cryptantha, Penstemon,* and *Phlox* specimens listed in Addendum 3.5-B.

BLM's Sensitive Plan Species list and Wyoming Natural Diversity Database's list of Special Species of Concern include species of *Cryptantha, Penstemon,* and *Phlox*. Therefore, there is

RAI Vegetation-5

Provide the cover summaries for the Sagebrush Grassland (Antelope), Breaks Grassland (Antelope), Sagebrush Grassland (JAB), and Big Sagebrush Shrubland (JAB).

Descriptions of the plant communities surveyed in Section 3.5.5.1 refer to Addendum 3.5-B for a complete cover summary for each plant community in the Antelope and JAB project areas. However the cover summaries for Sagebrush Grassland (Antelope), Breaks Grassland (Antelope), Sagebrush Grassland (JAB), and Big Sagebrush Shrubland (JAB) are not included in the addendum. Therefore, there is insufficient information to analyze the vegetation cover for each of the plant communities and identify any potential species of concern.

Provide all correspondence, jurisdictional determinations, and/or permits obtained from the United States Army Corps of Engineers or Wyoming Department of Environmental Quality relating to wetlands.

Concurrence from the United States Army Corps of Engineers that the wetlands in the project area are non-jurisdictional as recommended is not included in the environmental report. Isolated wetlands and associated mitigation are regulated by the WDEQ. The requested additional information is needed to verify compliance with Section 404 of the Clean Water Act.

RAI Wetlands-2

Provide a map showing the location of the wetlands identified from the National Wetlands Inventory within the Antelope and JAB permit boundaries and the surrounding ¼-mile area.

Section 3.4.1.1 of the environmental report provides only the number and type of wetlands. Also, Figures 3.5-2a and 3.5-2b provide locations of wetlands identified during the wetland survey. However, potential impacts to previously mapped wetlands may exist whether or not wetland conditions were present during the surveys or the wetlands identified are nonjurisdictional. Complete information on the location of wetlands is needed to provide a basis for determining potential impacts to surface water resources.

RAI Wetlands-3

Clarify what is meant by the 'Disturbance Areas' outlined in orange on Figures 3.5-2a and 3.5-2b.

Section 3.5.5.2.4 states that, based on the planned and potential well field locations, no wetlands will be impacted due to the construction of the well field sites. There is insufficient information to determine whether the 'Disturbance Areas' on Figures 3.5-2a and 3.5-2b are the potential well field locations. Consider including details on Figures 3.5-2a and 3.5-2b showing potential well field locations, proposed well locations, new road work, underground piping, utilities, and processing plants in relation to all drainages and wetlands so that NRC staff can analyze the potential impacts to wetlands from the proposed activities.

RAI Wetlands-4

Clarify the 2007 Delineated Wetlands identified during the surveys.

NRC staff understands that the locations of wetlands identified during the surveys are depicted by a purple dot on Figures 3.5-2a and 3.5-2b. However, the legend indicates that a field of light blue is used to show 2007 Delineated Wetlands. There are no fields of light blue used in the figures. Therefore, NRC staff cannot determine if 2007 Delineated Wetlands are present on the maps. Consider revising the legends or providing maps with a smaller scale to better depict the delineated wetland boundaries.

RAI AQ-1

Discuss the compliance status for air permitting for the JAB and Antelope site and provide related information (for example, facility classification, types of permits applicable, and permit conditions).

Table 1.5-1 of the environmental report identifies the necessary environmental approvals from federal and state agencies required for the proposed project. However no air quality permit is listed in the table or discussed in the text. In Wyoming's "In Situ Mining Permit Application Requirements Handbook", Clean Air Act permits are identified in the listing of permits or construction approvals (WDEQ, 2007). The environmental report is unclear on whether the State of Wyoming has been contacted or provided feedback concerning air permitting. The requested information is necessary to assess the impacts of the proposed project on air quality.

RAI AQ-2

Provide the technical basis, with references or supporting documentation, for the fugitive dust emission analyses for the operations phase of the proposed project. Also include a clear estimate of fugitive dust concentration for the proposed project in timeframes consistent with current federal regulations.

Section 4.6.1.1 of the environmental report provides an estimated annual mass of PM_{10} emitted for the operational phase of the proposed project. The environmental report also states that atmospheric dispersion modeling generally shows that fugitive PM_{10} emissions on this order result in insignificant impacts to ambient air beyond a distance of several hundred yards from the source. However, the environmental report does not clearly identify the value for the estimated concentration nor provide references to the atmospheric dispersion model used in developing this estimate. Furthermore, the environmental report states that the national ambient standard for annual average PM_{10} is 50 □g/m^3. This standard was revoked by the EPA in 2006 (EPA, 2008), although Wyoming regulations still use this standard. The current federal PM_{10} standard is for a 24-hour averaging time. The requested information is necessary to assess the impacts of the proposed project on air quality.

RAI AQ-3

Provide an expanded description of fugitive dust impacts, including (i) qualitative and quantitative analyses for all four ISR phases (construction, operations, restoration, and decommissioning), and (ii) the basic background information and assumptions used to generate the quantitative emission estimates.

Section 4.6 of the environmental report discusses fugitive dust impacts for construction (qualitative) and operation (qualitative and quantitative), however no impacts are discussed for restoration or decommissioning. The requested information is necessary to assess the impacts of the proposed project on air quality.

Provide air emission estimates for nonradiological contaminants other than fugitive dust that may be generated during each phase of the proposed project. Also, provide basic background information and assumptions used to generate any quantitative estimates and use terms (i.e. total mass, concentrations) and timeframes appropriate for comparison to any applicable regulations.

Nonradiological air emission estimates presented in Section 4.6 of the environmental report were limited to fugitive dust even though diesel emissions were identified as one of the primary sources of air quality impacts. In addition, the proposed project includes stationary sources such as the natural gas or propane fired heaters used to warm the heat transfer fluid for the yellowcake dryers (see Section 2.3.1.4). The requested information is necessary to assess the impacts of the proposed project on air quality.

RAI AQ-5

Provide a description of air quality for the affected environment. This description should identify the air quality region of influence for the proposed project and characterize the air quality, air emissions, attainment status, and any air quality issues or concerns within this region of influence.

The description of the affected environment in Section 3 of the environmental report does not contain an air quality section. In addition to other pertinent issues, the description should consider that the Wyoming Department of Environmental Quality is recommending that a portion of Sweetwater County be reclassified as nonattainment for ozone (WDEQ, 2009). The requested information is necessary to assess the impacts of the proposed project on air quality.

RAI AQ-6

Provide an expanded description of the use of water or chemical treatment to mitigate fugitive dust emission from unpaved roads, including (i) a rationale or basis for determining when such mitigation will be necessary, and (ii) the basis for stating that watering or chemical treatment of the unpaved roads would reduce emission factors by half or more.

Section 4.6.1.1 of the environmental report indicates that periodic watering or chemical treatment of the unpaved roads, if necessary, would reduce emission factors by half or more. An understanding of the mitigation implementation and effectiveness is necessary to assess the impacts of the proposed project on air quality.

RAI Noise-1

Provide an expanded description of current and future potential noise impacts to the project area and surrounding counties. This description should include (i) the methodology used to determine background sound levels (for example, traffic counts on existing roadways anticipated to be used during construction and operation of the proposed facility), (ii) field measurements recorded, and (iii) a comparison to noise levels expected to be generated during construction, operation, groundwater restoration, and decommissioning of the project.

According to Sections 3.7 and 4.7 of the environmental report, impacts to noise or congestion within the project area, the surrounding 2-mile area, and Sweetwater or other neighboring counties are not anticipated. However, the descriptions provided are not of sufficient detail to evaluate the significance of potential noise impacts. In particular, background noise levels or field noise measurements are not provided for comparison to anticipated noise levels. This information is needed to determine the impacts to noise from the proposed project.

RAI Cultural-1

Provide a report on the findings for the 117 acres omitted from the Antelope cultural resources inventory in Appendix B of the environmental report.

According to the Antelope cultural resources inventory (Appendix B of the environmental report), the remaining 117 acres of the total 10,535 acres of the Antelope area was to have been surveyed in early 2008 (Landem, 2008). A report of the findings of this survey is required to evaluate the impacts of proposed uranium project activities on the historic and cultural resources of the Antelope area.

RAI Cultural-2

Confirm that sites currently listed, or eligible for listing, on the National Register of Historic Places (NRHP) will be marked and protected during all phases of the proposed project.

Three sites in the Antelope area (48SW7621, 48SW16880, and 48SW16883) are potentially eligible for listing on the NRHP. In the JAB area, one site (48SW4882) is listed and two (48SW16903 and 48SW16907) are eligible for listing on the NRHP. The environmental report indicates that construction will be avoided near all three Antelope area sites; however, for the JAB area, only the NHRP-listed site will be avoided. The listing of a historic property in the NRHP ensures that such property is protected under provisions of the National Historic Preservation Act of 1966 (NHPA). In accordance with NHPA-implementing regulations at 36 CFR Part 800, properties deemed potentially eligible for NRHP listing are given this same protection also. This information is required to ensure protection of historic and cultural resources of the proposed project areas.

RAI Cultural-3

Review and clarify/correct the following inconsistencies:

1 The site 48SW4882 within the JAB area is mentioned in Section 4.8 of the environmental report, but omitted from Sections 3.8.2 and 5.8.2.
2 Two NHRP-eligible sites in the JAB area (48SW16903, and 48SW16907), which are discussed in Graves (2008), are included in Sections 3.8.2 and 5.8.2, but omitted from Section 4.8.

This information is required to ensure a consistent basis for evaluating the impacts to historic and cultural resources of the proposed project areas.

RAI Visual-1

Provide the basis for the determination of Bureau of Land Management Visual Resource Management (VRM) Class IV for the project area.

Section 3.9.1 of the environmental report states that visual resources were inventoried and classified according to the VRM system defined in the Lander Resource Management Plan (RMP) (BLM 1986) and that the project area is designated VRM Class IV. NRC staff did not find visual resources discussed in the referenced Lander RMP. Thus, there is insufficient basis for NRC staff to confirm the designated VRM class for the project area. Consider using the Lander Field Office 2009 Summary of the Analysis of the Management Situation, which contains recommendations based on the results of the visual resources inventory conducted. This information is needed to assess potential impacts of the proposed project on visual resources.

RAI Visual-2

Provide results from the contrast rating analysis in accordance with Bureau of Land Management Manual 8431, Visual Resource Contrast Rating, to determine whether the potential visual impacts from proposed surface-disturbing activities or developments will meet the management objectives of VRM Classes II and III, and appropriate visual mitigation measures are applied.

The Bureau of Land Management Manual 8431, Visual Resource Contrast Rating, provides a systematic means to evaluate proposed projects and determine whether the proposed projects conform with the approved VRM objectives, or whether design adjustments will be required. The requested information is needed to assess potential impacts of the proposed project on visual resources.

RAI Visual-3

Provide an evaluation of potential visual impacts of the proposed project to the Continental Divide National Scenic Trail.

The Continental Divide National Scenic Trail is located between 1.5 to 2 miles east and northeast of the proposed Antelope permit area. The environmental report does not discuss this sensitive visual feature. This information is required to determine the potential visual impact from the proposed project.

RAI SOC-1

Provide additional data on various demographic and socioeconomic parameters for the counties and cities surrounding the proposed project location. The data provided should be obtained from the most recent sources available.

Section 3.10 of the environmental report presents a broad range of demographic and socioeconomic data for counties and cities surrounding the proposed project. Additional data are required for the following parameters and locations:

1 Population trends for Riverton and Lander, similar to Table 3.10-1
2 Average labor and employment characteristics for Fremont County, Rawlins, Riverton, and Lander, similar to Table 3.10-5
3 Race and poverty characteristics for Carbon County, similar to Table 3.10-6, updated with 2008 data for Sweetwater, Carbon, and Fremont Counties, if available
4 Revenue and tax structure for Sweetwater, Carbon, and Fremont Counties, Rawlins, Riverton, and Lander, updated with 2008 data, if available
5 Schools and bus routes for Sweetwater, Carbon, and Fremont Counties
6 Local emergency services, including hospitals, fire, and police, for Sweetwater, Carbon, and Fremont Counties, Rawlins, Riverton, and Lander, including any available emergency management plans
7 Permanent and temporary housing for Riverton, Lander, Lamont and along

U.S. Highway 287

This additional information is required to evaluate the socioeconomic impacts of the proposed project.

RAI SOC-2

Provide additional data on any state "ad valorem taxes" levied for mineral production in Sweetwater, Carbon, and Fremont Counties. Also, provide information regarding any recent natural gas booms that have occurred in these counties since 2000.

Section 3.10.2 of the environmental report mentions that Carbon and Fremont Counties depend on mineral resource development, primarily coal, oil, and natural gas production, and that the largest growth rates have occurred in these counties since 2000 due to increases in coal production and coal bed methane development. NRC staff could not find any discussion of the state "ad valorem taxes" associated with these mineral extraction activities. This additional information is required to evaluate the socioeconomic impacts of the proposed project.

Provide full reference for "Wyoming Department of Employment, Research and Planning (2003" in Section 3.10.1.

This reference is needed to verify local labor information provided in the environmental report.

RAI HS-1

Provide a discussion of actual background radiation levels in the Antelope and JAB project areas of Wyoming so that the impacts of Antelope and JAB operations can be accurately evaluated.

Section 3.11.1 of the environmental report discusses average background radiological conditions for the United States, indicating that doses are higher in Wyoming because of higher elevations and above average concentrations of naturally-occurring uranium in the soil. This information is required to accurately evaluate the radiological impacts of the proposed project.

RAI HS-2

Discuss and provide references for previous public health studies (radiological or chemical) that may have been performed at and within the vicinity of the proposed roject.

This information is needed to obtain measure of public health in the region surrounding the proposed project.

RAI HS-3

Provide an expanded description of administrative and process safety controls to be implemented during operation of the proposed facilities. This description should explicitly reference the relevant regulations and industry guidelines, and include numeric standards stipulated therein.

Sections 2.3, 2.4, and 2.5 describe the processes, chemical storage, equipment, materials, and instrumentation to be used in the proposed project facilities. Also, this description includes the use of oxygen and various hazardous chemicals such as hydrogen sulfide, hydrochloric acid, sulfuric acid, and ammonia. However, specific details are not provided, for example, on the location of storage tanks relative to the facility buildings, the regulations or guidelines to be followed during operation and storage, and the process safety controls to be implemented when handling these chemicals. This information is needed to evaluate the effectiveness of the proposed safety precautions.

RAI WM-1

Clarify that contaminated soil would be included as byproduct waste

Section 4.13.3 of the environmental report discusses the types of solid wastes expected to be generated by the proposed action but does not include contaminated soils from, for example, well field leaks and spills as a potential byproduct waste. This information is needed to ensure the information in the environmental report is complete.

RAI WM-2

Clarify proposed disposal approach for hazardous wastes

Section 4.13.3.3 of the environmental report discusses hazardous wastes that would be generated by the proposed action but does not provide information on the disposal approach (e.g., material would be sent to a facility licensed by WDEQ) to complete the discussion of how the wastes would be managed by Uranium One. This information is needed to understand Uranium One's plans for disposal of hazardous wastes generated by the proposed project and evaluate potential waste management impacts.

RAI WM-3

Provide estimates of construction solid municipal waste volumes, decommissioning solid byproduct and municipal waste volumes, and further clarify the annual estimate for generated solid municipal waste

Section 4.13.3 of the environmental report discusses waste volumes generally; however, NRC staff could not locate any information on the volume and types of wastes that would be generated from both construction and decommissioning activities. For example, the environmental report gives an estimate of 4,000 yd^3 per year for municipal solid waste, and 500 d^3 per year for byproduct wastes, but does not clarify how these estimates relate to the different ISR project operation phases nor how this estimate relates to the total amount of solid and byproduct wastes generated over the life of the facility. Each phase of the project (construction, operation, aquifer restoration, and decommissioning) would be expected to generate different volumes of solid and byproduct wastes. This information is needed to evaluate waste management impacts from construction and decommissioning activities and gain a clearer understanding of the magnitude and types of solid wastes (including byproduct wastes) that would be generated from all phases during the proposed project lifecycle.

RAI Cumulative-1

Provide information on historical (closed or abandoned), currently active, and reasonable foreseeable future mining (coal, oil and gas) or wind farm facilities and land development activities located in the vicinity of the proposed Antelope and JAB project areas.

Section 2.10 discusses potential future Uranium One in-situ recovery activities in the area surrounding the proposed Antelope and JAB project areas, for example, potential future satellite facilities to the Antelope central processing plant. This discussion does not include other mining and land development activities that may also occur in the future. The response should define the geographic boundaries for studying each facility and activity identified. These boundaries may be airsheds, watersheds, aquifer zones, census boundaries, or habitat areas depending on the type of resource. This information is needed to provide the bases for a comprehensive cumulative impacts analysis.

BLM. "Environmental Assessment—Pappy Draw Exploratory Coal-Bed Natural Gas Pilot Project." WY-050-EA08-88. Lander, Wyoming: BLM. August 2008.

BLM. "Lander Field Office EIS/Resource Management Plan." 1986. <http://www.bim.gov/rmlp/WY/application/rmp toc.cfm?rmpid=101> (8 June 2007).

EPA. "PM Standards." 2008. <http://www.epa.gov/particles/standards.html> (18 September 2009).

Graves, A. "JAB Uranium Project, Addendum, Sweetwater County, Wyoming." ARCADIS Project Number: CO1252.0002. June 2008.

Landem, M.J. "Uranium One, Americas Antelope Uranium Project Cultural Resource Inventory Report, Sweetwater County, Wyoming." Jones and Stokes Project Number: 00178.07 002. April 2008.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Submittal of Source Material License Application and Supporting Technical Report for the Antelope and JAB Uranium Project." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 3, 2008a.

Uranium One. "Submittal of Source Material License Application and Supporting Environmental Report for the Antelope and JAB Uranium Project." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. August 7, 2008b.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Vols. 1–4. Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008c.

WDEQ. "Technical Support Document I for Recommended 8-Hour Ozone Designation for the Upper Green River Basin, WY." Cheyenne, Wyoming: WDEQ/Air Quality Division. March 2009.

WDEQ. "*In-Situ* Mining Permit Application Requirements Handbook. Application Content Requirements—Adjudication and Baseline Information." Cheyenne, Wyoming: WDEQ. March 2007.

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Geosciences and Engineering Division
6220 Culebra Road • San Antonio, Texas, U.S.A. 78238-5166
(210) 522-5160 • Fax (210) 522-5155

October 16, 2009
Contract No. NRC–02–04–014
Account No. 20.10890.16.016

U.S. Nuclear Regulatory Commission
ATTN: Ms. Johari Moore
FSME/DWMEP/Environmental Review Branch
Mail Stop T–8F05
Washington, DC 20555

Subject: Draft Requests for Additional Information and Interim Draft Supplemental Environmental Impact Statement for the Antelope and JAB Uranium Project (Intermediate Milestone No. 20.10890.16.016.105)

Dear Ms. Moore,

Please find enclosed the subject deliverable under Task Order 16, Technical Assistance for the Development of a Draft Supplemental Environmental Impact Statement for the Antelope and JAB *In-Situ* Recovery Project. The two documents in this deliverable are being transmitted for U.S. Nuclear Regulatory Commission (NRC) staff review and comment. We have developed a total of 61 requests for additional information (RAIs) grouped by environmental review topic. In preparing the interim draft supplemental environmental impact statement (SEIS), we have indicated where information provided in response to these RAIs would be used to support the environmental review.

Please note that the SEIS chapters addressing the alternative actions, cumulative impacts, environmental justice, and cost-benefit analysis are not included with this deliverable as the supporting impact evaluations are substantially incomplete. This is due in part to our focus on developing comprehensive draft RAIs through both reviewing the applicant's environmental report (ER) and resolving comments raised during our internal review of the interim draft SEIS document. We believe these efforts will ensure that all critical information gaps are identified and resolved with the applicant in a single round of RAIs. Also, the excluded chapters depend on information from the other SEIS chapters. Based on NRC staff comments on the interim draft SEIS and the responses to RAIs, we anticipate completing the aforementioned chapters in the draft SEIS revision.

Furthermore, our staff and subcontractors faced a number of challenges both in tiering from the Generic Environmental Impact Statement (GEIS, NUREG-1910) into the site-specific SEIS and in adopting the GEIS conclusions in the draft SEIS. In particular, it was difficult for us to develop a single style of writing that suited all environmental review topics. However, we were able to converge on two approaches for combining information from the GEIS and ER, and presenting the technical bases for the impact conclusions. As a result, you will notice that the style of writing for each review area section of the interim draft SEIS reflects either of these optional approaches. We hereby seek NRC staff guidance in developing an acceptable writing style to be used in preparing the next draft SEIS revision.

Washington Office
1801 Rockville Pike, Suite 105 • Rockville, Maryland 20852-1633

If you have any questions about this deliverable, please contact me at (301) 881-0290 or Dr. Olufemi Osidele at (210) 522-6824.

Sincerely,

John A. Stamatakos, Ph.D.
Director
Rockville Office and
Environmental Program

JAS/OO/ls
enclosures

NRC
P. Bubar
A. Kock
I. Yu
A. Malliakos
J. Webb
V. Whipple
E. Knox-Davin

GED/CNWRA (via e-mail)
W. Patrick
B. Sagar
GED Directors
GED Managers
O. Osidele
L. Naukam

SwRI (via e-mail)
D. Daruwalla
Records Copy B, IQS

INTERIM DRAFT SUPPLEMENTAL ENVIRONMENTAL **IMPACT STATEMENT FOR THE ANTELOPE AND JAB URANIUM PROJECT**

Prepared for

U.S. Nuclear Regulatory Commission
Contract NRC–02–07–006

Prepared by

S [1]
D. [illegible] [2]
J. Durham[3]
A Glovan[3]
. P [1]
P .[illegible][3]
. J [4]
O [illegible][3]
M [3]
J . Roberts [3]
. S[illegible][1]
B Strye [3]
. Werling

[1] Subcontractor

[2] Southwest Research Institute®

[3] Center for Nuclear Waste Regulatory Analyses
San Antonio, Texas

[4] U.S. Nuclear Regulatory Commission

October 2009

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ACRONYMS/ABBREVIATIONS

ADAMS Agency Wide Documents Access and Management System AUM animal unit months BLM U.S. Bureau of Land Management CDNST Continental Divide National Scenic Trail CEQ Council on Environmental Quality CORPS U.S. Army Corps of Engineers dB decibels EPA U.S. Environmental Protection Agency ER environmental report FWS U.S. Fish and Wildlife Service GEIS generic environmental impact statement I-80 Interstate 80 ISR *in-situ* recovery IX Ion exchange LSA low specific activity NAAQS National Ambient Air Quality Standards NEPA National Environmental Policy Act NPDES National Pollutant Discharge Elimination System NRC U.S. Nuclear Regulatory Commission NRHP National Register of Historic Places OSHA Occupational Safety and Health Administration RMP regional management plan ROI region of influence SEIS supplemental environmental impact statement SEO state engineer's office SER safety evaluation report SHPO State Historic Preservation Office TEDE total effective dose equivalent UIC Underground injection control UMTRCA Uranium Mill Tailing Radiation Control Act Uranium One Uranium One Americas VRM visual resource management WDEQ Wyoming Department of Environmental Quality WDEQ-LQD Wyoming Department of Environmental Quality-Land Quality Division WDEQ-WQD Wyoming Department of Environmental Quality-Water Quality Division WGFD Wyoming Game and Fish Department

ACKNOWLEDGMENTS

This report was prepared to document work performed by the Center for Nuclear Waste Regulatory Analyses (CNWRA®) and its subcontractors for the U.S. Nuclear Regulatory Commission (NRC) under Contract No. NRC–02–04–014. The activities reported here were performed on behalf of the NRC Office of Federal and State Materials and Environmental Management Programs. The authors gratefully acknowledge the help of the NRC staff in developing this interim draft report. This report is an independent product of CNWRA and does not necessarily reflect the views or regulatory position of NRC.

QUALITY OF DATA, ANALYSES, AND CODE DEVELOPMENT

DATA: Data used in this report are taken from published documents; the respective sources of these non-CNWRA data should be consulted for determining the level of quality assurance.

ANALYSES AND CODES: None.

1 INTRODUCTION

By letter dated July 3, 2008, Energy Metals Corporation, a subsidiary of Uranium One Americas (Uranium One), submitted a source material license application to the U.S. Nuclear Regulatory Commission (NRC) staff for the Antelope and JAB Uranium Project in Sweetwater County, Wyoming (Uranium One, 2008a). The proposed project will utilize *in-situ* recovery (ISR) processes. The proposed license area comprises approximately 5,900 ha [14,574 acres] of which a maximum surface area of 570 ha [1,400 acres] would be affected. Most of the land within the proposed permit boundary is owned by the U.S. Bureau of Land Management (BLM), and a smaller portion of the land is owned by the state of Wyoming.

NRC has statutory authority under the Atomic Energy Act and Uranium Mill Tailings Radiation Control Act (UMTRCA) to regulate uranium ISR facilities. NRC regulates commercial uranium milling activities under the Code of Federal Regulations (CFR) at 10 CFR Part 40, Domestic Licensing of Source Material, Appendix A. NRC's environmental review of the license application is required under the National Environmental Policy Act (NEPA). NEPA requires Federal agencies to consider the environmental effects of the proposed action and alternative actions as part of their decision-making process. The Council on Environmental Quality (CEQ) promulgated regulations to implement NEPA requirements at 40 CFR Parts 1500 to 1508. NRC has promulgated regulations to implement NEPA requirements at 10 CFR Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions.

1.1 The Proposed Action

The proposed action is for Uranium One to construct and operate the Antelope and JAB Uranium Project under an NRC source material license. Also, the proposed action includes groundwater (aquifer) quality restoration, facility decommissioning, and site reclamation. NRC has regulatory authority over the licensing of uranium milling facilities (including the ISR process) in the state of Wyoming and has the statutory obligation to assess each license application to ensure it complies with NRC regulations prior to its issuing a license. The proposed action is described in full detail in Section 2.1.

1.2 Purpose and Need for the Proposed Action

The purpose and need for the proposed action is to produce "yellowcake" slurry from the permit area, using the ISR process, and sell it for further processing for use in the nuclear power industry. In fulfilling its statutory responsibility under the Atomic Energy Act of 1954 to protect public health and safety and the environment in matters related to source nuclear material, NRC will regulate Uranium One's construction, operation, and decommissioning of facilities associated with the proposed Antelope and JAB Uranium Project.

1.3 Alternatives to the Proposed Action

Alternatives to the proposed action include the statutory no-action alternative, open-pit conventional mining, and heap leaching. These alternatives are discussed in Chapter 2. Additional alternatives may be identified based on the significance of potential impacts of the proposed action.

1.4 Structure of the Supplemental Environmental Impact Statement

In developing this Supplemental Environmental Impact Statement (SEIS), the NRC staff systematically evaluated the potential environmental impacts of the proposed action. This SEIS has been prepared in accordance with NEPA. In the interest of efficiency, this SEIS incorporates by reference parts of NUREG–1910, Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities (NRC, 2009a), relevant to this site. NRC developed the generic environmental impact statement (GEIS) to assist in fulfilling NRC's NEPA responsibilities and to improve the efficiency of the environmental review process for ISR license applications. The GEIS evaluates the broad impacts of ISR projects in a four-state region where such projects are common. The proposed project is situated in the Wyoming West Uranium Milling Region.

Information in GEIS Chapter 2, *In-Situ* Leach Uranium Recovery and Alternatives, and in GEIS Chapter 3, Description of the Affected Environment, that is consistent with the site-specific information regarding the proposed project has been incorporated into this SEIS by reference. Likewise, the conclusions in GEIS Chapter 4, Environmental Impacts of Construction, Operation, Aquifer Restoration and Decommissioning Activities, that are determined to be applicable to the proposed project facilities are incorporated by reference. Where the conclusions in the GEIS could not be adopted (i.e., the conclusions were outside the bounds established in the GEIS), site-specific analyses are presented and potential impacts evaluated.

1.4.1 Description of the ISR Operation

Chapter 2 of this SEIS describes the ISR process and alternatives. It discusses the specific ISR methods that would be used for the Antelope and JAB Uranium Project, addressing construction, operation, aquifer restoration, and decommissioning. The construction stage includes well field development and the building of surface facilities and supporting infrastructure. Operations include injection and production of solutions from uranium mineralization in the subsurface, as well as the process to recover uranium from these solutions. Aquifer restoration includes activities to restore the groundwater quality in the production zone after uranium recovery is completed within a well field. Decommissioning includes the final stages of removing surface and subsurface infrastructure and restoring the surface after uranium production activities have been completed. Chapter 2 of this SEIS also includes a section on financial surety arrangements, where the licensee establishes a bond or other financial mechanism prior to operations to ensure that sufficient funds are available to complete aquifer restoration and decommissioning activities.

1.4.2 Description of the Affected Environment

Chapter 3 of this SEIS describes the affected environment. The "affected environment" covers various "resource areas." This SEIS uses NUREG–1748, Environmental Review Guidance for Licensing Actions Associated with NMSS Programs (NRC, 2003a), as guidance to define the affected environment to be analyzed for potential environmental impacts. These resource areas are

- Land use • Noise
- Transportation • Historical and cultural resources
- Geology and soils • Visual and scenic resources
- Water resources • Socioeconomics

• Ecology • Public and occupational health
• Air quality • Waste management

1.4.3 Identifying Environmental Issues and Characterizing Significance

This SEIS identifies and evaluates potential environmental impacts associated with the construction, operation, aquifer restoration, and decommissioning activities for the Antelope and JAB Uranium Project. NRC staff uses the GEIS as a starting point in the environmental analysis contained in Chapter 4 of this SEIS, which assesses the potential impacts associated with the previously noted resource areas.

Once the impacts are identified, their "significance" is evaluated as a measure of the impacts and classified as small, moderate, or large. According to the CEQ, the significance of impacts is determined by examining both context and intensity (40 CFR 1508.27). Context is related to the affected region, the affected interests, and the locality, while intensity refers to the severity of the impact, which is based on a number of considerations. In describing the significance of potential impacts in the SEIS, the NRC staff uses the significance levels identified in NUREG–1748 (NRC, 2003a).

This SEIS also considers potential cumulative impacts, environmental justice, monitoring activities, mitigation measures, and best management practices that may reduce potential environmental impacts. The SEIS discusses the status of consultations with other federal, tribal, state, and local agencies.

1.5 Scope of the SEIS

NRC is reviewing Uranium One's license application in accordance with the requirements under 10 CFR Part 20, Standards for Protection Against Radiation, and 10 CFR Part 40, Domestic Licensing of Source Material, as well as the agency's environmental protection regulations in 10 CFR Part 51. This SEIS provides the results of NRC's environmental review. As mentioned earlier, this SEIS incorporates by reference parts of the GEIS that are relevant to this site. The NRC safety review of Uranium One's license application will be documented separately in a safety evaluation report (SER). NRC staff has prepared this SEIS in accordance with requirements in 10 CFR Part 51 and with the associated guidance in NUREG–1748.

In accordance with NEPA, a scoping process, which occurs early in the development of an EIS, provides an opportunity for the public and other stakeholders to identify key issues and concerns that they believe should be addressed in the document. The NRC requirements for scoping are found at 10 CFR 51.26–29, while the general NRC approach to scoping is described in NUREG–1748. Scoping for this SEIS includes scoping conducted during preparation of the GEIS as well as the site-specific information gathered during preparation of this SEIS.

1.6 Licensing and Permitting

NRC has statutory authority through the Atomic Energy Act and UMTRCA to regulate uranium ISR facilities. In addition to obtaining an NRC license, applicants must obtain the necessary permits from the appropriate federal, state, local, and tribal governmental agencies. The NRC licensing process and other potential federal, state, local, and tribal permitting processes are

discussed in GEIS Section 1.7. This section summarizes the key licensing and permitting requirements for the Antelope and JAB Uranium Project.

1.6.1 Federal Licenses and Permits

The NRC process for licensing ISR of uranium comprises four key tasks: (i) acceptance review, (ii) technical review, (iii) public hearing, and (iv) an inspection program. The NRC staff's acceptance review, documented in a letter to Uranium One dated March 9, 2009 (NRC, 2009b), found the license application acceptable to begin a detailed technical review. The technical review is composed of a safety review and an environmental review for compliance with regulatory requirements of 10 CFR Part 20; 10 CFR Part 40, Appendix A; and 10 CFR Part 51. The opportunity to request a hearing for the Antelope and JAB Uranium Project, in accordance with regulations at 10 CFR Part 2, Rules of Practice for Domestic Licensing Proceedings and Issuance of Orders, concluded July 20, 2009, with no requests for hearing. The NRC Region IV office in Arlington, Texas, would be responsible for managing inspection programs for the proposed project.

The U.S. Environmental Protection Agency (EPA) permits cover water quality, under the Clean Water Act and the Safe Drinking Water Act, and air quality, under Title V of the Clean Air Act. EPA permitting that is most relevant for uranium ISR facilities is related to (i) the underground injection of lixiviant and wastewater, (ii) surface discharge of treated waters and industrial and construction storm waters, and (iii) exemption of the aquifer into which fluid is being injected for uranium recovery. Except for aquifer exemption, EPA has authorized the state of Wyoming to implement these regulatory programs.

Other federal agencies involved in licensing and permitting ISR facilities include the BLM, U.S. Army Corps of Engineers (Corps), and U.S. Fish and Wildlife Service (FWS). Because BLM owns approximately 5,670 ha [14,000 acres] of land associated with the proposed Antelope and JAB Uranium Project, Uranium One will need to develop a plan of operations for BLM per 43 CFR 3809, Surface Management. If wetlands are affected by the proposed project site and the Corps determines these are "jurisdictional" wetlands, Uranium One will have to obtain a permit from the Corps and establish mitigation and control plans under Section 404 of the Clean Water Act. Under Section 7 of the Endangered Species Act, federal agencies must consult with the FWS to verify that there is no adverse impact from the proposed ISR operation on threatened and endangered species.

1.6.2 State of Wyoming Permits

The state agencies involved with permitting for ISR facilities include the Wyoming Department of Environmental Quality (WDEQ), the State Historic Preservation Office (SHPO), the Wyoming Game and Fish Department (WGFD), and the State Engineer's Office (SEO).

WDEQ provides general guidance on the state's requirements for ISR operations. WDEQ issues permits relevant to uranium ISR activities under Title 35, Chapter 11, of the Wyoming Environmental Quality Act. Most of these permits are related to water supply and air and water quality issues and include aquifer exemption; Underground Injection Control (UIC) Class I, III, and V permits; and National Pollutant Discharge Elimination System permits. Wyoming requires UIC Class III permits for injection wells in areas not previously mined using conventional mining and milling. UIC Class V permits are required for injection wells leaching from older conventional operations.

The WDEQ Air Quality Program administers and enforces the air quality standards, emission standards, and permitting requirements. In addition, the Wyoming State Land Use Planning Act established a State Land Use Commission to govern leases, easements, and temporary uses of state lands. The state also regulates drilling and well spacing and requires drilling permits for wells regardless of land ownership. The WDEQ Land Quality Division administers and enforces all regulations on land disturbances associated with mining and reclamation in the state of Wyoming. These permits identify site-specific requirements related to establishing baseline conditions (e.g., water, soils, vegetation, cultural values) and establishing reclamation bonds based on estimated site-specific costs.

The Wyoming SHPO promotes the preservation of cultural resources and explores alternatives for their preservation. The National Historic Preservation Act of 1966 establishes the SHPO's responsibilities. The applicant must provide surveys of the site to the SHPO to determine whether there are any cultural resources that may be adversely affected by the proposed ISR project.

The Wyoming SEO regulates and administers all of the water resources in the state. The Ground Water Division of the SEO registers groundwater rights for all uses except stock and domestic, and they issue permits prior to the drilling of any water wells. The applicant must obtain permits from the SEO prior to drilling wells on the subject property in addition to verifying that existing on-site wells are already approved.

The WGFD is responsible for controlling, propagating, managing, protecting, and regulating all wildlife in Wyoming under Wyoming Statutes (W.S.) 23-1-301-303 and 23-1-401. Because wildlife, including big game animals, is present on the proposed site, consultations with the WGFD are needed to verify that the wildlife will not be affected by the proposed project.

1.6.3 County Permits

The proposed Antelope and JAB Uranium Project is situated in Sweetwater County, Wyoming. Therefore Uranium One must provide (i) a general site plan for review under the county zone change process, (ii) a detailed development plan for approval by the county commissioners, and (iii) a building permit application. Each of these permitting stages may involve public hearings to elicit local stakeholder concerns. Approvals and/or permits from Sweetwater County will cover various on-site construction and operational activities.

1.7 Environmental Review Process

NRC's environmental review of the license application is required under NEPA. NEPA requires Federal agencies to consider the environmental effects of the proposed action as part of their decision-making process. The CEQ promulgated regulations to implement NEPA requirements at 40 CFR Parts 1500 to 1508. NRC has promulgated regulations to implement NEPA requirements at 10 CFR Part 51. NRC staff has prepared this SEIS in accordance with requirements in 10 CFR Part 51 and with the associated guidance in NUREG–1748 (NRC, 2003a). The key aspects of the environmental review process are detailed in the following sections.

1.7.1 Applicant's Environmental Report

By letter dated August 7, 2008 (ML082820499), Uranium One submitted four copies of the environmental report (ER) for the Antelope and JAB Uranium Project (Uranium One, 2008b). The technical report was submitted with the July 3, 2008, letter. These documents were submitted as part of the source material license application, following the format guidance described in NRC Regulatory Guide 3.46 (NRC, 1982). The license application is publicly available in the NRC Public Document Room located at One White Flint North, 11555 Rockville Pike, Rockville, Maryland, 20852, or from the NRC's Agencywide Documents Access and Management System (ADAMS). The ADAMS Public Electronic Reading Room is accessible at <http://www.nrc.gov/reading-rm/adams.html> (Uranium One, 2008a; 2008b).

1.7 2 Acceptance Review of the License Application and Environmental Report

The NRC staff reviewed the license application, including the ER, for completeness. This initial "acceptance review" ensured that the application and ER were adequate and addressed all relevant aspects of the proposed action following the guidance in NUREG–1569 (NRC, 2003b) and NUREG–1748 (NRC, 2003a). By email dated May 12, 2008, NRC staff determined that the application was acceptable for detailed technical review, and the application was officially docketed in accordance with NRC's regulations at 10 CFR Part 2. On May 19, 2009, NRC published in the *Federal Register* a notice of availability of the application for public view and an accompanying notice of opportunity for hearing (74 FR 23436).

The NRC staff, in its detailed technical review of the license application, analyzed both the health and safety impacts (documented in the SER) and the potential environmental impacts of the proposed action.

1.7.3 NRC's Site-Specific Environmental Review

To meet NRC's NEPA obligations for the environmental review of the Antelope and JAB Uranium Project license application, the NRC staff conducted an independent, detailed evaluation of the potential environmental impacts of the proposed action for construction and operation of the ISR activities. During the environmental review, the NRC staff requested additional information and data from the applicant that the staff considered necessary to conduct its evaluation of potential environmental impacts. This evaluation also used conclusions reached in the GEIS to the extent they are applicable for the Antelope and JAB Uranium Project.

As the basis for its independent evaluation in Chapters 3 and 4 of this SEIS, NRC staff relied initially on the ER for background information on the proposed action, including the potential ISR facilities locations; the extent of proposed operations and schedule; and the surrounding local and regional affected environment. NRC staff confirmed important attributes and data presented in the ER through a site visit to the proposed site and vicinity; independent research activities; and consultations with appropriate federal, tribal, state, and/or local agencies. The NRC staff visited the proposed site on August 12, 2009, as part of the licensing process.

The NRC staff focused on the licensee's assessment of potential environmental impacts from the proposed action and the alternatives considered. NRC evaluated a reasonable range of

alternatives that included those not identified by the licensee. These additional alternatives are discussed in Chapter 2 of this SEIS.

NRC staff used site-specific information to evaluate whether the conclusions concerning the potential impacts identified in the GEIS for each resource area could be adopted into this SEIS. This SEIS contains NRC staff's decisions regarding the adoption of the GEIS conclusions and any other analysis and conclusions of potential environmental impacts for each resource area at the proposed project site.

1.7.4 Public Participation Activities

Upon acceptance of a license application for detailed technical review, NRC publishes in the *Federal Register* a notice of opportunity for hearing on the application. Individuals or entities that may be affected by the potential issuance of the site-specific ISR license may request a hearing under NRC's formal hearing process. Information in 10 CFR Part 2 provides the requirements necessary for a hearing. There were no requests for a hearing on the Antelope and JAB Uranium Project.

1.7.5 NRC's Final Environmental Review Document and Findings

[Insert conclusion of SEIS]

1.8 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009a.

NRC. "Acceptance for Review of License Application, Energy Metals Corporation's Antelope and Jab Uranium Project, Sweetwater County, Wyoming (TAC J00570)." Washington, DC: NRC. May 2009b.

NRC. NUREG–1748, "Environmental Review Guidance for Licensing Actions Associated With NMSS Programs—Final Report." Washington, DC: NRC. August 2003a.

NRC. NUREG–1569, "Standard Review Plan for *In-Situ* Leach Uranium Extraction License Applications—Final Report." Washington, DC: NRC. June 2003b.

NRC. Regulatory Guide 3.46, "Standard Format and Content of License Applications, Including Environmental Reports for *In-Situ* Uranium Solution Mining." Washington, DC: NRC. June 1982.

Uranium One. "Submittal of Source Material License Application and Supporting Technical Report for the Antelope and JAB Uranium Project." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 3, 2008a.

Uranium One. "Submittal of Source Material License Application and Supporting Environmental Report for the Antelope and JAB Uranium Project." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. August 7, 2008b.

2 DETAILED DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

This chapter provides information on the *in-situ* recovery (ISR) process, the proposed action, and alternatives to the proposed action. The proposed action is detailed in Section 2.1; including descriptions of the ISR process and facilities that would be used and descriptions of the different stages of the Antelope and JAB Uranium Project facilities' life cycle, including preconstruction, construction, operation, aquifer restoration, and decommissioning. Other aspects of the project such as occupational health radiation monitoring, waste management, transportation, and financial assurance are also discussed. Generic information pertaining to the ISR process and the associated facilities is detailed in NUREG–1910, Generic Environmental Impact Statement for Uranium *In-Situ* Leach Milling Facilities (NRC, 2009).

In addition to the proposed action, the no-action alternative and [insert other alternatives] are discussed in Section 2.2. Conventional milling and heap leaching, which were considered but not carried forward for detailed analysis, are discussed in Section 2.3.

2.1 Proposed Action

The proposed action is for Uranium One Americas (Uranium One) to construct and operate the Antelope and JAB Uranium Project under a U.S. Nuclear Regulatory Commission (NRC) source material license. According to Uranium One's environmental report (Uranium One, 2008), the Antelope and JAB Uranium Project comprises processing facilities and well fields sited on two noncontiguous mining units, the Antelope unit and the JAB satellite unit (Figure 2-1). These units are described in this section. The uranium complexes would be loaded onto ion exchange (IX) resin at both the Antelope central plant and the JAB satellite facility. Elution, precipitation, drying, and packaging would take place at the Antelope central plant.

2.1.1 Description of the Proposed ISR Process and Facilities

The Antelope and JAB Uranium Project license area would be located in the Great Divide Basin area in Sweetwater County, south central Wyoming, approximately 72 km [45 mi] northwest of Rawlins, Wyoming. Elevations in the basin range from 2,100 to 2,260 m [6,900 to 7,400 ft] above mean sea level **[RAI: to clarify discrepancy in elevation ranges between Sections 3.1.1 and 3.4.1.1],** and the terrain comprises flat to rolling hills and slopes downward along ephemeral draws. The proposed license area would cover approximately 5,900 ha [14,574 acres] of land, owned in part by either the state of Wyoming or the U.S. Bureau of Land Management (BLM). Access to the Antelope and JAB Uranium Project site would be via westward travel on Wyoming State Highway 73 from Wyoming State Highway 287.

2.1.1.1 Antelope Unit

The Antelope unit (Township 26 North, Range 93 West, Sections 11–15 and 22–24; Township 26 North, Range 92 West, Sections 1, 2, 7–12, 14, 15–22, and 28–30) would occupy three-fourths of the overall project site (Figure 2-2). The Antelope site would be located approximately 24 km [15 mi] west of Bairoil, Wyoming, about 88 km [55 mi] northwest of Rawlins.

Figure 2-1. Antelope and JAB Uranium Project General Location Map (Uranium One, 2008)

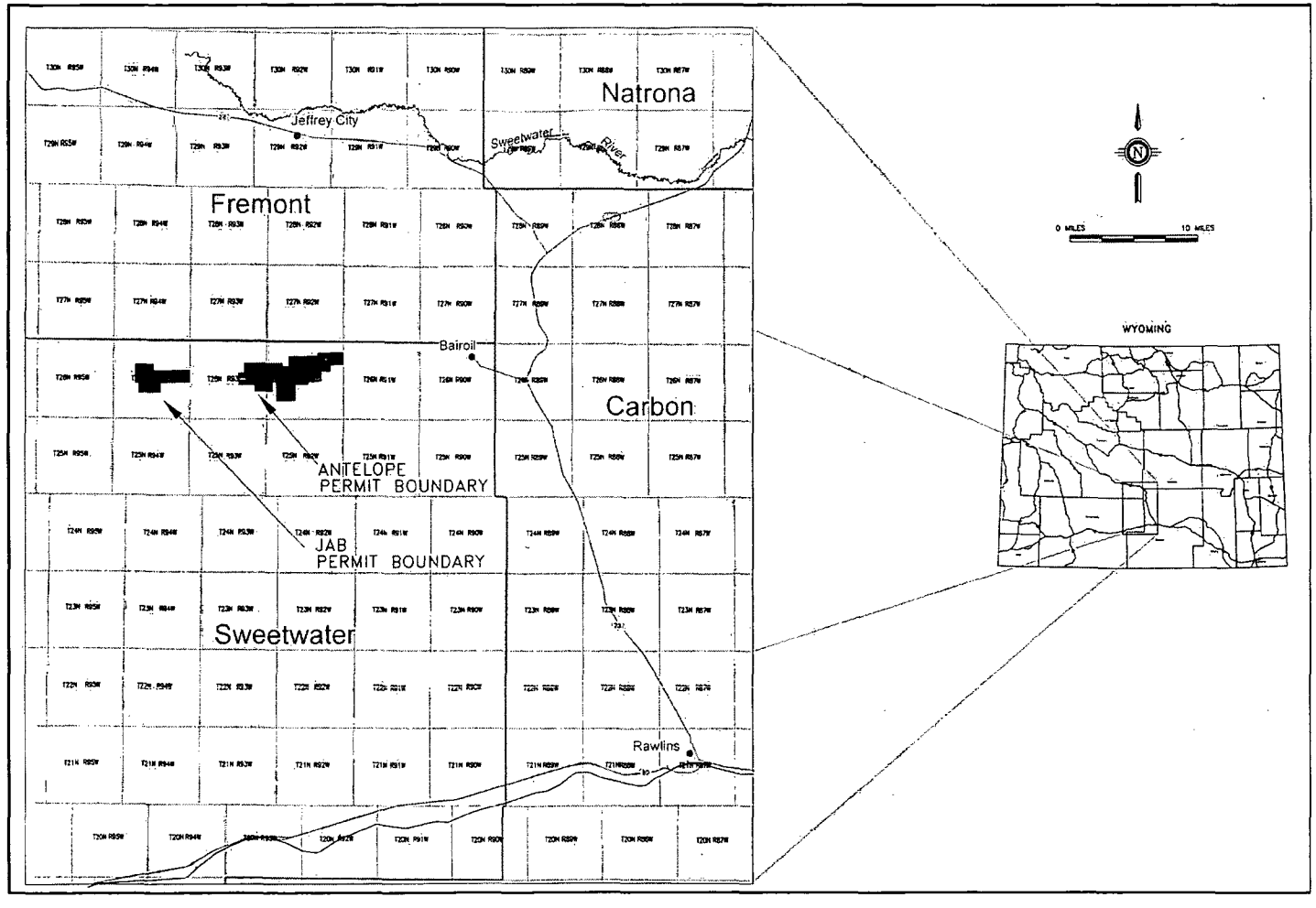

Natrona
Jeffrey City
Sweetwater River
Fremont
Bairoil
Carbon
ANTELOPE
PERMIT BOUNDARY
JAB
PERMIT BOUNDARY
Sweetwater
Rawlins
N
0 MILES
10 MILES
WYOMING

Figure 2-2. Antelope and JAB Uranium Project Site Plan (Uranium One, 2008)

2.1.1.2 JAB Satellite Unit

The JAB Satellite Unit (Township 26 North, Range 94 West, Sections 8–10, 13–17, and 20–24) would occupy approximately one-fourth of the overall project site (Figure 2-2) and would be located approximately 16 km [10 mi] west of the Antelope Unit.

2.1.2 Description of Proposed Facilities

The proposed facilities to be constructed as part of the Antelope and JAB Uranium Project include the buildings, wells, well field structures, underground piping, and access roads for both the Antelope and JAB units. The Antelope Unit will contain the central processing facility, which includes IX, resin elution, and the yellowcake drying and packaging system. The JAB unit will contain a satellite IX system. Uranium-loaded resins will be transported from the JAB satellite facility to the Antelope central plant for final processing. Currently, there are no evaporation or holding ponds planned for the Antelope or JAB project areas.

The proposed uranium recovery process at the Antelope and JAB Uranium Project would consist of eight key steps:

(1) Injection of gaseous oxygen or hydrogen peroxide and carbon dioxide or bicarbonate (barren lixiviant) solution through wells into the ore-bearing sandstone to oxidize and dissolve the uranium at the Antelope and JAB well fields

(2) Recovery of uranium-bearing (pregnant lixiviant) solution through wells to the surface at the Antelope and JAB sites

(3) Transfer of uranium-bearing solution to the central plant at the Antelope site or the satellite facility at the JAB site

(4) Loading of uranium complexes onto IX resin at the Antelope central plant and the JAB satellite facility

(5) Transfer of uranium-loaded resin from the JAB satellite facility to the Antelope central plant

(6) Processing of the loaded IX resin to remove the uranium complexes (elution) from the resin at the Antelope central plant

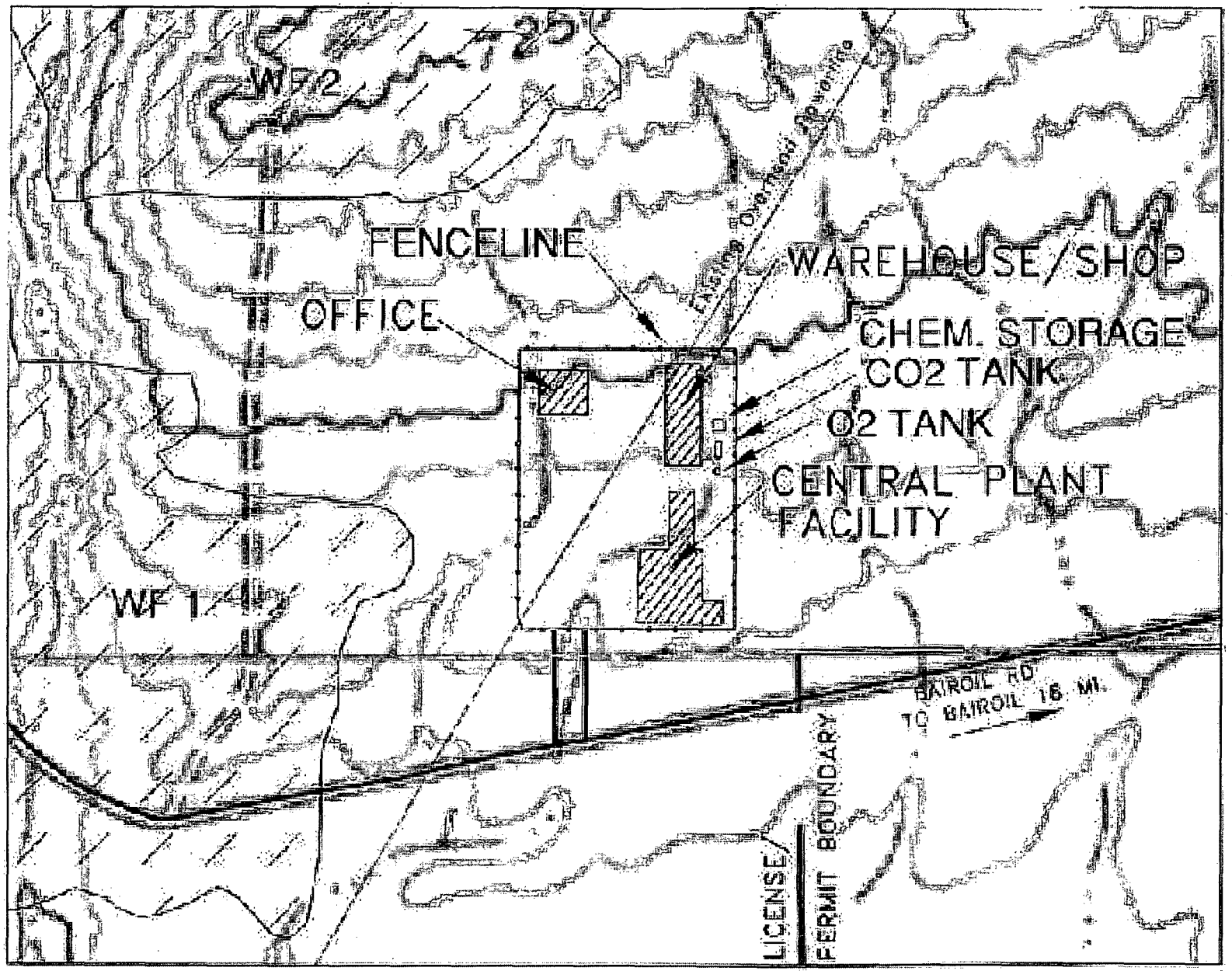
(7) Precipitation of uranium complexes from the eluate at the Antelope central plant

(8) Drying and packaging of the solid uranium (yellowcake) at the Antelope central plant

[RAI PA-3 to provide current status of BLM and Sweetwater County permits.]

2.1.2.1 Antelope Site Buildings

The proposed Antelope site central plant and auxiliary facilities are shown in Figure 2-3. The central plant would be able to fully process pregnant lixiviant obtained from the Antelope site well fields and process the uranium-loaded resin from the JAB satellite facility. The central plant would also have the capability to process resin from other potential nearby Uranium One satellite projects and/or resin received via potential tolling arrangements from other nearby


WP2
FENCELINE
OFFICE
WAREHOUSE/SHOP
CHEM. STORAGE
CO2 TANK
O2 TANK
CENTRAL PLANT
FACILITY
WP 1
BAIROIL RD
TO BAIROIL 16 MI.
LICENSE/
PERMIT BOUNDARY

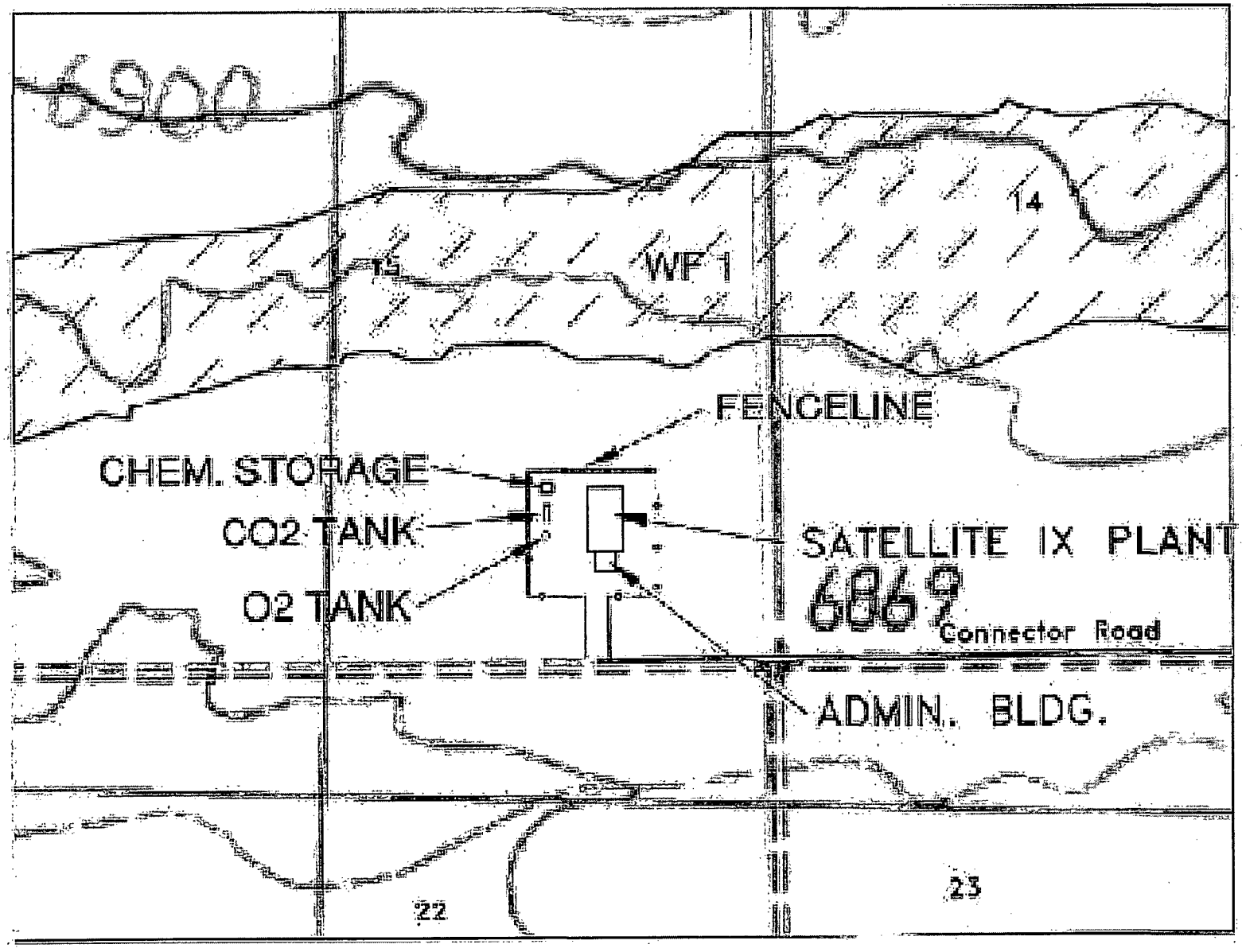
uranium recovery licensees. Processes performed at the central plant would include uranium recovery by IX, elution, precipitation of uranium, and dewatering and packaging of yellowcake. The central plant would initially be designed to produce 0.9 million kg [2 million lb] of U_3O_8 (yellowcake) per year, but capacity may be expanded to 1.8 million kg [4 million lb] per year with the potential licensing and construction of other satellite projects in the surrounding area.

The proposed central plant, as shown in Figure 2-3, would be an approximately 107 by 30 m [350 by 100 ft] building, housed within a 4.0-ha [10-acre] fenced area in the SWSE unit of Section 18, T26N, R92W. This fenced area may also contain the chemical storage area and at least one of the waste water disposal wells. Major process equipment housed in the central processing plant would include the IX system; resin transfer system; the elution/precipitation circuit; the chemical addition system; the filtration system the liquid waste stream circuit; and the yellowcake filtering, drying, and packaging facility. Bulk hazardous chemicals such as sodium sulfide would be stored outside and segregated from areas where licensed materials are processed and stored at a suitable distance to minimize hazards to people in the case of an accidental release. Sulfuric acid, hydrochloric acid, and hydrogen peroxide would each be stored in 22,710-L [6,000-gal] tanks. Bermed areas, tank containments, and/or double-walled tanks would direct any spills from any process chemical vessels located outside the central plant building. Nonhazardous bulk chemicals such as sodium carbonate may be stored within the central plant facilities. The central plant would be designed with a concrete curb that would direct any spills to a floor sump system; the sump system would direct any spilled solutions back into the plant process circuit or to the waste disposal system.

The combined uranium recovered from the Antelope and JAB Uranium Project would be processed into dry yellowcake, packaged in approved 208-L [55-gal] steel drums, and trucked offsite to Atomic Energy Act-licensed uranium conversion facilities. In a separate building attached to the central plant, there would be two to four rotary vacuum dryers, the baghouses on the dryers, and a condenser scrubber and vacuum pump system for each dryer. The dryers will be approximately 6 m [20 ft] in length and 1.5 m [5 ft] in diameter. Adjacent to the yellowcake drying area would be an enclosed warehouse used for the storage of yellowcake. This area within the central processing plant would be approximately 15 by 21 m [50 by 70 ft] in size. Onsite inventory of drummed yellowcake will typically be less than 91,000 kg [200,000 lb] except during periods of inclement weather or during potential shipment interruptions. All yellowcake will be stored onsite in restricted storage areas. All yellowcake shipments will be made in accordance with applicable U.S. Department of Transportation and NRC regulations.

2.1.2.2 JAB Unit Buildings

The JAB unit would include the satellite IX facility, an administration building, chemical storage, CO_2 and O_2 storage, storage yard, temporary byproduct storage, and employee parking within an approximately 2.0-ha [5-acre] fenced area about 16 km [10 mi] west of the Antelope unit. The JAB IX processing facility, which includes the IX facilities and the resin loading and transfer area, would be located in the SESE unit of Section 15, Township 26 North, Range 94 West as shown in Figure 2-4. The main satellite building would be approximately 30 by 55 m [100 by 180 ft] and would house an IX circuit, the lixiviant make-up circuit, and bleed treatment. This building would be contained within a concrete curb designed to contain the volume of the largest tank in the facility to prevent liquids from entering the environment. Uranium One's proposed engineering controls and operational monitoring program would ensure that spills and leaks would be quickly detected and minimized.


6900
15
WF1
14
FENCELINE
CHEM. STORAGE
CO2 TANK
O2 TANK
SATELLITE IX PLANT
6867
Connector Road
ADMIN. BLDG.
22
23

Carbon dioxide would be typically stored next to the IX facility, and oxygen would typically be stored at the IX well fields, but could be stored at the IX facility. Bulk inventories of chemicals to be used for ISR mining, such as sodium sulfide and hydrogen sulfide, would be stored at the IX facility. Byproducts would be stored in large covered bins or trailers beside the satellite facility. Storage areas would be designed according to best practices and marked with appropriate signage. Handling of hazardous materials would be conducted according to written procedures following Occupational Safety and Health Administration standards. Bulk quantities of non-process-related petroleum would be stored in aboveground tanks within secondary containment structures meeting U.S. Environmental Protection Agency (EPA) requirements outside of process areas at the plant. Bulk quantities of non-process-related propane would also be stored outside of these areas.

2.1.2.3 Access Roads

Material shipment and employee commutes will be primarily via Wamsutter-Crooks Gap Road (Sweetwater County Road 23), Bairoil Road (Sweetwater County Road 22), and State Highways 287 and 73. In addition to existing roads, a primary access road would be constructed to connect the JAB unit satellite facility with the Wamsutter-Crooks Gap and Bairoil Roads as shown in Figure 2-5. The proposed access road would be approximately 8 m [24 ft] in width, following the existing two-track road currently used to access the JAB satellite plant area. The road would be designed to be capable of carrying highway loads and would be constructed in accordance with BLM standards. Prior to construction, designs and plans for the proposed road to connect the Antelope and JAB areas will be submitted to BLM and Wyoming Department of Environmental Quality (WDEQ)-Land Quality Division (LQD) for approval. The anticipated road classification for primary access roads is BLM Local Road.

Secondary access roads would be designed to branch off primary access roads when possible to ensure minimal lengths and would be used lightly for one-way traffic to access well field headerhouses. Prior to construction, designs and plans for the proposed secondary access roads will be submitted to BLM and WDEQ-LQD for approval **[RAI PA-3 to provide current status of Sweetwater County permit]**. The anticipated road classification for secondary access roads is BLM Resource.

2.1.2.4 Well Fields

Well fields are the areas at the surface above the ore zones that the applicant delineated to reach desired production goals. The depths of the uranium-producing zones below the surface are approximately 60 to 180 m [200 to 600 ft] at the Antelope unit and 70 to 80 m [230 to 260 ft] at the JAB unit. The well fields and disturbance area would be approximately 570 ha [1,400 acres] for the Antelope and the JAB areas combined as shown in Figure 2-2. The well field areas shown in these figures are preliminary. The final well field footprints will be submitted to the WDEQ-LQD prior to construction and operation. Uranium One has not estimated the U_3O_8 content at the Antelope unit. Three and one-half million pounds is estimated to exist at the JAB Unit **[RAI PA-2 to provide estimate of U_3O_8 for Antelope area]**.

2.1.2.4.1 Injection and Production Wells

The injection and production (or recovery) wells used in the ISR process are the locations in which the barren lixiviant is injected and the pregnant lixiviant is recovered, respectively. The injection and recovery wells will be designed in a conventional square five spot pattern as

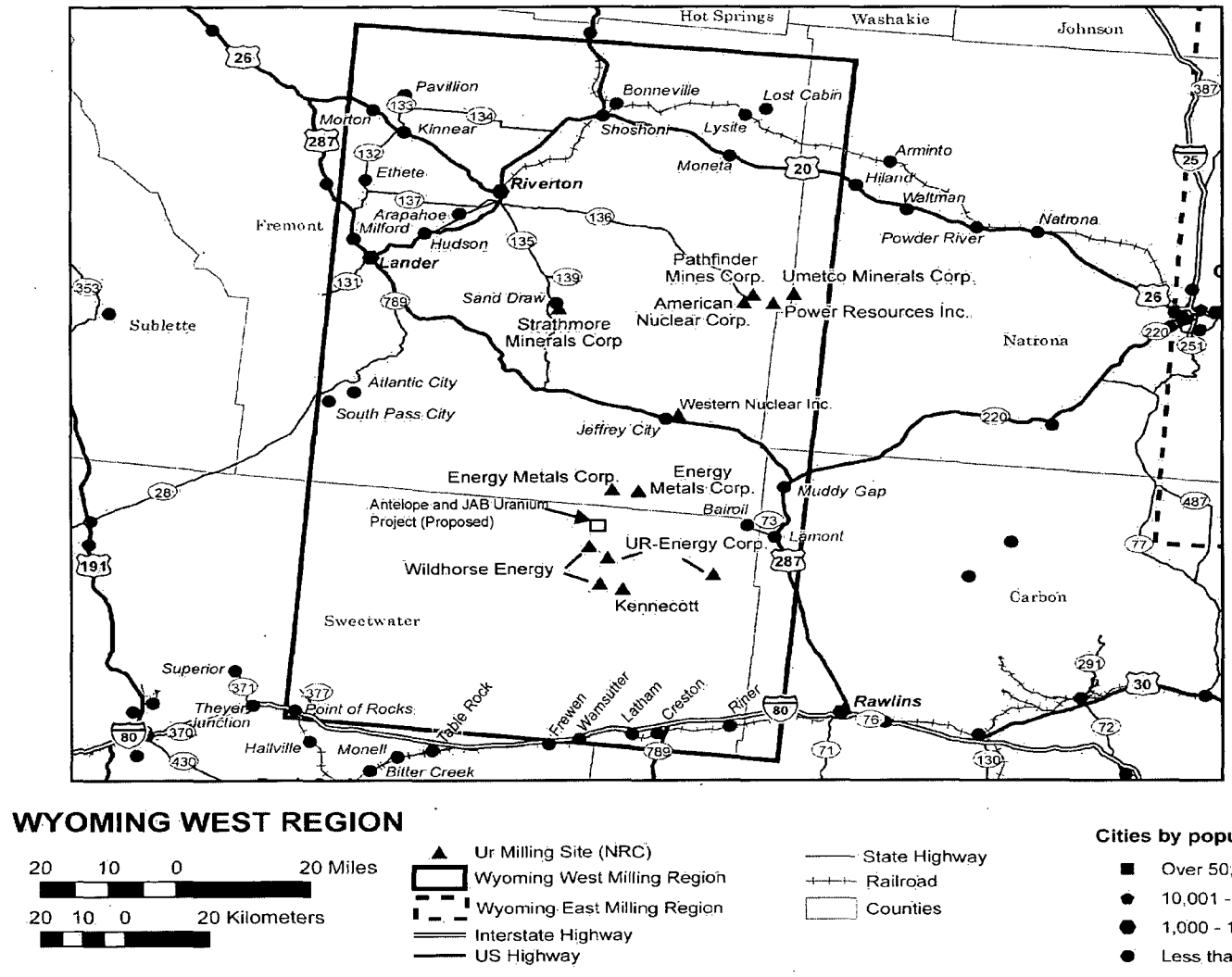


Figure 2-5. Proposed Access Road Layout

shown in Figure 2-6. The pattern contains four injection wells, placed 23 to 46 m [75 to 150 ft] apart, surrounding a central recovery well. Estimate of how many injection and production wells are needed? **[RAIPA-1 to provide well field layout.]** The actual well placement would depend on the characteristics of the ore body. Each well will be constructed to be used for both injection and recovery, allowing for flow patterns to be modified as necessary to improve uranium recovery during production and to improve groundwater restoration during reclamation. Recovery flows will be at a maximum rate of approximately 190 liters per second (L/s) [3,000 gal per minute (gpm)] for each project area, including a production bleed of about 2 L/s [30 gpm]. Restoration flow capacity will be approximately 63 L/s [1,000 gpm] for the Antelope unit and 32 L/s [500 gpm] for the JAB Unit. **[RAI PA-1 to provide the current well field plan]**

2.1.2.4.2 Monitoring Wells

Horizontal and vertical excursion monitoring wells would be installed at each well field as dictated by geologic and hydrogeologic parameters. The horizontal monitoring wells would be located in a ring around the well fields, approximately 152 m [500 ft] from the pattern area and with 152 m [500 ft] spacing between monitor wells. One vertical monitoring well for underlying and overlaying aquifers would be installed for every 1.6 ha [4 acres] of well field area. Figures 2-7 and 2-8 show the proposed monitoring well locations for the Antelope Unit and JAB Unit, respectively. Estimate of how many monitoring wells are needed? **[RAI PA-1 to provide well field layout.]**

2.1.2.4.3 Well Construction and Testing

Designing, constructing, testing, and operating injection wells are regulated by the underground injection control (UIC) program administered by the WDEQ, which has primacy for the program as delegated by EPA. The proposed program would require a UIC permit from the WDEQ to use Class III injection wells. **[RAI PA-3 to provide current status of permit.]** Wells would be drilled and constructed using standard mud-rotary drilling techniques for deep-water wells in which the wells are drilled to the bottom of the target completion interval with a small rotary drilling unit using native mud and drilling fluid additive for viscosity control.

Casing material in injection, production, and monitoring wells would be polyvinyl chloride (PVC), approximately 6 m [20 ft] in length with a 13-cm [5-in] outside diameter and 0.63-cm [0.248-in] wall thickness (schedule 40 wall thickness) or 0.74-cm [0.291-in] wall thickness (SDR-17). Casings with larger diameters may be used if a larger pump size is necessary. The casings will be set at the center of the drill holes, leaving 7.6 cm [3 in] of annulus space that will be backfilled with cement. Casing centralizers would be run on the casing to ensure the casing is centered in the drill hole. Cement would be pumped down the bottom of the casing and forced through the bottom and back up the annulus to ensure a complete seal. If the cement fails to return to the surface due to a larger than expected annulus, the upper portion of the annulus will be cemented from the surface. After the well is cemented to the surface and the cement has set, the well is completed. A schematic for a completed well is shown in Figure 2-9. **[RAI PA-2 to provide additional specifications of well screens to be used.]**

Each well would be tested for mechanical integrity before use following construction and after any repair where a downhole drill bit or underreaming tool is used, in the absence of subsurface damage. In addition, all wells will be tested for mechanical integrity once every 5 years. These tests will ensure that the wells do not allow hydraulic communication between one aquifer and another. The tests are designed to detect imperfections in the casing sections

Figure 2-6 Typical Well Field Layout (Uranium One, 2008)

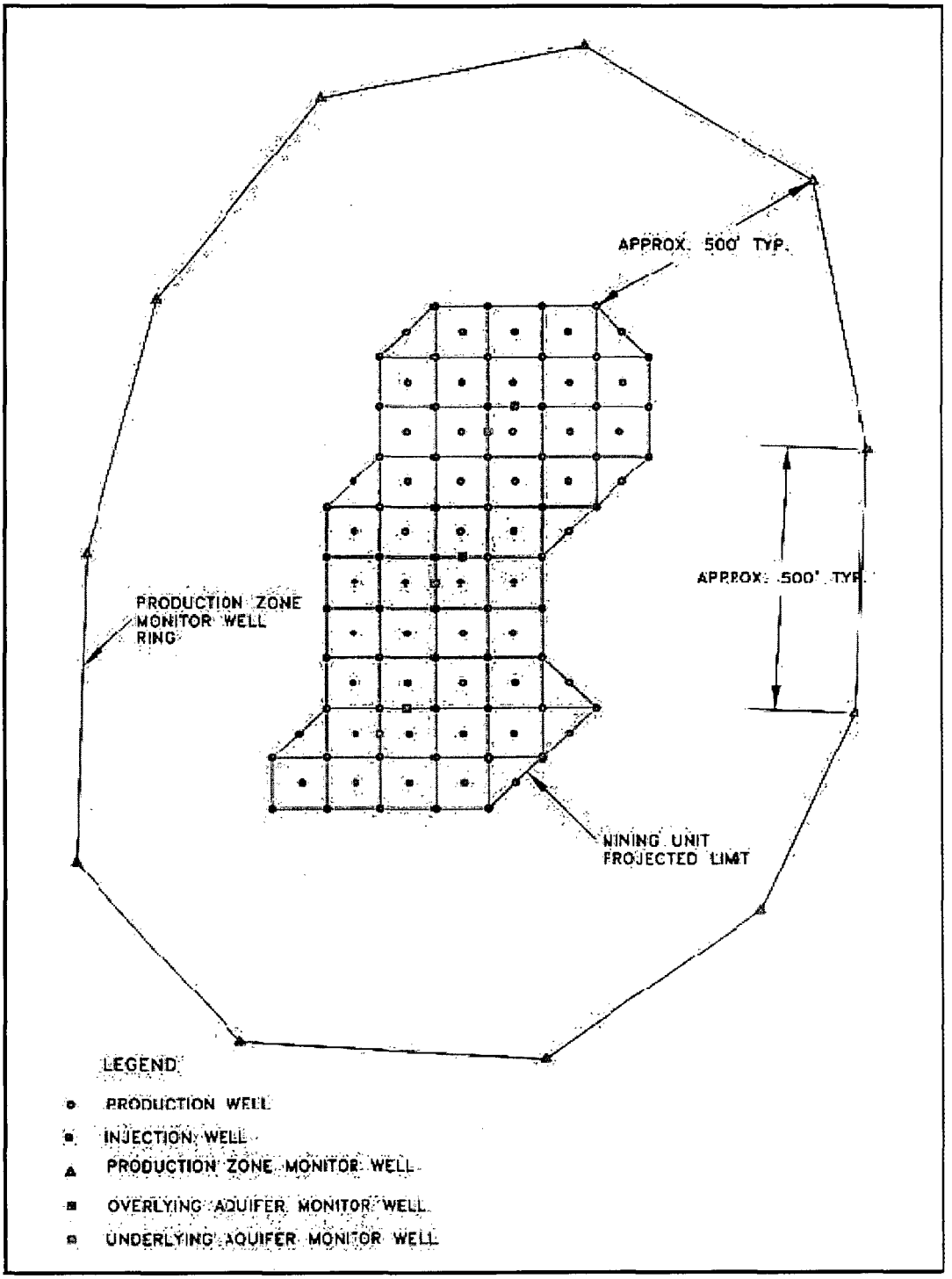


Figure 2-6. Typical Well Field Layout (Uranium One, 2008)

Figure 2-7. Proposed Well Field Layout at the Antelope Unit [RAI: To Provide Well Field Layout]

Figure 2-9. Schematic for a Completed Well (Uranium One, 2008)

Figure 2-8. Proposed Well Field Layout at the JAB Unit [RAI: To Provide Well Field Layout]

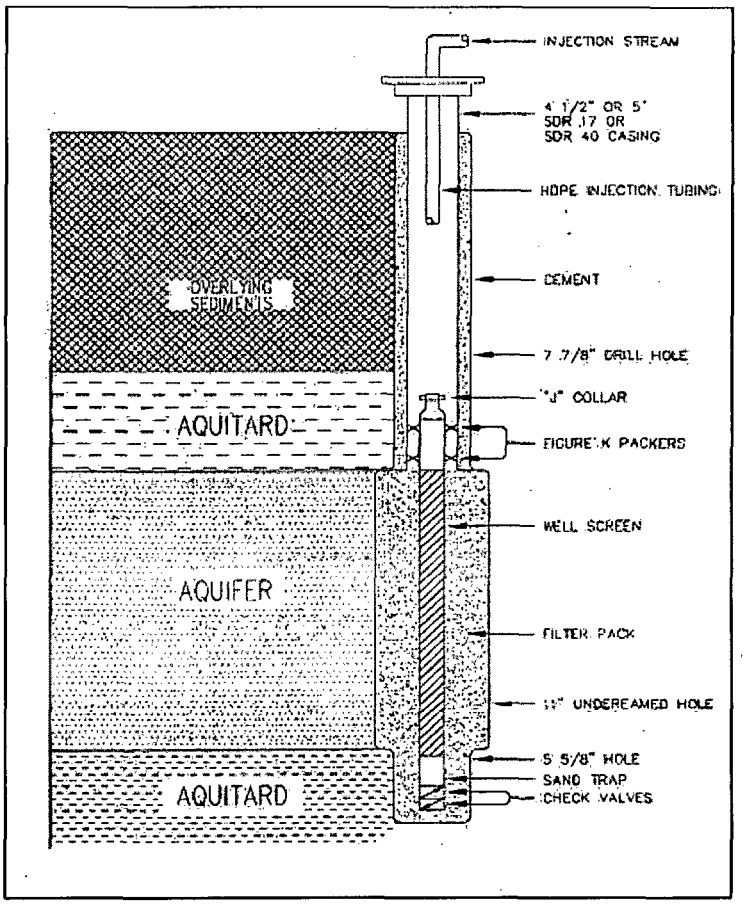


Figure 2-9. Schematic for a Completed Well (Uranium One, 2

and inadvertent damage from underreaming, and to ensure that there are connections between sections and cement grout sealing the casing in place.

Uranium One's proposed test consists of pressurizing the casing and monitoring it for pressure loss. Uranium One's proposed testing program would be required by NRC license condition.

Wells that do not pass the test would be taken out of service to repair the casing and retested; otherwise, the faulty wells may be plugged and abandoned. Results of mechanical integrity tests are documented and maintained onsite for NRC and WDEQ inspection. Also, in accordance with WDEQ and EPA requirements, test results are reported to the WDEQ quarterly.

2.1.2.4.4 Pipelines

Uranium One proposes to use high density polyethylene, PVC, and/or steel piping for its well field distribution pipelines. The individual well lines and the trunk lines to the IX facility would be buried to prevent freezing and to mitigate visual impact (how deep?). All piping would be designed for an operating pressure of 10 kg/cm^2 [150 pounds per square inch gauge (psig)] or higher, not to exceed the *maximum rating, which would be between 11 and 21 kg/cm^2 [160 and 300 psig]. The lines would be tested for mechanical integrity before use.* Each well would be connected to the respective injection or production manifold in a well field headerhouse building

using PVC pipe and fittings. Insert more info on headerhouses. Manifolds would direct recovery solutions to the pipelines, which carry the solutions to and from the IX facilities. Meters and control valves in individual well lines would monitor and control flow rates and pressures for each well. **[RAI PA-1 to provide well field layout.]**

2.1.3 Preconstruction

Uranium One performed several preconstruction activities to support its application for a license to construct and operate ISR facilities as part of the Antelope and JAB Uranium Project. These activities included performing baseline surveys and researching the history of the project site to establish baseline conditions prior to construction and operation.

Exploratory work was conducted at both the Antelope and JAB properties in the 1970s. This work continued into the 1980s for the JAB property and through the 1990s at the Antelope property. At both sites, Uranium One conducted verification drilling in 2007 and collected baseline resource data from 2007 through 2008. Uranium One conducted a Class III cultural resource inventory of the Antelope and JAB project areas. Uranium One conducted baseline vegetation studies to determine the vegetation and habitat types that comprise the site. Additionally, wildlife surveys were conducted. To determine background radiological characteristics, Uranium One conducted an extensive sampling survey of surface and subsurface soils, sediment, vegetation, and groundwater **[RAI HS-1 to provide details of background radiation surveys conducted.]**. Single-well and multiwell pump tests were conducted at both the Antelope and JAB units to better understand the properties of the aquifers (i.e., transmissivities, hydraulic conductivity, average storage coefficient, water levels). Samples from numerous wells in several aquifers were also analyzed for groundwater quality.

2.1.4 Construction

Primary surface disturbance would take place during construction of the Antelope central processing plant and JAB satellite facility as well as maintenance and office buildings. More minor surface disturbances would be caused by well drilling, pipeline and well installations, and road construction. Surface disturbances caused by drilling and pipeline installation would be reclaimed and reseeded as soon as weather conditions permit, whereas disturbances from building construction would remain for the life of the buildings. Vegetation in reclaimed and reseeded areas would be expected to be reestablished within 2 years.

Topsoil from building sites, permanent storage areas, main access roads, chemical storage areas, and graveled well field access roads will be salvaged during construction of these areas in accordance with WDEQ-LQD requirements. Uranium One estimates that typical topsoil stripping depths would range from 8 to 30 cm [3 to 12 in]. Topsoil salvaged during construction activities would be stored with a highly visible sign, reading "Topsoil," in designated stockpiles located onsite in such a way to minimize loss of material. Topsoil would not be stored in drainage channels and, to minimize wind erosion, stockpiles would be generally stored on the leeward side of hills (which hills?). Additionally, during mining operations, topsoil stockpiles would be seeded to establish a vegetative cover to minimize erosion due to wind and/or water.

(How many acres of topsoil is planned to be salvaged, stockpiled, and re-applied?)

(How is this 100 acres broken down by construction of buildings vs. well fields vs. access roads vs. pipelines?)

(What is the plan for construction – approximate duration, types and quantities of construction materials to be used, where would materials come from, will construction occur during normal working hours or also at night?)

(What are the land areas involved in construction of the buildings, well fields, access roads, burying pipelines?)

(What are the number of vehicles and trucks to be used, types of construction equipment to be used, estimated fuel usage, where will fuel be stored, leak protection of fuel storage?)

(What's the water use for construction activities that would be obtained from offsite sources and trucked to site for dust suppression and concrete mixing?)

[RAI PA-1 to provide detailed land development plan for the proposed project.]

Uranium One estimates 50 percent of the construction workforce would be based in Sweetwater County, Wyoming, and the rest from Rawlins in Carbon County, Wyoming.

2.1.5 Operations

The ISR process as part of the Antelope and JAB Uranium Project would generally involve two operations. First, barren lixiviant would be injected to mobilize uranium in the production zone of the underground aquifer. Second, the pregnant lixiviant in surface facilities would be extracted and processed to recover the uranium and prepare it for shipment. Uranium One anticipates that a workforce of 40 to 60 people would be needed for the operation of the proposed Antelope and JAB Uranium Project.

2.1.5.1 Uranium Mobilization

During ISR operations as part of the Antelope and JAB Uranium Project, chemicals would be added to the groundwater to produce a lixiviant. Chemicals used to oxidize the uranium would include oxygen or hydrogen peroxide. Sodium bicarbonate would also be added to complex the uranium in the solution. The lixiviant would then be injected into the production zone to dissolve uranium from the underground formation, remove it from the deposit, and transport it to the processing facility where uranium would be removed from solution via IX.

2.1.5.1.1 Lixiviant Injection and Production

Uranium, present in the aquifer in a reduced insoluble form, would be oxidized and dissolved by the lixiviant solution injected into the ore zone. Once uranium is oxidized, it easily complexes with bicarbonate anions in the groundwater and becomes mobile.

Uranium One proposes to use a lixiviant solution composed of native groundwater, sodium carbonate (Na_2CO_3), sodium bicarbonate ($NaHCO_3$), oxygen, and carbon dioxide (CO_2). Carbon dioxide would be provided to keep both the pH around neutral and to provide another source of carbonate and bicarbonate ions. The oxidized uranium would react with the lixiviant to form either a soluble uranyl tricarbonate complex or a dicarbonate complex. The uranium-bearing solution would migrate through the pore spaces in the sandstone and be recovered by production wells. Uranium One has designed the Antelope and JAB units to operate at a flow rate of 190 L/s [3,000 gpm]. Pregnant lixiviant solution will be pumped from the well fields to either the central processing plant at the Antelope unit or the satellite facility at

the JAB unit for uranium extraction by IX. The resulting barren lixiviant will be chemically refortified with carbonate/bicarbonate and oxidant and returned to the well field to repeat the leaching cycle.

2.1.5.1.2 Excursion Monitoring

Uranium One proposes an operational groundwater monitoring program to detect and correct for any condition that could lead to an excursion affecting groundwater quality near the well fields. These excursions can be caused by improper water balance between injection and recovery rates, undetected high permeability strata or geological faults, improperly abandoned exploration of drill holes, discontinuity within the confining layers, poor well integrity, or hydrofracturing of the ore zone or surrounding units. The program would include monitoring of injection and production rates and volumes, well head pressure, water levels, and water quality.

The monitoring wells in the ore zone and overlying and underlying aquifers would be sampled four times at least 2 weeks apart. **[RAI PA-1 to provide detailed plan for excursion monitoring.]** Samples from these wells would be analyzed for various water quality parameters specified by WDEQ (WDEQ-LQD, 2005) as well as for upper control limit parameters such as chloride, total alkalinity, and conductivity. Uranium One would adequately maintain all of the analytical data from the monitoring wells and submit the data to the WDEQ quarterly.

If an excursion is detected, Uranium One would have to notify the NRC and WDEQ verbally within 24 hours and in writing within 7 days of a verified excursion. Additional and more frequent sampling may be warranted to confirm that an excursion occurred. Corrective actions such as adjusting the injection and recovery flow rates in the affected area would be implemented as soon as practical and as long as it would take for the excursion to be mitigated. Within 60 days of the confirmed excursion, Uranium One would have to file a written report to the NRC describing the event and corrective actions taken.

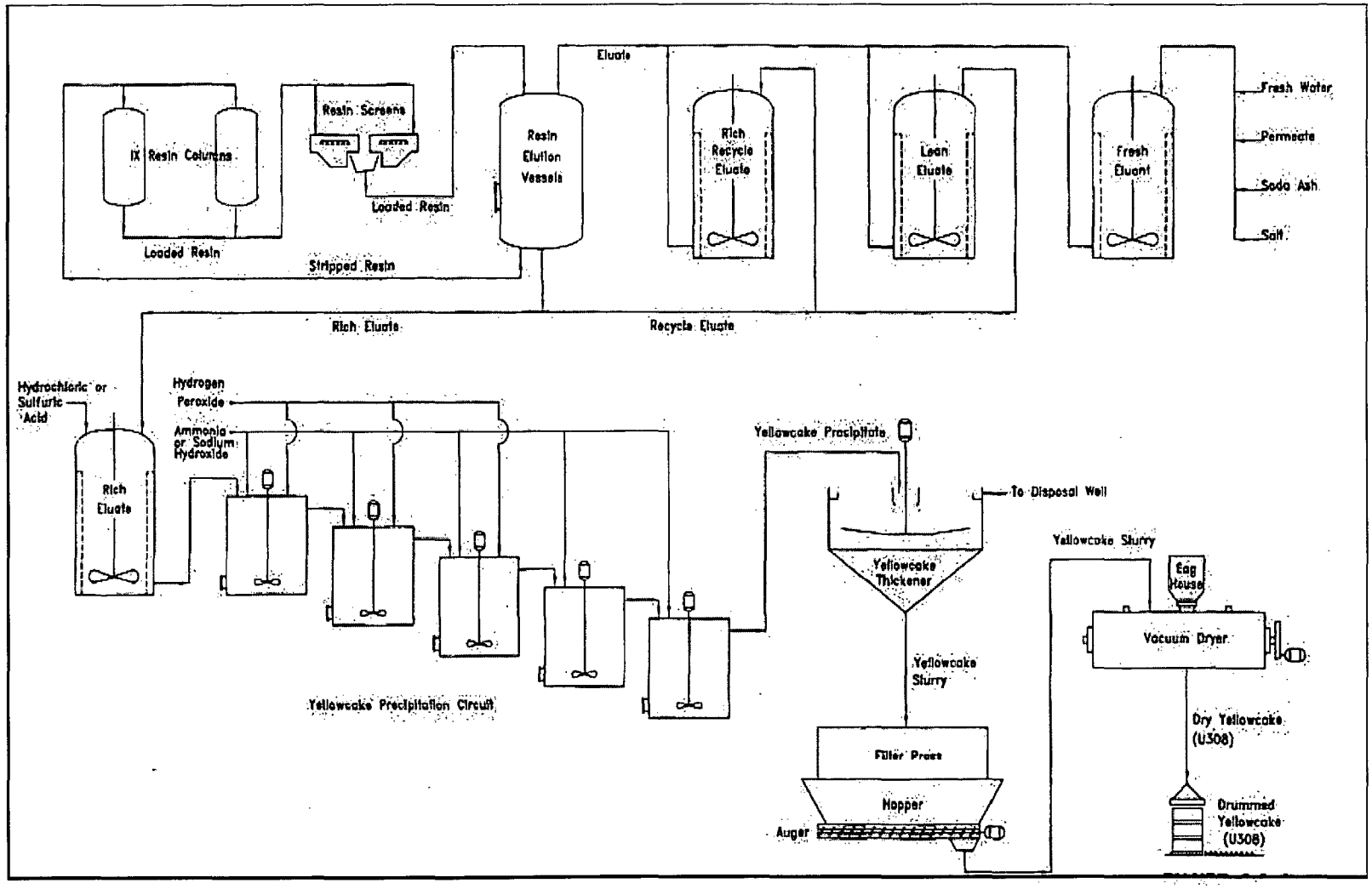
2.1.5.2 Uranium Processing

Uranium would be recovered from the pregnant lixiviant and processed as yellowcake in a multistep process. These steps would include IX, elution, precipitation, drying, and packaging.

2.1.5.2.1 Ion Exchange

For the Antelope and JAB Uranium Project, the pregnant lixiviant would be pumped from the well fields to the IX systems at either the central processing plant at the Antelope Unit or at the satellite facility at the JAB unit for the extraction of uranium. The IX system proposed for the Antelope unit consists of a series of eight fixed bed IX vessels, each sized for 14 m^3 [500 ft^3] of resin (Figure 2-10). The IX system proposed for the JAB satellite unit consists of a series of six fixed bed IX vessels (Figure 2-11). **[RAI PA-2 to clarify if JAB IX vessels are each sized for 500 cubic feet also.]**. Uranium One anticipates using production flow rates of up to 190 L/s [3,000 gpm] for the IX system for both the Antelope and the JAB units. Uranium from the uranium-rich solution would be absorbed by IX onto resin beds. Sand or silt would also be trapped by the resin beds. As resins in the IX column become saturated with uranium, the column would be taken offline for the elution circuit. Loaded resin from the JAB circuit will be transferred in 14 m^3 [500 ft^3] lots to a 15,140-L [4,000-gal] capacity tanker trailer for transport to the Antelope central plant. Loaded resin from other potential future Uranium One satellite facilities would be transported to the Antelope central plant via tanker truck. Uranium One currently anticipates transporting up to two loads of loaded resin to the Antelope central plant

Figure 2-10. Antelope Central Plant Process Flow Diagram (Uranium One, 2008)


IX Resin Columns
Resin Screens
Loaded Resin
Loaded Resin
Stripped Resin
Resin Elution Vessels
Eluate
Rich Recycle Eluate
Lean Eluate
Fresh Eluant
Fresh Water
Permeate
Soda Ash
Salt
Rich Eluate
Recycle Eluate
Hydrochloric or Sulfuric Acid
Hydrogen Peroxide
Ammonia or Sodium Hydroxide
Rich Eluate
Yellowcake Precipitation Circuit
Yellowcake Precipitate
To Disposal Well
Yellowcake Thickener
Yellowcake Slurry
Filter Press
Hopper
Auger
Yellowcake Slurry
Egg House
Vacuum Dryer
Dry Yellowcake (U3O8)
Drummed Yellowcake (U3O8)

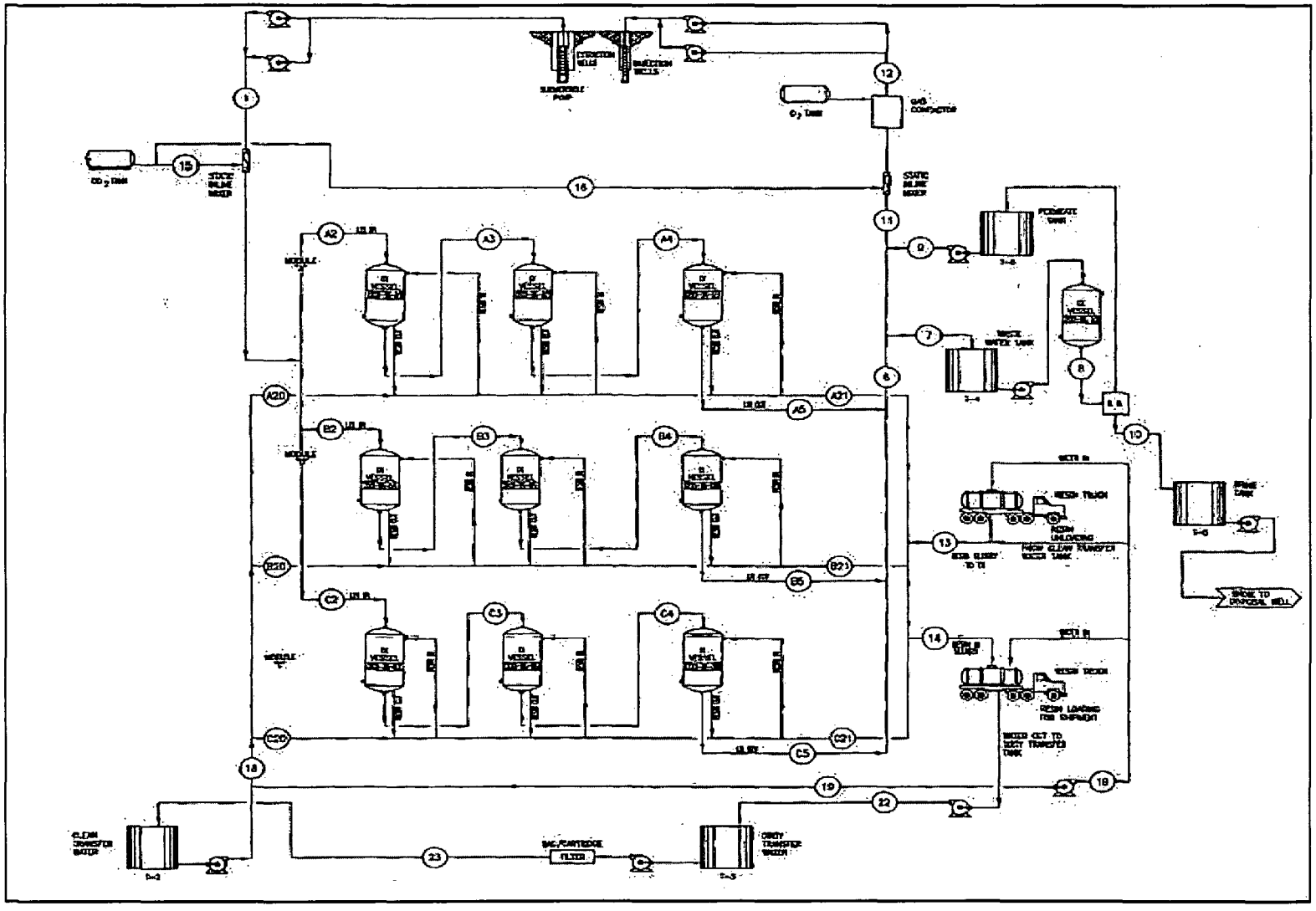


Figure 2-11. JAB Satellite Plant Process Flow Diagram (Uranium One, 2008)

and up to two loads of barren eluted resin back to the Jab satellite facility on a daily basis. The lixiviant solution leaving the IX circuit would contain less than 2 ppm of uranium.

[RAI PA-2 to clarify inconsistency between illustration in Figure 2.2-7 and process description in Section 2.3.1.3.]

2.1.5.2.2 Elution

The elution circuit at the Antelope unit central processing plant would be designed to accept and elute uranium-loaded resin from the Antelope unit and the JAB unit satellite facility. The loaded resin from the JAB unit would be removed from the transfer trailer trucks using a pressurized transfer system. In the three-stage elution circuit (Figure 2-10), the uranium would be released from the loaded IX resin in the dedicated elution vessel by applying an eluate, which is a solution of salt (sodium chloride), soda ash (sodium carbonate), and water, at a rate of 13 L/s [210 gpm]. The salt solution would be generated in a brine generator. The soda ash solution would be generated by passing warm water >41 °C [>105 °F] through a bed of soda ash. The resulting eluate solution would be approximately 9 percent NaCl and 2 percent Na_2CO_3. Approximately 42,468 L [11,220 gal] {43 m^3 [1,500 ft^3]} of fresh eluate would be required per elution batch.

In the first two stages, used eluate with varying concentrations of residual uranium from a previous cycle would be passed through the elution vessels containing the IX resin. In the first stage, "rich" eluate (eluate that has previously passed through two loaded resin beds) is passed through the resin, stripping approximately 84 percent of the uranyl carbonate ions from the resin and becoming pregnant eluate. In the second stage, "lean" eluate (eluate that has previously passed through one loaded resin bed) is passed through the resin, stripping approximately 68 percent of the remaining uranyl carbonate ions and becoming rich eluate. In the final stage, "fresh" eluate (eluate that has not had previous contact with loaded resin) is passed through the resin, stripping approximately 35 percent of the remaining uranyl carbonate and becoming lean eluate. The resulting solution from the first stage, pregnant eluate, would have a volume of approximately 42,468 L [11,220 gal] and contain approximately 15,500 mg/L of U_3O_8. The pregnant eluant from several batches of resin is stored until enough pregnant eluate is obtained, at which time the final precipitation and drying circuit can begin **[RAI PA-2 to quantify eluate storage capacity, how many batches of eluate will be stored before precipitation and drying begins]**.

At the end of the third stage, approximately 124,900 L [33,000 gal] of eluate would have passed through 14 m^3 [500 ft^3] of resin and the uranyl carbonate concentration remaining on the resin would be approximately 3.33 percent. After being washed with fresh water and/or a sodium bicarbonate rinse, the resin would be transferred back to the appropriate vessel within the Antelope central plant or to a trailer for transfer back to the JAB Unit or any other potential satellite mining areas.

2.1.5.2.3 Precipitation, Drying, and Packaging

The precipitation system at the Antelope central processing plant would be initiated by adding hydrochloric or sulfuric acid to the pregnant eluate to break the carbonate portion of the uranium complex, leaving carbon dioxide and uranyl ions, which form uranyl sulfate ions. This fluid is then pumped through a series of five tanks to further isolate the uranium (Figure 2-10). In the first two tanks, hydrogen peroxide would be used to precipitate out the uranium as an insoluble uranyl peroxide compound. Sodium hydroxide or ammonia would be added with compressed

air in the third tank to adjust the pH for optimum crystal growth and settling of the precipitated uranyl peroxide or yellowcake slurry. Following settling, the precipitated yellowcake slurry would be pumped from the final precipitation tank to a gravity thickener, 12 m [38 ft] in diameter. The yellowcake slurry would then be pumped into a plate and frame filter press to be washed with fresh water to flush the dissolved chlorides and other soluble contaminants. The filtered yellowcake, containing approximately 60 percent solids, would be pumped with the help of added water to the indirect heated rotary vacuum dryers. The dryers would be operated under a vacuum at approximately 121 °C [250 °F] to reduce the ability of water-soluble uranium oxides and other compounds to form and to pull solids and water vapor toward the center of the system, which helps to prevent unwanted releases. Water-sealed vacuum pumps would comprise the vacuum source. The dryers would be heated with a heat transfer fluid, which would be heated by two natural gas or propane-fired heaters. A baghouse would be located on the top of the dryer and used to remove particles down to an approximately 1-micron-sized fraction from off gases. Particulates of smaller sized fractions would be removed in a surface condenser, which would also cool the off gases and remove water vapor.

Following drying, the yellowcake would be packaged in approved 208-L [55-gal] steel drums and stored for shipment offsite via truck to a licensed uranium conversion facility. Conversion facilities are currently located in Metropolis, Illinois, and Port Hope, Ontario, Canada. Uranium One estimates the maximum annual production rate to be 1.8 million kg [4 million lb] of yellowcake per year from the Antelope and JAB Uranium Project, including any other future satellite or tolling operations, with an initial production rate of 0.9 million kg [2 million lb] per year. Uranium One estimates that it will take approximately 10 years for extraction from the Antelope and JAB units.

2.1.5.3 Management of Production Bleed and Other Liquid Effluents

Uranium mobilization and processing at the Antelope and JAB Uranium Project would produce excess water that must be properly managed. Pumping more water from the recovery wells than is injected into the host aquifer creates a pressure gradient that results in a net groundwater flow toward the well field. This net flow, called the well field (or production) "bleed," provides additional control of the recovery solution movement. The average production bleed for the Antelope and JAB areas would be approximately 1 percent of the overall flow rate, or 2 L/s [30 gpm]. Other liquid waste streams would result from process drains, well development water, pumping test water, elution circuit bleed, and wash down water. Liquid waste streams would be disposed of through deep disposal well injection.

2.1.5.4 Operation Schedule

If Uranium One is granted an NRC license and additional approval, construction of the first well field at the Antelope unit and the JAB satellite unit, as well as construction of the Antelope central plant, the JAB Satellite facility, and the ancillary facilities, would begin in February 2010. Uranium One anticipates the operation of the Antelope central plant to begin in November 2010 and continue through 2030. The mine schedule for the Antelope unit is preliminary and currently includes potential development of six well fields on the western portion of the project site. Uranium One anticipates the operation of the Antelope unit well field #1 to begin in November 2010 and continue through 2014. The mine schedule for the JAB satellite unit is also preliminary and currently includes potential development of the satellite facility as well as two well fields on the southwestern portion of the project site. Uranium One anticipates the operation of the JAB satellite facility to begin in November 2010 and continue through 2019. Uranium One proposes the operation of the JAB satellite unit well field #1 to begin in

November 2010 and continue through 2018. Construction of the next sequential well fields at both sites would begin in November 2011, with operation beginning in 2012.

2.1.6 Aquifer Restoration

After the uranium is recovered, the groundwater in the well field contains constituents that were mobilized by the lixiviant. Uranium One plans to begin aquifer restoration in each well field as the uranium recovery operations end. Consistent with current ISR restoration practices, Uranium One proposes that restoration criteria or restoration target values be established on a parameter-by-parameter basis and that the primary goal of restoration be to return all parameters to premining class of use or better using Best Practicable Technology as defined in 35-11-103(f)(i) of the Wyoming Environmental Quality Act of 2006. Uranium One would conduct a baseline water quality survey for each well field prior to operation to determine the premining class of use as defined by WDEQ, Water Quality Division (WQD.)

The aquifer restoration program for the Antelope and JAB Uranium Project may involve any or all of three processes, depending on the progress of restoration: (i) groundwater transfer, (ii) groundwater sweep, and (iii) groundwater treatment. These phases would be designed to effectively and efficiently restore the groundwater, minimize groundwater loss, and optimize restoration equipment. Stability monitoring would also be conducted as part of the program, following aquifer restoration.

2.1.6.1 Groundwater Transfer

The groundwater transfer process involves transferring water between the well field where groundwater restoration is beginning and another well field where ISR operations are beginning or within the same well field, if one area is in a more advanced state of restoration than another. The purpose of groundwater transfer is to blend the water in the two well fields until they are similar in conductivity, based on total dissolved solids measurements. By moving water from one well field to another, groundwater transfer reduces the amount of water sent to the deep disposal wells during restoration because. **[RAI PA-2 to provide estimate of groundwater transfer flow rate.]**

2.1.6.2 Groundwater Sweep

Groundwater sweep removes water from the well field without reinjection. As the water is pumped out of the well field, cleaner groundwater flows in to flush contaminants from the production zone, thus "sweeping" the aquifer. The water extracted may be treated before disposal. The rate of groundwater sweep is dependent on the capacity of the selected disposal system. Uranium One does not anticipate using groundwater sweep in significant amounts because of limited success in using this method at other *in-situ* operations. **[RAIPA-2 to provide estimate of groundwater sweep flow rate.]**

2.1.6.3 Groundwater Treatment

Groundwater treatment involves IX, reverse osmosis or electro-dialysis reversal, and may be used either after or in conjunction with groundwater sweep. The environmental report indicates that restoration pumping rates from the well fields would be approximately 63 L/s [1,000 gpm] at the Antelope central processing facility and 32 L/s [500 gpm] at the JAB satellite facility. IX would remove most of the soluble uranium, and a reverse osmosis system would reduce the total dissolved solids concentration. If the treated water will be reinjected into the well field, a

biological or chemical reductant may be added to reduce the oxidation-reduction potential and sodium hydroxide added to return the groundwater to baseline pH levels. In addition, the water may be passed through a decarbonation unit to remove any residual carbon dioxide. The brine water waste product from the reverse osmosis is disposed through deep well injection. **[RAI PA-2 to provide estimates of anticipated volumes of reductant and sodium hydroxide that would be used for groundwater treatment.]**

2.1.6.4 Restoration Monitoring and Stabilization

The environmental report indicates a minimum 6-month groundwater stability monitoring period will be implemented for the Antelope and JAB Uranium Project to show that the restoration goal has been adequately maintained. During this period, the monitor ring wells will be sampled once every 2 months and analyzed for chloride, total alkalinity (or bicarbonate), and conductivity. Also, at the beginning, middle, and end of the stability period, the pumping wells will be sampled and analyzed for water quality parameters.

2.1.6.5 Restoration Schedule

Uranium One anticipates the restoration of the Antelope unit well field #1 to begin in 2013 and continue through 2016. Uranium One anticipates the restoration period of each sequential well field to remain constant with each restoration period beginning approximately 1 year following the start of restoration for the previous well field. Uranium One proposes the restoration of the JAB unit well field #1 to begin in 2014 and continue through 2016. Uranium One proposes the restoration of the JAB unit well field #2 to begin in 2014 and continue through 2017. NRC requires that the restoration schedule conform to the decommissioning requirements outlined in 10 CFR 40.42.

2.1.7 Decontamination, Decommissioning, and Reclamation

Once the Antelope and JAB Uranium Project is complete, all of the buildings and structures would be decontaminated in accordance with NRC regulatory standards in 10 CFR Part 40, Appendix A; the processing plant and satellite facility will be decommissioned; and all disturbed lands will be restored to their premining land use of livestock grazing and wildlife habitat.

All production, injection, monitoring wells, and drill holes would be abandoned in place according to WDEQ regulations to prevent adverse impacts to groundwater quality. Well abandonment would include plugging all wells with a gel specifically designed for well abandonment. The casing would be cut off and the well abandonment gel used to fill the void to the top of the cut-off casing. A plug, either cement or plastic, would be placed at the top of the well casing. Well field decommissioning would include the removal of well field piping, well heads, and associated equipment. If still usable, the well field piping, well heads, and associated equipment would be taken to a new production area. However, if no longer usable, the equipment would be gamma surveyed and placed in either a contaminated or noncontaminated bone yard located near the central processing plant for temporary storage until disposal. If the final production area is being reclaimed, the contaminated piping, well heads, and associated equipment that are not salvageable would be taken to an NRC-approved disposal facility.

Following completion of groundwater restoration in the final production area, the Antelope unit central processing plant and the JAB unit satellite facility and auxiliary facilities associated with both units would be decommissioned. All process equipment associated with the processing

plant and satellite facility would be dismantled and either sold to another NRC-licensed facility or decontaminated in accordance with NRC regulations and guidance documents. Materials unable to be decontaminated would be disposed of at an NRC-approved facility. Materials able to be decontaminated would be reused, sold, or removed and disposed of offsite. Once the buildings have been removed, the former building sites would be contoured to blend in with the surrounding terrain. Gamma surveys would be conducted to verify that radiation levels are within acceptable limits.

Topsoil salvaged during construction would be reapplied during reclamation. Final revegetation of the mining area would consist of seeding the area with a seed mixture approved by BLM and WDEQ-LQD. The proposed reclamation seed mix includes a combination of Bluebunch Wheatgrass, Slender Wheatgrass, Streambank Wheatgrass, Bottlebrush Squirreltail, Indian Ricegrass, American Vetch, and Showy Evening Primrose. WDEQ-LQD would determine final revegetation and bond release. The access roads would either be reclaimed or if BLM requests, the roads would be left in place when operations are complete for future access and maintained by BLM. If the access roads are reclaimed, they will be ripped and/or disked to relieve compaction and gravel on the road surface would be removed. Culverts would also be removed, and premine drainages would be reestablished. Along with being graded, roads and ditches would be recontoured to blend with the surrounding terrain and topsoil would be uniformly reapplied onto the road surface prior to revegetation.

2.1.8 Effluents and Waste Management

The ISR process at the Antelope and JAB Uranium Project would generate effluents and waste streams, all of which must be handled and disposed of properly. These would include gaseous emissions, liquid wastes, and solid wastes.

2.1.8.1 Gaseous or Airborne Particulate Emissions

During the four stages of the Antelope and JAB Uranium Project (construction, operation, aquifer restoration, and decommissioning), gaseous emissions from the ISR process would primarily consist of fugitive dusts, combustion engine exhausts, radon gas emissions from various stages of the processing system, and uranium particulate emissions from yellowcake drying.

Fugitive dusts and engine exhausts would be generated primarily from vehicle traffic within the Antelope and JAB Uranium Project site and on and off the project site during construction, transportation, and decommissioning activities. The fugitive dust would be generated by travel on unpaved roads and from disturbed land associated with the construction of well fields, roads, and auxiliary facilities. Combustion engine exhausts would be generated by workers' vehicles commuting to and from the project site, trucks transporting construction materials and product, drill rigs, diesel-powered water trucks, and other construction equipment. In addition, emissions from wind erosion could be caused by disturbance to natural vegetation during construction and well field development. **[RAI AQ-1 to discuss compliance status for air permitting and if available, provide related information.** Uranium One projects the total PM_{10} emissions for the Antelope and JAB operations, if uncontrolled through watering or treating unpaved roads, would be 184.10 metric tons [202.93 short tons] per year. **[RAI AQ-2 to clarify and expand the informational basis for the fugitive dust emission analyses for the operations phase.] RAI AQ-2. [RAI AQ-3 to expand the description of fugitive dust emissions to include analyses for all four *in-situ* leach phases: construction, operation, restoration, and**

decommissioning.] [RAI Aq-4 to expand the description of nonradiological air emission estimates to include contaminants other than fugitive dust..]

Radon gas emissions are most likely to occur during the operation and aquifer restoration stages of the Antelope and JAB Uranium Project. Radon can be released when the pregnant lixiviant is brought to the surface from the ore zone aquifer. Radon gas can also be released from well field venting for sampling events, leaks in well field and IX equipment, as well as when IX columns are taken offline for resin transfer and opened to the atmosphere, or when maintenance is performed on well field and IX equipment. Uranium One estimates that the annual release of radon-222 from the well field and main plant facility would be 4×10^{12} and 3.6×10^{12} Bq/yr [107 and 96 Ci/yr], respectively. During restoration, Uranium One estimates that radon-222 releases from the well field and treatment facilities would be 1.85×10^{12} and 1.63×10^{11} Bq/yr [50 and 44 Ci/yr], respectively, at the Antelope site and 9.25×10 and 8.14×10 Bq/yr [25 and 22 Ci/yr], respectively, at the JAB site. The use of general area and local ventilation systems would help control radon buildup within the onsite facilities. General area ventilation may involve forced air ventilation of work areas in process buildings. Local ventilation for process vessels where radon releases are more likely may involve ducting or piping near the point of release and fans that exhaust to the outside.

The yellowcake dryer located at the central processing plant in the Antelope unit would also be a potential source for airborne particulate emissions. In a vacuum dryer, the heating source is contained in a separate, isolated system so that no radioactive materials are entrained in the heating system or the exhaust it generates. The drying chamber containing yellowcake slurry would be subject to strong vacuum pressure. Moisture in the yellowcake would be the only source of vapor remaining in the system.

The dust deposited in the closed loop dust collection system would then be emptied into 208-L [55-gal] drums. Instrumentation used to monitor drying and packaging operations would provide an audible and/or visible alarm if the vacuum level exceeds specifications.

2.1.8.2 Liquid Wastes

Liquid wastes would be generated during all phases of uranium recovery at the Antelope and JAB Uranium Project as well as accidental spills, domestic activities, and stormwater runoff. Liquid wastes from the uranium recovery phases include well development water, pump test water, process bleed (eluant and IX), process solutions, washdown water, and restoration water. Process bleed and production bleed would be transferred to a deep disposal well. Process solutions (small volumes of released lixiviant and recovery fluids) would be placed into the wastewater disposal systems for deep well injection. The restoration water from groundwater sweep and brine from reverse osmosis would be sent to the waste disposal systems for injection into deep disposal wells. The permeate (clean water from reverse osmosis) would either be reinjected into the well fields or sent to the waste disposal systems. Liquid waste potentially produced by accidental spills due to storage tank or piping failure and washdown water would be drained through a sump and sent to the liquid waste system. Sanitary (domestic) wastes, generated from restrooms and lunchrooms, would be disposed of in an onsite septic system meeting the requirements of the State of Wyoming. Stormwater would be routed away from the plant, ancillary building, parking, and chemical storage areas and managed in accordance with NPDES permits issued by WDEQ-WQD.

Uranium One anticipates that the maximum volume of liquid waste at the Antelope site would be approximately 3 L/s [40 gpm] during normal operations and approximately 15 L/s [240 gpm]

during restoration. At the JAB satellite site, Uranium One anticipates a maximum volume of liquid waste of 2 L/s [35 gpm] during normal operations and 9 L/s [135 gpm] during restoration. Any deep disposal wells Uranium One developed would be permitted in accordance with WDEQ-WQD Class I UIC rules and regulations prior to use. Uranium One is currently conducting seismic and geological evaluations to determine the best locations for deep disposal wells. Uranium One plans to build an adequate number of wells to provide enough capacity for peak flow conditions as well as an additional backup well for maintenance or shutdown periods.

2.1.8.3 Solid Wastes

All phases of the Antelope and JAB Uranium Project would generate solid wastes. These wastes would include spent resin, resin fines, filters, miscellaneous pipe and fittings, empty chemical containers and packaging, tank sediments, and domestic trash. Solid wastes are classified as nonradioactive or radioactive prior to disposal. Nonradioactive solid wastes will be collected onsite in designated areas and disposed of in the nearest WDEQ-permitted sanitary landfill. Uranium One estimates that the Antelope and JAB Uranium Project would generate approximately 3,060 m^3 [4,000 yd^3] of nonradioactive solid waste annually. Domestic solid waste would be collected in septic systems and disposed of in accordance with WDEQ solid waste management rules and regulations. Radioactive wastes are disposed of as byproduct material under Section 11e.(2) of the Atomic Energy Act at an NRC-licensed waste disposal site or mill tailings facility. Uranium One plans to temporarily store these wastes onsite and periodically transport them to offsite facilities for disposal. Uranium One estimates that the Antelope and JAB Uranium Project would generate approximately 380 m^3 [500 yd^3] of radioactive solid waste (byproduct material) annually. The Antelope and JAB Uranium Project expects to produce less than 100 kg [220 lb] of hazardous waste. This waste would include waste oil and spent batteries. Soil potentially contaminated from accidental spills would be surveyed and either removed immediately or documented for future cleanup during decommissioning in accordance with 10 CFR Part 40, Appendix A. Contaminated soil would be disposed of as byproduct material under Section 11e.(2) of the Atomic Energy Act.

2.1.9 Transportation

Transportation at the Antelope and JAB Uranium Project site would primarily encompass the use of trucks, which transport construction equipment and materials, operational processing chemicals and supplies, IX resins, yellowcake product, and waste materials, during all phases of the project. Transportation to and from the JAB and Antelope units would include shipment of refined yellowcake from the Antelope central processing plant to a uranium conversion facility, shipment of loaded resin from the JAB unit satellite facility to the Antelope central processing plant, shipment of process chemicals from suppliers to the JAB and Antelope units, shipments of byproduct material under Section 11e.(2) of the Atomic Energy Act to an NRC-licensed facility for disposal, and the transport of employees to and from the site.

Loaded IX resin from the JAB satellite plant would be transported in a 15,140-L [4,000-gal]-capacity tanker trailer on a combination of private, county, and state roads. Uranium One anticipates transporting two loads of uranium-loaded resin from the JAB satellite plant to the Antelope central plant and two loads of barren resin from the Antelope central plant to the JAB satellite facility daily by properly licensed and trained drivers. The resin would be shipped "Exclusive Use Only" with the outside of each container or tank marked "Radioactive Low Specific Activity" (LSA) and placarded on four sides with "Radioactive" diamond signs. A bill of lading indicating package information and the presence of hazardous cargo would be included with each shipment.

Dried yellowcake would be shipped as LSA material to conversion facilities in Metropolis, Illinois, and/or Port Hope, Ontario, Canada, using 208-L [55-gal] drums and in accordance with NRC and Department of Transportation regulations.

Uranium One anticipates that four bulk chemical, fuel, and supply deliveries will be made per working day throughout the operational life of the Antelope and JAB Uranium Project. Shipments would be made in accordance with applicable Department of Transportation standards and would include carbon dioxide, oxygen, salt, soda ash, hydrogen peroxide, ammonia, sulfuric acid, and fuel.

Low level radioactive 11(e).2 byproduct material would be shipped in bulk in sealed roll off containers to a licensed disposal site in accordance with applicable Department of Transportation hazardous material provisions.

2.1.10 Radiological Health and Safety

Uranium One would develop a radiological protection program for the proposed Antelope and JAB Uranium Project. An NRC-approved radiation protection program typically contains plans and procedures addressing effluent control, external radiation exposure monitoring, airborne radiation monitoring, exposure calculations, bioassays, contamination control, and airborne effluent and environmental monitoring.

Effluent control techniques to be used at the Antelope and JAB Uranium Project would include the use of vacuum drying and packaging equipment to eliminate particulate releases and the control of radon using passive and mechanical ventilation in buildings where radon gas venting is expected. Administrative and engineering controls would be established to prevent surface and subsurface releases to the environment. Such releases would include vessel failures, piping failures, and well excursions.

The external radiation exposure monitoring program would include personnel monitoring using thermoluminescent or optically stimulated luminescent dosimeters. In addition, gamma surveys would be performed at normally and periodically occupied locations and areas of potential gamma sources such as near process vessels, the filter press, the dryer, and the yellowcake storage area. The individual dosimeters would be processed quarterly, and the surveys would be performed quarterly.

The airborne radiation monitoring program at the Antelope and JAB Uranium Project site would include the determination of concentration of radioactive materials in the air during routine and nonroutine operations, maintenance, and cleanup. Airborne uranium particulate monitoring would include breathing zone (lapel) and area sampling. Breathing zone sampling measures for the worker's intake of uranium. Area samples verify that confinement or containment is working. Radon monitoring would be conducted in the general work areas. Workers would use respirators when other means are not available or are not sufficient to control radioactive exposure.

Exposure calculations would be completed for routine and nonroutine operations, maintenance, and cleanup activities. The intake estimates would be based on actual exposure times and the airborne concentrations of radioactive materials. Exposure times would be determined via interviews with the workers, the radiation work permit, and any additional work records.

The bioassay program is essential to confirm results of the airborne radioactivity monitoring program. The program would apply to all workers routinely or potentially exposed to airborne uranium. The program would include baseline urinalysis from all new employees followed by monthly collections from those working with uranium extracted into solution from IX through final packaging and those conducting regular maintenance work on drying and ventilation/filtration equipment. Random sampling would also occur monthly. Employees terminating employment would also be subject to exit urinalysis samples.

The contamination control program would prevent contaminated employees and equipment from entering clean areas or from leaving the site. The program would include surveys for surface contamination in restricted areas such as drying and packaging areas, surveys for surface contamination in unrestricted areas such as break rooms and offices, surveys for contamination of skin and personal clothing, surveys of equipment prior to release to unrestricted areas, and surveys for contamination on respirators. Wipe tests and direct alpha surveys using a scaler/ratemeter would be the main methods of sampling utilized as part of this program.

The airborne effluent and environmental monitoring program serves to measure concentrations and quantities of radioactive materials released to and in the environment surrounding the project site. The program would include stack sampling of the vacuum drying process, radon air samples, surface water samples, groundwater samples, sediment samples, surface soil samples, and direct radiation/gamma measurements. The town of Bairoil, Wyoming is the location nearest to the site {16 to 32 km [10 to 20 mi] east} with known residences. Uranium One has set up an air monitoring station at the western edge of this community.

2.1.11 Financial Surety

Uranium One would maintain financial surety instruments to cover the costs for decommissioning, reclamation and revegetation of disturbed areas, waste disposal, dismantling, disposal of all facilities including buildings and well fields, and groundwater restoration for the Antelope and JAB Uranium Project. **[RA PA-1 to provide the bases for the initial surety estimate (e.g. based on the first year of operation?)]** NRC and WDEQ would require annual revisions to the surety estimate to reflect existing operations and planned construction or operation for the following year. Once WDEQ and NRC have reviewed and approved the revised surety estimate, Uranium One will update the financial surety instruments with the revised amount.

2.2 Alternatives Considered

This section describes three reasonable alternatives to the proposed action that were carried forward for detailed analysis.

2.2.1 Alternative 1 (*No-Action Alternative*)

The no-action alternative means that NRC would not issue Uranium One a license for the construction and operation of ISR facilities as part of the Antelope and JAB Uranium Project. The no-action alternative would not result in any construction or operation of ISR facilities at the proposed site. Expand if necessary in order to have enough background info to address the impacts.

2.2.2 Alternative 2 (*Applicant-Defined Alternative*)

(Alternative site for one or both facilities based on environmental impacts and/or ecological/historical/cultural info presented in the affected environment chapter or info revealed through consultations/scoping.)

2.2.3 Alternative 3 (*NRC-Preferred Alternative*)

[Alternative processes that would eliminate or lessen the severity of some impacts as will be revealed in the environmental impacts chapter and such as presented as "the NRC Preferred Alternative" in the HRI Crownpoint EIS...NUREG–1508 (NRC, 1997)]

2.3 Alternatives Considered but Not Carried Forward for Detailed Analysis

This section describes two reasonable alternatives to the proposed action that were considered but not carried forward for detailed analysis at this time. Alternative methods for uranium recovery include conventional milling and heap leaching. The economic costs and environmental impacts associated with conventional milling and heap leaching are typically greater than the corresponding costs and impacts of an ISR facility. Therefore, these alternatives are less preferred than the proposed action and are not carried forward for detailed analysis.

2.3.1 Conventional Milling

Conventional milling involves extracting uranium ore from a pit, shaft, or decline and then transporting the ore to a mill by truck or conveyor. Depending on the chemical characteristics of the ore, conventional uranium mills either use the acid-leach process coupled with solvent extraction, IX, the alkaline-leach process, or all of the above. Acid leach is the most commonly used of these processes.

The initial step of conventional milling involves crushing, grinding, and classification of the crude ore to produce sand-sized particles. Ore is fed from crushers to the grinding circuit or is fed directly into the grinding circuit following sizing where it is mechanically milled via semi-autogenous grinding or other techniques to reduce the size of the ore. Water is added to the system in the grinding circuit to aid the movement of solids and for dust control. Screening devices and/or cyclones are used to size the finely ground ore, returning coarse materials for additional grinding. The slurry generated in the grinding circuit typically contains 50 to 65 percent solids. Fugitive dust generated during crushing and grinding is usually controlled by water sprays or, if collected by air pollution control devices, recirculated into the leaching circuit. After grinding, the slurry is pumped to a series of tanks for leaching. The pregnant lixiviant is separated from the residual solids (tails). Typically the solids are washed with fresh lixiviant until the desired level of recovery is attained. The uranyl ions are recovered from the pregnant lixiviant using an organic solvent in the solvent extraction circuit at the facility. The final steps consist of precipitation to produce yellowcake, followed by drying and packaging. Ultimately, the solids may be washed with water prior to being pumped to the tailings pond; this wash serves to recover any remaining lixiviant and reduce the quantity of chemicals being placed in the tailings pond.

A conventional mill generates a number of radioactive and nonradioactive wastes of which tailings represent the overwhelming majority. Conventional mills can generate 1,800 to 3,600 metric tons [2,000 to 4,000 tons] per day of waste disposed of in the form of a slurry composed of tailings, dissolved minerals, spent process reagents, and process water-bearing carbonate complexes (alkaline leaching) and sulfuric acid (acid leaching), sodium, manganese, and iron. Depending on the ore, the extraction procedure, and the source of water, the waste characteristics can vary greatly. NRC or Agreement States regulate all uranium milling wastes (including tailings) as byproduct material under Section 11e.(2) of the Atomic Energy Act.

2.3.2 Heap Leaching

For low-grade ores, heap leaching is a viable alternative. Low-grade ore removed from open-pit or underground mining operations can undergo further processing to remove and concentrate the uranium. Heap leaching typically occurs very near or at the mine site. The low-grade ore is crushed to approximately a 2.5-cm [1-in] size and mounded above grade on a prepared pad. The heap leaching pads must be constructed to the same standards as the tailings impoundments per 10 CFR Part 40, Appendix A, including the requirement for a double liner. A sprinkler or drip system, positioned over the top, continually distributes leach solution over the mound. For ores with low lime content (less than 12 percent), an acid solution is used, while alkaline solutions are used when the lime content is above 12 percent. The leach solution trickles through the ore and mobilizes uranium, as well as other metals, into solution. The solution is collected at the base of the mound by a manifold and processed to extract the uranium. The uranium recovery from heap leaching is expected to range from 50 to 80 percent, resulting in a final tailings materials of around 0.01 percent U_3O_8 content. Once heap leaching is complete, the depleted materials are byproduct materials under Section 11e.(2) of the Atomic Energy Act that must be placed in a tailings impoundment unless NRC grants an exemption for disposal in place.

2.4 References

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3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 Land Use

The proposed Antelope and JAB Uranium Project is located in Sweetwater County, Wyoming, within the area known as the Great Divide Basin (Uranium One, 2008). The proposed project areas are located on land managed predominantly by the U.S. Bureau of Land Management (BLM); however, smaller parcels of land within the proposed licensed area are managed by the state of Wyoming **[RAI Land Use-2 and -4 to clarify state land use planning and surface versus subsurface ownership status and whether split estate situations exist, and whether private land exists within the proposed site area]**. Uranium One characterized the proposed project areas as rangeland. Current and historic land uses on the project areas and in the vicinity include grazing, fish and wildlife habitat, recreation, and industrial activities. No residences are located on or adjacent to the proposed sites. The nearest residences to the proposed project areas are located in the communities of Bairoil approximately 26 km [16 mi] to the east and Jeffrey City approximately 50 km [25 mi] to the north.

Livestock grazing of cattle, sheep, and wild horses is the predominant land use of the rangeland in the proposed project areas. BLM or the state of Wyoming administer these land uses depending on the ownership of the rights to the land. The proposed project areas are located within the Green Mountain Common Allotment. This allotment includes 209,330 ha [517,240 acres] of which 90 percent is administered by the BLM Lander Office, 6.6 percent by the state of Wyoming, and 2.9 percent by private landowners (BLM, 1986). **[RAI Land Use-7 to clarify status of BLM resource planning information used in the ER.]** The allotment is permitted for 47,361 animal unit months (AUMs), which includes 35,910 AUMs for cattle and 11,451 AUMs for sheep (BLM, 2008). An AUM is a standard unit that approximates the amount of forage a 1,000-lb cow with a calf will consume in 1 month. An additional 3,550 AUMs are allowed for wild horses, which range across much of this area, including the proposed project areas (BLM, 2008; Uranium One, 2008). The average stocking rate is 4 ha [9 acres] per AUM. Permitted seasons for cattle are May 1–October 31 and May 15–November 15; the sheep season is March 1–February 28 (BLM, 2008; Uranium One, 2008).

Industrial activity in the vicinity of the proposed project areas is limited but predominantly oil and gas development. Mineral resources that exist on the project areas and beyond 3.2 km [2 mi] include uranium, natural gas, and oil (Uranium One, 2008). Nineteen current oil and gas leases exist within the proposed Antelope area, and eight are located partially or wholly within the proposed JAB area. Some of these leases are associated with a coal bed methane pilot project that has been proposed for an area that overlaps with portions of the northwestern Antelope area (BLM, 2008).

Recreational activities in the vicinity of the proposed project areas include hunting, camping, hiking, horseback riding, rock collecting, bicycling, motorcycling, and off-road vehicle use (U.S. Department of the Interior, BLM, 1986). The environmental report (ER) did not provide data regarding recreational activities on the proposed project areas but indicates low use due to the small local population, distance from major population centers, and lack of well-known natural attractions. Fall season hunting for antelope, mule deer, sage grouse, rabbits, and coyotes occurs in the region (BLM, 1986). The Continental Divide National Scenic Trail (CDNST) is the nearest managed recreational area, which passes within 2.5 km [1 mi] of the boundary of the proposed Antelope area **[RAI Land Use-1 requests clarification of conflicting distance statements in the ER]**. For planning purposes, BLM has classified the

land in the proposed project areas as semiprimitive motorized using its Recreation Opportunity Spectrum classification system. This classification indicates there is evidence of human activity, motorized vehicles are allowed, and consumption of natural resources is allowed; however, the concentration of users is low, the areas are managed to provide a natural-appearing environment, and effort is taken to reduce the impact of surface-disturbing projects on the natural environment.

Other proposed, existing, and reclaimed uranium recovery facilities exist in the vicinity of the proposed Antelope and JAB sites and within the broader regional area. These include the proposed Lost Soldier *in-situ* recovery (ISR) facility approximately 20 km [19 mi] to the east near Bairoil and the proposed Lost Creek ISR facility approximately 13 km [8 mi] to the south. The U.S. Nuclear Regulatory Commission (NRC)-licensed Sweetwater conventional uranium mill is located approximately 20 km [13 mi] to the south. Approximately 30 km [19 mi] to the north near Jeffrey City is the reclaimed Split Rock conventional uranium mill.

References:

BLM. "Lander Field Office EIS/Resource Management Plan." 1986. <http://www.bim.gov/rmlp/WY/application/rmp toc.cfm?rmpid=101> (8 June 2007).

BLM. "Environmental Assessment: Pappy Draw Exploratory Coal-Bed Natural Gas Pilot Project." WY–050–EA08–88. Lander, Wyoming: U.S. Department of the Interior. BLM, Lander Field Office. August 2008.

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Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

3.2 Transportation

Transportation access to the proposed Antelope and JAB Uranium Project areas is by road. Figure 3.2-1 shows the regional road networks in the vicinity of the proposed project areas. There are no railroads in the vicinity of the proposed project areas (Uranium One, 2008). Access to the project areas from the east is by State Highway 287 at Lamont, west on State Highway 73 to Bairoil, and then west on Bairoil Road (Sweetwater County Road 22). From the north, the project areas can be accessed from State Highway 287 and at Jeffrey City south on Wamsutter-Crooks Gap Road (Sweetwater County Road 23). The proposed central plant facilities in the Antelope area and satellite facility and well fields in the JAB area would be accessed by Bairoil Road, and State Highways 73 and 287. The nearest residences along this route occur driving past the town of Bairoil.

Traffic counts for roads the proposed project would utilize are provided by Uranium One for year 2005 in the ER (Uranium One, 2008; Wyoming Department of Transportation, 2005) and by NRC in the generic environmental impact statement (GEIS) (NRC, 2009). Table 3.2-1 summarizes the applicable local and regional traffic information provided in the GEIS. While some road segment locations addressed in the ER do not directly overlap with segment locations described in the GEIS, the magnitude of annual average daily traffic counts along the

Figure 3.2-1. Wyoming West Uranium Milling Region Transportation Corridor (NRC, 2009)

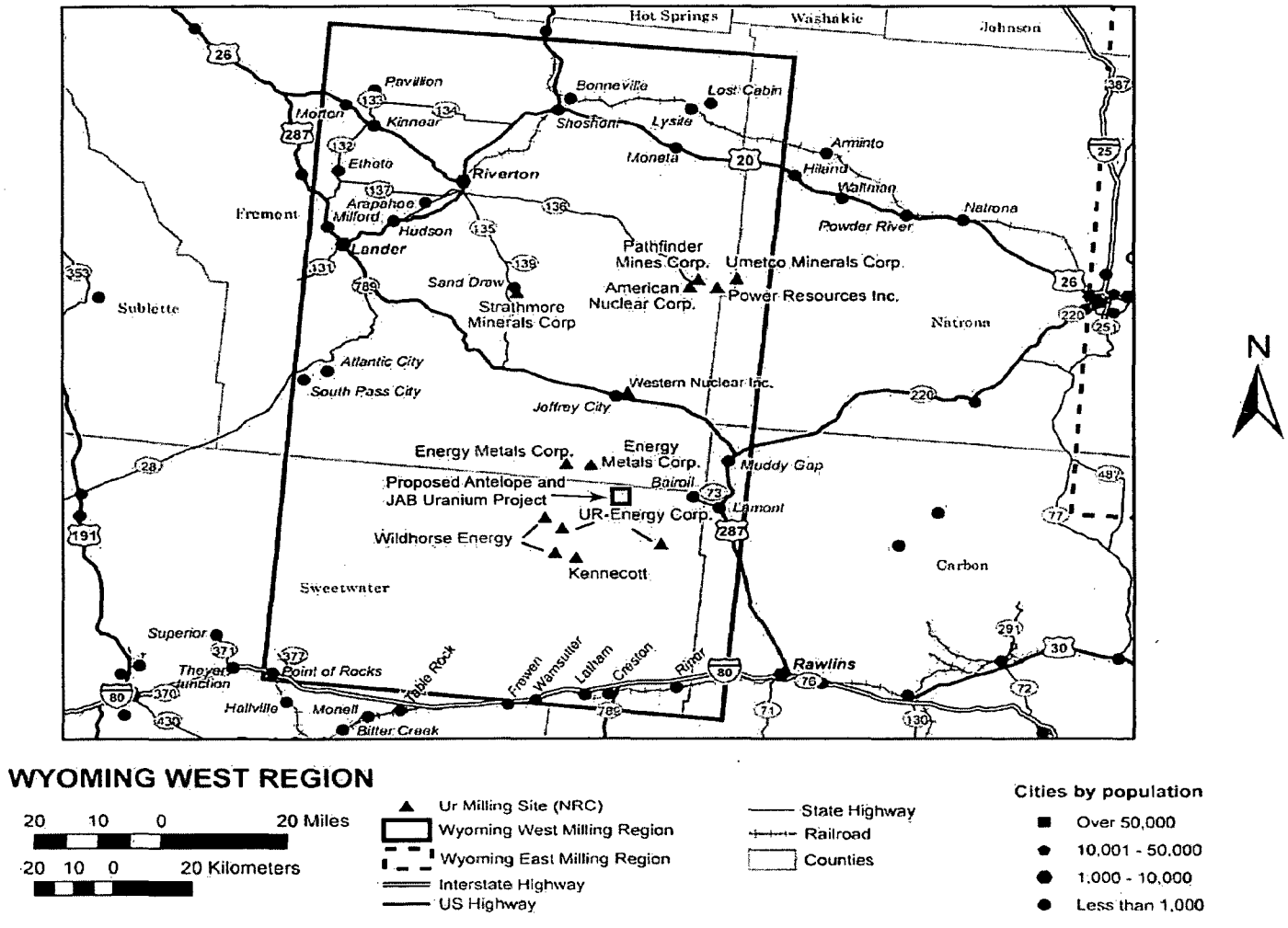

Figure 3.2-1. Wyoming West Uranium Milling Region Transportation Corridor (NRC, 2009)

Table 3.2-1. Average Annual Daily Traffic Counts for Roads in the Vicinity of the Proposed Antelope and JAB ISR Facilities*					
Road Segment	Distance (mi)	Trucks		All Vehicles	
		2005	2006	2005	2006
U.S. Highway 287 (State Route 789) at Lander South	—	390	400	5,080	4,550
U.S. Highway 287 (State Route 789) at Jeffrey City	—	140	140	850	890
U.S. [illegible]	—	140	140	910	910

broader transportation corridors from both sources are similar. The ER provides an all-vehicle annual average daily traffic count of 2,200 for State Highway 287 near State Route 73 for year 2004. The GEIS provides counts for U.S. Highway 287 from Lamont to Muddy Gap for year 2005 and 2006 of 2,400 vehicles. The ER also provides counts for State Highway 73 from Lamont west to Bairoil of 230 for year 2004. The GEIS reports the same count on this road for years 2005 and 2006. In addition, the ER provides an all-traffic count of 2,310 for year 2004 on U.S. Highway 287 traveling north from Rawlins 17.1 km [10.7 mi] to Bell Springs Draw. Truck traffic counts for the roads listed in Table 3.2-1 range from a low of 30 on State Route 73 to a high of 700 on U.S. Highway 287 (from Lamont to Muddy Gap).

Table 3.2-3 of the GEIS (NRC, 2009) describes representative routes and distances for shipments of yellowcake from locations of uranium milling interest in the Wyoming West Uranium Milling Region, where the proposed Antelope and JAB ISR facilities are located. Representative routes are considered in the GEIS owing to the number of routing options available that a shipper could use for an ISR facility. Because transportation risks are dependent on shipment distance, representative routes are identified to generate estimates of shipment distances for evaluation of transportation impacts in Chapter 4. The proposed Antelope and JAB ISR facilities could use a variety of routes for actual yellowcake shipments, but the shipment distances for alternate routes are not expected to differ significantly from those estimated for the representative routes. The ER indicates yellowcake shipments could go to conversion facilities in Metropolis, Illinois, or Port Hope, Canada. The representative route in the GEIS for this region assumes local access roads would be taken south to Wamsutter as a means to connect with Interstate (I)-80. Once on the interstate system, a series of highways are assumed to travel to Metropolis, Illinois. Based on Uranium One's description of the local access roads that would be used, the proposed project would be expected to follow Bairoil Road east to State Route 73 and U.S. Highway 287 south to access I-80; however, the miles traveled for the route to Metropolis, Illinois, would be comparable to the 2,180 km [1,360 mi] reported in the GEIS. While the GEIS did not evaluate routes to Canada, the road distance traveled in the United States to Port Hope is not substantively different from the distance estimate for travel to Metropolis, Illinois.

References:

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

3.3 Geology and Soils

3.3.1 Regional Geology

The proposed Antelope and JAB Uranium Project areas are located within the Wyoming West Uranium Milling Region as defined in GEIS Section 3.2.3 (NRC, 2009). The GEIS identifies that the uranium mineralization within the Wyoming West Uranium Milling Region is found in fluvial and alluvial sandstones in two major uranium districts: the Crooks Gap area of the Great Divide Basin and the Gas Hills area of the Wind River Basin. The proposed project locations are part of the Crook's Gap area of the Great Divide Basin, which was developed by the Laramide Orogeny, then filled with 4,600 m [15,000 ft] of Tertiary basin fill sediments overlying Cretaceous and older rocks (Uranium One, 2008). The uranium ore-grade mineralization in the sandstones of this area is amenable to recovery by ISR. GEIS Section 3.2.3 and GEIS Figure 3.2-5 describe the generalized stratigraphic units that may be involved in potential milling operations (NRC, 2009). **[RAI Geology-2, request a cross-section linking strata underneath both sites to clarify time equivalences, facies and stratigraphic hierarchy between both project.]**

In the Crook's Gap area, the lowermost basin fill deposits are part of the Tertiary (Paleocene) Fort Union Formation, which consists of up to 1,900 m [6,200 ft] of interbedded lacustrine shales and fluvial siltstones and sandstones. The Tertiary (Eocene) Battle Spring Formation unconformably overlies the Fort Union Formation and consists of approximately 1,980 m [6,500 ft] of alluvial fan sediments, likely derived from the Granite Mountains to the north (Uranium One, 2008).

3.3.2 Site Geology

The Battle Spring Formation, which is the primary stratigraphic unit in both the Antelope and JAB areas, is the host unit for local uranium mineralization. The Battle Spring Formation was deposited as a large alluvial fan system, hence the lithology in the project areas varies both laterally and vertically. The uranium mineralization occurs as roll front and tabular type deposits of primarily uraninite and coffinite over a depth range from near surface to 366 m [1,200 ft] deep (NRC, 2009). Beneath the Antelope area, the main zones of mineralization range from 90–180 m [300–600 ft] in the western portion to 60–120 m [200–400 ft] in the eastern portion. In the JAB area, the primary uranium deposit is 50–95 m [150–310 ft] deep (Uranium One, 2008).

The Uranium One ER describes the stratigraphic units in the Antelope project area as sand packages with overlying and underlying confining shale units, as summarized in Table 3.3-1. The Uranium One ER discusses the site geology of the JAB area in terms of five informal

Table 3.3-1. Summary of Uranium One Unit Characteristics at Antelope Project Area*			
Uranium One Unit Name	**Average Thickness {m [ft]}**	**Rock Characteristics**	**Accessory Minerals**
245 Shale	3.6 [12]	Greenish-gray, pale purple and yellow shale and siltstone	
240-200 Sand	77 [254]	Arkosic very-fine- to coarse-grained sandstone with interbedded yellow, green-gray to purple shale.	Minor chert Minor pyrite
195 Shale	4.2 [14]	Greenish-gray shale	
190-150 Sand	77 [252]	Very-fine to coarse-grained arkosic sandstone with interbedded shale and siltstone	Minor black chert Moderate pyrit

sedimentary units, progressing upward in the sequence from the lowermost: the *Underlying Sand Unit*, the *Lower Confining Unit*, the *Mineralized Unit*, the *Upper Confining Unit*, and the *Overlying Sand Unit*. The *Underlying Sand Unit* consists of arkosic sandstone with interbedded shales and mudstones with an average sand thickness of 3 m [15 ft]. The *Underlying Confining Unit* is a carbonaceous shale with an average thickness of 3-4 m [10-12 ft]. The ER (Uranium One, 2009) states the carbonaceous shale may also be the primary reducing agent responsible for the formation of the roll-front deposit. The *Mineralized Zone* is a typical alluvial fan with a thickness of 7–16 ft [22–54 ft]. The *Upper Confining Unit* is part of the normal fining upward sequence of an alluvial fan and consists of thinly interbedded sandstone, shale and mudstone with an average thickness of 3–5 m [10–15 ft]. The uppermost unit, the *Overlying Sand Unit,* is also typical of an alluvial fan and consists of fine- to coarse-grained arkosic sands.

3.3.3 Soils

Within the Wyoming West Uranium Milling Region of the Great Divide Basin, the soils are diverse over short distances (NRC, 2009). This region contains loamy-skeletal soils, which vary in composition and accumulation, both regionally and in terms of local characteristics such as slope changes, vegetation, and geology. Uranium One conducted a soil survey involving field and laboratory sampling covering about 5,900 ha [14,600 acres] of the proposed project area; 26 sites from the Antelope area and 34 sites from the JAB area were sampled. A soil map of

the proposed project areas was constructed using National Cooperative Soil Survey techniques and procedures. The ER describes the soils for the proposed Antelope and JAB Uranium Project areas as typical of the semiarid grasslands and shrublands in the Western United States (Uranium One, 2008). Most soils are classified taxonomically as Typic Torriorthents, Ustic Haplargrids, Ustic Torriorthents, Ustic Calciargids, and Aridic Ustifluvents.

3.3.4 Seismicity

There are two active fault systems: the Chicken Springs Fault System and the South Granite Mountain Fault System in the vicinity of the project areas (Uranium One, 2008). The east-west trending Chicken Springs Fault System, located 10 km [6 mi] from the project area, last showed activity in the Holocene according to the Wyoming State Geological Survey (Case, et al., 2002,a,b). Studies of the fault show it has the potential of generating a magnitude 6.5 earthquake, with the town of Bairoil located about 24 km [15 mi] northeast of the permit area receiving the greatest intensity. The South Granite Mountain Fault System is composed of several northwest-southeast trending normal and thrust faults. This fault system has the potential to generate a 6.75 magnitude earthquake, with the greatest intensity at Bairoil and at Jeffrey City, located about 30 km [20 mi] from the permit area (Case, et al., 2002b).

The northern boundary of the mineralized zone in the JAB project area is marked by a normal, high-angle scissor fault. The Uranium One ER stated, based on data gathered from pump tests performed in 1981 and 2008 that this fault may act as a hydrologic barrier.

[RAI Geology-1 to provide a detailed fault location map with the locations of both the Antelope and JAB permit boundaries and mineralized areas clearly identified, including all known fault systems, and identify fault(s) within the JAB project area that are mentioned in Section 3.3.1 of the ER.]

References:

Case, J.C., R.N. Toner, and R. Kirkwood. "Basin Seismological Characterization for Fremont County, Wyoming." Laramie, Wyoming: Wyoming State Geological Survey. September 2002a.

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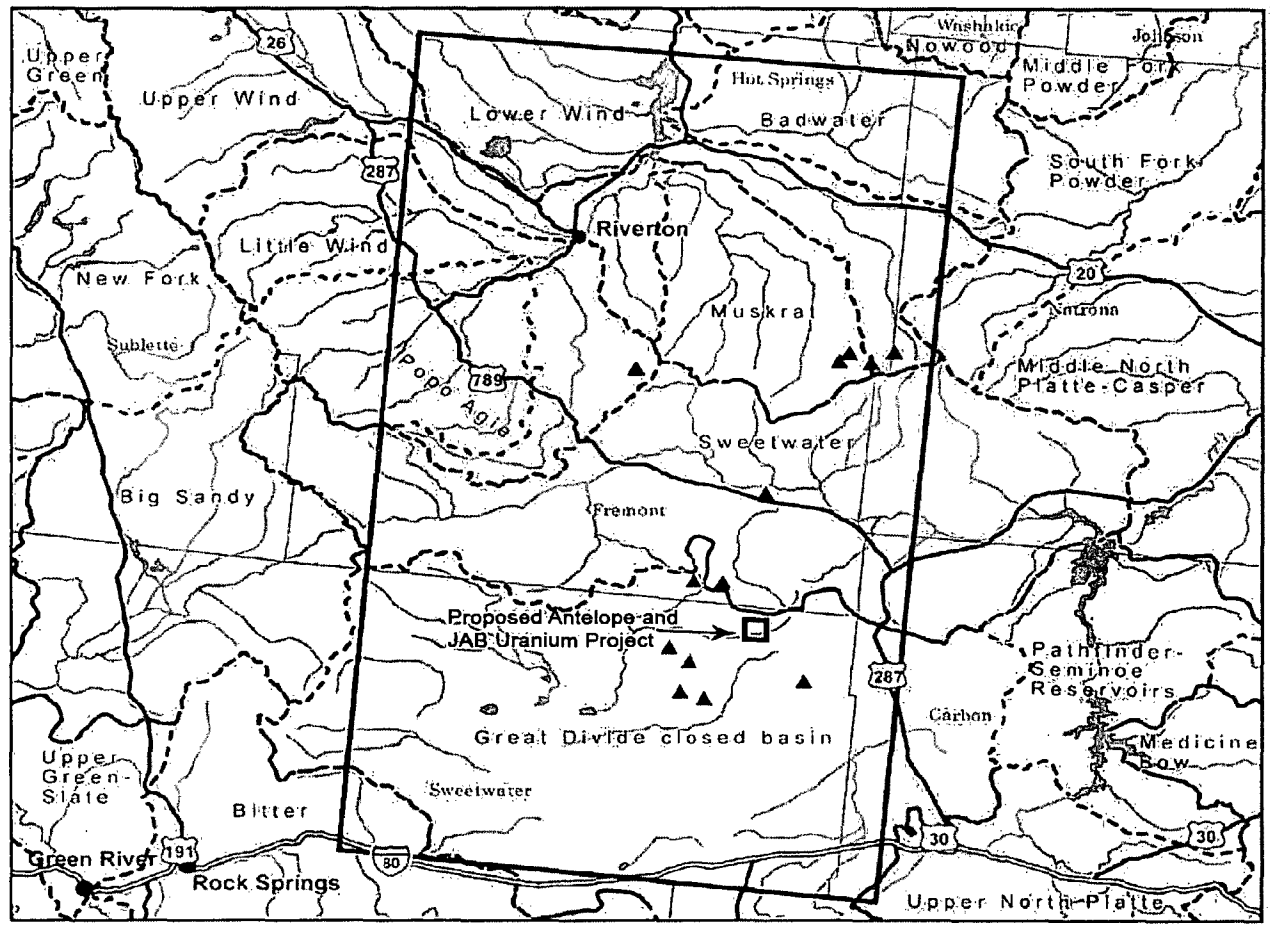
3.4 Water Resources

The proposed project is situated in the north central portion of the Great Divide Basin (U.S. Geological Survey Hydrologic Unit Code: 14040200). The 9,920 km^2 [3,875 mi^2] Great Divide Basin covers parts of northeastern Sweetwater County and western Carbon County, Wyoming, in an area with internal drainage (Figure 3.4-1). This section describes the water

Figure 3.4-1. Watersheds in the Wyoming West Uranium Milling Region including the Great Divide Basin (NRC, 2009)



WYOMING WEST REGION

20 10 0 20 Miles

▲ Ur Milling Site (NRC)
● Major City
Wyoming West Milling Region

Interstate Highway
US Highway
Water bodies (Lakes, Bays, ...)

resources of the region surrounding the proposed Antelope and JAB project areas in terms of surface waters (including wetlands) and groundwater.

3.4.1 Surface Waters

The proposed project areas are located entirely within the Lost Creek watershed in the north central portion of the Great Divide Basin (Figure X2) **[RAI Water-1 to provide a hydrography of the Lost Creek Watershed]**. The Lost Creek watershed drains from north to south. Table 3.4-1 summarizes the surface water characteristics of the Lost Creek watershed and its four subwatersheds: the Upper Lost Creek, Arapahoe Creek, Lower Lost Creek, and Osborne Draw watersheds. The majority of the Antelope project area is within the Osborne Draw watershed with a smaller portion within the Arapahoe Creek watershed. The Arapahoe Creek watershed covers most of the JAB site with smaller portions in the remaining subwatersheds of the Lost Creek watershed.

In the Lost Creek watershed, surface runoff averages less than 1.3 cm/yr [0.5 in/yr] (Gebert, et al., 1987). The streams are classified as 3A and 3B surface waters by the State of Wyoming with designated uses limited to recreation, wildlife, agriculture, industry, and other aquatic life; Class 3 waters do not support drinking, fishing, and fish consumption (WDEQ, 2001). The Lost Creek watershed includes more than 10 ha [25 acres] of intermittent surface reservoirs. There are no perennial streams or surface reservoirs within the proposed project areas and wetlands exist mainly as ponds and intermittent streams that are temporarily flooded on a seasonal basis (NRC, 2009). Surface water in the vicinity of the proposed project areas is predominantly of the sodium bicarbonate type, with total dissolved solids concentration ranging from 10 to 150 mg/L (Uranium One, 2008). There are no active surface water rights within the propose project permit boundaries; however, there is one for stock use within 0.8 km [0.5 mi] of the JAB permit boundary (Uranium One, 2008).

3.4.2 Groundwater

The groundwater resources available to the proposed project are part of the Upper Colorado Regional Aquifer System as defined by the US Geological Survey (Whitehead, 1996). Within the proposed project areas, this aquifer system contains aquifers in the Quaternary, Lower Tertiary, and Upper Cretaceous formations (Uranium One, 2008). The Quaternary aquifer includes discontinuous quaternary gravel deposits beneath the JAB area. The Lower Tertiary aquifers are composed of the Battle Springs and the Fort Union formations, while the Lance/Fox Hills, Mesa Verde, and Frontier formations make up the Upper Cretaceous aquifers. These

aquifers are separated by several hundreds to thousands of meters [feet] of shale confining units. Section 3.3 describes the geologic origins of these formations. The Battle Springs Formation hosts the uranium-bearing aquifers of primary interest within the proposed project areas. This formation consists of very fine- to coarse-grained sandstone deposits interbedded with shales and mudstones, which provide confinement within the Battle Springs Formation.

Table 3.4-1. Surface Water Characteristics of the Watersheds Surrounding the Antelope and JAB Project Areas*				
Watershed	**Hydrologic Unit Code**	**Drainage Area km2 [mi2]**	**Stream Length km [mi]**	**Wetland Area ha [acre]**
Lost Creek	14040 20001	1,060 [415]	1,600 [1,006]	
Upper Lost	14040 20001	121.6 [47.5]	289.6 [181]	12.9 [31.8]

From the proposed project areas, groundwater flows generally in the south-southwest direction toward the Great Divide Basin. Because of the closed nature of this basin, there is no runoff and very little groundwater discharge out of the basin. Most of the groundwater loss is through evaporation and transpiration. Discharge from the aquifers within the basin is by upward leakage to shallower aquifers and major streams.

The ER describes the site-specific hydrogeological features and aquifer properties (such as hydraulic coefficient, transmissivity, and storage coefficient) for the proposed project areas based on field investigations in 2007 and 2008, as well as historic aquifer tests conducted at the JAB area in 1982 (Uranium One, 2008). Table 3.3-1 lists the 12 hydrostratigraphic units for the Antelope area. Uranium mineralization exists in the 240-200 Sand and 190-150 Sand units underlying the Antelope area. The five hydrostratigraphic units for the JAB project area are the Overlying Sand; Overlying Confining Unit; Production Sand; Underlying Confining Unit; and Underlying Sand. The proposed production zones for *in-situ* uranium mining in the JAB area are within the Production Sand unit. Uranium One's investigations and aquifer tests have indicated (i) hydraulic continuity within each production zone at the proposed project areas; (ii) vertical aquifer confinement varies spatially across both project areas, probably due to localized pathways such as an open historic drill hole or improperly sealed historic well; and (iii) a known fault north of the proposed JAB project area does not appear to provide a significant flow pathway **[RAI Geology-1 to provide a detailed fault map of the proposed project areas]**. Future aquifer and mine unit testing will be conducted to confirm hydraulic continuity and aquifer confinement (Uranium One, 2008). **[RAI PA-1 to provide update on well field plan.]**

For *in-situ* uranium recovery operations to be practical, the hydraulic conductivity of the production aquifer must be sufficiently large to allow water flow between the injection and recovery wells. Hence, during mine unit testing for well field design, portions of the production aquifer locations with low hydraulic conductivity may be unsuitable for well construction. Estimates of transmissivities from historic aquifer tests in the JAB project area range from 500 to 58,300 L/day/m {40 to 4,700 gal per day per ft [gpd/ft]}, while hydraulic conductivities range from 50 to 3,300 L/day/m^2 [1.3 to 82.3 gpd/ft^2]. Uranium One's aquifer tests in the JAB area estimated transmissivities in the range of 7,250 to 51,800 L/day/m [585 to 4,180 gpd/ft], hydraulic conductivities from 590 to 4,880 L/day/m^2 [14.6 to 120 gpd/ft^2], and storage coefficients from 6.9×10^{-6} to 1.9×10^{-4}. At the Antelope area, transmissivity estimates ranged from 2,100 to 59,900 L/day/m [169 to 4,830 gpd/ft], hydraulic conductivities from 24 to 2,460 L/day/m^2 [0.6 to 60.4 gpd/ft^2], and storage coefficients from 2.7×10^{-4} to 3.6×10^{-3}. Collentine, et al. (1981) reported that wells in the Battle Spring aquifer typically yield 110 to 150 L/min [30 to 40 gal/min], but are capable of yielding at least 570 L/min [150 gal/min]. Porosities in the underlying Fort Union Formation range from 15 to 39 percent (uranium One, 2008).

The Battle Springs Formation has the best water quality within the proposed project areas, with total dissolved solids concentrations less than 1,000 mg/L [1,000 ppm] (Uranium One, 2008). Water quality tends to be poorer in the deeper aquifers, although locations near recharge areas can have good quality water. Uranium One sampled 29 wells in the proposed project areas for

water quality analysis. Results showed average total dissolved solids concentrations of 250 and 900 mg/L [250 and 900 ppm] at the Antelope and JAB areas, respectively. Based on WDEQ limits, these results generally indicate Class I groundwater at Antelope and Class II at JAB. However, due to high radium-226 concentrations, groundwater in the uranium-bearing units is characterized as Class VI water, hence unsuitable for human or livestock consumption.

Based on a query of the Wyoming State Engineers Office (WYSEO) Water Rights Database, there are 56 active groundwater rights within the Antelope and JAB permit boundaries and the surrounding 5-km [3-mi] buffer (Uranium One, 2008). Of these, 29 are permitted to Uranium One and the remaining are permitted wells for stock, industrial, domestic, monitoring, test, and miscellaneous uses.

3.4.3 References

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Gebert, W.A., D.J. Graczyk, and W.R. Krug. "Average Annual Runoff in the United States, 1951–1980." U.S. Geological Survey Hydrologic Investigations Atlas HA-710. Scale 1:7,500,000. 1987.

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Whitehead, R.L. "Groundwater Atlas of the United States, Montana, North Dakota, South Dakota, Wyoming." U.S. Geological Survey Report HA730–I. Denver, Colorado: U.S. Geological Survey. 1996. <http://pubs.usgs.gov/ha/ha730/ch_i/> (27 January 2009).

3.5 Ecology

Uranium One's ER indicates that the proposed Antelope and JAB Uranium Project areas occupy a total of approximately 6,300 ha [15,575 acres] of wildlife habitat (Uranium One, 2008). No perennial streams are present in the project area, and all natural flow along drainages is categorized as intermittent or ephemeral. The project area is drained by Obsorne Draw, Arapahoe Creek, and Lost Creek and their tributaries. Snowfall is the only water source for wildlife during winter months.

GEIS Section 3.2.5 describes the Wyoming West Uranium Milling Region as consisting primarily of the Wyoming Basin and Middle Rockies ecoregions. The Crook's Gap Uranium District consists of Rolling Sagebrush Steppe, Salt Desert Shrub Basins and Slopes, and Foothill Shrublands and Low Mountains ecoregions. GEIS Figure 3.2-7 indicates that the proposed project is located in the Rolling Sagebrush Steppe ecoregion of the Wyoming Basin and is composed of rolling plains with hills, mesas, and terraces. The most abundant shrub vegetation in the region is Wyoming big sagebrush (*Artemisia tridentata* spp. *wyomingensis*) (NRC, 2009).

Approximately 285 different species of birds, mammals, amphibians, and reptiles (terrestrial vertebrates) are found within the Wyoming Basin (World Wildlife Fund, 2007a,b; NRC, 2009). Crucial wintering habitats are found within the Wyoming West Uranium Milling Region for large game mammals including antelope, big horn sheep, elk, moose, mule deer, and the greater sage-grouse. Numerous sage-grouse leks and nesting areas are located near sites in both the Crook's Gap and Gas Hills Uranium Districts, particularly in the Crook's Gap portion of the region. According to GEIS Figures 3.2-8 through 3.2-12, the proposed project is not located within birthing areas, crucial winter areas, or crucial winter/yearlong areas for antelope, big horn sheep, elk, moose, and mule deer.

3.5.1 Terrestrial Ecology

Uranium One conducted vegetation, wetland, and wildlife studies for the proposed project areas primarily during the spring/summer of 2007. Some wildlife surveys continued through spring 2008. Survey areas include the proposed project areas and, if deemed needed for a particular species, a surrounding 0.8- to 16-km [½- to 10-mi] perimeter, depending on the species. Survey protocols and habitat models for species of interest were obtained from BLM biologists and/or the Wyoming Game and Fish Department (WGFD). The following survey results discuss the vegetation, big game species, small mammals, raptors, upland game birds, migratory birds, reptiles and amphibians, fisheries, and special status wildlife species, including threatened and endangered species and BLM sensitive species, that were documented within the survey areas (Uranium One, 2008).

The ER describes five different plant communities for the proposed Antelope area, three of which are also located at the proposed JAB area. The plant communities are dominated by the Sagebrush Grassland that comprises approximately 63 percent of the project area. Other plant communities consist of Breaks Grassland (Antelope area only), Mix-grass/Mat-cushion Grassland, Intermittent Stream Grassland (Antelope area only), and Big Sagebrush Shrubland. No threatened or endangered species were encountered in the Antelope and JAB areas. No state-designated weeds were encountered in the survey areas. The Antelope area plant communities, species composition, and acreage are summarized in Table 3.5-1; the JAB area plant communities, species composition, and acreage are summarized in Table 3.5-2. The locations of the plant communities are shown in the Antelope Survey Area Vegetation Map (Figure 3.5-1) and JAB Survey Area Vegetation Map (Figure 3.5-2) (Uranium One, 2008).

The proposed project areas are finely transected by ephemeral streams and shallow drainages in the Lost Creek watershed. During the wetland surveys, the main drainages in the Antelope and JAB areas were dry. Two wetlands of similar size were identified at drainage bottoms that total 0.11 ha [0.268 acre]. Neither of the wetlands is located within a planned or potential well field location. One wetland was recorded in the Antelope area along a tributary of Osborne Draw in Section 8, T26N, R92W. This wetland was designated on previous National Wetland Inventory maps as Palustrine Emergent Seasonally Flooded. This wetland lacked preemergent vegetation during the survey. Because of hydrophytic vegetation, only secondary hydrology indicators, and hydric soil were present, the surveyors changed the designation to Palustrine Unconsolidated Bottom. The locations of the wetlands are shown on the Antelope Wetland Map (Figure 3.5-3) (Uranium One, 2008). **[This figure is expected to change as a response to RAI Wetland-2 to clarify wetland locations.]**

Table 3.5-1. Summary of the Antelope Plant Communities*		
Plant Community	**Species Composition (Percent of Plant Community)**	**Acreage (Percent of Permit Area)**
Sagebrush Grassland	Perennial shrubs (55.01%) and subshrubs (1.63%): black sagebrush, big sagebrush, Douglas rabbitbrush, fringed sagewort, winterfat, granite prickly phlox, birdfoot sagebrush, birdfoot sagebrush, broom snakeweed. Cool season perennial grasses (32.96%): Sandberg bluegrass, prairie junegrass, Indian ricegrass, Cusick's bluegrass. Perennial forbs (10.22%): Hooker sandwort, stemless mock goldenweed, tufted fleabane. Annual forbs (0.19%): spreading groundsmoke.	6,636.17 (63.01%)
Breaks Grassland	Perennial shrubs (50.02%) and subshrubs (4.10%): black sagebrush, big sagebrush, Douglas rabbitbrush, fringed sagewort, winterfat, granite prickly phlox, Gardner saltbush, broom snakeweed. Cool season perennial grasses (31.96%): Sandberg bluegrass, prairie junegrass, needle and thread, bluebunch wheatgrass. Perennial forbs (12.70%): Hooker	2,104.60 (19.98%)

Table 3.5-1. Summary of the Antelope Plant Communities* (continued)		
Plant Community	**Species Composition (Percent of Plant Community)**	**Acreage (Percent of Permit Area)**
Big Sagebrush Shrubland	Perennial shrubs (69.22%) big sagebrush, Douglas rabbitbrush, black sagebrush, greasewood. Cool season perennial grasses (20.42%): Sandberg bluegrass, needle and thread, bluebunch wheatgrass, Indian ricegrass, crested wheatgrass, squirrel tail, intermediate wheatgrass, prairie Junegrass, Cusick's bluegrass, green needlegrass, pine needlegrass. Perennial forbs (7.3%): Hooker sandwort, stemless mock goldenweed, tufted fleabane, littleleaf pussytoes, woollypod milkvetch,	1,058.58 (10.05%)

Table 3.5-2. Summary of the JAB Plant Communities*		
Plant Community	**Species Composition**	**Acreage (Percent of Permit Area)**
Sagebrush Grassland	Cool season perennial grasses (35.62%): Sandberg bluegrass, Indian ricegrass, and needle and thread. Perennial shrubs (46.26%) and subshrubs (10.01%): black sagebrush, big sagebrush, Douglas rabbitbrush, fringed	2,537.49 (62.76%)

Table 3.5-2. Summary of the JAB Plant Communities* (continued)		
Plant Community	**Species Composition**	**Acreage (Percent of Permit Area)**
Mix-grass/Mat-cushion Grassland	Cool season perennial grasses (43.12%): Sandberg bluegrass, prairie Junegrass, Indian ricegrass, intermediate wheatgrass, squirrel tail, bluebunch wheatgrass, needle and thread. Perennial forbs (25.56%): musk phlox, Hooker sandwort, Hoods phlox, goldenbush, sulphur-flower buckwheat, alpine golden buckwheat, milkvetch, stemless mock goldenweed, littleleaf pussytoes. Perennial shrubs (17.10%): black sagebrush, big sagebrush, Douglas rabbitbrush, rubber rabbitbrush. Perennial subshrubs (13.50%): fringed sagewort, birdsfoot sagewort, Gardner's	1,005.01 (24.86%)

Figure 3.5-1. Antelope Survey Area Vegetation Map (Uranium One, 2008, Figure 3.5-1a)

One wetland was recorded in the JAB area along Arapahoe Creek in Section 16, T26N, R94W. No wetlands were previously mapped within the proposed JAB area **[RAI Wetlands-2 to provide national wetland inventory maps]**. The wetland that was present during the Uranium One's wetland delineation was designated as Palustrine Unconsolidated Bottom. An earthen dam was found in the same drainage as the wetland. The locations of the wetlands identified during the Uranium One's surveys are shown on the JAB Wetland Map (Figure 3.5-4) (Uranium One, 2008).

The wetlands identified by the Uranium One during the survey are isolated and do not support interstate commerce. Since the Great Divide Basin is a closed watershed, all of the wetlands identified during the survey are recommended by Uranium One to be nonjurisdictional. The U.S. Army Corps of Engineers has not issued a jurisdictional determination. **[RAI Wetlands-1 to provide jurisdictional determination.]**

The Uranium One conducted wildlife studies of birds and vertebrates for the proposed project areas. Raptor nests were not observed inside the Antelope and JAB Uranium Project areas during surveys conducted in 2007 and 2008. Ten raptor nest sites, four intact and six previous nest records, were observed in the JAB survey area at least 0.8 km [0.5 mi] from the project

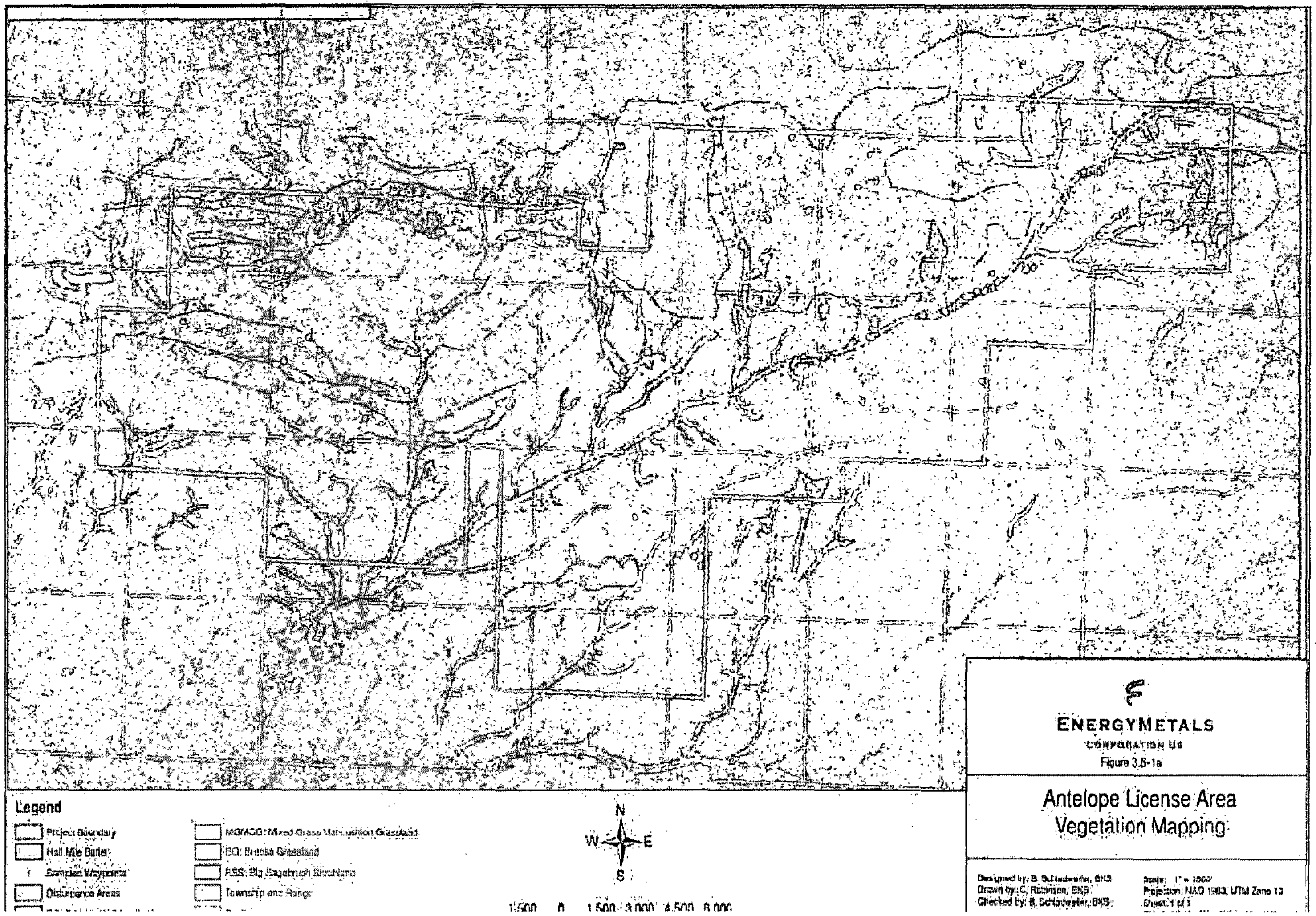
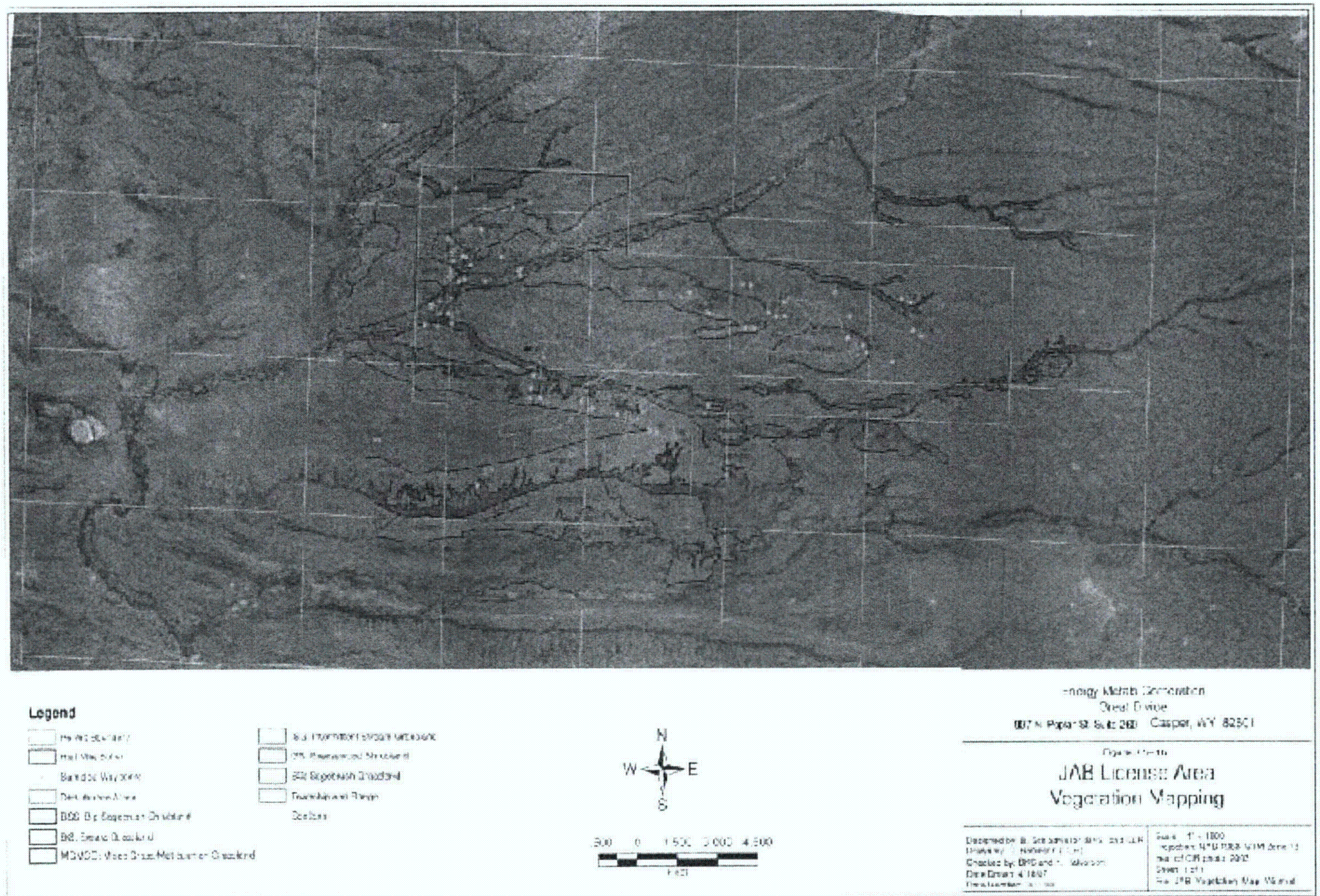


Figure 3.5-2. JAB Survey Area Vegetation Mapping (Uranium One - 2008 - Figure 3.5-1b)


Legend
N
W
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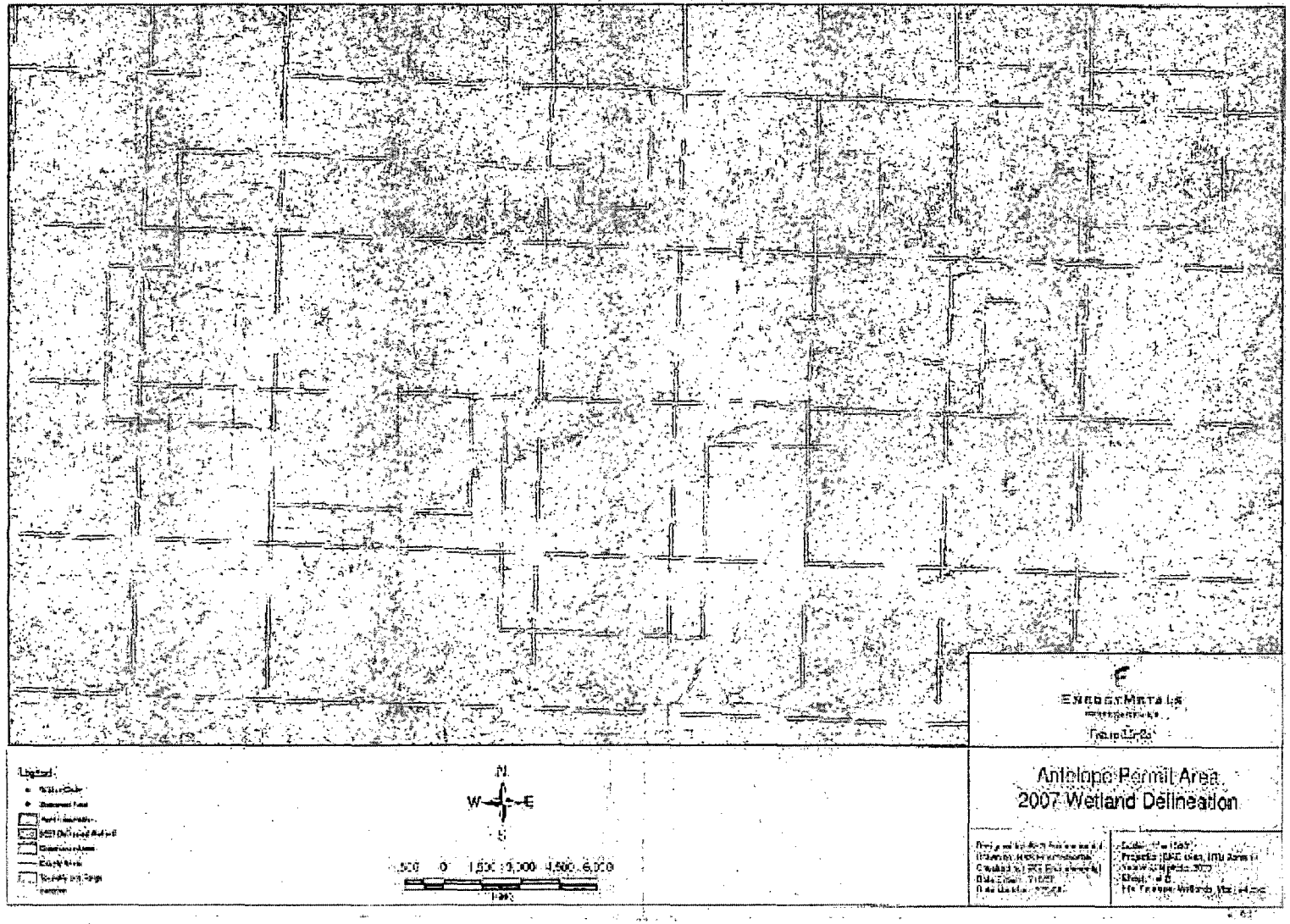
Energy Metals Corporation
Great Divide
Casper, WY 82601
JAB License Area
Vegetation Mapping


N
W
E
S
500 0 1,500 3,000 4,500 6,000
Antelope Permit Area
2007 Wetland Delineation

Legend

- Wetland Point
- Datasheet Waypoint
- Permit Boundary
- 2007 Delineated Wetlands
- Disturbance Areas
- County Roads
- Township and Range
- Sections

N
W E
S

1,500 0 1,500 3,000 4,500

ENERGY METALS

Figure 3.5-2b

JAB Permit Area 2007 Wetland Delineation

Designed by: BKS Environmental
Drawn by: BKS Environmental
Checked by: BKS Environmental
Date Drawn: 5/1/07
Date Modified: 5/25/07

Scale: 1" = 1500'
Projection: NAD 1983 UTM Zone 13
Year of CIR photo: 2003
Sheet 3 of 8
File: JAB_Wetland_Map_V5.mxd

TD-214

boundary. Two pairs of ferruginous hawks (*Buteo regalis*) nested in the JAB survey area in both 2007 and 2008. BLM recognizes a distance of 0.8 km [0.5 mi] as an adequate buffer distance between raptor nest sites and disturbance. Locations of the BLM recorded raptor nests relied on for the wildlife surveys are shown on the JAB Wildlife Map (Figure 3.5-5) (Uranium One, 2008).

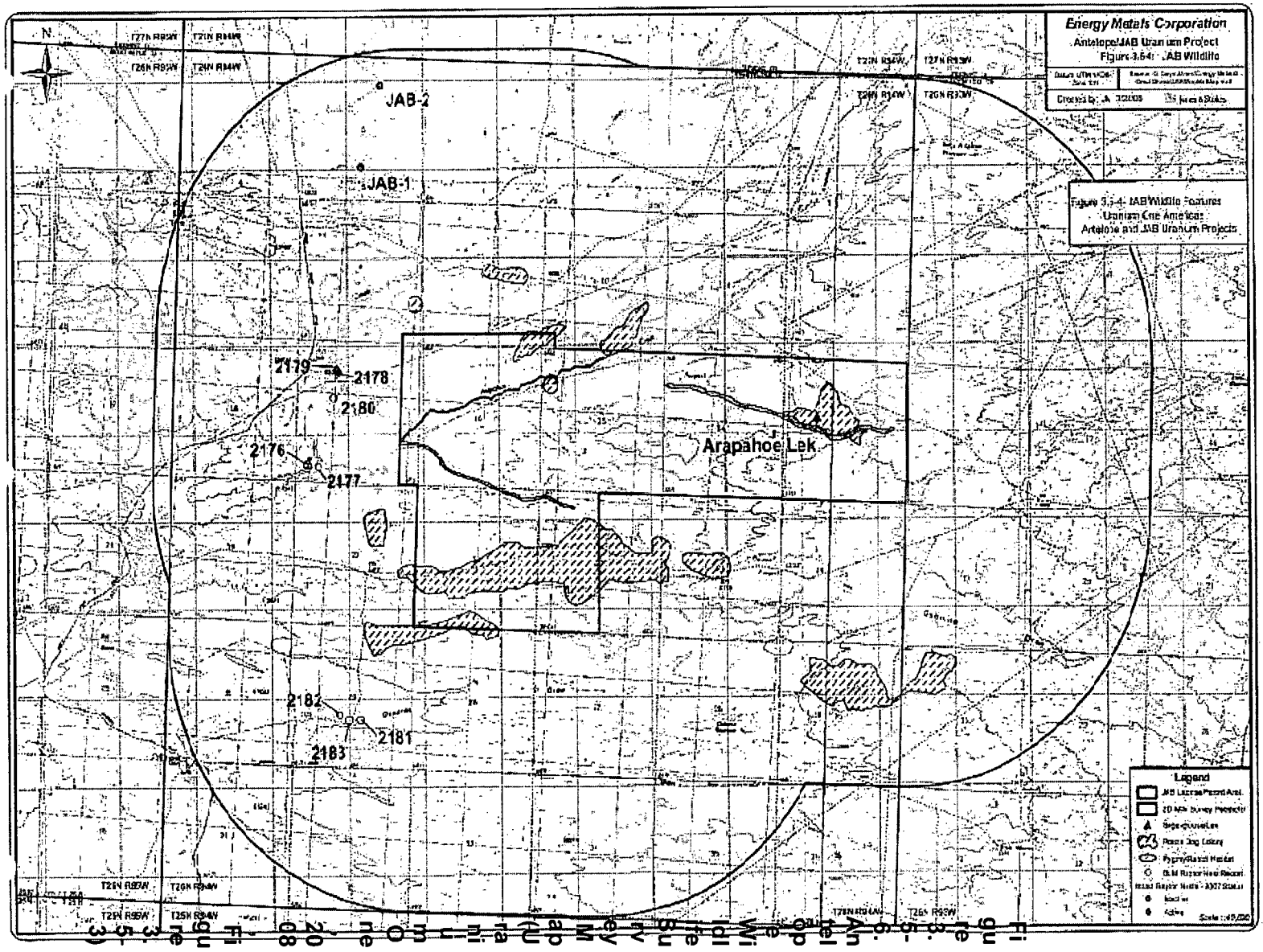
Water in Arapahoe Creek, Lost Creek, and man-made ponds for livestock could serve as suitable habitat for waterfowl and shorebirds mainly during spring migration. One gadwall was observed in the survey area, but not within the project area and was the only waterfowl species observed during the wildlife surveys.

The most prevalent bird found inside the proposed project areas is the Greater sage-grouse (*Centrocerus urophasianus)*, which is designated as a Sensitive Species. The Uranium One's survey area for the Greater sage-grouse encompasses a 3.2-km [2-mi] perimeter surrounding the Antelope and JAB project areas. Six leks were monitored in the Antelope and JAB survey area during the 2007 and 2008 surveys. Two of the six leks named Harrier (Antelope area) and Arapahoe (JAB area), are located within the proposed project area. Grouse and/or evidence of their presence were documented throughout the proposed project areas in spring and summer 2007. Peak counts of between 64 and 138 grouse were recorded at each lek during the survey. Incidental sage-grouse sightings were documented only in 2007 for the survey areas. Locations of the leks recorded by the Uranium One are shown on the JAB Wildlife Map (Figure 3.5-5) and Antelope Wildlife Map (Figure 3.5-6) (Uranium One, 2008).

Other Sensitive Species are located in the vicinity of the proposed project areas. Uranium One reported that one vertebrate and seven avian BLM Sensitive Species for the Lander and Rawlins Field Offices (BLM, 2002) were observed within the Antelope and JAB survey areas during surveys conducted in 2007: the white-tailed prairie dog (*Cynomys leucurus),* ferruginous hawk, greater sage-grouse, sage thrasher *(Oreoscoptes montanus),* loggerhead shrike *(Lanius ludovicianus),* Brewer's sparrow *(Spizella breweri),* mountain plover (*Charadrius montanus),* and sage sparrow *(Amphispiza billi*). All but the mountain plover were observed within the project areas. All but the loggerhead shrike are also Species of Special Concern according to the WGFD. Five of the seven Sensitive Species were known or presumed to breed within the proposed project areas. Eleven white-tailed prairie dog colonies were mapped in the JAB survey area totaling 355 ha [878 acres]. Five of those 11 colonies, approximately 168 ha [415 acres], are located within the proposed JAB project area.

Further wildlife studies conducted by Uranium One concluded that there are no big game crucial habitats, critical migration corridors, or important parturition areas in or within 14 km [9 mi] of the proposed Antelope and JAB Uranium Project areas. The entire Antelope and JAB project areas are classified as winter-yearlong range for the pronghorn (*Antilocapra americana*). Elk (*Cervus elaphus*) were present during the baseline survey period in 2007, mostly outside the project areas. Mule deer (*Odocoileus hemionus*) were not observed during Uranium One's surveys conducted in 2007 and 2008. Small bands of wild horses (*Equus* spp.) were observed in the proposed Antelope and JAB Uranium Project areas. Locations of the big game ranges are shown on the Antelope Big Game Range Map (Figure 3.5-7) and JAB Big Game Range Map (Figure 3.5-8) (Uranium One, 2008).

According to the U.S. Department of Agriculture Natural Resources Conservation Service list of Invasive and Noxious Weeds in Wyoming, plants documented during Uranium One's vegetation survey conducted for the project area may be considered noxious or a Sensitive Species


Energy Metals Corporation
Antelope/JAB Uranium Project
Figure 3.6-4: JAB Wildlife
JAB-2
JAB-1
2179
2178
2180
2176
2177
Arapahoe Lek
2182
2181
2183
Figure 3.6-4: JAB Wildlife Features
Uranium One Americas
Antelope and JAB Uranium Projects
Legend

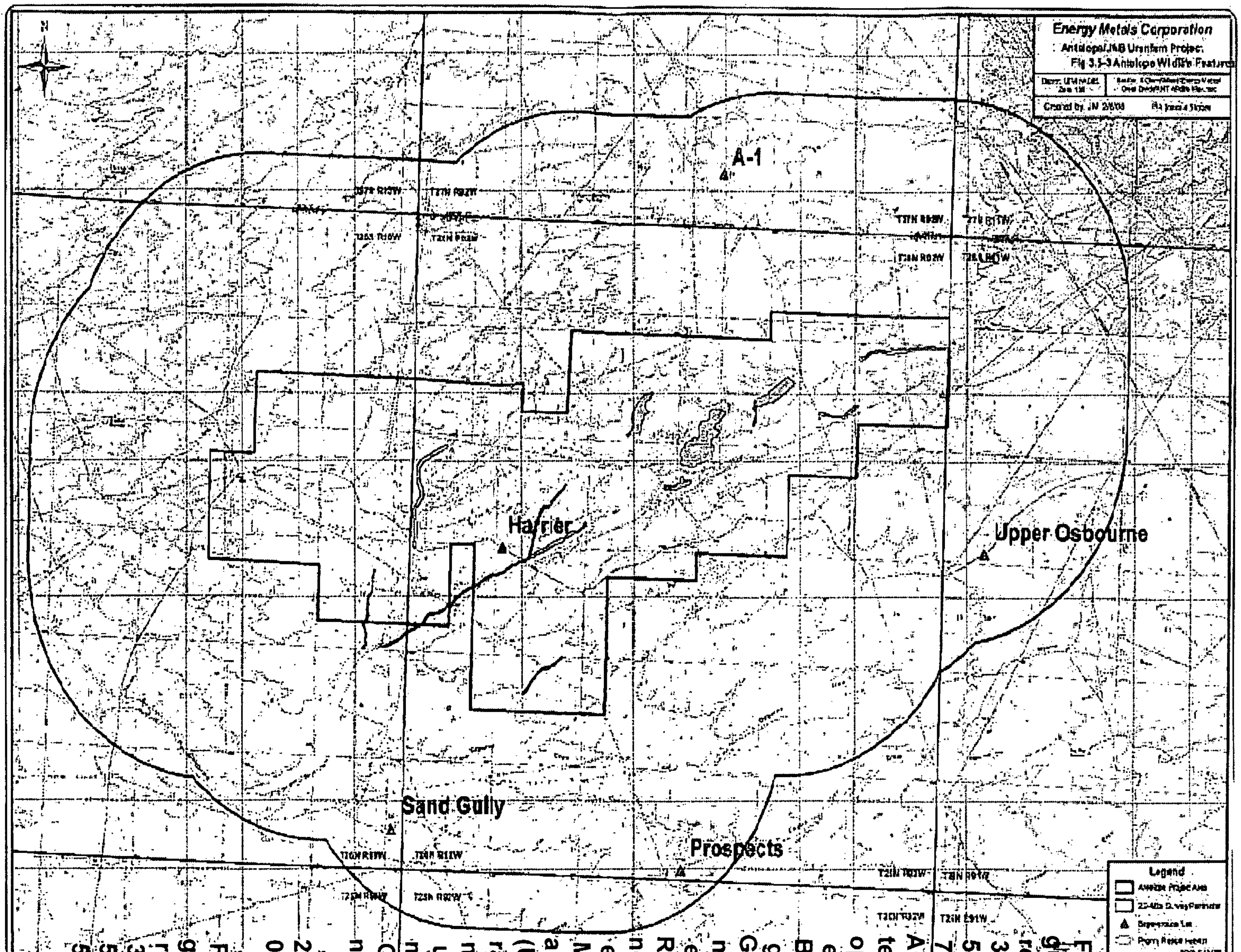
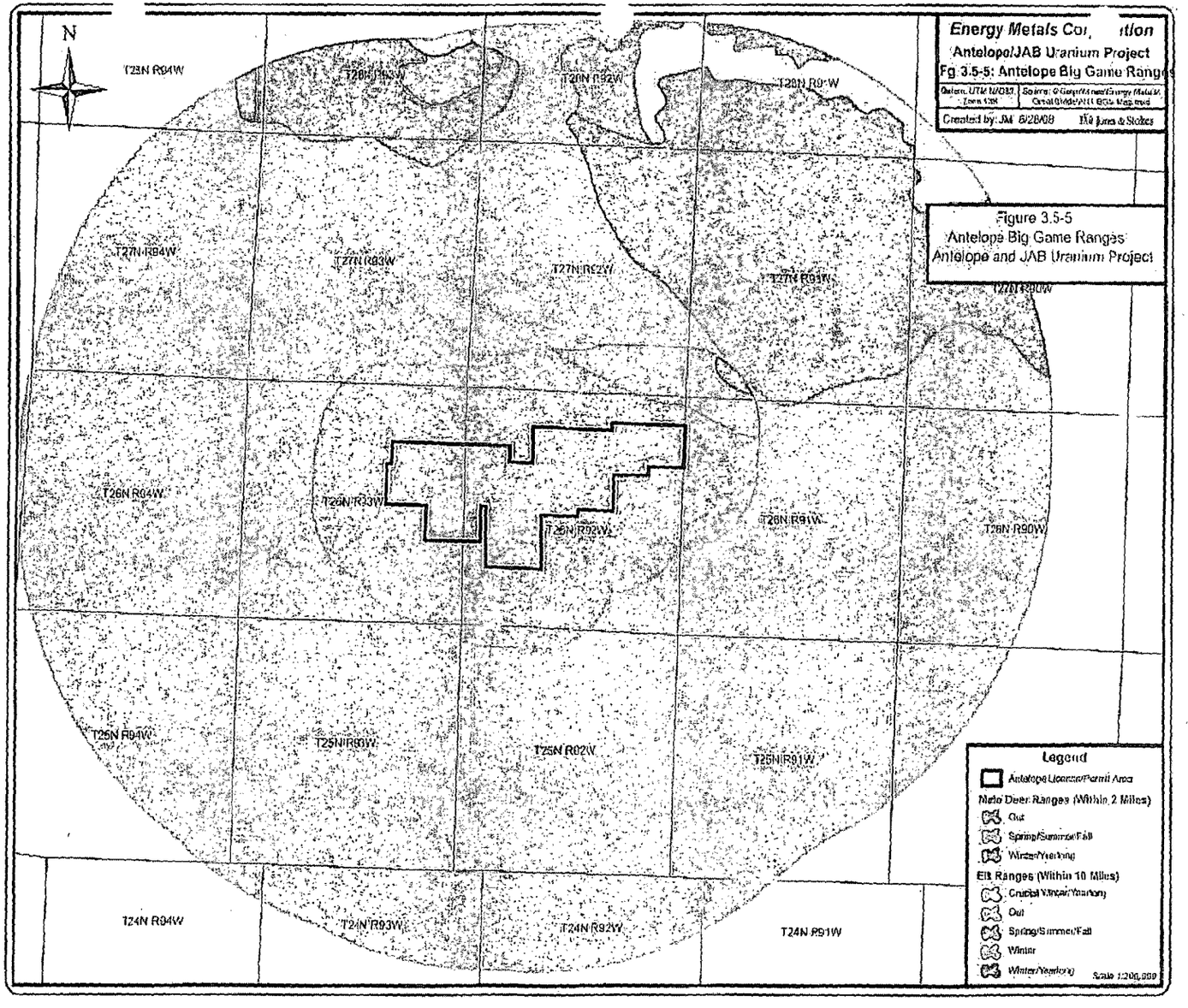
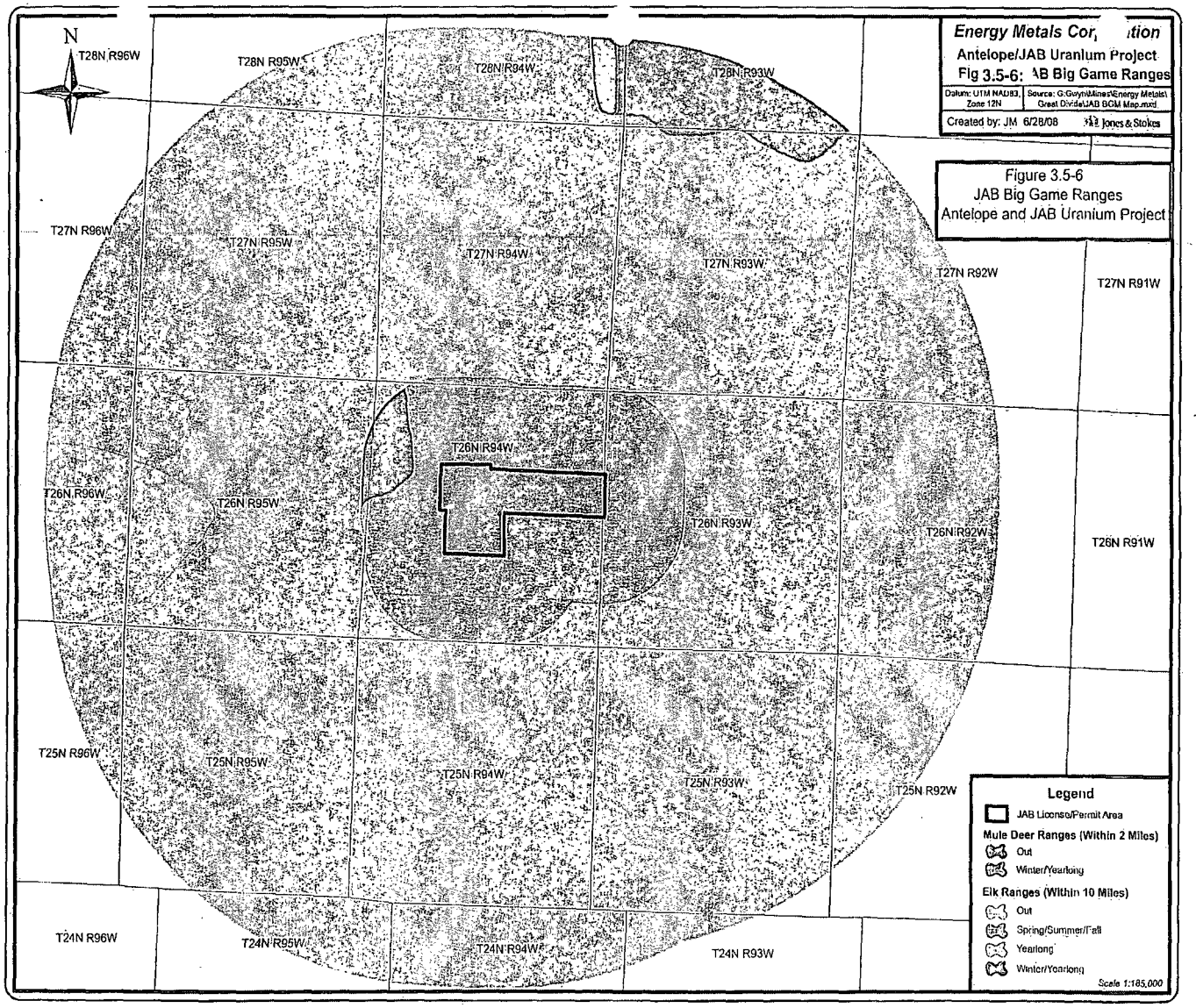


Figure 3.5-7. Antelope Big Game Range Map (Uranium One 2008 Figure 3.5-5)


Energy Metals Co, ntion
Antelope/JAB Uranium Project
Fg 3.5-5: Antelope Big Game Range
Datum: UTM NAD83 Zone 13S
Created by: JM 6/28/08
Figure 3.5-5
Antelope Big Game Ranges
Antelope and JAB Uranium Project
N
T28N R94W
T28N R93W
T28N R92W
T28N R91W
T27N R94W
T27N R93W
T27N R92W
T27N R91W
T27N R90W
T26N R94W
T26N R93W
T26N R92W
T26N R91W
T26N R90W
T25N R94W
T25N R93W
T25N R92W
T25N R91W
T24N R94W
T24N R93W
T24N R92W
T24N R91W
Legend
Antelope Licence/Permit Area
Mule Deer Ranges (Within 2 Miles)
Out
Spring/Summer/Fall
Winter/Yearlong
Elk Ranges (Within 10 Miles)
Crucial Winter/Yearlong
Out
Spring/Summer/Fall
Winter
Winter/Yearlong


N
T28N R96W
T28N R95W
T28N R94W
T28N R93W
T27N R96W
T27N R95W
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T27N R93W
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T25N R94W
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T25N R92W
T24N R96W
T24N R95W
T24N R94W
T24N R93W
Energy Metals Cor, tion
Antelope/JAB Uranium Project
Fig 3.5-6: AB Big Game Ranges
Datum: UTM NAD83, Zone 12N
Source: G:\Gwyn\Mines\Energy Metals\Great Divide\JAB BGM Map.mxd
Created by: JM 6/28/08
Jones & Stokes
Figure 3.5-6
JAB Big Game Ranges
Antelope and JAB Uranium Project
Legend
JAB Liconse/Permit Area
Mule Deer Ranges (Within 2 Miles)
Out
Winter/Yearlong
Elk Ranges (Within 10 Miles)
Out
Spring/Summer/Fall
Yearlong
Winter/Yearlong
Scale 1:185,000

(U.S. Department of Agriculture Natural Resources Conservation Service, 2003). Some plants that Uranium One observed during the survey were not identified on the species level **[RAI Vegetation-1 and -2 to clarify species and consultation with Sweetwater County]**. As an example, *Cirsium* was recorded and *Cirsium arvense*, Canada thistle, is listed as a noxious weed. In addition, BLM's Sensitive Plant Species list and Wyoming Natural Diversity Database Species of Special Concern list include four genus types, *Cryptantha, Penstemon, Phlox,* and *Astragalus,* that were also observed during the surveys but not identified on the species level (BLM, 2002; Wyoming Natural Diversity Database, 2009). **[RAI Vegetation-4 to verify sensitive plant species.]**

In February 2008, the U.S. Fish and Wildlife Service (FWS) initiated a status review of the greater sage-grouse to determine whether the species should be protected under the Endangered Species Act throughout its range or any significant portion of its range (FWS, 2008). It is anticipated that the FWS will complete the status review and make a new determination in February 2011. On August 1, 2008, the governor of Wyoming issued Executive Order 2008-2 Greater Sage-Grouse Core Area Protection providing management measures in sage-grouse core population areas. In July 2008, WGFD issued Stipulations for Development in Core Sage-Grouse Population Areas and a map of the sage-grouse core breeding areas. The stipulations state that because there is no research on specific impacts to sage-grouse from *in-situ* uranium mining, the same stipulations for oil and gas facilities should be implemented at ISR facilities. The core area map, stipulations, and additional standard management practices and guidelines that would apply to ISR facility development and operations are incorporated into the Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats (WGFD, 2009b).

According to the Sage-Grouse Core Breeding Areas Version 2 map issued by WGFD, the proposed project areas are located within the designated core area (Figure 3.5-9) (WGFD, 2009b) **[RAI Wildlife-1 to provide location of project area in relation to sage-grouse core breeding areas]**. Based on information WGFD provided to NRC, the four sage-grouse leks located within 3.2 km [2 mi] of the permit boundaries that were not identified in Uranium One's ER are the Osborne Draw lek (SESE Section 28, T26N, R93W), Eagles Nest Draw lek (NWSE Section 1, T25N, R93W), an unnamed lek (Section 3, T25N, R92W), and Little Osborne lek (Section 31/32, T26N, R93W) **[RAI Wildlife-3 to provide sage-grouse lek locations]**. Locations of the 10 occupied sage-grouse leks that are within 3.2 km [2 mi] of the permit boundaries are shown on the Antelope Sage-Grouse Leks and Observations Map (Figure 3.5-10) and JAB Sage-Grouse Leks and Observations Map (Figure 3.5-11) provided by WGFD.

In January 2009, the WGFD revised the Strategic Habitat Plan that includes Habitat Priority Area Maps and Narratives (WGFD, 2009a). The habitat priority areas are identified as Crucial Habitat Priority Areas and Enhancement Habitat Priority Areas based on habitat values and habitat issues within those areas. The proposed project is located within the Terrestrial Crucial Priority Area **[RAI Wildlife-1 to provide location of sage-grouse core breeding areas]**. The area was defined by the intersection of the sage-grouse core area, known active sage-grouse leks, and pronghorn crucial winter habitat. The WGFD considers this area as a high priority regarding habitat protection and management activities. A copy of the 2009 Terrestrial Crucial and Combined Crucial Priority Areas Map is shown as Figure 3.5-12 (WGFD, 2009b).

Figure 3.5-9. Sage-Grouse Core Breeding Areas Version 2 Map (WGFD, 2009a)

Sage-Grouse Core Breeding Areas Version 2

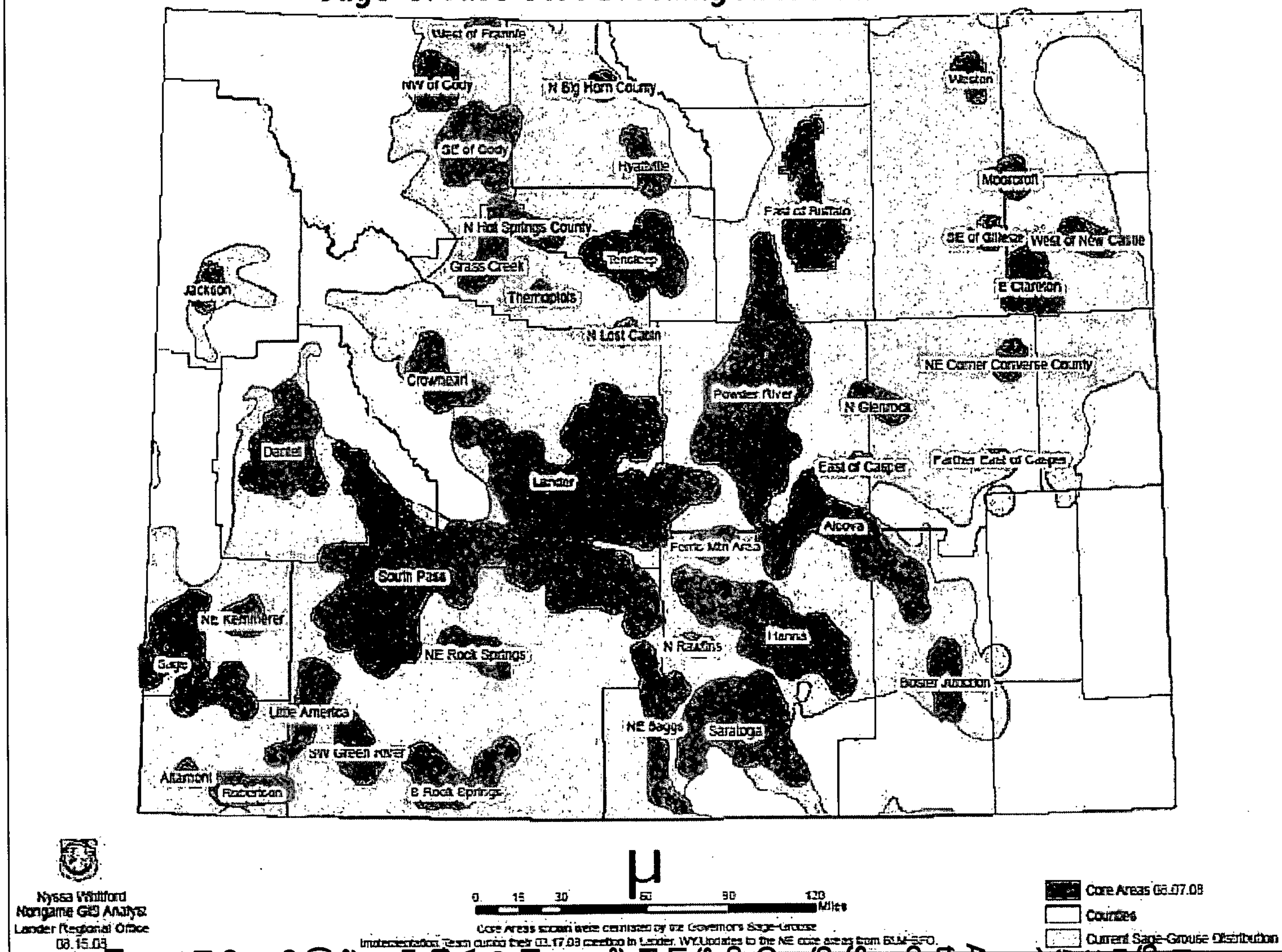


Figure 3.5-10. Antelope Sage-Grouse Leks and Observations Map (provided by WGFD)

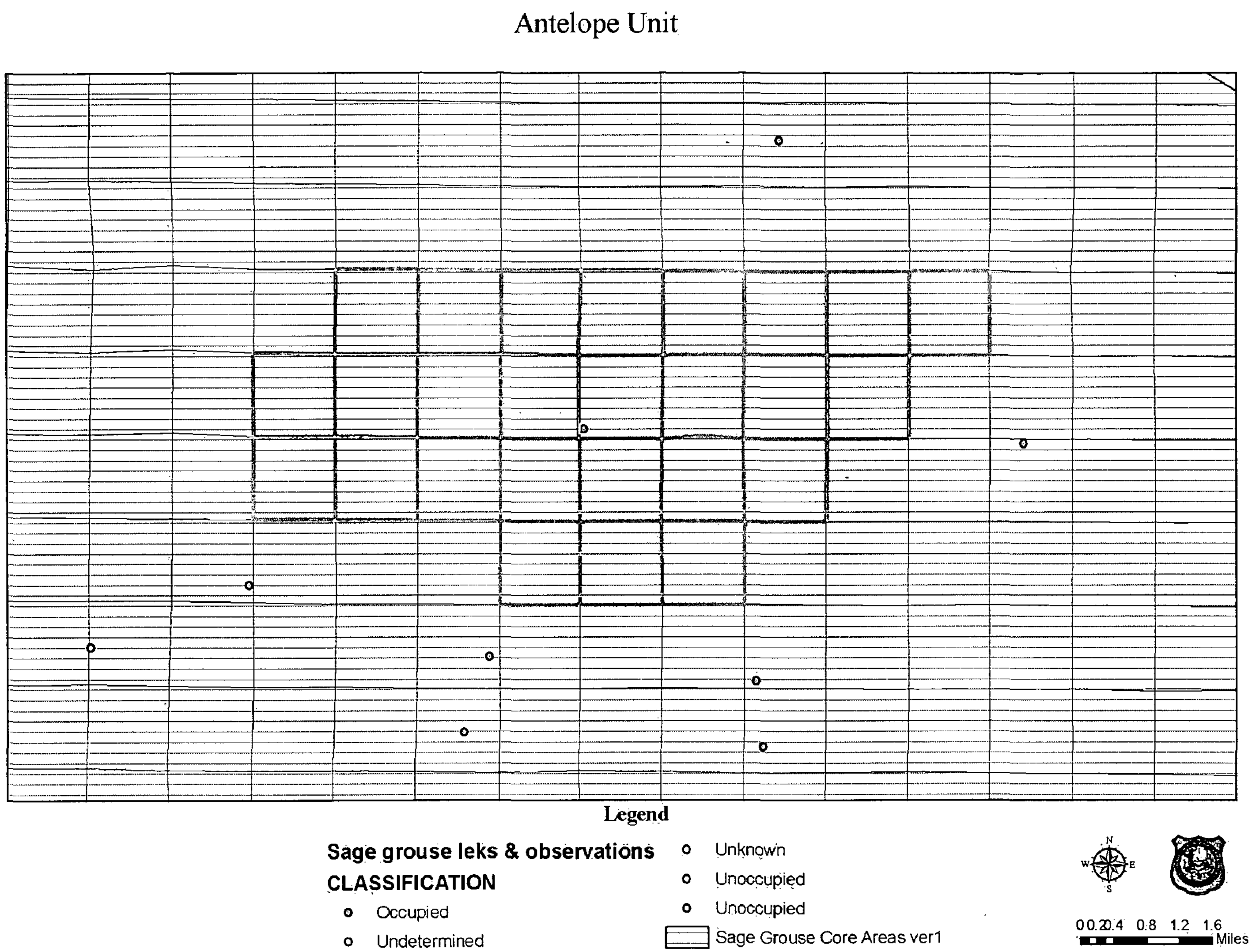
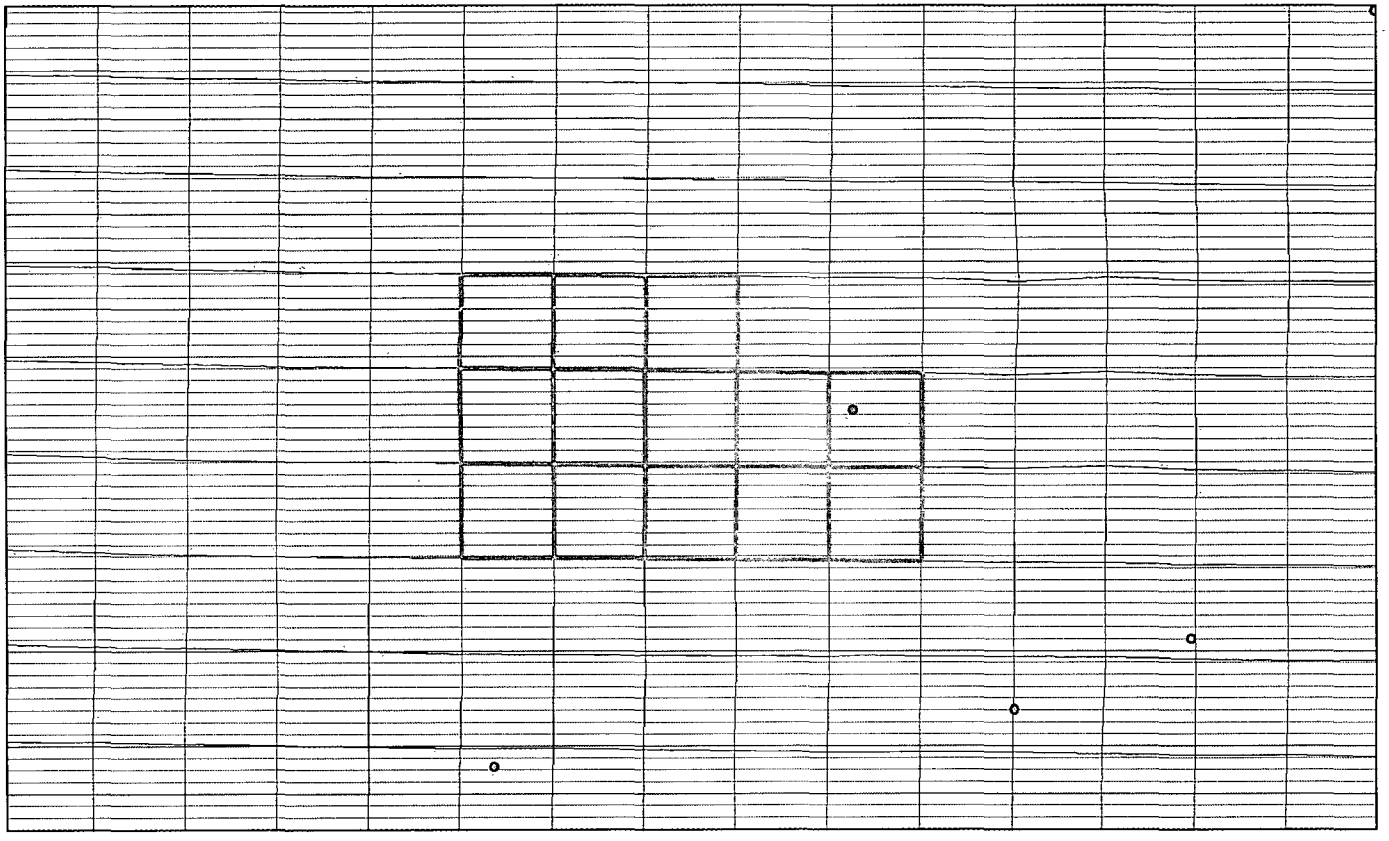


Figure 3.5-11. JAB Sage-Grouse Leks and Observations Map (provided by WGFD)

JAB Satellite Unit



Legend

Sage grouse leks & observations

CLASSIFICATION

- Occupied
- Undetermined
- Unknown
- Unoccupied
- Unoccupied
- Sage Grouse Core Areas ver1

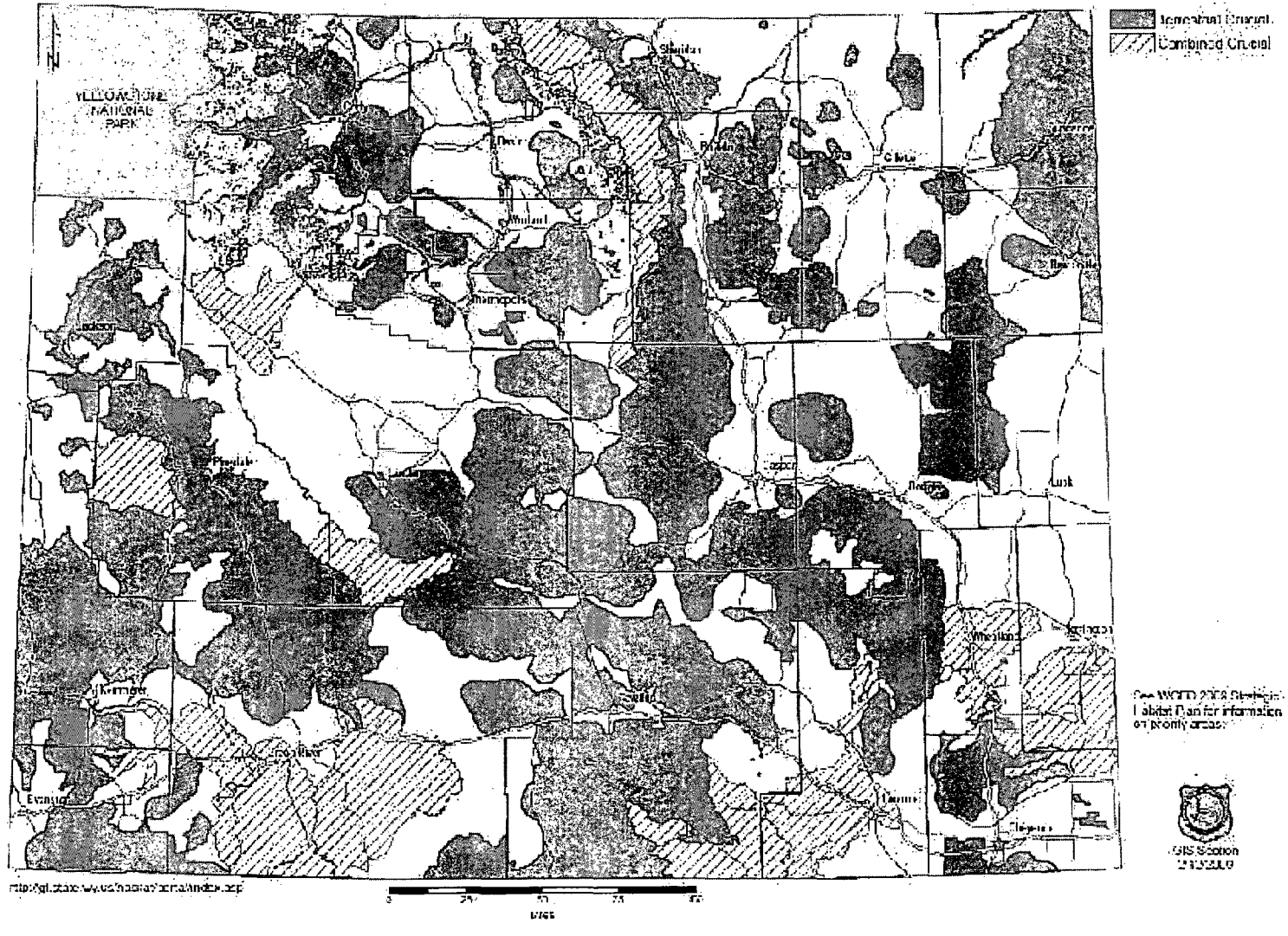
0 0.2 0.4 0.8 1.2 1.6 Miles

Figure 3.5-12 Terrestrial Core Area and Connectivity Habitat Management Areas (WGFD 2009, b)

Wyoming Game and Fish Department Habitat Priority Areas

Revised January 2009

Terrestrial Crucial and Combined Crucial Priority Areas



3.5.2 Aquatic Ecology

According to Uranium One's ER, the proposed project is located in the north central portion of the Great Divide Basin (U.S. Geological Survey Hydrologic Unit Code 4040200). The proposed project is also completely contained within the Lost Creek watershed. Lost Creek is an ephemeral stream located along the eastern project area boundary that flows south into the Lost Creek Lake, a topographically closed basin located in the middle of the Great Divide Basin. The JAB area contains 21 km [13 mi] of intermittent streams, no perennial streams, no surface waterbodies, and one 0.05 ha [0.13 acre] Palustrine Unconsolidated Bottom wetland. The Antelope area contains 104 km [64.7 mi] of intermittent streams, no perennial streams, and one 0.05 km [0.13 acre] Palustrine Unconsolidated Bottom wetland in the northeast portion. Annual flows for all channels in the project area generally occur in response to snowmelt during spring months or from thunderstorms in the summer and fall. Wyoming Department of Environmental Quality (WDEQ) classifies surface waters according to quality and degree of protection. Section 3.5.5.3.3 of the ER states that reptiles, amphibians, and aquatic species were not observed during the baseline surveys conducted in 2007 and early 2008. Based on the WDEQ surface water classification list, all three major streams in the project area (Lost Creek, Arapahoe Creek, and Osborne Draw) are classified as Class 3B waters, which support recreation, wildlife, agricultural, and industrial uses. Lost Creek, Arapahoe Creek, and Osborne Draw are not designated to support game fish or nongame fish (WDEQ, 2001). Although suitable habitat exists for snakes and lizards, the lack of water sources limits the potential for aquatic and semiaquatic species to inhabit the project area.

3.5.3 Threatened and Endangered Species

The Uranium One's ER indicates that no threatened or endangered plant or vertebrate species inhabit the proposed Antelope and JAB survey areas (Uranium One, 2008). Federally listed vertebrate species for Sweetwater County include the black-footed ferret, yellow-billed cuckoo (*Coccyzus americanus*), and four fish species. Due to the absence of trees and perennial water, Uranium One did not consider the yellow-billed cuckoo and fish potential inhabitants of the project area. FWS issued a block clearance for ferrets, eliminating the need to conduct ferret surveys. Biologists conducting the wildlife surveys watched for ferrets and evidence of their presence during visits to prairie dog colonies in the project area. Several occupied white-tailed prairie dog colonies were present in the proposed Antelope and JAB survey areas.

GEIS Section 3.2.5.3 identifies 15 federally listed threatened and endangered species known to exist in habitats in the West Wyoming Uranium Milling Region

The WGFD does not maintain a list of threatened or endangered species, but has established a lists of nongame bird, mammal, amphibian, and reptile species of special concern. The WGFD considers all the federally listed animal species to be species of special concern. The Wyoming BLM also has prepared a list of Sensitive Species. Uranium One provided the BLM list as Addendum 3.5-L in the ER. The species list referenced in the ER is consistent with species that could occur on the proposed project site.

The pygmy rabbit (*Brachylagus idahoensis)* is considered a Sensitive Species by BLM, but is not listed to potentially occur in the Lander and Rawlins Field Office regions. Pygmy rabbits were not observed in the protected areas during the Uranium One's survey. However, potential pygmy rabbit habitat is present along a number of sagebrush-lined seasonal creeks and larger tributaries throughout the proposed Antelope and JAB Uranium Project areas.

On February 2, 2004, FWS issued a block clearance letter and map in which it indicates that ferret surveys are no longer necessary in black-tailed prairie dog (*Cynomys ludovicianus*) towns statewide or in white-tailed prairie dog (*Cynomys leucurus*) towns except those noted in an attachment to the letter (FWS, 2004). However, FWS also stated that the clearance from surveys must not be interpreted to mean that the area is free of all value to black-footed ferrets, and coordination with FWS is necessary to ensure that the most recent information is accessed. This clearance from the need for surveys does not provide insight into an area's value for recovery of the species through future reintroduction efforts. Thus, while an action proposed in a cleared area needs no survey and is not likely to result in loss of individuals, the action could adversely effect the value of a prairie dog town as a future reintroduction site and should be evaluated to determine the significance of that effect (BLM, 2005).

3.5.4 References

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U.S. Department of Agriculture Natural Resources Conservation Service. "Wyoming State-Listed Noxious Weeds." 2003. <http://plants.usda.gov/java/noxious?rptType=State&statefips=56>. (18 September 2009.)

WDEQ. "Wyoming Surface Water Classification List." Cheyenne, Wyoming: WDEQ. June 2001.

WGFD. "Strategic Habitat Plan." Cheyenne, Wyoming: WGFD. January 2009a.

WGFD. "Wyoming Game and Fish Habitat Priority Areas—Terrestrial Crucial and Combined Crucial Priority Areas." Revised January 2009b. <http://gf.state.wy.us/habitat/Narratives/Maps/Statewide_TandC_Crucial.pdf> (18 September 2009).

World Wildlife Fund. "Wildfinder—Mapping the World's Species: Ecoregion NA1313 (Wyoming Basin Shrub Steppe)." Washington, DC: World Wildlife Fund. 2007a. <http://www.worldwildlife.org/wildfinder/searchByPlace.cfm?ecoregion=Na1313> (15 October 2007).

World Wildlife Fund. "Wyoming Basin Shrub Steppe." Washington, DC: World Wildlife Fund. 2007b. <http://www.worldwildlife.org/wildworld/profiles/terrestrial/na/na1313_full.html> (13 September 2007).

Wyoming Natural Diversity Database. "Species of Special Concern." <http://www.wy.blm.gov/botany/wyndd/wyndd2-pot.htm> (18 September 2009).

3.6 Meteorology, Climatology, and Air Quality

3.6.1 Meteorology and Climatology

The ER presents regional meteorological information based on a compilation of data from more than a dozen National Weather Service stations surrounding the Antelope and JAB License Area (Uranium One, 2008). These data records cover various periods from 1928 to 2005. In addition, the ER presents 5 years of meteorological information, including wind data, from the Seminoe II Mine site, which is located about 113 km [70 mi] southeast of the proposed project site. Seminoe II station is reported to have operated for about 15 years. The ER considers the Seminoe II Mine data to be the most representative basis for analyzing the meteorology and climatology of the proposed project site. Both sites exhibit similar terrain and are influenced by mountain ranges located 16 to 24 km [10 to 15 mi] to the north oriented in an east-southeast to west-northwest direction. The proposed project site is located about 61.0 to 91.4 m [200 to 300 ft] higher in elevation than the Seminoe site.

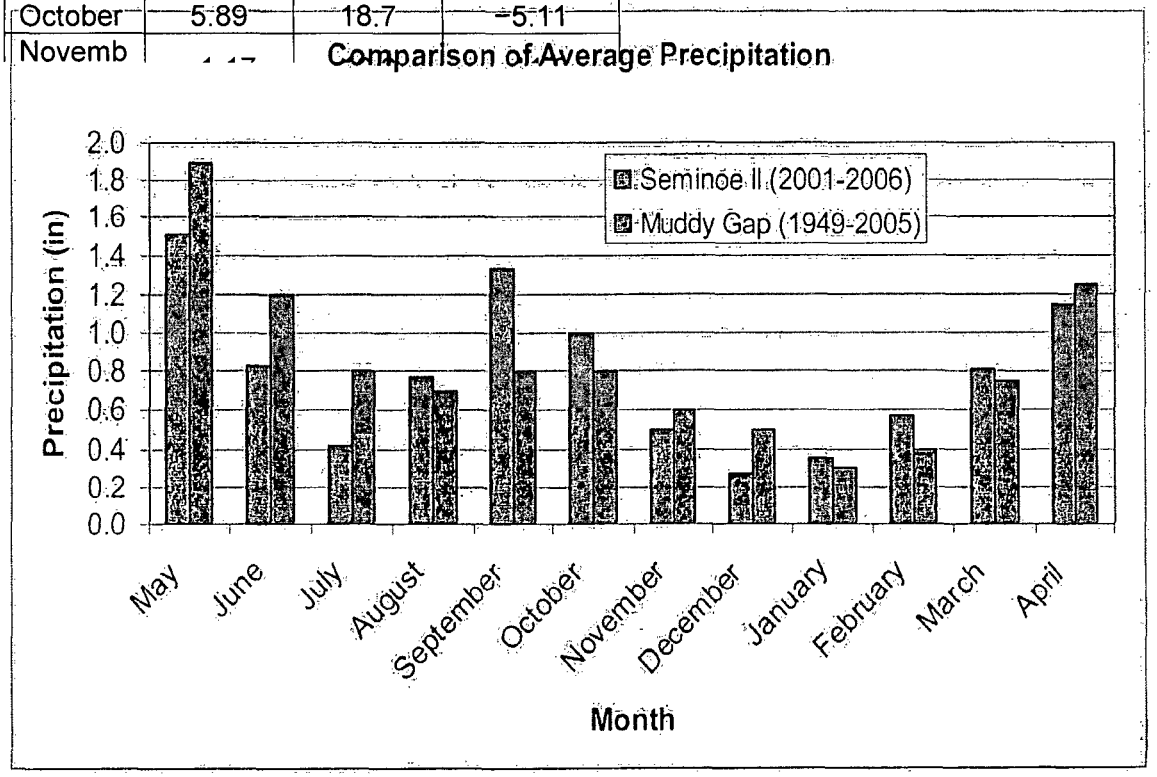
The proposed project is located in a semiarid or steppe climate characterized by moderately cold winters, relatively warm springs, hot dry summers, and cool autumns. Temperature extremes can range from −28.9 to 35 °C [−20 to 95 °F]. Freezes typically start in early September and extend into June. Table 3.6-1 contains Seminoe II seasonal temperature information. Table 3.6-2 contains Seminoe II monthly temperature information.

The region is characterized by extremely dry conditions. The average annual precipitation for the region ranges from 22 to 26.7 cm [8.5 to 10.5 in]. The Seminoe II site averages 24 cm [9.4 in] per year. Thunderstorms account for much of the precipitation during the spring and early summer. Seminoe II site monthly precipitation averages range from about 0.8 to 3.8 cm [0.3 to 1.5 in]. Figure 3.6-1 contains Seminoe II monthly precipitation information.

Table 3.6-1. Seminoe II Site Seasonal Temperature Information*

Season	Average Temperature (°C)†	Maximum Temperature (°C)	Minimum Temperature (°C)
Winter	−3.67	18.7	−26.2
Spring	10.2	32.2	−13.2
Summer	17.3	33.9	−4.00
Fall	0.05	23.2	−27.6

Table 3.6-2. Seminoe II Site Monthly Temperature Information*			
Month	Average Temperature (˚C)†	Average Daily Maximum Temperature (˚C)	Average Daily Minimum Temperature (˚C)
January	−4.55	5.00	−15.4
February	−5.89	4.28	−19.1
March	−1.11	11.5	−12.8
April	4.89	16.9	−6.00
May	9.94	22.8	−1.61
June	15.8	28.6	4.00
July	21.1	31.5	10.4
August	18.3	28.9	8.61
September	12.7	24.4	1.39
October	5.89	18.7	−5.11
Novemb			



Interpolated data for the National Weather Service stations indicate that the region averages between 114 and 127 cm [45 to 50 in] of snow annually. The region experiences one to two snowstorms a year in which more than 15 cm [6 in] of snow accumulates per day. The region experiences snow in amounts greater than 15 cm [6 in] per month for half of the year. Monthly snowfall rates exceeding 2.5 cm [1 in] occur in an additional 3 months out of the year.

The region experiences three to four severe weather events a year. These severe events are usually either hailstorms or damaging winds. Tornadoes rarely occur, with the region averaging one every 8 years.

Windy conditions are common to the region. The Seminoe II Mine site average hourly wind speed is 6.55 m/s [14.7 mph] with a maximum hourly average of 22.90 m/s [51.23 mph] for the

5-year time period between 2001 and 2005. The predominant wind direction is west/southwest with the wind blowing from that direction about 30 percent of the time. Spring experiences the greatest variability in wind direction. Figure 3.6-2 contains Seminoe II seasonal wind rose diagrams. The hourly wind speed averages at the Seminoe II site exceed 4.5 m/s [10 mph] about 85 percent of the time. Most of the year the site averages wind speeds about 7 to 8 m/s [16 to 18 mph]. The exception is in the summer when the average wind speeds drop to about 5 to 6 m/s [11 to 13 mph]. Light wind speeds are a rare occurrence at the site. Figure 3.6-3 contains Seminoe II seasonal and diurnal wind speed information.

No pan evaporation was measured at the Seminoe II site. However, the pan evaporation rate for the Sweetwater Uranium Project averaged 150 cm [60 in] per year. The Sweetwater site is located about 20 km [12 mi] southeast of the location of the proposed project.

GEIS Section 3.2.6.1 provides meteorological information for the Wyoming West Uranium Milling Region (NRC, 2009). The temperature, precipitation, and snowfall data in GEIS Table 3.2-7 were obtained from two of the same National Weather Service stations reported in the ER. Hailstorms are identified as the most destructive storm event for Wyoming. Wyoming is windy and ranks first in the United States with an annual average speed of 6 m/s [12.9 mph]. The pan evaporation rates for the region range from about 76 to 127 cm [30 to 50 in]. One GEIS commenter noted that the Sweetwater Uranium Project rate was 154 cm [60.66 in] (see GEIS Section G5.26.2, Comment 028-012).

References:

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

Figure 3.6-2. Seminoe II Site Seasonal Wind Rose Diagrams (Modified From Uranium One, 2008). To Convert Meters per Second (m/s) to Miles per Hour (mph), Multiply by 2.237

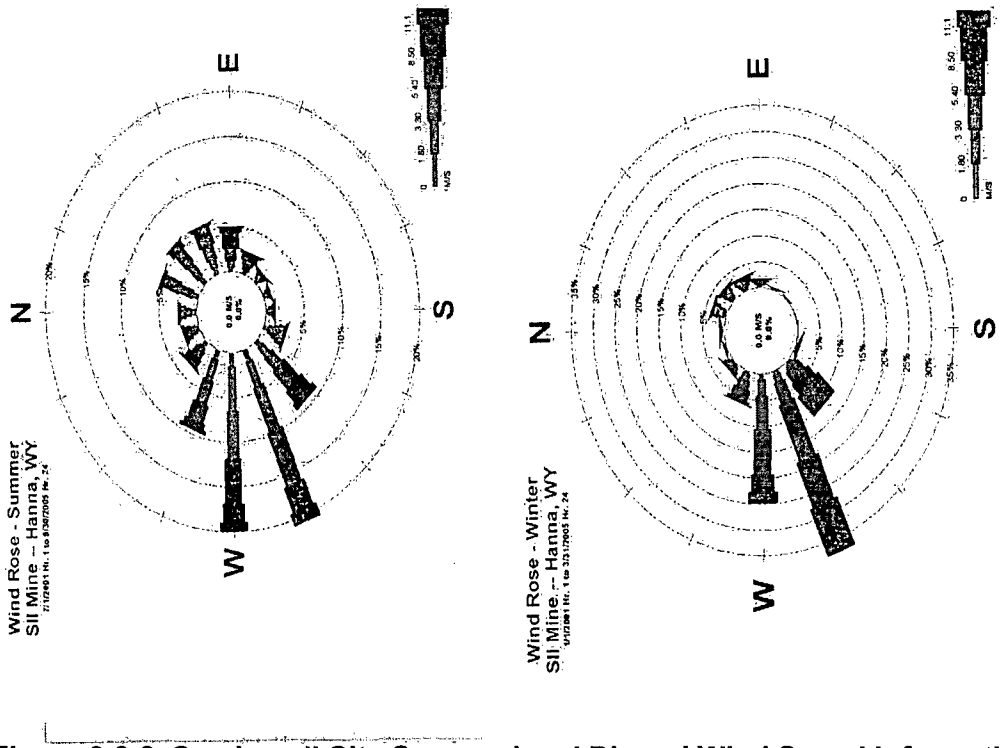


Figure 3.6-3. Seminoe II Site Seasonal and Diurnal Wind Speed Information (Modified From Uranium One, 2008). To Convert Meters per Second (m/s) to Miles per Hour (mph), Multiply by 2.237.

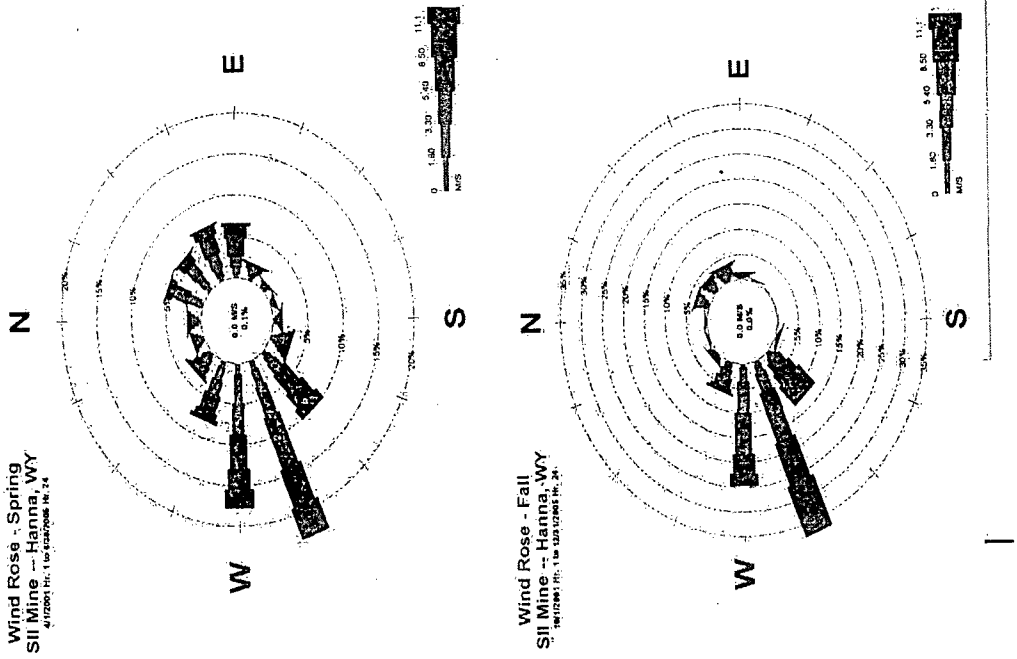


Figure 3.6-2. Seminoe II Site Seasonal Wind Rose Diagrams (Modified From Urani One, 2008).
To Convert Meters per Second (m/s) to Miles per Hour (mph), Multiply by 2.237

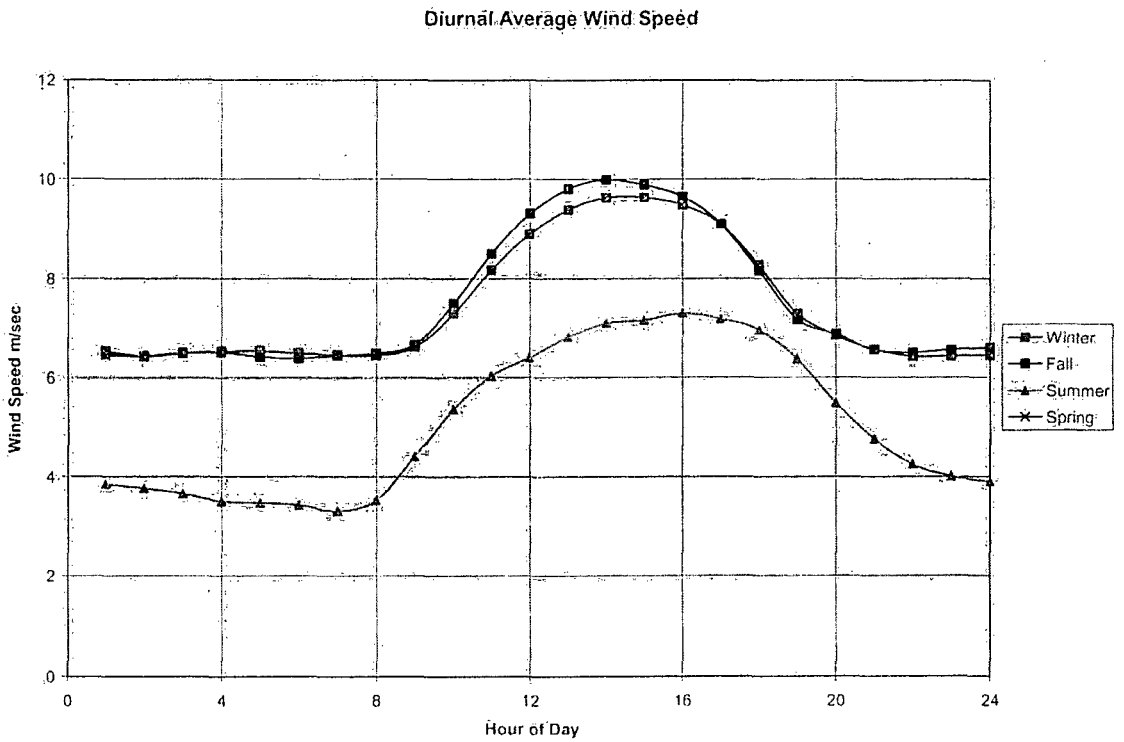


Figure 3.6-3. Seminoe II Site Seasonal and Diurnal Wind Speed Information (Modified From Uranium One, 2008).
To Convert Meters per Second (m/s) to Miles per Hour (mph), Multiply by 2.237.

3.6.2 Air Quality

[RAI AQ-5 to provide a description of air quality for the affected environment].

The Wyoming West Uranium Milling Region air quality description in GEIS Section 3.2.6.2 (NRC, 2009) focused on two topics: The National Ambient Air Quality Standards (NAAQS) attainment status and Prevention of Significant Deterioration classifications in the region. The GEIS reported that the Wyoming West Uranium Milling District was classified in attainment status for NAAQS and contained no Prevention of Significant Deterioration Class I areas.

The NAAQS attainment status is determined based on whether the ambient air concentrations are above or below thresholds established for six common air pollutants: nitrogen oxides, ozone, sulfur oxides, carbon monoxide, lead, and particulates. GEIS Table 3.2-8 contains the NAAQS. The U.S. Environmental Protection Agency (EPA) is in the process of revising the ozone standard. The old standard of 0.08 ppm over an 8-hour averaging time is being replaced with the new standard of 0.075 ppm over an 8-hour averaging time (EPA, 2008). The old standard and its implementation rules will remain in place as EPA undertakes rulemaking for transition from the old to the new standard.

Related to the new ozone standard is the recommendation from the Wyoming Department of Environmental Quality that the Upper Green River Basin be reclassified from its current attainment status to nonattainment (WDEQ, 2009). Part of the Upper Green River Basin identified for reclassification is located in the northwestern portion of Sweetwater County. A

portion of the Wyoming West Uranium Milling Region, including the Antelope and JAB areas, is located in the northeastern portion of Sweetwater County. States may develop standards that are stricter or supplement the NAAQS. Wyoming has a more restrictive annual average standard for sulfur dioxide at 60 $\mu g/m^3$ [1.6×10^{-6} oz/yd^3] and a supplemental 50 $\mu g/m^3$ [1.3×10^{-4} oz/yd^3] PM10 standard with an annual averaging time (NRC, 2009). PM10 is defined as particulate matter smaller than 10 µm [3.9×10^{-4} in].

Prevention of Significant Deterioration requirements identify maximum allowable increases in concentration for particulate matter, sulfur dioxide, and nitrogen dioxide for areas designated as attainment. Different increment levels are identified for different classes of areas. GEIS Table 3.2-9 contains these increment levels for Class I and Class II areas. Class I areas are high value locations and have the most stringent standards. GEIS Table 3.2-10 contains the list of EPA Class I Prevention of Significant Deterioration areas in Wyoming. As reported in the GEIS, the Wyoming West Uranium Milling Region does not contain any of these federal Class I areas.

References:

EPA. "PM Standards." 2008. < http://www.epa.gov/particles/standards.html> (18 September 2009).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

WDEQ. "Technical Support Document I for Recommended 8-Hour Ozone Designation for the Upper Green River Basin, WY." Cheyenne, Wyoming: WDEQ, Air Quality Division. March 2009.

3.7 Noise

Section 3.7 of the ER indicates that the existing ambient noise in the vicinity of the Antelope and JAB Uranium Project site is dominated by traffic noise from the Wamsutter-Crooks Gap Road and Bairoil Road used for surrounding oil and gas operations, uranium exploration, grazing lessees, and recreational users (Uranium One, 2008). **[RAI Noise-1 to describe current and future potential noise impacts.]**

GEIS Section 3.2.7 (NRC, 2009) provides basic information on noise and describes background noise levels in the Wyoming West Uranium Milling Region. Existing ambient (background) noise levels are the result of naturally occurring sounds such as wind, rain, insects, birds, and other wildlife. In general, baseline noise levels are anticipated to range from day-night average sound levels of 22 decibels (dB) on calm days to 38 dB on windy days (Brattstrom and Bondello, 1983). The most utilized roads during the construction, operation, aquifer restoration, and decommissioning phases would be Bairoil Road west of Bairoil, State Highway 73 between Lamont and Bairoil, and State Highway 287 between I-80 through Rawlins north to State Highway 73 at Lamont. A study along I-80 in Wyoming concluded traffic noise was an average of 54–62 dB for cars and 58–70 dB for trucks (Federal Highway Administration, 2004). Traffic noise levels would be less for the non-interstate roads because they carry less traffic with relatively fewer trucks.

Smaller communities within 40 km [25 mi] of the Antelope and JAB Uranium Project site include Bairoil on State Highway 73, and Lamont, Muddy Gap, and Jeffrey City on U.S. Highway 287.

Noise levels would be expected to be slightly higher as a result of human activities in these areas. Rawlins is the closest major community, approximately 88 km [55 mi] southeast, where U.S. Highway 287 meets I-80. In a more urbanized community such as Rawlins, ambient noise levels are influenced by street noise, traffic, emergency vehicles, and construction. Noise levels in these types of suburban residential/urban areas range from 45 to about 78 dB, with lower noise levels at night (Washington State Department of Transportation, 2006).

References:

Brattstrom, B.H. and M.C. Bondello. "Effects of Off-Road Vehicle Noise on Desert Vertebrates." *Environmental Effects of Off-Road Vehicles, Impacts and Management in Arid Regions.* R.N. Webb and H.G. Wilshire, eds. New York City, New York: Springer-Verlag Publishing. 1983.

Federal Highway Administration. "Synthesis of Noise Effects on Wildlife Populations." FHWA–HEP–06–016. Washington, DC: Federal Highway Administration, Department of Transportation. 2004.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August 2008.

Washington State Department of Transportation. "WSDOT's Guidance for Addressing Noise Impacts in Biological Assessments—Noise Impacts." Seattle, Washington: Washington State Department of Transportation. 2006. <http://www.wsdot.wa.gov/TA/Operations/Environmental/NoiseChapter011906.pdf> (12 October 2007).

3.8 Historical and Cultural Resources

The following sections summarize the historic and cultural resources background, legislation, and authorities regarding the historical and cultural resources for the proposed Antelope and JAB Uranium Project.

3.8.1 Cultural Resources Overview

GEIS Section 3.2.8.1 provides an overview of the prehistoric and historic cultures documented in the central and northern plains region, which includes the proposed project area (NRC, 2009). The ER indicates that a Class III cultural resources inventory of 4,216 ha [10,418 acres] within the Antelope project area was performed in 2007. A survey of the remaining 47.3 ha [117 acres] was to have been performed in early 2008 (Landem, 2008). **{RAI Cultural-1 to provide a summary of findings for the 47.3 ha [117 acres.]}.** The cultural resources survey identified 10 sites during the 2007 investigation of the Antelope project area. Three sites (48SW7621, 48SW16880, and 48SW16883) are eligible for inclusion in the National Register of Historic Places (NRHP) (Uranium One, 2008; Landem, 2008). Site 48SW7621, recorded in 1989, is a prehistoric campsite situated on a terrace that has potential for subsurface cultural materials. Site 48SW16880 is a prehistoric campsite with a buried cultural component. The site

is eligible for listing in the NRHP. No drilling or development is planned in the vicinity of the site. Site 48SW16883 is a prehistoric campsite with intact cultural deposits; an existing roadway bisects the site; this site is eligible for listing in the NRHP The ER states that these NRHP-eligible sites within the Antelope project area will be avoided (Uranium One, 2008). **[RAI Cultural-2 to provide information on how the site should be marked and protected to ensure.]**

A Class III cultural resources inventory of the 1,635-ha [4,040-acre] JAB project area resulted in the evaluation of 15 previously recorded sites and 10 new sites. Three of the 25 sites located within the JAB project area are currently listed (48SW4882) or eligible for listing in the NRHP (48SW16903 and 48SW16907) (Uranium One, 2008; Hahn, 2007; Graves, 2008). Site 48SW4882 was first recorded in 1982 and is currently listed in the NRHP. The site consists of a historic sheep operation and a prehistoric open campsite with several hearth features and lithic scatters. No drilling or development is planned in the vicinity of the site (Uranium One, 2008; Hahn, 2007). **[RAI Cultural-3 to cross-reference JAB inventory sites discussed in Sections 3.8.2, 4.8, and 5.8.2 of the ER.]** Site 48SW16903 is a prehistoric lithic scatter with intact cultural deposits. Based on the presence of subsurface cultural materials and diagnostic artifacts, the site is eligible for listing in the NRHP. Site 48SW16907 is a prehistoric lithic scatter with intact cultural deposits. Due to the presence of diagnostic artifacts, subsurface cultural materials, and datable features, the site is eligible for inclusion in the NRHP. No drilling or development activities are anticipated in the vicinity of Site 48SWI6907 (Graves, 2008). **[RAI Cultural-2 requesting how the site will be marked and protected to ensure avoidance.]**

3.8.2 National Register of Historic Places and State Registers

GEIS Section 3.2.8.2 lists sites in the Wyoming West Uranium Milling Region that are listed on the Wyoming state and/or NRHP. The ER indicates that six sites designated eligible for listing in the NRHP or currently listed in NRHP are located within the Antelope and JAB Uranium Project area.

The NRC staff reviewed Uranium One's ER for the proposed project. The NRC staff determined that it is possible to avoid the historic and cultural resources currently listed or eligible for listing in NRHP, identified during the cultural resources investigations of the Antelope and JAB Uranium Project areas.

3.8.3 Tribal Consultation

GEIS Section 3.2.8.3 provides a summary of Native American tribes located within or immediately adjacent to the state of Wyoming that have interests in the state and in the Wyoming West Uranium Milling Region. The U.S. government and the state of Wyoming recognize the sovereignty of select Native American tribes. Under Executive Order 13175, executive branch federal agencies are required to undertake consultation and coordination with each tribal government. GEIS Appendix D, Section D2.1 discusses how Native American groups that have ties to the region or locality of the proposed project should be consulted during the early stages of a project.

3.8.4 Places of Cultural Significance

A definition and summary of traditional cultural properties as places of cultural significance is presented in GEIS Section 3.2.8.4. Places of cultural significance are typically not found in the

State Historic Preservation Office files. However, a number of cultural properties such as plant and mineral gathering areas, caves and rock shelters, springs, and trails are examples of traditional cultural properties that might be identified during the tribal consultation process.

3.8.5 References

Graves, A. "JAB Uranium Project, Addendum, Sweetwater County, Wyoming." ARCADIS Project Number: CO1252.0002. June 2008.

Hahn, A. "Energy Metals Corporation US JAB Uranium Project Class III Cultural Inventory, Sweetwater County, Wyoming." ARCADIS Project Number: CO1252.0002. September 2007.

Landem, M.J. "Uranium One, Americas Antelope Uranium Project Cultural Resource Inventory Report, Sweetwater County, Wyoming." Jones and Stokes Project Number: 00178.07 002. April 2008.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Volumes 1–4. Docket No. 040-09079. Casper, Wyoming: Uranium One. July 2008.

3.9 Visual/Scenic Resources

GEIS Section 3.2.9 provides basic information on visual resources in the Wyoming West Uranium Milling Region (NRC, 2009). Uranium One's ER states that the scenery in the Antelope and JAB Uranium Project area contains expansive views across flat to moderately undulating terrain with a mix of low, mat-forming plants and low sagebrush in open exposed areas. Numerous small drainages dissect the landscape as well as unimproved roads, evidence of past uranium exploration development, and some oil and gas production facilities. A site visit by the NRC confirms that the appearance of the project area is a treeless, grey-green sagebrush-dominated rolling terrain with "islands" of bare ground or similar range vegetation scattered among and within other range cover types. Overhead power lines traverse the open land, and mountain ranges are present in the background.

Federal land management agencies such as the BLM and the U.S. Forest Service have established guidelines to inventory and manage visual resources. Because there are a variety of visual values, different levels of management are necessary. These activities are typically part of a regional management plan (RMP) visual resource management (VRM) system. The VRM system identifies and inventories existing scenic values, establishes management objectives for those values, and evaluates the potential visual resource impacts resulting from future management projects. The VRM classes are from I to IV, I being the most protected landscape. BLM also designates a Scenic Quality Class (A, B, or C) to rate the visual quality of the scenic resource on all BLM-managed lands (BLM, 1980). Uranium One's ER identifies both permit areas designated VRM Class IV and Scenic Quality Class C, the least protected landscapes. Most of the Antelope and JAB Uranium Project area is not visually sensitive, because of the remoteness of viewpoints used by the public or the screening of views by terrain (Uranium One, 2008). **[RAI Visual-1 to provide basis for determination of VRM Class.]**

Each BLM regional field office maintains a separate RMP that guides the resource management and planning for that region. The majority of the project area is located in BLM's Lander Field Office region, and a small portion of the eastern extent of the Antelope area is located in the Rawlings Field Office region. The Lander RMP was written in 1987 and is now out of date. As a result, the Lander RMP is in the process of being revised to include an updated VRM plan (BLM, 2009). The proposed Lander RMP includes maps of the inventory classes (Figure 3.9-1), distance mapping zones (Figure 3.9-2), sensitivity ratings (Figure 3.9-3), and scenic quality classes (Figure 3.9-4) for the region. According to proposed Lander RMP and existing Rawlins RMP, the northeast corner of the Antelope site is VRM Class II and the remaining portion is VRM Class IV (BLM, 2mm09, 2008). The JAB site is designated VRM Class III. According to the proposed Lander RMP, Scenic Quality Class B is designated for the majority of the project area that lies in the Lander region (BLM, 2009).

CDNST is located between 2.4 to 3.2 km [1.5 to 2 mi] east and northeast of the proposed Antelope permit area **[RAI Visual-3 to provide evaluation of impacts to CDNST]**. The CDNST trail segment consists of existing two-track roads and includes the trail crossing of Crooks Gap County Road and Bairoil Road. The peak elevation of this portion of the trail at approximately 2,300 m [7,550 ft] above mean sea level occurs about 1.9 km [1.2 mi] north of Bairoil Road. This segment of the trail is designated as VRM Classes II and III.

References:

BLM. "Summary of the Analysis of the Management Situation for the Lander Resource Management Plan Revision." Lander, Wyoming: U.S. Department of the Interior, BLM, Lander Field Office. June 30, 2009.

BLM. "Record of Decision and Approved Rawlins Resource Management Plan." Rawlins, Wyoming: U.S. Department of the Interior, BLM, Rawlins Field Office. December 2008.

BLM. "Record of Decision for the Lander Resource Management Plan." Rawlins, Wyoming: BLM. June 1987.

BLM. "Visual Resource Management." Manual 8400. Washington, DC: U.S. Department of the Interior, BLM. 1980. <http://www.blm.gov/nstc/VRM/8400.html> (11 September 2009).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August, 2008.

Figure 3.9-1. Updated Inventory Classes for the Lander RMP Revision (BLM, 2009)

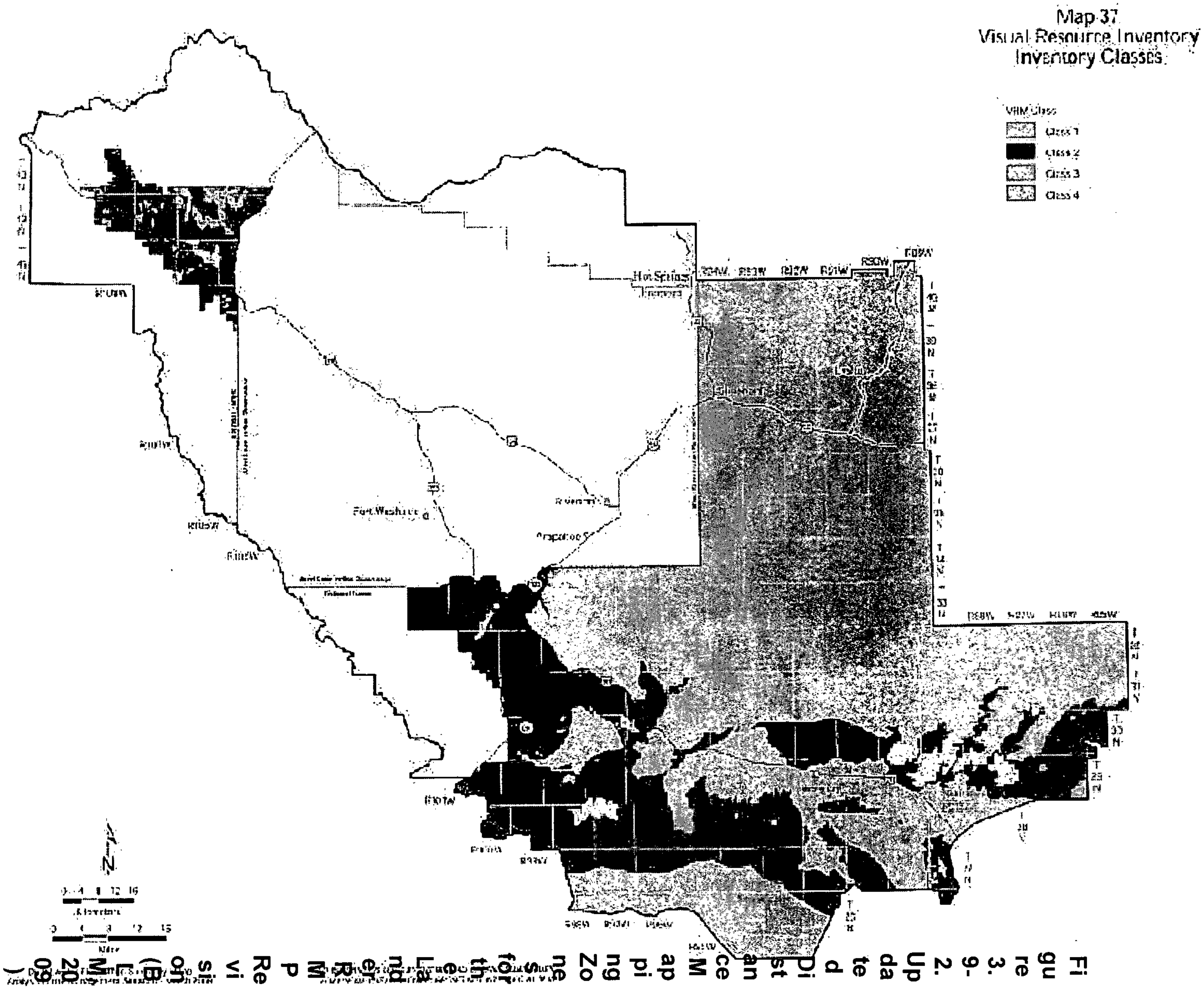
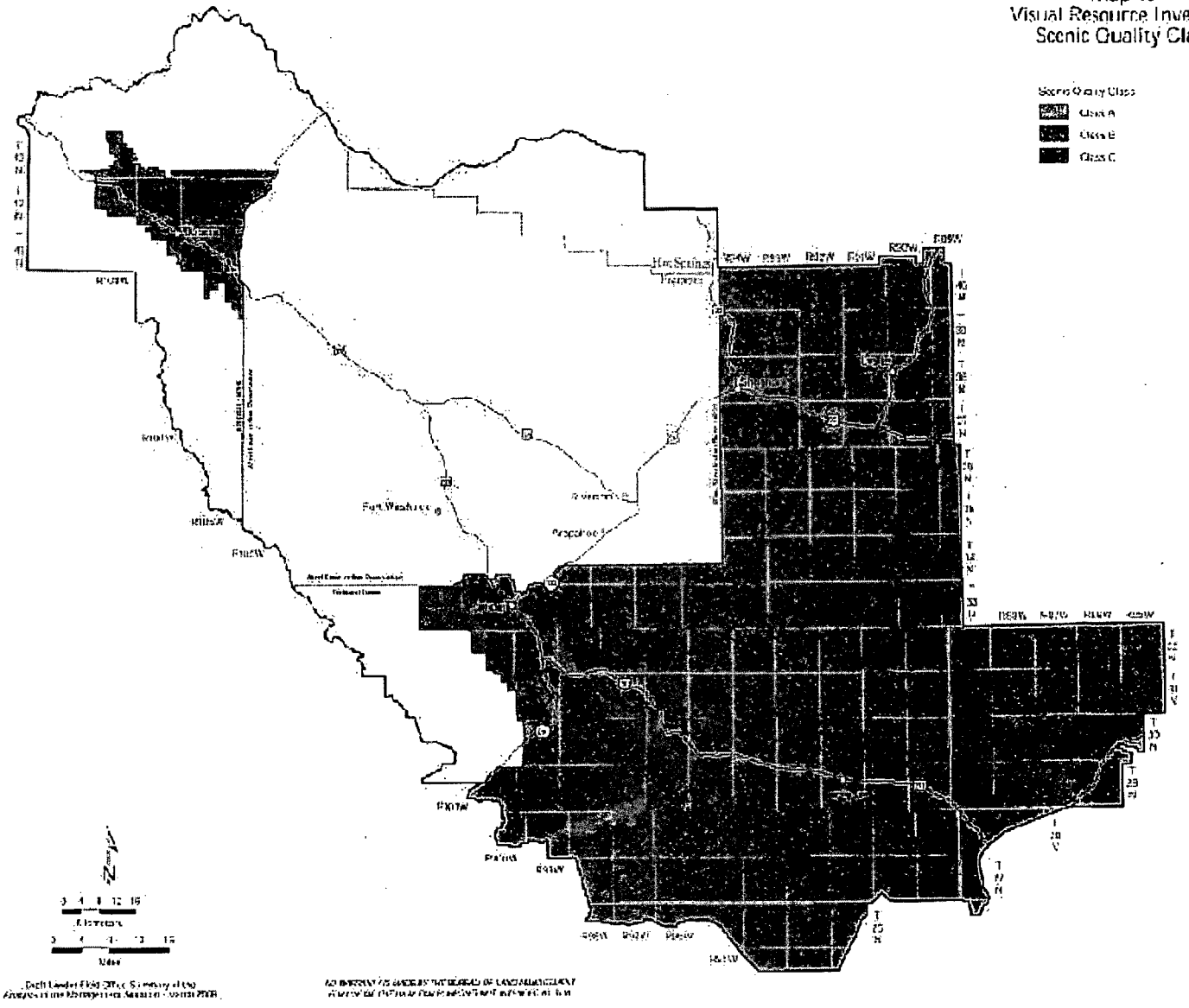


Figure 3.9-2. Updated Distance Zones for the Lander RMP Revision (BLM 2009)

Figure 3.9-3. Updated Sensitivity Rating for the Lander RMP Revision (BLM, 2009)

Figure 3.9-4. Updated Scenic Quality Classes for the Lander Resource Management Plan Revision (BLM, 2009)

Map 40
Visual Resource Inventory
Scenic Quality Class



3.10 Socioeconomics

The proposed Antelope and JAB Uranium Project areas are located in northeast Sweetwater County, Wyoming. The nearest community, Bairoil, is located to the east on Bairoil Road, which provides the primary access route to the Antelope area. The ER considers an 80-km [50-mi] region of influence (ROI) from the project area (Uranium One, 2008). This ROI includes portions of four counties in central and south central Wyoming: Sweetwater, Fremont, Carbon, and Natrona Counties. The ER also mentions the nearby communities of Muddy Gap, Lamont, and Jeffrey City, all located along State Highway 287. Several towns to the south of the project area include Rawlins, Riner, Creston, Latham, Wamsutter, Frewen, and Table Rock, all located along the I-80 highway corridor in Carbon and Sweetwater Counties. These communities are within the ROI considered in the ER.

The GEIS indicates communities within a 48-km [30-mi] ROI would be considered potentially affected by an ISR facility. For consistency, the NRC staff evaluation of potential socioeconomic impacts of the proposed Antelope and JAB Uranium Project is based on a 48-km [30-mi] ROI surrounding the project area. This would exclude several towns identified in the ER. However, Rawlins, Lander, and Riverton are included in this evaluation because these towns are expected to provide the workforce and other community services required to support the proposed project.

3.10.1 Demographics

Section 3.10.1.6 of the ER estimates the existing population within an 80-km [50-mi] ROI using 16 compass sectors, from the center of the project area, for a total of 208 sectors. The report mentions that the sectoral population was estimated from the U.S. Census Bureau's Population Estimates Program. Subtotals by sector and compass points as well as the total population are provided in Table 3.10-4 of the ER. The report cites the most recent available population data uses U.S. Census 2000 boundary and demographic information for block groups within the United States and intercensal population estimates for 2004 from the Population Estimates Program. The ER mentions that the area within the ROI is rural, with the majority of the population residing in small communities near the project area or in larger urban areas in the sectors furthest from the project area center. The report estimates the total population within an 80-km [50-mi] ROI to be 12,247. **[RAI SOC-1 to update county/town data.]**

Section 3.10.1.2 of the ER presents the 2005 population by age and sex for counties within an 80-km [50-mi] ROI is shown in Table 3.10-2. The ER indicates that the 40- to 64-year age group is the largest age group in each of the counties as a result of immigration of workers during the oil boom years from the late 1970s and early 1980s. The report mentions that the population in the 27- to 42-year age group is relatively low because of a high net out-migration (outflow greater than inflow) between 1995 and 2000 as young adults left the state during a declining economy. The ER indicates that the aging population is expected to affect the economy through changes in the labor supply as the 40- to 64-year age group reaches retirement age and is replaced by fewer new workers. The older population would also require different types of goods and services, requiring a shift in local economic sectors to accommodate the changing demographics. Section 3.10.1.2 of the ER indicates that in 2005, 91.8 percent of the population in the four counties within an 8-km [5-mi] radius of the project area was classified as white. The report indicates Native Americans and persons of Hispanic origin comprised 5.6 and 7.0 percent, respectively, of the total four-county population of 146,474. The report mentions that the populations in all other racial categories account for less

than 1 percent of the total population. Racial characteristics for Carbon, Natrona, and Sweetwater Counties were mentioned to be similar to the racial characteristics of the state. The ER mentions that the American Indian population in Fremont County was 20.6 percent of the total county population, which is significantly larger than the 2.4 percent American Indian proportion of the state population. This larger American Indian population is a result of the Wind River Indian Reservation located within Fremont County. Section 3.10.1.3 of the ER presents the projected population for selected years by county within the 80-km [50-mi] ROI in Table 3.10-3. The ER states that the population projections between 2000 and 2020 are anticipated to be relatively stable. The ER also indicates that there is not likely to be large in-migrations of population typical of the 1980s. The ER estimates that the projected growth of Sweetwater County between 2003 and 2010 would be 9.6 percent or 3,461 people, which would be an average annual population increase of 494 people.

Section 3.10.1.1 of the ER indicates historical and current population trends between 1980 and 2006. According to the report, Sweetwater County was the only one of the four-county area (Carbon, Fremont, Natrona, and Sweetwater Counties) that did not experience a decline in population in the 1980s, as a result of a strong dependence on trona (soda ash) mining and processing, which was a relatively stable industry during the 1980s and 1990s. The ER indicates that the Sweetwater County annual population growth rates have declined since 2000—a direct result of stagnant growth in the soda ash market and the elimination of jobs in soda ash mining and processing.

Section 3.10.1.4 of the ER indicates that tourism is a source of seasonal population and includes outdoor recreation activities. The report mentions that the project area consists of public lands in northeast Sweetwater County and that the surrounding area within an 80-km [50-mi] ROI contains mostly public lands; private lands are located at distances of 16 to 24 km [10 to 15 mi] from the project area boundaries. The closest recreation facility to the project area is the CDNST, which has an estimate of 45 visits annually. The Seminoe State Park is located 67 km [42 mi] east-southeast of the east boundary of the project area, which had approximately 21,176 visitors in 2005. This was a decrease of 43 percent from the 37,385 people who visited the park in 2001. The report also mentions Independence Rock State Historic Site, located 58 km [36 mi] northeast of the project area, as having 30,960 people in 1998.

GEIS Section 3.2.10.1 describes demographic data for the ROI in Table 3.2-14, including race and population estimates. According to this data, the largest populated area in the ROI is Sweetwater County and the smallest populated area is Carbon County. The largest minority-based county is Fremont County, which has a Native American population of 19.7 percent.

3.10.2 Income

According to the ER, in 2005, personal income per capita in Sweetwater County was $38,039, which was 102 percent of the state average of $37,305. Carbon County had a lower per capita income of $30,961 (83 percent of the state average) and ranked 18th in the state. The ER indicated that Sweetwater County had a higher personal per capita because of relatively high paying jobs in the trona mining industry.

GEIS Section 3.2. I 0.2 lists income information from 2000 U.S. Census data, including labor force, income, and poverty levels, in Table 3.2-16. Based on this data, the smallest labor force population is Carbon County and the largest labor force population in the ROI is Sweetwater County.

3.10.3 Housing

Section 3.10.2.2 of the ER indicates the nearest substantial housing stock is located in the town of Rawlins in Carbon County. The report indicates that nearby communities such as Bairoil (Sweetwater County) and Jeffrey City (Fremont County) are small, with correspondingly small numbers of available housing. The report mentions that according to U.S. Census 2000 data, there were 78 housing units in Bairoil, of which 42 units were occupied, and the vacancy rate was 46.2 percent. According to the report, in Jeffrey City, there were 112 housing units in 2000, with a 59.8 percent vacancy rate. The report indicates that in Rawlins, there were 3,860 housing units in 2000, including 540 vacant units for a vacancy rate of 13.4 percent. **[RAI OSC-1 to update county/town data.]**

Section 3.10.2.2 of the ER mentions that current vacancy rates in the ROI have decreased since 2000 as a result of increasing in-migration of workers for employment in ongoing mineral resource development. The ER indicates that according to a rental vacancy survey summarized in the Wyoming Community Development Authority report, rental vacancy rates in Carbon County decreased to 0.98 percent from a post-U.S. Census 2000 high of 16.08 percent in 2001. The report indicates a more modest decrease in rental vacancy rates in Sweetwater County, from a high of 8.16 percent in 2000 to the 2006 rate of 0.63 percent. The ER concluded this occurred because the influx of labor into these counties, as a result of economic growth stimulated by mineral production, has outstripped the available rental housing. **[RAI SOC-1 to update county/town data.]**

Section 3.10.2.2 of the ER indicates a housing forecast for households in Sweetwater County from 14,105 in 2000 to 26,037 in 2030. According to the ER, the number of renters in Sweetwater County is projected to increase from 3,519 in 2000 to 5,472 in 2030. The report indicates that in Carbon County, the number of households is projected to increase by 2,389, from 6,129 in 2000 to 8,518 by 2030 and that the number of renters is expected to increase from 1,775 in 2000 to 1,967 in 2030.

Section 3.10.2.3 of the ER indicates temporary housing options in the vicinity of the project area are hotels, motels, and campgrounds. The report indicates that vacancy rates are not currently available for temporary accommodations in Sweetwater and Carbon Counties. According to the report, available local motels/hotels/cabin establishments in the region generally have low vacancy rates during hunting seasons. According to the ER, there is also a high level of occupancy by coal bed methane gas workers and many motels and recreational vehicle campgrounds in the region report long-term visits by the week or month.

Section 3.10.2.3 of the ER also indicates that the temporary lodgings closest to the project area are in Rawlins and smaller communities along the I-80 corridor to the south. The report mentions accommodations in Rawlins include 867 rooms in 14 hotels/motels and 230 spaces in 5 campground/recreational vehicle parks.

GEIS Section 3.2.10.3 describes housing information from 2000 U.S. Census data in Table 3.2-17. According to this data, Carbon County has the most single-family, owner-occupied homes and Fremont County has the most renter-occupied units.

According to GEIS Section 3.2.10.3, the majority of housing is available in larger populated areas such as the town of Riverton. Temporary housing along major highways and towns within the ROI include hotels/motels, apartment complexes, and trailer camps.

3.10.4 Employment Structure

Section 3.10.2.1 of the ER indicates the largest labor force for the project area would be from Sweetwater and Carbon Counties because communities in these counties provide a relatively large resident labor force for mineral extraction and construction industries in south central Wyoming. The report indicates that a substantial portion of the project labor force is likely to be based in Rawlins.

Section 3.10.2.1 of the ER indicates that according to data provided by the Wyoming Department of Employment Research and Planning (2003), a portion of the available labor pool in Wyoming consists of nonresidents **[RAI SOC-3 to provide reference to the source report]**. According to this data, the construction sector is one of the industries most dependent upon seasonal and short-term workers. The report indicates that of all persons working in heavy construction in 2000, 38.4 percent did not work in Wyoming in 1999. Section 3.10.1.4 of the ER indicates that the primary source of seasonal labor in the four-county area is short-term labor for mineral resource development, construction, and service industries engaged in tourist/recreation activities. The ER indicates that these workers are most likely to relocate temporarily from neighboring counties and states including Montana, Nebraska, Colorado, and South Dakota. Table 3.10-5 of the ER shows the labor force characteristics in Sweetwater and Carbon Counties in 2005. According to this data, unemployment rates were highest in the early 1990s and have decreased overall by 2005 because of renewed energy development in south-central Wyoming. **[RAI SOC-1 to update county/town data.]**

GEIS Section 3.2.10.4 indicates that unemployment ranges from 3.3 percent in Carbon County to 5.7 percent in Fremont County, based on the 2000 U.S. Census.

3.10.5 Local Finance

Section 3.10.2.1 of the ER mentions that the economy of Sweetwater County depends on trona mining and production and that the Carbon and Fremont Counties' economy depends on the energy sector, primarily coal mining oil and gas extraction, crude, petroleum-natural gas, and supporting oil and gas field services. **[RAI SOC-1 and RAI SOC-2 to update county/town data and state ad valorem tax information.]**

GEIS Section 3.2.10.5 describes local finance, such as revenue and tax information for ROI, in Table 3.2-19 (NRC, 2009). According to this data, Sweetwater County generated the largest gross revenue in 2007. According to the GEIS, Wyoming also imposes "ad valorem taxes" on mineral extraction properties. Taxes levied for uranium production were 10.0 percent in 2007 (6.0 percent "ad valorem" and 4 percent severance) totaling $1.7 million. A small portion of this uranium tax revenue ($715.90)] was generated in Sweetwater County.

3.10.6 Education

Section 3.10.1.5 of the ER indicates that the project area is located within Sweetwater County School District No. 1, which serves all of Sweetwater County within 80 km [50 mi]; however, the schools closest to the project area that would likely serve the project labor force are located in Carbon County School District No. 1. The report mentions that the nearest Sweetwater County community that provides education services to residents in the vicinity of the project area is the Bairoil Elementary School, which had a 2005 fall enrollment of 10 students. The report mentions that Rawlins is the closest town to the project area, which provides a full range of

education facilities including three elementary schools (total 2005 fall enrollment of 685), one middle school (2005 rail enrollment of 349), and one high school (2005 fall enrollment of 431). The ER indicates historic enrollment data for this school to steadily declined a high of 2,216 students in the fall of 1996 to a low of 1,664 in the fall of 2004. The fall enrollment of 1,727 in 2005 was the first time in the reported years of 1996 through 2005 that there was any increase in the number of students enrolled in district schools. **[RAI SOC-1 to update county/ town data.]**

GEIS Section 3.2.10.6 describes Sweetwater County as having 2 school districts with a total of 10 elementary schools, 3 intermediate/middle schools, 4 high schools, and 4 private or parochial schools. About 7,175 students are listed for the county. The majority of schools within each district provide bus services. Carbon County has 2 school districts (Carbon County School Districts Nos. 1 and 2) with a combined 2007 enrollment of approximately 2,650 students. The majority of schools within each school district provide bus services. Fremont County is described as having more than eight school districts, with a combined 2007 enrollment of approximately 7,125 students. The majority of school districts provide bus services.

3.10.7 Health and Social Services

[RAI SPC-1 to provide county/town data.]

GEIS Section 3.2.10.7 indicates that the closest health care facilities within the vicinity of the project area are located in Riverton, Rawlins, and Lander and consist of hospitals, clinics, emergency centers, and medical services. Riverton, Rawlins, and Lander each have one hospital. GEIS Section 3.2.10.7 also indicates that the local police in the ROI are under the jurisdiction of each county. Carbon County is described as having six police, sheriff, or marshal offices, and Sweetwater and Fremont Counties are listed as having three. The GEIS lists seven fire departments within the ROI, with Riverton and Lander having one each.

3.10.8 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

3.11 Public and Occupational Health

3.11.1 Background Radiological Conditions

Background radiological conditions in the proposed project area are described in Section 3.11.1 of the ER. This section discusses the average dose to the general public from background radiation sources in the United States and indicates that doses are higher than the United States average because of higher elevation and above average concentrations of naturally occurring uranium in the soil in Wyoming (Uranium One, 2008). The GEIS (Section 3.2.11, however, indicates that background radiation levels in Wyoming are lower than the national average because of lower-than-average radon gas levels. **[RAI HS-1 to provide information**

specific to western Wyoming to allow an accurate evaluation of the radiological impact of the proposed project operations.]

Although Uranium One's discussion of average background radiation levels in the United States is consistent with a similar discussion in the GEIS, a recently published report indicates that the average background radiation dose per person in the United States is 3.2 mSv [320 mrem] (National Council on Radiation Protection and Measurements, 2009), which is slightly lower than the dose of 3.6 mSv [360 mrem] reported in 1987. NRC staff agrees that comparison with the 1987 recommendations is appropriate to assess the impacts of radiological operations on the public health because the two values are similar.

3.11.2 Public Health and Safety

NRC has the statutory responsibility, under the Atomic Energy Act of 1954, as amended, to protect the public health and safety and the environment. NRC's regulations in 10 CFR Part 20 specify annual dose limits to members of the public of 1 mSv [100 mrem] total effective dose equivalent (TEDE) and 0.02 mSv/hr [2 mrem/hr] from any external sources.

Public health in a region can be measured by reviewing health studies that have been conducted in the region. Uranium One did not indicate whether any radiological or chemical public health studies have been previously conducted for the Antelope and JAB Uranium Project region. **[RAI HS-2 to provide determination if any public health studies have been previously conducted for the populations at and within the vicinity of the proposed project.]**

3.11.3 Occupational Health and Safety

As stated in the GEIS, occupational health and safety risks to workers include exposure to radioactive materials. Radiation safety practices for workers at uranium ISR facilities should be such that the dose to the workers is kept as low as is reasonably achievable. Radiation exposure limits are specified in 10 CFR Part 20. Occupational dose is determined by the more limiting of (i) 0.05 Sv [5 rem] TEDE or (ii) sum of the deep-dose equivalent and the committed dose equivalent to any individual organ or tissue other than the lens of the eye being equal to 0.5 Sv [50 rem]. The lens of the eye is limited to a dose equivalent of 0.15 Sv [15 rem], and the skin (of the whole body or any extremity) is limited to a shallow dose equivalent of 0.5 Sv [50 rem].

Nonradiological occupational health and safety for the proposed project is discussed in Section 3.11.2 of the ER. This section discusses the incident rates of nonfatal occupational injuries and illnesses by industry and case type in the state of Wyoming for 2006. Although the method for determining the incident rate is provided, the incident rate is not explicitly provided in the text. Instead, Uranium One refers to Addendum 3-11A and the category "metal/nonmetal mining" is referenced in the text (Uranium One, 2008). However, Addendum 3–11A (Uranium One, 2008), which contains data from both 2005 and 2006, does not contain a category of that name and other labor categories appear to be more closely aligned with the ISR extraction process than mining (e.g., drilling oil and gas wells).

3.11.4 References

National Council on Radiation Protection and Measurements. "Ionizing Radiation Exposure of the Population of the United States." Report No. 160. Bethesda, Maryland: National Council on Radiation Protection and Measurements. 2009.

4 ENVIRONMENTAL IMPACTS OF CONSTRUCTION, OPERATION, AQUIFER RESTORATION, AND DECOMMISSIONING ACTIVITIES

4.1 Proposed Action

4.1.1 Land Use Impacts

The proposed Antelope and JAB facilities are located on unpopulated rangeland used for livestock grazing, fish and wildlife habitat, oil and gas development, and recreational activities (see Section 3.1). The unpopulated rangeland is managed by the U.S. Bureau of Land Management (BLM) and the state of Wyoming. Proposed land access restrictions and land disturbances could potentially impact the other land uses in the area and are therefore evaluated in this section. Impacts from alterations to ecological resources and to historical and cultural resources are evaluated in Sections 4.1.5 and 4.1.8 of this supplemental environmental impact statement (SEIS), respectively.

The proposed project includes plans to construct fencing to restrict livestock access to facility buildings {covering approximately 6 ha [15 acres]} and well field areas {covering approximately 570 ha [1,400 acres]} for the duration of the project. **[RAI Land Use-6 to request basis for estimate of disturbed land.]** The proposed Antelope and JAB Uranium Project areas cover 4,262 ha [10,531acres] and 1,636 ha [4,043 acres], respectively, for a total of 5,900 ha [14,574 acres]. The environmental report (ER) estimates the maximum amount of land disturbance for the duration of the proposed project at approximately 57 ha [1,400 acres], or approximately 10 percent of the total proposed licensed area.

The generic environmental impact statement (GEIS) evaluated land use impacts of licensing *in-situ* recovery (ISR) facilities in a region of Wyoming that included the Great Divide Basin area where the Antelope and JAB facilities are proposed to be located (NRC, 2009). Characteristics and land use activities described for the region in the generic GEIS are consistent with the site specific descriptions summarized in Section 3.1. This includes a sparsely populated area of Wyoming with land areas managed predominantly by the BLM for grazing, oil and gas development, wildlife habitat, and recreational activities such as hunting and hiking.

The GEIS evaluated the potential impacts to these land uses by considering the range of past ISR facility areas and the associated magnitude of land disturbance associated with these facilities. The analyses addressed facilities that ranged in size from 1,000 to 7,000 ha [2,471 to 17,297 acres] with disturbed area estimates of 50 to 750 ha [120 to 1,860 acres] that averaged 15 percent of the licensed area. The proposed Antelope and JAB Uranium Project areas are within the range of site permitted and disturbed areas that were evaluated in the GEIS. Because the land use characteristics of the proposed project are consistent with the characteristics evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the proposed project and therefore provides an acceptable framework for conducting this site-specific impact analysis. The following sections apply the GEIS impact analysis framework to evaluate the potential land use impacts from each of the four ISR lifecycle phases. These evaluations incorporate additional site-specific details applicable to the proposed project, as needed, to support the site-specific impact conclusions.

4.1.1.1 Construction Phase

The proposed construction of the Antelope and JAB Uranium Project could potentially impact land uses by (i) changing and disturbing existing land uses, (ii) restricting access or establishing right-of-way for access, (iii) affecting mineral rights, (iv) restricting livestock grazing areas, and (v) restricting recreational activities.

Changes and Disturbances in Land Uses: Construction of the proposed project would temporarily prevent land from being used for other purposes. Because the predominant land use at the proposed project areas is BLM-managed rangeland, grazing areas would be temporarily lost.

Land use changes and disturbances would be expected to be most intense during the construction phase. These disturbances are typically temporary, with initial construction of facilities expected to be complete in 1 year, followed by phased construction of additional well fields during the operational period. Drilling, trenching, excavating, grading, and erection of surface facilities would be expected to disturb the land most during the construction phase. Section 2.1.2.4 indicates a relatively small fraction (approximately 10 percent) of the proposed licensed area is expected to be disturbed. The amount of disturbed land is small compared to the total ranchland area BLM manages in the region. Also, Section 3.1 indicates the proposed project areas are within a BLM management area that permits 47,361 animal unit months (AUMs); at the reported average stocking rate of 4 ha [9 acres] per AUM, this represents approximately 172,503 ha [426,249 acres] of grazing land. The estimated maximum disturbed area for the proposed project is 570 ha [1,400 acres] or 0.3 percent of the grazing allotment in the region. This cumulative land disturbance is planned to occur at different times over the duration of the project based on the planned phased construction of well fields; therefore, the actual amount of lost grazing land at any particular time would be less than 570 ha [1,400 acres]. Also, Uranium One Americas (Uranium One) would be required to implement postconstruction reclamation of disturbed land in well fields to cover disturbed areas through the operational and aquifer restoration phases until final site decommissioning and reclamation commence.

Access Restrictions: Access restrictions would be expected to be limited but continue beyond the construction phase over the operational life cycle of an ISR facility. The proposed area of fenced surface facilities would be approximately 573 ha [1,415 acres] as Uranium One plans to restrict livestock access to well fields (Uranium One, 2008). This would restrict access to grazing, potential mineral rights, and recreation opportunities. Temporary right-of-way for access to dirt roads and well fields would be established for the duration of the project. **[RAI Land Use-3 to clarify whether any access restrictions proposed for local roads.]**

Mineral Rights: It is anticipated that future mineral rights for resources in the permit area other than uranium could be either delayed or intermixed within the overall permit area for the duration of the proposed project. Nineteen current oil and gas leases exist within the proposed Antelope area, and eight are located partially or wholly within the proposed JAB area (see Section 3.1). Some of these leases are associated with a pilot coal bed methane project that overlaps portions of the Antelope area. U.S. Nuclear Regulatory Commission (NRC) staff expect any future oil and gas, or coal and metals mining exploration and production activities will be addressed by obtaining mineral rights and surface owner consent before the Antelope and JAB facilities are constructed. For example, the Wyoming Department of Environmental Quality (WDEQ) requires a surface owner consent form for all surface owners (WDEQ, 2007). Existing oil and gas exploration and production or coal bed methane well sites could coexist

within the Antelope and JAB permit area given that the footprint of the facility is small relative to the total permit area. The coexistence and potential conflicts among different mineral rights on an ISR permit area on public or private lands is expected to be negotiated and agreed upon between the different mineral rights owners involved. **[RAI Land Use-5 to verify currency/completeness of Uranium One's information on existing oil and gas leases that overlap proposed site.]**

Livestock Grazing: One of the main commercial uses of publicly or privately owned open rangelands in the vicinity of the proposed project is livestock grazing, but rangelands also provide scenic vistas, open spaces, wildlife, and recreational opportunities. Livestock grazing is an integral and historical part of the western rangeland and contributes to maintaining its ecological, historical, and social values for owners, residents, and visitors. A relatively small portion of the grazing permit area available in the local area BLM manage would be restricted on fenced portions of the land used for the proposed project. These restrictions would be temporary because the proposed project operation will use a phased approach to well field development and the land of a particular well field where operations ceased could be partly or totally reclaimed and returned to previous grazing or recreational uses. **[The response to RAI Land Use-5 will establish whether the proposed site land is currently being used for grazing; if so, text would be added to mention potential mitigation measures.]**

Restriction on Recreational Activities: Fencing and right-of-way conditions would minimally restrict hunting and off-road vehicle access to previously open areas. These recreational activities are most common on the grass- or shrub-covered rolling hills of the region surrounding the proposed Antelope and JAB facilities on BLM and private lands. The fenced area of the proposed facilities would be relatively small and temporary, and there would be abundant open space available around the facilities for recreational activities.

Based on the foregoing discussion of potential impacts to the major aspects of land use for the proposed project, the NRC staff conclude that land use impacts during the construction phase would be SMALL.

4.1.1.2 Operation Phase

The types of land use impacts for operational activities would be expected to be similar to construction impacts regarding access restrictions because the infrastructure would be in place. Additional land disturbances would not be expected from conducting the operational activities. During the operation phase of the proposed project, the primary changes to land use would be the expansion of well fields, with potential impacts similar to those of the construction phase. Sequentially moving active operations from one well field to the next would shift potential impacts. For example, Uranium One plans to decommission and reclaim well sites individually once groundwater restoration is complete. Therefore, a well field where uranium recovery activities have ceased could be partly restored and reopened for grazing or recreation while a new well field is being developed. Because access restriction and land disturbance impacts would be expected to be similar to or less than those expected for construction, NRC staff conclude that the overall potential impacts to land use from operations would be SMALL.

4.1.1.3 Aquifer Restoration Phase

During aquifer restoration, the land use impacts described previously for the construction phase and the operations phase would remain. In terms of specific activities, the aquifer restoration uses the same infrastructure as the operations phase and maintenance would be at a similar

level. Land use impacts from aquifer restoration could also decrease as fewer wells and pump houses would be used and overall equipment traffic and use would diminish. Thus, NRC staff conclude that the overall potential impacts to land use during the aquifer restoration phase are comparable to those of the operation phase and would be SMALL.

4.1.1.4 Decommissioning Phase

The types of land use impacts described for construction, operation, and aquifer restoration would be similar during the decommissioning of the facilities. Site activities and their effects would temporarily increase during decommissioning compared to the operation and aquifer restoration phases, because there would be greater use of earth- and material-moving equipment and other heavy equipment associated with land reclamation, dismantling, removal, and disposal of well field materials, pipelines, and central and satellite processing facilities. Additionally, surface reclamation activities would involve use of earth-moving equipment for regrading certain areas. Reclaimed areas would be replanted in accordance with appropriate state or federal regulations and standards. Because most of the decommissioning phase would occur on previously disturbed and access-restricted land, the additional potential impacts to land use during the decommissioning phase are expected to be temporarily MODERATE based on the existence of noticeable surface disturbance, however impacts would diminish to SMALL once decommissioning and reclamation are completed, revegetation becomes established, and land is restored to previous uses. The principal outcome of decommissioning would be to end uranium recovery activities, restore the land to its original condition, and reestablish the prior land uses or redevelop the land for other potential uses.

4.1.1.5 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium. July 2008.

WDEQ. "*In-Situ* Mining Permit Application Requirements Handbook. Application Content Requirements—Adjudication and Baseline Information." Cheyenne, Wyoming: WDEQ, Land Quality Division. March 2007.

4.1.2 Transportation Impacts

Truck and automobile use is associated with all phases of the proposed Antelope and JAB project. Potential impacts to the existing transportation corridor including potential public health and environmental impacts from the proposed activities are evaluated based on the magnitude and nature of proposed transportation activities.

The proposed project includes (i) transportation activities that would increase vehicular traffic in the transportation corridor from employee commuting (ii) and various material shipments (i.e., construction materials and supplies, yellowcake product, remote IX resins, radioactive and solid wastes, and hazardous chemical supply shipments). The roads that would be used for these activities are described in Section 3.2, and the magnitude of the shipping activities is discussed in Section 2.1.9. **[RAI Transportation-1, -2, and -4 to obtain estimates of construction traffic, confirm the estimate of the operations workforce, and clarify the**

magnitude of hazardous chemical supply shipments.] This includes approximately 75 or fewer worker commutes per day (i.e., up to 150 one-way trips), [insert number] construction supply shipments per day, 4 one-way remote IX shipments per day, and 4 operational supply shipments per day (Uranium One, 2008). In addition, the less frequent proposed transportation activities include approximately 110 or fewer yellowcake shipments per year to a conversion facility in Metropolis, Illinois, or Port Hope, Canada; 200 solid waste shipments per year to a local landfill; and 25 byproduct waste shipments per year to a licensed NRC facility.

The GEIS evaluated transportation impacts of licensing ISR facilities in a region of Wyoming that includes the Great Divide Basin area where the proposed Antelope and JAB Uranium Project is located (NRC, 2009). Characteristics of the transportation corridors described for this region in the GEIS, including specific roads and traffic counts, are consistent with the site-specific descriptions summarized in Section 3.2. The magnitudes of ISR transportation activities evaluated in the GEIS are also consistent with the activities included in the proposed project with a few exceptions. These include facilities with 20 to 200 commuting employees, and shipping activities that constitute approximately 1 or 2 trucks per day during the construction and operation phases and a truck every 2.5 days during decommissioning. The magnitude of trucking activity estimated for the proposed project (about five trucks per day) is therefore greater than that evaluated in the GEIS (fewer than two trucks per day); however, both estimates represent a low level of daily trucking for the roads that were evaluated.

Because the transportation activities and characteristics of the proposed project are consistent with the activities and characteristics evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the proposed project and therefore the GEIS impact conclusions can be tiered from the GEIS to this site-specific environmental review. The following sections summarize the GEIS impact analyses and conclusions from each of the four ISR life cycle phases. These evaluations incorporate additional site-specific details applicable to the proposed project, as needed, to support the site-specific impact conclusions.

4.1.2.1 Construction Phase

The magnitude of estimated construction-related transportation is expected to vary depending on the size of the facility; however, when considered with the regional traffic counts (see Section 3.2), most roads that would be used for construction transportation in the transportation corridor that serves the Antelope and JAB areas would not gain significant increases in daily traffic. Bairoil Road, an unpaved road that is expected to have the lowest daily traffic count (as the connecting State Highway 73 at Bairoil has approximately 30 trucks per day and 230 vehicles total per day), would have higher traffic and potential infrastructure impacts; also, impacts due to noise and dust would be higher during the construction period. More specifically, residents of Bairoil that live in the vicinity of Bairoil Road would experience temporarily higher dust and noise levels. An increase in incidental livestock and wildlife kills is possible but not expected to occur with a frequency that would destabilize animal populations. **[RAI Transportation-3 to clarify whether Bairoil Road is used for herding/grazing activities.]** Similar types of impacts are possible on County Road 23 as it could be used by some commuting workers traveling through Jeffrey City from the north or through Wamsutter from the south. This transportation route is not paved, however, and is expected to be less preferable than the existing paved roads. The limited duration of construction activities suggests impacts would be temporary. State Highway 73, which is paved, would experience a temporary significant increase in traffic each day from the commuting facility workforce while the remaining more heavily traveled roads in the corridor such as U.S. Highway 287 traveling North from Rawlins, with an average daily traffic count of 2,310 vehicles, would be far less likely to

notice the increased traffic from worker commute. Overall, the NRC staff conclude that the transportation impacts during construction would be MODERATE.

4.1.2.2 Operation Phase

Transportation during the operation phase would include employee commuting, supply shipments, waste transportation, IX resin transport, and yellowcake transportation. Overall, the estimated magnitude of truck transportation that would bypass the town of Bairoil is generally low (approximately five trucks per day or less exiting the area with an additional four trucks per day for IX shipments in between the Antelope and JAB areas) and unlikely to generate any significant environmental impacts above those for the construction period. Commuting impacts during operations depend on the size of the workforce, which Uranium One has estimated at approximately 60 employees, slightly less than the 75-employee workforce estimated for the construction phase (Uranium One, 2008). Therefore, the commuting-related transportation impacts would be similar to the construction phase. For the roads with the lowest traffic counts, including Bairoil Road and State Route 73, and County Road 23, Antelope and JAB facility commuting could temporarily significantly increase traffic during daily rush hour periods and impacts would be similar to those discussed for construction phase.

Transportation risks to the public and the environment associated with proposed Antelope and JAB facility operations involving shipments of radioactive and hazardous materials including yellowcake, IX resins, radioactive wastes, and hazardous chemicals are similar to or less than those already analyzed in the GEIS, which concluded the impacts would be SMALL. These GEIS impact analyses apply to the proposed Antelope and JAB facility operations because the types of shipping activities and the materials and quantities shipped are within the bounds of what was considered in the GEIS impact assessments. An exception is the number of chemical supply and fuel shipments, which the ER estimates at four per day (compared to fewer than one per day considered in the GEIS). **[RAI Transportation-4 to clarify magnitude of hazardous chemical supply shipments.]** Based on the foregoing discussion of potential impacts of worker commute and shipment risks, the NRC staff conclude that transportation impacts during the construction phase of the proposed project would be MODERATE.

Additional safety measures for the proposed remote IX resin shipments include training an emergency response team and tracking shipments to quickly investigate any delayed shipments. Safety in radioactive and hazardous material shipments is enhanced by compliance with the applicable NRC requirements at 10 CFR Part 71 and the incorporated U.S. Department of Transportation regulations at 49 CFR Parts 171–189.

4.1.2.3 Aquifer Restoration Phase

The magnitude of transportation activities during aquifer restoration are expected to be less than during construction and operation. Transportation for aquifer restoration would include shipments of chemical supplies (e.g., for reverse osmosis), chemical waste shipments, onsite transportation, and employee commuting. No additional unique transportation activities are expected during aquifer restoration; therefore, no additional types of impacts associated with aquifer restoration are anticipated. Considering the potential impacts of commuting on the low traffic roads in the vicinity of the proposed Antelope and JAB facilities, the transportation impacts for aquifer restoration would be SMALL for most roads and MODERATE for Bairoil, State Route 73, and County Road 23.

4.1.2.4 Decommissioning Phase

Decommissioning 11e.(2) byproduct material (as defined in the Atomic Energy Act) would be shipped offsite by truck for disposal at a licensed disposal site. Section 2.1.9 provides estimates of the number of decommissioning-related waste shipments **[RAI WM-3 to obtain estimates of decommissioning solid byproduct and municipal waste volumes]**. All radioactive waste shipments must be shipped in accordance with the applicable NRC safety requirements in 10 CFR Part 71. As shown in Section 2.1.9, the number of estimated decommissioning waste shipments is fewer than those needed to support facility operations, and therefore potential traffic and accident impacts are expected to decrease during the decommissioning phase. Risks from transporting yellowcake shipments during operations bound the risks expected from waste shipments owing to the concentrated nature of shipped yellowcake, the longer distance yellowcake is shipped relative to waste destined for a licensed disposal facility, and the relative number of shipments for each type of material. Commuting impacts would decrease from peak employment due to cessation of operations, though this effect would be offset to some degree by an increase in decommissioning workers. Overall, based on the magnitude of transportation activities expected for the proposed Antelope and JAB facilities during decommissioning, NRC staff conclude that impacts would be SMALL.

4.1.2.5 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

4.1.3 Geology and Soils Impacts

4.1.3.1 Construction Phase

A generalized analysis of impacts to geology and soils that are expected during the construction phase is presented in GEIS Section 4.2.3.1. During construction, most impacts would result from earth-moving activities associated with clearing of ground or topsoil to prepare surfaces for facilities, excavating and backfilling trenches for pipelines, and excavating evaporation ponds and embankments. Geology and soil impacts from facilities construction would be temporary and SMALL. At the Antelope and JAB Uranium Project areas, the topsoil will be stripped and stockpiled and maintained in accordance with WDEQ-(Land Quality Division) LQD rules and regulations. The surface will be graded, and stormwater will be routed to reduce the effect of construction on soil erosion. The NRC staff concluded from the evaluation in the GEIS that geology and soils impacts during construction of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL.

NRC staff reviewed the Uranium One ER (Uranium One, 2008) and identified no significant new information. For more information on soil types of the Antelope and JAB Uranium Project site, see Section 3.3.3 of this report. Also, NRC staff determined that the GEIS evaluation of geology and soils during construction is applicable to proposed project areas. Therefore, NRC staff conclude that the overall geology and soils impacts during construction of the Antelope and JAB Uranium Project would be SMALL.

4.1.3.2 Operation Phase

A generalized analysis of impacts to geology and soils that are expected during the operation phase is presented in GEIS Section 4.2.3.2. Removal of the pregnant lixiviant from targeted sandstones will remove the uranium mineral coatings from sediments, but the uranium mobilization and recovery techniques do not result in the removal of the rock matrix. Accordingly, there would be little impact on the structural characteristics of the host rock. Moreover, given the depth of the target zone sandstones (hundreds to thousands of feet beneath the surface) it is unlikely that any collapse would translate to the ground surface. Therefore, impacts to geology from ground subsidence would be SMALL.

Changes in fluid pressure as a result of maintaining a negative water balance are unlikely to impact the transmissivity of faults in the project areas or result in their reactivation **[RAI Geology-1 to Provide a detailed fault location map with the locations of both the Antelope and JAB permit boundaries and mineralized areas clearly identified, including all known fault systems and identify fault(s) within the JAB project area that are mentioned in Section 3.3.1 of the ER].**

Soil contamination during operation could occur from pipeline leaks and ruptures, or from transportation accidents. Contamination impacts to soils could range from small to large, depending on volume spilled and response time. Using best management practices—specifically, the required immediate responses, spill recovery actions, and routine monitoring programs—the impacts to soils are likely to be small and temporary.

The NRC staff concluded from the evaluation in the GEIS that geology and soils impacts during operation of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL. Based on the information provided in the ER, the NRC staff conclude that impacts to ge9ology and soil during the operation phase would be SMALL.

4.1.3.3 Aquifer Restoration Phase

A generalized analysis of impacts to geology and soils that are expected during aquifer restoration is presented in GEIS Section 4.2.3.3. The main potential impact would be spills of contaminated groundwater. Spills can occur through pipeline leaks and ruptures and spills of lixiviant during operations. By the implementation of water monitoring programs and soil surveys, the potential impact to geology and soils would be expected to be SMALL.

The NRC staff concluded from the evaluation in the GEIS (NRC, 2009) that geology and soils impacts during aquifer restoration at ISR facilities in the Wyoming West Uranium Milling Region would be SMALL. NRC staff's review of the ER ....**[pending response to RAI Geology-3 requesting differentiation of construction, operation, aquifer restoration, and decommissioning impacts.]**

4.1.3.4 Decommissioning Phase

A generalized analysis of impacts to geology and soils that are expected during the decommissioning of ISR facilities is presented in GEIS Section 4.2.3.4. The major activities during this phase would include land reclamation and land clean-up of contaminated soils. The goal of decommissioning is to reclaim and restore the site to preproduction conditions; therefore, most activities associated with decommissioning are temporary, and the overall long-term impacts to the geology and soils would be SMALL.

The NRC staff concluded from the evaluation in the GEIS that geology and soils impacts during decommissioning of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL. NRC staff's review of the Uranium One ER for the Antelope and JAB Uranium Project ....**[pending response to RAI Geology-3 requesting differentiation of construction, operation, aquifer restoration and decommissioning impacts.]**

4.1.3.5 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Volumes 1–4. Docket No. 040-09079. Casper, Wyoming: Uranium One Americas. July 2008.

4.1.4 Water Resources Impacts

Analyses of potential impacts to water resources during each phase of the proposed project are presented in Section 4.1.4.1 for surface water and 4.1.4.2 for groundwater.

4.1.4.1 Surface Water Impacts

4.1.4.1.1 Construction Phase

Analyses of potential surface water impacts, including wetlands, during the construction phase are presented in GEIS Section 4.2.4.1.1. Potential impacts to surface water bodies would include (i) increased storm runoff, soil erosion, and sediment generation; (ii) modified stream channel morphology and bank stability; (iii) reduced stream flow and filling of wetlands due sediment deposition; and (iv) degraded water quality from spills or leaks of hazardous construction fluids resulting in failure to meet designated uses.

Land clearing and other site preparation activities for constructing roads, well pads, pipelines and other structures would expose bare soil, thereby increasing the erosion potential. Soil compaction for roads and well pads would increase the area of impervious surfaces, which would increase runoff volume and flow rate, resulting in further erosion and sediment transport to streams. Hydrostatic testing of pipes and tanks, construction dewatering, and well pumping tests may temporarily discharge wastewater to surface water bodies. These activities are controlled under federal and state clean water regulations and permits, which also recommend best management practices to mitigate potential impacts. Based on this evaluation, the NRC staff concluded in the GEIS that surface water impacts from ISR facilities in the Wyoming West Uranium Milling Region during construction would be small and temporary, but may be moderate if a site-specific permit is required from the U.S. Army Corps of Engineers for road and pipe crossings over water bodies (such as culverts and bridges).

The NRC staff reviewed Uranium One's ER for the proposed project, as summarized in Section 3.4, and determined that low regional rainfall would reduce potential peak runoff rates ... **[RAI Water-3 to provide site plan, including discharge points, to confirm that (i) diversion ditches, etc. have been designed, and (ii) area disturbed will be small compared to affected watershed area**]. A site visit by NRC staff confirmed there are no perennial streams within the proposed project area, thus limiting the temporal and spatial extent

of potential surface water impacts. GEIS evaluation of surface water impacts is applicable to the Antelope and JAB project areas and its environs. Therefore, the NRC staff concludes that the overall surface water impacts during construction at the proposed project would be ... [**pending RAI responses**]. During construction, impacts to surface water resources would be mitigated if Uranium One strictly complies with applicable clean water regulatory requirements and use best management practices to minimize spills, runoff, soil erosion, and sediment mobilization.

4.1.4.1.2 Operation Phase

Analyses of potential surface water impacts, including wetlands, during the operation phase are presented in GEIS Section 4.2.4.1.2. During operations, surface waters may be impacted by accidental spills or permitted discharges. Spills from the processing plants and well fields or during transportation may contaminate stormwater runoff. Concrete curbing and berms are typically used to contain spills and facilitate cleanup in accordance with approved operating procedures. Stormwater discharges are controlled through a Storm Water Pollution Prevention Plan permit issued by the WDEQ, which also includes monitoring requirements and best management practices to prevent storm water contamination. Based on this evaluation, the NRC staff concluded in the GEIS that operation of ISR facilities in the Wyoming West Uranium Milling Region would result in small impacts to surface waters.

The NRC staff reviewed Uranium One's ER for the proposed project and determined that adequate design has been provided to contain spills at the well fields and within the processing facilities. A site visit by NRC staff confirmed that Uranium One will be required to obtain zone change and development permits from Sweetwater County, Wyoming, which include requirements for drainage and stormwater pollution prevention ... **[RAI for county and state permit applications, including site and development plans (see Sweetwater County package]**. Therefore, the NRC staff concludes that the overall surface water impacts during operations at the proposed project would be ... [**pending RAI responses**]. During operation, Uranium One should strictly comply with applicable clean water regulatory requirements and use best management practices to minimize spills and surface water contamination.

4.1.4.1.3 Aquifer Restoration Phase

Analyses of potential surface water impacts during the aquifer restoration phase are presented in GEIS Section 4.2.4.1.3. Aquifer restoration activities that could impact surface waters include management of produced water, storm water runoff and accidental spills, and management of brine from the reverse osmosis treatment process. Similar to the operation phase, storm water quality would be controlled under a Wyoming Storm Water Pollution Prevention Plan permit. Because of permit requirements and subsequent decommissioning, the NRC staff concluded in the GEIS that potential aquifer restoration impacts to surface water would be small.

The NRC staff reviewed Uranium One's ER for the proposed project and determined that adequate processes have been designed to treat and dispose of produced water and reverse osmosis brine through deep well injection. A site visit by NRC staff confirmed that Uranium One will be required to obtain appropriate WDEQ permits for activities associated with deep well injection. Therefore, the NRC staff concludes that the overall surface water impacts during operations at the proposed project would be SMALL.

4.1.4.1.4 Decommissioning Phase

During decommissioning of the proposed facility, potential impacts to surface waters would result from sediment loads generated from removal of piping, linear crossings, and other facility infrastructure. Storm water runoff would be controlled by implementing a WDEQ Storm Water Pollution Prevention Plan permit. NRC staff therefore conclude that impacts to surface water from decommissioning activities would be SMALL.

4.1.4.2 Groundwater Impacts

4.1.4.2.1 Construction Phase

Analyses of potential groundwater impacts during the construction phase are presented in GEIS Section 4.2.4.2.1. Groundwater impacts would result primarily from consumptive use, introduction of drilling fluids and muds from well drilling, and spills of fuels and lubricants from construction equipment. Consumptive use would be limited to dust suppression, mixing cements, and drilling support. The amounts of groundwater used in these activities would be small relative to pumpable water and would have minimal impacts to the aquifer water quality (NRC, 2009). Surface activities would be protected by best management practices to minimize soil contamination and protect shallow aquifers. Based on this evaluation, the NRC staff concluded in the GEIS that construction of ISR facilities would have small and temporary impacts on groundwater resources in the Wyoming West Uranium Milling Region.

The NRC staff reviewed Uranium One's ER for the proposed project and determined that ... **[RAI Water-5 to provide distance-drawdown information for the proposed well fields]**. A site visit by NRC staff confirmed the GEIS evaluation of potential groundwater impacts is applicable to the Antelope and JAB project areas. Therefore, the NRC staff concludes that the overall groundwater impacts during construction at the proposed project would be SMALL.

4.1.4.2.2 Operation Phase

Analyses of potential groundwater impacts during the operation phase are presented in GEIS Section 4.2.4.2.2. ISR operations can impact groundwater at various depths above, within, below, as well as adjacent to the uranium-bearing (production) aquifer. Potential impacts to shallow aquifers would result from lixiviant leaks from pipelines, wells, or header houses. Additional impacts may be due to waste management practices such as the use of evaporation ponds and disposal of treated wastewater by land application. Potential impacts to the production and adjacent aquifers would involve consumptive water use and changes to water quality. Water quality changes would result from normal operations in the production aquifer and from possible horizontal and vertical lixiviant excursions beyond the production zone. Also, disposal of processing wastes by deep well injection may impact groundwater resources. GEIS Section 4.2.4.2 identified small to large impacts to groundwater resources from operation of ISR facilities in the Wyoming West Uranium Milling Region. Thus, evaluation of site-specific conditions is needed to determine potential groundwater impacts for the proposed project.

The NRC staff reviewed Uranium One's ER for the proposed project. Several important design information are yet to be provided, including (i) results of the well field testing; (ii) a detailed well field plan indicating the number and location of injection, recovery, and monitoring wells; (iii) a detailed deep well injection plan; and (iv) the best management practices to minimize impacts of lixiviant leaks from well, pipes, and header houses. **[RAI PA-1to provide detailed well field plan, deep well injection plan, and BMPs]**. NRC staff identified and discussed these

information gaps with Uranium One staff during a site visit to the proposed project areas. More discussions will be needed once response to the RAI is obtained. Therefore, the NRC staff concludes that the overall groundwater impacts during operation at the proposed project would be ... **[pending RAI responses]**.

4.1.4.2.3 Aquifer Restoration Phase

Analyses of potential groundwater impacts during the operation phase are presented in GEIS Section 4.2.4.2.3. Potential impacts would be depletion of groundwater resources due to consumptive use and changes to local groundwater quality near the well field being restored. The severity of these impacts would depend on the scheduling of well field operations, the specific restoration methods chosen, the severity and extent of groundwater contamination during ISR operations, and the current and future use of the production and surrounding aquifers in the vicinity of the facility. Because these factors are site-specific, NRC staff reviewed the ER and found that Uranium One intends to use a combination of three restoration methods: (i) groundwater transfer, (ii) groundwater sweep, and (iii) groundwater treatment. These methods will be used in phases to optimize restoration equipment and to minimize groundwater consumptive use during aquifer restoration. **[RAI Water-5 to provide drawdown information from aquifer restoration scenario models]** Because of the uncertainties in consumptive use associated with these factors, NRC staff conclude that potential impacts to groundwater resources during aquifer restoration would be SMALL to MODERATE. These impacts would be mitigated by closely monitoring the quality of groundwater in selected wells during aquifer restoration to determine the efficiency of the methods being used and to determine if additional or alternative techniques would be necessary.

4.1.4.2.4 Decommissioning Phase

Analyses of potential groundwater impacts during decommissioning are presented in GEIS Section 4.2.4.2.4. Potential impacts to groundwater during this phase are mainly due to consumptive use and spills of fuels and lubricants. Also, improperly abandoned wells could impact groundwater quality by providing hydrologic connections between aquifers. The amount of groundwater use for facility decommissioning activities such as dust suppression, revegetation, and reclamation of disturbed areas would be less than that used for operation and aquifer restoration. Implementation of best management practices would reduce the likelihood and magnitude of spills and facilitate cleanup. In addition, all wells must be plugged and abandoned in accordance with Wyoming underground injection control (UIC) program requirements. Section 1.5 of the ER indicates Uranium One plans to obtain the necessary UIC approvals before commencing work on the proposed project. Based on this evaluation, the NRC staff conclude that impacts to the groundwater resources from decommissioning would be SMALL.

4.1.4.2.5 References

NRC. "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. July 2008.

4.1.5 Ecological Resources Impacts

4.1.5.1 Construction Phase

Analysis of impacts to ecological resources that are expected during the construction phase are presented in GEIS Section 4.2.5.1 (NRC, 2009). The GEIS describes that *in-situ* leach facility construction can affect terrestrial vegetation through (i) the removal of vegetation from the milling site during construction (and associated reduction in wildlife habitat and forage productivity and an increased risk of soil erosion and weed invasion); (ii) the modification of existing vegetative communities as a result of milling maintenance; (iii) the loss of sensitive plants and habitats as a result of construction clearing and grading; and (iv) the potential spread of invasive species and noxious weed populations as a result of construction. The magnitude of these potential impacts is associated with the amount of land area disturbed by the proposed action. Previous ISR facilities with permit areas ranging from 1,034 to 6,480 ha [2,552 to 16,000 acres] of land have reported vegetation removal from 49 to 490 ha [120 to 1,200 acres] (NRC, 2009, Section 4.2.5.1). The GEIS explains that clearing herbaceous vegetation during construction in an open grassland or shrub steppe community is anticipated to have a short-term impact especially if active revegetation measures are used. The GEIS described that rapid colonization by annual and perennial herbaceous species in the disturbed staging areas and rights-of-way would restore most vegetative cover within the first growing season. Uranium One plans to conduct weed control as needed to limit the spread of undesirable and invasive, non-native species on disturbed areas as well as revegetate disturbed areas with an approved seed mix.

Increased traffic and soil disturbance during construction may accelerate the dispersal of noxious plants and invasive weeds. BLM's Sensitive Plan Species list and Wyoming Natural Diversity Database's list of Special Species of Concern include species of *Cryptantha, Penstemon,* and *Phlox,* which were recorded during the vegetation surveys for the project (BLM, 2009) **[RAI Vegetation-4 will verify plant species observed during plant survey]**. Although these specimens may not be the same species on the aforementioned lists, it is possible that suitable growing conditions are present for those listed species or other sensitive plants within the proposed project area.

Wyoming big sagebrush occupies relatively warm low elevation sites highly susceptible to cheatgrass (*Bromus tectorum*), an exotic annual, particularly after fire events (WGFD, 2004). Medusahead (*Taeniatherum caput-medusae*) is also a problematic species within the sagebrush biome. These species were not identified during Uranium One's vegetation surveys. For more information on the vegetation surveys at the project site, see Section 3.5. The U.S. Department of Agriculture, Natural Resource Conservation Service Wyoming State-Listed Noxious Weeds include species of *Cirsium,* which were recorded during Uranium One's vegetation surveys for the project. Although the specimens observed may not be the same species on the noxious weed list, it is possible that suitable growing conditions are present for the listed species or other noxious plants within the project area **[RAI Vegetation-1, -2, -3, and -5 to verify invasive and noxious weeds were not present; identify species observed during surveys; provide complete cover summaries, and if consulted with Sweetwater County Weed and Pest Control District]**. Due to the lack of noxious plants and invasive weeds recorded during the surveys, the NRC staff conclude that the threat of invasive or spread of noxious plants during construction at the proposed project would be SMALL. Based on this evaluation, the NRC staff conclude that a construction impacts resulting from vegetation removal, modification of plant communities, and potential presence of sensitive or invasive plants would be SMALL and temporary.

The GEIS explains that clearing woody shrubs and trees would have a primary long-term impact on vegetation associated with the project if the project is located in a wooded area. Woody shrubs and trees would recolonize after construction of the right-of-way and staging areas, although recolonization of disturbed areas would be slower than for herbaceous species. The NRC staff concluded in the GEIS that impacts from clearing this community would be SMALL to MODERATE depending on the amount of surrounding wooded area. A site visit by NRC staff confirmed that the primary plant community consists of sagebrush grassland with a species composition dominated by woody shrubs; black sagebrush, big sagebrush; and Douglas rabbitbrush. Effects from construction would be greatest in the short term and would decrease over time because of stabilization, reclamation, and revegetation. Uranium One describes the estimated acreage of disturbance would occur on 14 development areas across [approximately 10 percent] 570 noncontinuous ha [1,400 noncontinuous acres], or 40 ha [100 acre] plots. According to the Wyoming Game and Fish Department (WGFD) Stipulations for Development in Core Sage-Grouse Population Areas discussed earlier in Section 3.9, surface disturbance should be limited to less than 5 percent or [32 acres] of sagebrush habitat per [640 acres] or 2.6 km^2 [1 mi^2] (WGFD, 2009).

Although Uranium One plans to implement active seeding in disturbed areas to reestablish vegetation, sagebrush-dominant plant communities will experience the greatest impact. WGFD considers interim reclamation effort successful when areas not needed for long-term operations or vehicle travel have been recontoured, protected from erosion, and revegetated with a self-sustaining, vigorous, diverse, native (or otherwise approved) plant community sufficient to minimize visual impacts, provide adequate habitat and forage for wildlife and livestock, stabilize soils, and impede the invasion of noxious weeds (WGFD, 2009). Sagebrush is a woody shrub that does not resprout and must recolonize by seed dispersal. The Wyoming big sagebrush has a long life span relative to most other plant species and a slow growth rate. At maturity, the typical Wyoming big sagebrush will reach up to1 m [3 ft] high, with a maximum height at 20 years of 1 m [3 ft] (Garden Guides, 2009). Sage-grouse habitats are not expected to be restored to predisturbance conditions for up to 30 years, because of the time needed to reestablish sagebrush stands with characteristics that are preferred by sage-grouse. This delayed restoration would also affect potential pygmy rabbit habitat. Areas not fully reclaimed would result in continued habitat loss and fragmentation. Using clearing methods such as bush hogging or mowing rather than blading would leave sagebrush roots and stems in place and reduce soil erosion. Remaining vegetation would regrow, and disturbed areas would be reclaimed to BLM and WGFD standards. The WGFD defines the impacts of habitat alteration on sage-grouse as short-term impacts lasting 1–14 years, midterm impacts lasting from 15–30 years, and long-term impacts lasting more than 30 years (WFGD, 2007). Based on this discussion, the NRC staff conclude that the overall impact to the vegetation during construction at the proposed project would be MODERATE.

Analysis of impacts to wetlands that are expected during the construction phase is presented in GEIS Section 4.2.4.1.1 and is restated here because of the relationship between wetlands and ecology. The GEIS describes that if overall compliance with the applicable federal and state regulations and permit conditions and the implementation of best management practices and other mitigation measures are implemented, the potential impacts during construction would be SMALL. Uranium One plans to follow regulatory guidelines to restore habitat provided by jurisdictional wetlands. Potential surface runoff and sedimentation from construction will be minimized through erosion control measures that Uranium One plans to implement as part of visual resources mitigation thus minimizing the potential for indirect impacts to wetland sites. Therefore, the NRC staff conclude that the overall wetland impacts during construction at the

proposed project would be ... **[RAI Wetlands-1, 2, 3, and 4 to clarify limits of previously identified and surveyed wetlands and to clarify terminology.]**

Migrating waterfowl traditionally rely on wetlands for habitat and temporary nesting. Migrating waterfowl and shorebirds do not have a large amount of suitable habitat with the exception of portions of Arapahoe Creek, Lost Creek, and man-made ponds used for livestock. Impacts to migratory birds in the project area would depend on the season of construction, drilling, and human disturbance.

Wildlife is vitally dependent on vegetation, but may be affected by aspects of construction other than impacts to vegetation. GEIS Section 4.2 describes three primary impacts of *in-situ* leach construction on terrestrial wildlife: (i) habitat loss or alteration and incremental habitat fragmentation, (ii) displacement of wildlife from project construction, and (iii) direct and/or indirect mortalities from project construction and operation. As previously discussed, the GEIS predicts the greatest impacts would be experienced in vegetative communities where clearing would be required. Some small wildlife may die during construction from vehicles or moving equipment, but most wildlife would disperse when construction activities begin. Displaced species may relocate or return after construction ends, but some shrubs for food, nesting, and cover would be lost. Returning or displaced wildlife entering the project area may be forced to compete with preexisting species. Noise, dust, and increased human presence may preclude use of the area by wildlife. The NRC staff concluded in the GEIS that habitat fragmentation, temporary displacement, and direct or indirect mortalities from construction impacts to wildlife in the Wyoming West Uranium Milling Region would be SMALL to MODERATE. The following discussion of site-specific impacts to wildlife provide the bases for conclusions made by the NRC staff for the proposed Antelope and JAB Uranium Project.

GEIS Section 4.2.5.1 explains that wintering and year-long ranges of big game and sage-grouse are present in the region, and that WGFD guidelines for development of oil and gas resources would apply at ISR facilities depending on site specific conditions, if applicable (WGFD, 2009). Uranium One outlines regulatory guidelines designed to prevent or reduce impacts to all wildlife in Section 5.5.2 of the ER. Uranium One has committed to honor timing and spatial limitations as directed by regulating and permitting agencies. Uranium One plans to conduct exploration activities between August and the end of January and delay road and drilling activity within established buffer zones during recognized breeding and nesting seasons between February 1 through July 31. Pronghorn are the most common big game species in the project area and would experience the greatest impact. Based on the previous discussion, the NRC staff also conclude that impacts to big game at the Antelope and JAB Uranium Project would be small. **[RAI Wildlife 2: to provide WGFD crucial priority areas in project areas.]**

The sage-grouse is a sensitive species that requires aggressive conservation measures. Uranium One plans to adhere to restrictions during the sage-grouse breeding season (March 1 through June 15). As previously discussed, the WGFD has developed Stipulations for Development in Core Sage Grouse Population Areas. As previously discussed in Section 3.5.1, 10 sage-grouse leks are potentially within 3.2 km [2 mi] of the project areas depending on the lek perimeters **[RAI Wildlife-3: verify lek locations and perimeters]**. Two of the 10 leks are located within the permit boundaries, one each in the Antelope and JAB areas. Stipulations and additional standard management practices and guidelines that apply to ISR facility development are incorporated into the Recommendations for Development of Oil and Gas Resources within Important Wildlife Habitats (WGFD, 2009). **[RAI Wildlife-4 to provide agency permit requirements.]** The WGFD has stated that if development does not exceed these and other thresholds outlined in the WGFD stipulations and if applicable management practices and

stipulations are applied, impacts to sage-grouse populations are presumed low and do not require additional mitigation (WGFD, 2009).

The sage thrasher, loggerhead shrike, Brewer's sparrow, and sage sparrow are other BLM sensitive species observed during Uranium One's bird surveys. If construction, drilling, and completion occurred during the spring/summer months, the proposed project could result in temporary displacement, which could have adverse impacts to individual bird health (nest/burrow abandonment and/or mortality of eggs or young) and overall flock populations. For avian species and sensitive small mammal species, there is a risk of drowning in open containers of water or sludge related to drilling operations.

Noise during construction (commuting workers; truck shipments to and from the facility; and construction equipment such as trucks, bulldozers, and compressors) would be primarily limited to highways in the vicinity of the site, secondary roads to the site, and access roads within the site and in the well fields. Because noise levels generally decrease with distance from the source, ambient noise levels would return to background levels at distances more than 300 m [1,000 ft]. Noise from construction may disrupt the behavior of some species, causing individuals to avoid otherwise suitable habitats.

Nearly X miles **[RAI Wildlife-5: to clarify proposed distance of utility lines]** of new aboveground utility lines are included in the proposed project. The presence of the power poles for these lines would increase raptor perching and/or nesting opportunities in the project area and increased opportunity for raptor species to use the lines as perches to hunt prey such as smaller birds, pygmy rabbits, and white-tailed prairie dogs. These potential perches could alter raptor foraging habits by providing attractive perch sites in the absence of mature trees and other natural perches. To discourage raptor perching near sage-grouse leks, WGFD discourages construction of new aboveground utility lines within 0.8 km [0.5 mi] of the perimeter of an occupied sage-grouse lek and encourages antiperching devices be installed on structures within a 3.2-km [2-mi] buffer or buried when possible. While antiperching devices are not expected to alleviate perching, perching is expected to be significantly reduced (WGFD, 2009). Fences, like overhead utility lines, introduce new perches for raptors and potentially change the rate of sage-grouse predation. Uranium One may consider avoiding areas within 800 m [0.5 mi] of active raptor nests, constructing alternate nest sites on natural features, or burying power lines. The NRC staff conclude that raptor breeding or fatalities from construction impacts in the Wyoming West Uranium Milling Region would be SMALL.

Other infrastructure associated with the proposed project also could provide corridors, shelters, or den sites for small ground dwelling animals and predators such as skunks and foxes.

White-tailed prairie dog colonies observed during Uranium One's wildlife surveys ranged in size from approximately 2.6 to 161 ha [6.5 to 397 acres]. The construction of new access roads, wells, pipelines, and aboveground utility lines in the project area could result in the fragmentation of white-tailed prairie dog habitat as much as 0.8 km [0.5 mi] on each side of the corridors where predator perching is encouraged. Some burrow entrances could become filled in, while others could be artificially created if vegetation clearing is conducted by blading. Prairie dog colonies serve as potential habitat for the burrowing owl and piping plover—BLM sensitive species. Piping plovers were observed adjacent to the prairie dog colonies in the proposed JAB area during previous wildlife surveys. Burrowing owls were not observed during Uranium One's surveys. Disturbed ground such as buried pipeline corridors and roads may produce open areas initially sparse or devoid of vegetation that may be attractive to plovers.

Review of Uranium One's ER and a site visit by NRC staff confirmed that the proposed project area is consistent with the ecoregions and magnitude of surface disturbance that was evaluated in the GEIS. Also, the species composition and ISR processes are similar to those evaluated in the GEIS. Therefore, the NRC staff agrees with the GEIS evaluation that the majority of the wildlife impacts would be a result of habitat loss or alteration and incremental habitat fragmentation, displacement of wildlife from project construction, and direct and/or indirect mortalities from project construction and operation. The NRC staff conclude that the overall wildlife impacts during construction would be SMALL.

Disturbances associated with construction such as trenching, physical disturbance of the streambed, removal of riparian vegetation, and noise are not expected to significantly affect fisheries. There is no information available for game and nongame fish that might inhabit the mostly ephemeral water resources in the project area. Pools in Lost Creek and man-made ponds are not known to support game or nongame fish populations; therefore the proposed project would not affect fisheries. Sediment loads could temporarily be increased downstream by transport from rain and snow melt and affect sensitive fish eggs, fish fry, and invertebrates. However, construction impacts are not expected to permanently alter aquatic habitats and would be temporary. The NRC staff concluded in the GEIS that if WGFD-issued standard management practices are followed, impacts to aquatic life from construction in the Wyoming West Uranium Milling Region would be SMALL. Due to the lack of occurrence of suitable habitat for aquatic species at the Antelope and JAB Uranium Project, the NRC staff conclude that the impacts to aquatic life during construction at the proposed project would be SMALL.

Special status wildlife species would likely be more sensitive than other more common species to impacts related to construction. As discussed earlier in Section 3.5, numerous threatened and endangered species and state species of concern are located within the Wyoming West Uranium Milling Region. The species listed as threatened or endangered that is a candidate for habitation in the proposed project area is the black-footed ferret. The black-footed ferret behavior is influenced by prairie dogs. Destruction of prairie dog towns and/or disturbance from equipment could impact black-footed ferret populations. The NRC staff concluded in the GEIS that if prairie dog colonies are present within close proximity to the construction area, impacts from construction activities would be MODERATE or LARGE. As previously discussed in Section 3.5.3, the U.S. Fish and Wildlife Service (FWS) issued a block clearance for ferrets, eliminating the need to conduct ferret surveys. Biologists conducting the wildlife surveys for Uranium One watched for ferrets and evidence of their presence during visits to prairie dog colonies in the proposed project area and found no presence of ferrets. No other threatened or endangered species that have been documented during previous surveys or are likely to be present at the project areas. Therefore, the NRC staff concludes that the impacts to threatened and endangered species during construction at the proposed project would be SMALL.

4.1.5.2 Operation Phase

Analysis of impacts to ecological resources during the operation phase is presented in GEIS Section 4.2.5.2. The primary impacts of ISR facility operation on terrestrial wildlife are (i) habitat alteration and incremental habitat fragmentation, (ii) misplacement and/or stress to wildlife from human activity, and (iii) direct and/or indirect mortalities from project construction and operation. Movement of big game through the project area is not expected to be impacted by most mining operations. The limited use of WGFD-preferred fencing will mitigate the impediment of ingress to and egress from the project area. Direct impacts to wildlife that may occur from vehicles or moving equipment are not expected to affect species populations unless the operations are in close proximity to crucial wintering ranges or active sage-grouse leks and raptor nests. The

GEIS acknowledges that wildlife species may be exposed to selenium and other contaminants from evaporation ponds although there are no previously documented wildlife impacts from evaporation ponds at NRC-licensed ISR facilities. The best management practices described in the GEIS provide guidelines and possible suggestions that applicants can use to minimize ecological impacts including perimeter and surface fencing of evaporation ponds. Impacts to the aquatic resources and vegetation from facility operations resulting from spills around well heads and leaks from pipelines would be handled using best management practices such as leak detection systems and spill response plans to remove affected soils and capture release fluids. Potential impacts to vegetation may occur as a result of land application of wastewater generated from the operation. These impacts could range from increased vegetation growth due to the increase of available water and/or the destruction of vegetation from the build-up of salts in the soils. The NRC staff concluded in the GEIS that total impacts to wildlife from operation impacts in the Wyoming West Uranium Milling Region would be SMALL with the potential of MODERATE to LARGE impacts to crucial wintering ranges, sage-grouse leks, and raptor nests.

NRC reviewed Uranium One's ER that states fencing will be placed around the 4-ha [10-acre] processing plant site and 2.0-km [5-acre] employee parking area. During a site visit by NRC, Uranium One indicated that temporary fencing will be placed around individual well sites during drilling activities. The report also states that currently no evaporation ponds or land applications as a disposal method are planned for the proposed project; therefore, potential impacts associated with these options are not evaluated further. Uranium One proposes the use of deep well injection for waste disposal well(s) to dispose of liquid wastes generated from production and restoration activities (Uranium One, 2008).

As previously discussed in Section 3.5.1, 10 sage-grouse leks are within or approximately 3.2 km [2 mi] from the project areas depending on the lek perimeters. Two of the 10 leks are located within the project areas, one each on the Antelope and JAB sites. Uranium One plans to follow direction from regulatory and permitting agencies regarding activities near sage-grouse leks.

The noise sources in the well fields would be from groundwater pumps and occasional truck traffic for performing maintenance and inspections. Most noise would be generated indoors and associated with equipment operation at the central processing facility. Well field and processing plant equipment would be operated inside buildings, thus reducing sound levels to wildlife. Trucks transporting uranium-loaded resins to the central processing facility and shipping yellowcake from the project site would generate short-term noise. Traffic noise from commuting workers and trucks would be localized, limited to access roads within the site and roads in well fields. Thus, potential noise impacts to wildlife are anticipated to be less than during the construction phase.

The site visit by NRC staff confirmed that the proposed project area is consistent with the ecoregions and magnitude of surface disturbance that was evaluated in the GEIS. Also, the species composition and ISR processes are similar to those evaluated in the GEIS. Therefore, the NRC staff agrees with the GEIS evaluation of ecological impacts during operation are applicable to the proposed project site and its environs. Therefore, the NRC staff conclude that the overall wildlife impacts during operation at the proposed project would be SMALL.

4.1.5.3 Aquifer Restoration Phase

Analysis of impacts to ecological resources during the aquifer restoration phase is presented in GEIS Section 4.2.5.3. Because the existing infrastructure would already be in place and similar to facility operations, the NRC staff concluded in the GEIS that potential impacts to wildlife from aquifer restoration impacts in the Wyoming West Uranium Milling Region would be SMALL.

Noise generation during aquifer restoration is expected to be less than during the construction and operations phases but may continue over much of the life of the ISR project as operations are completed in different well fields.

A site visit by NRC staff confirmed that the proposed project area is consistent with the ecoregions and magnitude of surface disturbance that was evaluated in the GEIS. Also, the species composition and ISR processes are similar to those evaluated in the GEIS. Therefore, the NRC staff agrees with the GEIS evaluation of ecological impacts during aquifer restoration is applicable to the proposed project site and its environs. Also, the NRC staff reviewed Uranium One's ER for the proposed project and determined that impacts associated with aquifer restoration are expected to be similar to or less than those impacts previously discussed during the operation phase. Based on this evaluation, the NRC staff conclude that the ecological impacts during aquifer restoration would be SMALL.

4.1.5.4 Decommissioning Phase

Analysis of impacts to ecological resources during the decommissioning phase is presented in GEIS Section 4.2.5.4. The GEIS describes that some impacts from decommissioning would be similar to those experienced during construction including those impacts to vegetation as a result of removing piping, impacts to streams and wetlands as a result of soil disturbance, impacts to the land used for irrigation as a result of possible contamination, and displaced wildlife as a result of heavy equipment needed to dismantle buildings and haul equipment. These impacts would be temporary and reduce with time. Based on this evaluation, the NRC staff concluded in the GEIS that impacts to ecological resources during decommissioning of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL.

Equipment used to dismantle buildings and milling equipment, removal of contaminated soils, or grading the surface as part of reclamation activities would generate noise levels that would be noticeable only in proximity to operating equipment and would be temporary, typically occurring during the daytime only.

A site visit by NRC staff confirmed that the proposed project area is consistent with the ecoregions and magnitude of surface disturbance that was evaluated in the GEIS. Also, the species composition and ISR processes are similar to those evaluated in the GEIS. Therefore, the NRC staff agrees with the GEIS evaluation of ecological impacts during decommissioning is applicable to the proposed project site and its environs. Also, the NRC staff reviewed Uranium One's ER for the proposed project and determined that impacts associated with decommissioning are expected to be similar to or less than those impacts previously discussed during the construction phase.

Mitigation and Monitoring [This section could be modified or used to develop license conditions.]

The ER indicates that the proposed central plant would be an approximately 107 by 30 m [350 by 100 ft] building, housed within a 4.0-ha [10-acre] fenced area, in the Antelope area in SESE Section 18, T26N, R92W. The proposed location is approximately 0.8 km [0.05 mi] from the Harrier lek and potentially within the Harrier lek perimeter. An alternative location for the central processing plant is recommended to comply with the provisions in the WGFD Stipulations for Development in Core Sage-Grouse Population Areas (WGFD, 2009). Alternatives for proposed facility and infrastructure locations and designs for the proposed project also should be considered with respect to the following stipulations that may be enforced by WGFD and BLM during BLM's permitting process and NRC's National Environmental Policy Act (NEPA) analysis:

1 One well pad per square mile. No more than 11 well pads within 3.0 km [1.9 mi] of the perimeter of occupied sage-grouse leks with densities not to exceed 1 pad per square mile. Clustering of well pads may be considered and approved on a case-by-case basis.
2 Surface disturbance will be limited to <5 percent of sagebrush habitat per square mile. Distribution of disturbance may be considered and approved on a case-by-case basis.
3 No surface occupancy within 1.0 km [0.6 mi] of the perimeter of occupied sage-grouse leks.
4 Locate main haul truck roads used to transport production and/or waste products to a centralized facility or market point ≥3.0 km [≥1.9 mi] from the perimeter of occupied sage-grouse leks. Locate other roads used to provide facility site access and maintenance ≥1.0 km [≥0.6 mi] from the perimeter of occupied sage-grouse leks. Construct roads to minimum design standards needed for production activities while minimizing surface disturbance and traffic.
5 Locate electrical supply lines at least 750 m [0.5 mi] from the perimeter of occupied sage-grouse leks. Design electrical lines to be raptor-proof by installing antiperching devices or by burying them when possible.
6 Conduct exploration and development activity between 1 July and 14 March. In core population areas that also contain sage-grouse winter concentration areas, the window for exploration and development activity is 1 July to 14 November.
7 Limit noise sources to 10 dBA above natural, ambient noise (~39 dBA) measured at the perimeter of a lek from March 15 to May 15.

As discussed in Section 4.1.1.5 earlier, Uranium One plans to honor timing and spatial limitations as directed by regulatory and permitting agencies. Potential mitigation measures for the applicant to consider as license conditions include the following:

- Avoiding construction during the fawning/calving season between May 1 and June 30 and working during daylight hours will decrease impacts to big game.

- Schedule construction after the breeding and nesting seasons of sensitive species observed during the wildlife surveys to avoid indirect mortalities of offspring and nesting adults.

- Refrain from construction activities that encourage raptor perching within 0.8 km [0.5 mi] of the prairie dog colonies.

- Light construction activities in areas near prairie dog colonies should be limited to the nonbreeding season of the mountain plover and burrowing owl.

- Install temporary fences over and around open water or sludge containers used for drilling to reduce impacts of drowning

- BLM recognizes a buffer distance of 0.8 km [0.5 mi] between raptor nest sites and disturbance as adequate.

- Complete construction activities in areas with suitable migratory waterfowl and shorebird habitat during the late fall and winter after the water source has dried up after most migratory species have left the project area for southern wintering grounds.

4.1.5.5 References

BLM. "Sensitive Plant Species." 2009. <http://www.blm.gov/wy/st/en/programs/plant_conservation/Sensitive.html> (18 September 2009).

Garden Guides. "Wyoming Big Sagebrush—Plant Information, *Artemisia tridentata ssp. wyomingensis.*" <http://www.gardenguides.com/plants/ plant.asp?symbol=ARTRW8> (20 September 2009).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August 2008.

WGFD. "Recommendations for Development of Oil and Gas Resources Within Important Wildlife Habitats." Cheyenne, Wyoming: WFGD. May 2009.

WGFD. "Sage-Grouse Habitat Management Guidelines for Wyoming." J. Bohne, T. Rinkes, S. Kilpatrick, eds. Cheyenne, Wyoming: WGFD. July 24, 2007.

WGFD. "Conservation Assessment of Greater Sage-grouse and Sagebrush Habitats." J.W. Connelly, S.T. Knick, M.A. Schroeder, and S.J. Stiver, eds. Cheyenne, Wyoming: Western Association of Fish and Wildlife Agencies. Unpublished Report. June 2004.

4.1.6 Air Quality Impacts

4.1.6.1 Construction Phase

Analyses of air quality impacts expected during the construction phase are presented in GEIS Section 4.2.6.1 (NRC, 2009). Potential impacts were assessed by examining the air quality of the region and representative nonradiological air emissions. NAAQS) attainment status and contained no Prevention of Significant Deterioration Class I areas. The nonradiological emissions in this phase include particulates (fugitive dust) and gaseous (combustion products) emissions. Most of the combustion emissions are expected to be from diesel engines and of short duration. The representative particulate and combustion product emission levels used in the GEIS were below the major source threshold for NAAQS attainment areas and complied with applicable regulatory limits. The representative particulate matter annual average concentration was under 2 percent of the federal and state ambient air standards and also under 2 percent of the applicable Class II Prevention of Significant Deterioration allowable increment. The representative sulfur dioxide annual average concentration was under 1 percent of the federal and state ambient air standards and also under 1 percent of the applicable Class II Prevention of Significant Deterioration allowable increment. The representative nitrogen oxide annual average concentration was slightly over 2 percent of the federal and state ambient air standards and less than 9 percent of the applicable Class II Prevention of Significant Deterioration allowable increment. ISR facility emission levels would be expected to comply with any applicable restrictions such as permit conditions. Based on this evaluation, the NRC staff concluded in the GEIS that nonradiological air impacts from ISR facilities in the Wyoming West Uranium Milling Region during construction would be small.

As noted in Section 3.6.2 of this report, the NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined ... **[Note: The air quality impact assessment is incomplete due to incomplete foundational information. This section will be expanded or modified based on responses to the following: RAI AQ-1 (provide NAAQS compliance status), AQ-3 (provide fugitive dust emission levels for all ISR phases), and RAI AQ-4 (provide emission estimates for nonradiological contaminants other than fugitive dust for all ISR phases)].**

Uranium One should consider implementing mitigation measures to reduce air quality impacts. If WDEQ issues an air permit for the proposed facility, Uranium One may be required to mitigate certain air quality impacts under conditions imposed by the permit. Section 4.6.1 of the ER identifies the use of water on unpaved roads to mitigate fugitive dust generation (Uranium One, 2008). **[RAI AQ-3 to expand the description of the fugitive dust mitigation for unpaved roads to address the implementation requirements and effectiveness.]** Other mitigation measures include implementing speed limits on unpaved roads, coordinating dust-producing activities, using vehicles that meet applicable emission standards, reclaiming or revegetating disturbed areas, using particle traps or other pollution abatement systems on diesel equipment, using properly tuned and maintained equipment, using ultra-low sulfur diesel fuel, avoiding unnecessary idling of operating equipment, and using newer and cleaner equipment.

4.1.6.2 Operation Phase

Analyses of air quality impacts expected during the operation phase are presented in GEIS Section 4.2.6.2 (NRC, 2009). The operation phase would introduce new potential sources of nonradiological emissions including liquefied gases (such as oxygen and carbon dioxide) used in the lixiviant that come out of solution and gases in the underground environment that are

mobilized. Low volumes of these gases could be emitted from pipeline relief valves in the well fields, or during resin transfer or elution, and would disperse rapidly in the atmosphere. Nonradiological gaseous effluents produced by yellowcake drying operations would be treated by engineering controls or minimized by using vacuum dryers. The nonradiological emissions during operation may also include particulates (fugitive dust) and gaseous (combustion products) emissions from the same sources as the construction phase. However, the operations phase would use the existing infrastructure, and emissions would not include fugitive dust and diesel emissions associated with well field construction. Therefore, impacts are less than during the construction phase. Operating ISR facilities are not major point source emitters and are not expected to be classified as major sources under the operation (Title V) permitting program. Facility emissions would be expected to comply with any applicable licensing conditions. Based on this evaluation, the NRC staff concluded in the GEIS that nonradiological air impacts from ISR facilities in the Wyoming West Uranium Milling Region during operation would be small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined ... **[Note: The air quality impact assessment is incomplete due to incomplete foundational information. This section will be expanded or modified based on responses to the following: RAI AQ-1 (provide NAAQS compliance status), RAI AQ-2 (provide technical basis for fugitive dust analyses for the operational phase), and RAI AQ-4 (provide emission estimates for nonradiological contaminants other than fugitive dust for all ISR phases)].**

Uranium One should consider implementing mitigation measures to reduce air quality impacts. If WDEQ issues an air permit for the proposed facility, Uranium One may be required to mitigate certain air quality impacts under conditions imposed by the permit. Many of the mitigation measures identified for the construction phase would also apply to the operation phase.

4.1.6.3 Aquifer Restoration Phase

Analyses of air quality impacts expected during the restoration phase are presented in GEIS Section 4.2.6.3 (NRC, 2009). Potential nonradiological air impacts during aquifer restoration would include fugitive dust and vehicle emissions from many of the same sources identified for the construction phase. The plugging and abandonment of production and injection wells use equipment that generates gaseous emissions. The aquifer restoration phase would use the existing infrastructure, and the impacts would not be expected to exceed those of the construction phase. Therefore, the GEIS concluded that aquifer restoration phase impacts to air quality would be small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined ... **[Note: The air quality impact assessment is incomplete due to incomplete foundational information. This section will be expanded or modified based on responses to the following: RAI AQ-1 (provide NAAQS compliance status), AQ-3 (provide fugitive dust emission levels for all ISR phases), and RAI AQ-4 (provide emission estimates for nonradiological contaminants other than fugitive dust for all ISL phases)].**

Uranium One should consider implementing mitigation measures to reduce air quality impacts. If WDEQ issues an air permit for the proposed facility, Uranium One may be required to mitigate certain air quality impacts under conditions imposed by the permit. Mitigation measures identified for the construction phase would also apply to the aquifer restoration phase.

4.1.6.4 Decommissioning Phase

Analyses of air quality impacts expected during the restoration phase are presented GEIS Section 4.2.6.3 (NRC, 2009). Potential impacts to air quality during the decommissioning phase would include fugitive dust, vehicle emissions, and diesel emissions from many of the same sources identified for the construction phase. In the short term, emission levels may increase, especially for particulate matter from activities such as dismantling buildings and milling equipment, removing contaminated soil, and grading the surface as part of reclamation activities. Potential impacts from decommissioning activities would be expected to be similar to construction phase impacts and would decrease as decommissioning proceeds. Therefore, the GEIS concluded that decommissioning phase impacts to air quality would be small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined ... **[Note: The air quality impact assessment is incomplete due to incomplete foundational information. This section will be expanded or modified based on responses to the following: RAI AQ-1 (provide NAAQS compliance status), AQ-3 (provide fugitive dust emission levels for all ISR phases), and RAI AQ-4 (provide emission estimates for nonradiological contaminants other than fugitive dust for all ISL phases)].** Uranium One should consider implementing mitigation measures to reduce air quality impacts. If WDEQ issues an air permit for the proposed facility, Uranium One may be required to mitigate certain air quality impacts under conditions imposed by the permit. Mitigation measures identified for the construction phase would also apply to the decommissioning phase.

4.1.6.5 References

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August 2008.

4.1.7 Noise Impacts

4.1.7.1 Construction Phase

Analysis of impacts and representative noise ranges that are expected during the construction phase are presented in GEIS Section 4.2.7.1 (NRC, 2009). Potential impacts were evaluated based on the level of background noise in rural, undeveloped areas. Traffic noise during construction (commuting workers, truck shipments to and from the facility, and construction equipment such as trucks, bulldozers, and compressors) would be localized, limited to highways in the vicinity of the site, secondary roads to the site, and access roads within the site and in the well fields. Because noise levels generally decrease with distance from the source, ambient noise levels would return to background levels at distances more than 300 m [1,000 ft]. Traffic noise is usually not a serious problem for people who live more than 150 m [500 ft] from heavily traveled freeways or more than 30 to 60 m [100 to 200 ft] from lightly traveled roads (Federal Highway Administration, 1995). During construction, worker hearing would be protected by compliance with Occupational Safety and Health Administration (OSHA) noise regulations. Also, wildlife would be anticipated to avoid areas where noise-generating activities were ongoing. Potential impacts to wildlife from noise are discussed in the Ecological Impacts section.

Based on this evaluation, the NRC staff concluded in the GEIS that noise impacts from ISR facilities in the Wyoming West Uranium Milling Region during construction would be SMALL and temporary or intermittent (traffic) for residences, communities, or sensitive areas that are located more than about 300 m [1,000 ft] from the noise-generating activities, but may be MODERATE for lightly traveled rural roads through less populated communities such as Bairoil, Muddy Gap, and Lamont.

The NRC staff review of noise in Uranium One's ER (Uranium One, 2008) for the Antelope and JAB Uranium Project is described in Section 3.7. Staff determined that expected noise levels generated during construction would be noticeable in proximity to operating equipment but would be temporary, typically during the daytime only. A site visit by NRC staff confirmed the GEIS evaluation of traffic-related noise levels is applicable to the Antelope and JAB Uranium Project site and its environs. In particular, Bairoil and Lamont would experience noticeable increase in traffic due to worker commute and equipment shipments. Therefore, the NRC staff concludes that the overall noise impacts during construction at the Antelope and JAB Uranium Project would be SMALL ... **[pending response to RAI Noise-1]**.

The Antelope and JAB Uranium Project should consider implementing mitigation measures to reduce the significant impacts to noise receptors during construction. These measures would reduce the noise impacts during the construction phase and remain applicable to the currently proposed project. Uranium One and its contractors should utilize the quietest equipment available, and all internal-combustion-powered equipment shall be equipped with properly operating mufflers and kept in tune to avoid backfires. In addition, if exposed, engines should be fitted with protective shrouds to reduce motor noise. Where feasible, electricity should be obtained from the local power grid to avoid the use of portable generators. Uranium One should appoint a disturbance coordinator for responding to noise complaints. The name and telephone number of this appointee should be clearly posted at the construction site.

4.1.7.2 Operation Phase

Analysis of impacts and representative noise ranges that are expected during the operation phase are presented in GEIS Section 4.2.7.2. The noise sources in the well fields would be groundwater pumps and occasional truck traffic for performing maintenance and inspections. Additional noise would be associated with equipment operation at the central processing facility. Well field and processing plant equipment would be operated inside buildings, thus reducing sound levels to offsite receptors. Short-term noise would be generated by trucks transporting uranium-loaded resins to the central processing facility and shipping yellowcake from the project site. Traffic noise from commuting workers and trucks would be localized, limited to highways in the vicinity of the site, access roads within the site, and roads in well fields. Relative increases in traffic levels would be small for larger roads, but may be moderate for lightly traveled rural roads through less populated communities. Most noise would be generated indoors and controlled in accordance with OSHA regulations. Thus, potential noise impacts during the operation phase are anticipated to be less than construction phase impacts.

Based on this evaluation, the NRC staff concluded in the GEIS that noise impacts during operation of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL and temporary. Because the operation phase activities and characteristics of the proposed project are consistent with those evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the proposed project. Therefore, the NRC staff concludes that the overall noise

impacts during operation at the Antelope and JAB Uranium Project would be ... **[pending response to RAI Noise-1].**

4.1.7.3 Aquifer Restoration Phase

Analysis of impacts and representative noise ranges that are expected during the aquifer restoration phase are presented in GEIS Section 4.2.7.3. Noise generation during aquifer restoration will be mostly in the well fields. Cement mixers, compressors, and pumps would be the largest contributors to noise, but would be operated only for a relatively short daytime duration. Noise generated during the aquifer restoration phase is expected to be less than noise generated during the construction or operations phases. However, aquifer restoration activities may continue over much of the life of the ISR project as operations are completed in different well fields. Based on this evaluation, the NRC staff concluded in the GEIS that noise impacts from ISR facilities in the Wyoming West Uranium Milling Region during the aquifer restoration phase would be SMALL to MODERATE.

Because the aquifer restoration phase activities and characteristics of the proposed project are consistent with those evaluated in the GEIS, the staff concludes the GEIS impact analysis is applicable to the proposed project. Also, the NRC staff reviewed the ER for the Antelope and JAB Uranium Project and determined that noise during aquifer restoration would be generated typically during the daytime only. Therefore, the NRC staff conclude that the overall noise impacts during aquifer restoration would be ... **[pending response to RAI Noise-1]**.

4.1.7.4 Decommissioning Phase

Analysis of impacts and representative noise ranges that are expected during the decommissioning phase is presented in GEIS Section 4.2.7.4. General noise levels during decommissioning would be noticeable only in proximity to operating equipment and would be temporary, typically during the daytime only. Equipment used to dismantle buildings and milling equipment, remove contaminated soils, or grade the surface as part of reclamation activities would generate noise levels that would exceed the background. Once decommissioning and reclamation activities are complete, noise levels would return to baseline, with occasional vehicle traffic for any longer term monitoring activities. Based on this evaluation, the NRC staff concluded in the GEIS that noise impacts during decommissioning of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL.

Because the decommissioning phase activities and characteristics of the proposed project are consistent with those evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the proposed project. Also, the NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined that the GEIS evaluation of noise levels during decommissioning is applicable to the Antelope and JAB Uranium Project site and its environs. Therefore, the NRC staff conclude that the overall noise impacts during decommissioning of the Antelope and JAB Uranium Project would be ... **[pending response to RAI Noise-1]**.

4.1.7.5 References

Federal Highway Administration. "Highway Traffic Noise Analysis and Abatement Policy and Guidance." Washington, DC: Federal Highway Administration Office of Environment and Planning Noise and Air Quality Branch, Department of Transportation. 1995.

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August, 2008.

4.1.8 Historical and Cultural Resources Impacts

4.1.8.1 Construction Phase

An analysis of the historic and cultural resources impacts anticipated during the construction phase is presented in GEIS Section 4.2.8.1 (NRC, 2009). Most of the potential for significant adverse effects to National Register of Historic Places (NRHP)-eligible or potentially NRHP-eligible historic properties and traditional properties will likely occur during land-disturbing activities related to building an ISR uranium recovery facility. Buried cultural features and deposits that were not visible on the surface during initial cultural resources inventories might also be discovered during earth-moving activities.

Indirect impacts may also occur outside the ISR project area and related facilities and components. Visual intrusions, increased access to formerly remote or inaccessible resources, impacts to traditional cultural properties and culturally significant landscapes, as well as other ethnographically significant cultural landscapes may adversely affect these resources. These significant cultural landscapes should be identified during literature and records searches and may require additional archival, ethnographic, or ethnohistorical research that encompasses areas well outside the area of direct impacts. Indirect impacts to some of these cultural resources may be unavoidable and exist throughout the life cycle of an ISR project.

Because of the localized nature of land-disturbing activities related to construction, impacts to cultural and historical resources are anticipated to be small, unless the facility is located adjacent to a known resource. Wyoming historical sites listed in the NRHP and traditional cultural properties are provided in GEIS Section 3.2.8.4. In terms of cultural resources, the most significant impacts to sites that are present will occur during the initial construction within the area of potential effect. Based on this evaluation, the NRC staff concluded in the GEIS that subsequent changes in the footprint of the project (i.e., expansion outside of the original area of potential effect) may also result in significant impacts depending on the presence or absence of cultural and historical resources at a specific site.

The NRC staff reviewed the ER for the proposed project and determined that it is possible to avoid the historic and cultural resources currently listed or eligible for listing on NRHP that were identified during the cultural resources investigations of the Antelope and JAB Uranium Project area (see Section 3.8.1 of this report). Therefore, the NRC staff conclude that the overall impacts to cultural and historic resources during the construction phase at the proposed project would be SMALL.

4.1.8.2 Operation Phase

Potential impacts possible during the operation phase are presented in GEIS Section 4.2.8.2. Overall impacts to cultural and historical resources during operations would be expected to be less than those during construction, as the operation phase is generally limited to previously disturbed areas (e.g., access roads, central processing facility, well sites). Based on this

evaluation, the NRC staff conclude in the GEIS that cultural and historic impacts during operation of ISR facilities in the Wyoming West Uranium Milling Region would be small.

The NRC staff reviewed the ER for the proposed project and determined that it is possible to avoid the historic and cultural resources currently listed or eligible for listing on NRHP, identified during the cultural resources investigations of the Antelope and JAB project area (Section 3.8.1). Therefore, the NRC staff concluded that the overall impacts to cultural and historic resources during the operation phase at the proposed project would be SMALL.

4.1.8.3 Aquifer Restoration Phase

Analysis of the historic and cultural resources impacts possible during the aquifer restoration phase are presented in GEIS Section 4.2.8.3. Overall impacts to cultural and historical resources during aquifer restoration would be expected to be less than those during construction, as aquifer restoration activities are generally limited to the existing infrastructure and previously disturbed areas (e.g., access roads, central processing facility, well sites). Based on this evaluation, the NRC staff concluded in the GEIS that cultural and historic impacts during aquifer restoration in the Wyoming West Uranium Mining Region would be small. The NRC staff reviewed the ER for the proposed project (Section 3.8.1) and determined that it is possible to avoid the historic and cultural resources currently listed or eligible for listing on NRHP that were identified during the cultural resources investigations of the Antelope and JAB Uranium Project area. Therefore, the NRC staff conclude that the overall impacts to cultural and historic resources during the aquifer restoration phase at the proposed project would be SMALL.

4.1.8.4 Decommissioning Phase

Analysis of the historic and cultural resources impacts possible during the decommissioning phase are presented in GEIS Section 4.2.8.4. Historic and cultural resources impacts during decommissioning would be expected to be less than those during construction as decommissioning activities are generally limited to previously disturbed areas (e.g., access roads, central processing facility, well sites). Because cultural resources within the existing area of potential effect are known, potential impacts can be avoided or lessened by redesign of decommissioning project activities. As a result, the overall impacts to historic and cultural resources from decommissioning would be expected to be small.

The NRC staff reviewed the ER for the proposed project (Section 3.8.1) and determined that it is possible to avoid the historic and cultural resources currently listed or eligible for listing on NRHP, identified during the cultural resources investigations of the Antelope and JAB Uranium Project area. Therefore, the NRC staff conclude that the overall impacts to cultural and historic resources during decommissioning at the proposed project would be SMALL.

4.1.8.5 Reference

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington DC: NRC. May 2009.

4.1.9 Visual/Scenic Resources Impacts

4.1.9.1 Construction Phase

Analysis of impacts to visual resources that are expected during the construction phase are presented in GEIS Section 4.2.9.1 GEIS (NRC, 2009). Potential impacts were compared to the typical baseline visual landscape of rural areas. During construction, most impacts would result from drilling equipment, earth moving equipment, and well field development, presenting the most dramatic contrast against the existing landscape. Section 4.2.9.1 of the GEIS describes the number of drill rigs likely to be operating, the size of typical drill rigs, possible night drilling operations, and dust that would be expected during the construction phase. Because of the generally rolling topography, most visual impacts during construction would not be expected to be visible from more than about 1 km [0.6 mi]. Based on this evaluation, the NRC staff concluded in the GEIS that visual and scenic impacts from ISR facilities in the Wyoming West Uranium Milling Region during construction would be SMALL.

The NRC staff reviewed Uranium One's ER (Uranium One, 2008) and visited the proposed site for the Antelope and JAB Uranium Project. The proposed Lander regional management plan discussed in Section 3.9 identifies scenic quality and visual resource management (VRM) classes for the project area that are more restrictive than reported in Uranium One's ER and the GEIS **[RAI Visual-1 to provide basis for VRM classification]**.

The following descriptions outline the level of change acceptable for each of the VRM classes identified for the project area:

- **Class II Objective:** To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.
- **Class III Objective:** To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.
- **Class IV Objective:** To provide for management activities that require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

Changes to the characteristic landscape during the construction phase are imminent. Such landscape changes during the construction phase may dominate the view and be the major focus of viewer attention. The level of contrast to the landscape would be moderate to high until construction activities cease. BLM's Contrast Rating System Manual 8431 (BLM, 1980) provides a systematic means to evaluate proposed projects and determine whether proposed activities conform to the above VRM class objectives. According to the contrast rating analysis conducted for the project area, the construction phase [would/would not] conform to VRM Class II and III objectives ... **[RAI Visual-2 to provide contrast rating analysis]**. Based on this evaluation the NRC staff conclude that the overall visual impacts during construction at the Antelope and JAB Uranium Project would be ... **[pending response to RAI Visual-1, -2, -3]**.

4.1.9.2 Operation Phase

Analysis of visual and scenic impacts that are expected during the operation phase are presented in GEIS Section 4.2.9.2. The visual and scenic impacts would be from long-term structures, roads, well sites, overhead power lines, storage pads, retention or evaporation

ponds, and monitoring wells. Short-term impacts would be from maintenance and inspections. Impacts to offsite users would be localized, limited to users on roads in the vicinity of the project area. Any indirect effects to offsite users are expected to be minimal because of the low profile of the well field infrastructure and reduced visual contrast of the facility structures once mitigation measures have been applied (paint; sodium vapor fully shielded, down-facing lights; vegetation and topographic screens; irregular design; removal of construction debris). Thus, visual and scenic impacts during the operation phase at the Antelope and JAB Uranium Project would be expected to be less than during the construction phase.

Based on this evaluation, the NRC staff concluded in the GEIS that visual and scenic impacts during operation of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL. Because the operation phase activities and characteristics of the proposed project are consistent with those evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the Antelope and JAB project. Therefore, the NRC staff conclude that the overall visual and scenic impacts during operations at the Antelope and JAB Uranium Project would be ... **[pending response to RAI Visual-1, -2, -3]**.

4.1.9.3 Aquifer Restoration Phase

Analyses of visual and scenic impacts that are expected during the aquifer restoration phase are presented in GEIS Section 4.2.9.3. The greatest source of visual contrast during aquifer restoration would be from equipment used when production and injection wells are plugged and abandoned. These activities would not involve active drilling and would be temporary. Because aquifer restoration activities use the same infrastructure, additional visual and scenic impacts are not anticipated. However, aquifer restoration activities may continue over much of the life of the ISRL project as operations are completed in different well fields. Based on this evaluation, the NRC staff concluded in the GEIS that visual and scenic impacts from ISL facilities in the Wyoming West Uranium Milling Region during the aquifer restoration phase would be SMALL.

Because the aquifer restoration phase activities and characteristics of the proposed project are consistent with those evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the Antelope and JAB Uranium Project. Also, the NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Uranium Project and determined that visual and scenic impacts during aquifer restoration would be similar to the operation phase. Therefore, the NRC staff conclude that the overall visual and scenic impacts during aquifer restoration would be ... **[pending response to RAI Visual-1, -2, -3]**.

4.1.9.4 Decommissioning Phase

Analysis of visual and scenic impacts that are expected during the decommissioning phase are presented in GEIS Section 4.2.9.4. During decommissioning and reclamation, temporary impacts to the visual landscape would be expected to be MODERATE and similar to those during the construction period. Although temporary, the equipment used to dismantle buildings and milling equipment, remove contaminated soil, or grade the surface as part of reclamation activities would generate visual contrasts. Once decommissioning and reclamation activities are complete, the visual landscape would return near baseline, with occasional equipment present for longer term monitoring activities. Some roadside cuts, hill slope modifications, and areas where vegetation has not been well established may vary visually from the surrounding sagebrush communities and persist beyond decommissioning and reclamation. However, this would not distract from visual resources associated with recreation such as hunting and using the Continental Divide National Scenic Trail. Based on this evaluation, the NRC staff concluded

in the GEIS that total visual and scenic impacts during decommissioning of ISR facilities in the Wyoming West Uranium Milling Region would be SMALL.

Because similar decommissioning activities proposed for the project were analyzed in the GEIS, the NRC staff has determined that the GEIS evaluation of visual and scenic impacts during the decommissioning phase is applicable to the Antelope and JAB Uranium Project site and its environs Therefore, the NRC staff concludes that the overall visual and scenic impacts during decommissioning of the Antelope and JAB Uranium Project would be ... **[pending response to RAI Visual-1, -2, -3]**.

4.1.9.5 Reference

BLM. "Visual Resource Contrast Rating." Manual 8431. Washington, DC: BLM. 1980. <http://www.blm.gov/nstac/VRM/8431.html?>

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August, 2008.

4.1.10 Socioeconomic Impacts

A summary of socioeconomic conditions in the project region is provided in Section 3.10 of this report.

4.1.10.1 Construction Phase

Analysis of socioeconomic impacts expected during the construction phase is presented in GEIS Section 4.2.10.1 (NRC, 2009). Potential impacts to demographics were analyzed based on a skilled workforce from outside of the Wyoming West Uranium Milling Region with a peak workforce of 200. Impacts would be greatest for communities with small populations, such as Carbon County (population 15,600) and the town of Bairoil (100). However, due to the short duration of construction (12–18 months), workers would have only a limited effect on public services and community infrastructure. Further, construction workers are less likely to relocate their entire family to the region, thus minimizing impacts from an outside workforce. Based on this evaluation, the NRC staff concluded in the GEIS that construction impacts to demographics would be small to moderate.

Potential impacts to housing from construction activities described in the GEIS were concluded to be small to moderate. The majority of construction workers would most likely use temporary housing such as apartments, hotels, or trailer camps. Many construction workers use personal trailers for housing on short-term projects. Impacts on the region's housing market would therefore be considered small. However, the impact upon specific facilities (apartment complexes, hotels, or campgrounds) could potentially be moderate, if construction workers concentrated in one general area.

Analysis of impacts to employment structure from construction activities, as described in the GEIS would be greatest to communities with high unemployment rates, due to the potential increase in job opportunities. Assuming the majority of employment requirements for

construction is filled by outside workers (a peak of 200), the NRC concluded that there would be small to moderate impacts to employment structure. The use of an outside workforce would be expected to have moderate impacts to communities with high unemployment rates, due to the potential increase in job opportunities. If the majority of construction activities relies on the use of a local workforce, impacts would be anticipated to be small to moderate depending upon the size of the local workforce. Analysis of construction impacts to local finance as described in the GEIS would be affected by ISR construction through additional taxation and the purchase of goods and services. Though Wyoming does not have an income tax, it does have a state sales tax (4 percent), a lodging tax (2–5 percent), and a use tax (5 percent). Construction workers are anticipated to contribute to these as they purchase goods and services within the region and within the state while working on an ISR facility. In addition, and more significant, is the "ad valorem tax" the state imposes on mineral extraction. In 2007 for uranium alone, the state collected $1.2 million from this tax (Wyoming Department of Revenue, 2008). Based on this information, NRC staff concluded that ISR facility development could have a moderate impact on local finances within the region.

Potential impacts to education from construction activities as described in the GEIS would be considered small. This is because construction workers are less likely to relocate their entire family for a relatively short duration (12–18 months).

Analysis of construction impacts to local health services as described in the GEIS was concluded to be small. Potential accidents resulting from construction of an ISR facility are not expected to be different than those from other types of similar industrial facilities.

The NRC staff reviewed Uranium One's ER (Uranium one, 2008) for the Antelope and JAB Uranium Project and determined that socioeconomic impacts from construction activities to demographics, income, housing, employment structure, local finance, education, and health and social services would be ... **[pending response to RAIs requesting socioeconomic data for the nearby towns and counties]**.

4.1.10.2 Operation Phase

Analysis of socioeconomic impacts expected during the operation phase is presented in GEIS Section 4.2.10.2. Potential impacts to demographics were analyzed based on requirements of an ISR to use specialized workers, such as plant managers, technical professionals, and skilled tradesmen; operating ISR generally requires a labor force of 50 to 80 personnel. If the majority of operational requirements is filled by a workforce from outside the region, assuming a multiplier of about 0.7, there could be an influx of between 35 and 56 jobs per ISR facility (up to 140, including families). Based on this information, the NRC staff concluded that the potential impact to the local population and public services resulting from the influx of workers and their families would range from small to moderate, depending upon the location (proximity to a population center) of an ISR within the region.

Potential impacts to housing from operation activities described in the GEIS were concluded to be small to moderate. It is assumed that as many as 56 families (80 workers × 0.7 economic multiplier) would be required to relocate into the Wyoming West Uranium Milling Region and that the most likely available housing markets would be located in the larger communities such as Lander, Riverton, and Rawlins. Analysis of operation impacts to income and the labor force structure within the Wyoming West Uranium Milling Region as described in the GEIS would be similar to construction impacts, but longer in duration. Based on this information, NRC

concluded that impacts from ISR operation would be small to moderate, depending on where the majority of the workforce settles.

Potential operational impacts to employment structure as described in the GEIS were concluded to be small to moderate. If a local workforce is used, there would be small impacts to the local employment structure similar to construction impacts. If the entire labor force for the ISR facility came from outside the affected community, the workforce would be small to moderate relative to the employment structure for most of the affected counties. Impacts from inflow of an outside workforce would be similar to construction impacts.

Analysis of operational impacts to education was concluded to be small in the GEIS. Even though the number of people associated with an ISR facility workforce could be as many as 140 (including families), there would only be about 30 school-aged children involved. While the influx of new students would be the greatest in the smaller school districts, even in these districts the impacts are anticipated to be small. For example, the city of Lander has one school district with 1,930 students (elementary through high school) in 12 schools. With an average of 160 students per school, even if all the ISR workers' children attended the same school (which is unlikely), the increase in that school's student population would be less than 20 percent.

Potential operational impacts to community services (e.g., health care, utilities, shopping, recreation) as described in the GEIS were concluded to be similar to construction (less in volume/quantity, but longer in duration). Therefore, the potential impacts would be small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined that socioeconomic impacts from operational activities to demographics, income, housing, employment structure, local finance, education, and health and social services would be ... **[pending response to RAIs requesting socioeconomic data for the nearby towns and counties]**.

4.1.10.3 Aquifer Restoration Phase

Analysis of socioeconomic impacts expected during the aquifer restoration phase is presented in GEIS Section 4. 2.10.3. The GEIS concluded that the same ISR facility components and workforce would be involved in aquifer restoration as during operations use. Thus, the number of personnel involved would also be the same and the potential impacts would be similar. These potential impacts would extend beyond the life of the facility (typically 2–10 years) and were concluded to be small.

According to the GEIS, income and labor force requirements during aquifer restoration would be anticipated to be the same as during operations (technical requirements are similar), and therefore potential impacts were concluded to be small.

Potential impacts to employment structure during aquifer restoration were described in the GEIS to be unchanged both during and after the operational phase. However, a smaller number of specialized workers would be required to return the site to pre-ISL levels. The potential impacts to the region were concluded to be small.

According to the GEIS, impacts to housing, education, health, and social services during aquifer restoration would also be expected to be similar to operations, but continue beyond the life of the site. The overall potential impacts were concluded to be small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined that socioeconomic impacts from aquifer restoration activities to demographics, income, housing, employment structure, local finance, education, and health and social services would be ... **[pending response to RAIs requesting socioeconomic data for the nearby towns and counties]**.

4.1.10.4 Decommissioning Phase

Analysis of socioeconomic impacts expected during the decommissioning phase is presented in GEIS Section 4.2. 10.4. The GEIS concluded that a workforce (up to 200 personnel) with similar skills as the construction phase would be expected. The impacts to affected communities in the Wyoming West Uranium Milling Region during decommissioning would therefore be similar to the construction phase. The decommissioning phase may last up to a year longer than the construction phase, depending upon the condition of the ISL at termination. Therefore, the GEIS concluded that the overall potential impacts would be expected to be small to moderate.

According to the GEIS, the income levels and labor force requirements during decommissioning are also anticipated to be similar to the construction phase, and the potential impacts to the region would therefore be considered small to moderate.

The GEIS concluded that the employment structure during decommissioning would be similar to the construction phase; however, a reduction of the workforce would result toward the end of the decommissioning phase. Therefore, the GEIS concluded that impacts to employment would be small to moderate.

Potential impacts to housing during the decommissioning phase as discussed in the GEIS would be similar to the construction phase and would be SMALL for the larger communities within the region, but may be moderate if the temporary housing was concentrated in a smaller community. Decommissioning would be expected to involve similar numbers (up to 200) of workers (likely without families because of the short duration of the activity) as construction. Therefore, the GEIS concluded that the anticipated impacts to the local education system would be small.

According to the GEIS, impacts to community services (health care, entertainment, shopping, recreation) would also be similar to construction, and thus, would be considered small.

The NRC staff reviewed Uranium One's ER for the Antelope and JAB Uranium Project and determined that socioeconomic impacts from decommissioning activities to demographics, income, housing, employment structure, local finance, education, and health and social services would be ... **[pending response to RAIs requesting socioeconomic data for the nearby towns and counties]**.

4.1.10.5 References

NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

Uranium One. "Antelope and JAB Uranium Project, USNRC License Application, Sweetwater County, Wyoming—Environmental Report." Docket No. 040-09079. Casper, Wyoming: Uranium One. August, 2008.

Wyoming Department of Revenue. "State of Wyoming Department of Revenue 2008 Annual Report." Cheyenne, Wyoming: Wyoming De3partment of Revenue. 2008.

4.1.11 Public and Occupational Health and Safety Impacts

4.1.11.1 Construction Phase

Construction activities involve establishing well fields, surface processing structures, and support roads. Fugitive dust and emissions from diesel-powered equipment would result from construction activities and vehicle traffic but would likely be of short duration. According to the GEIS (Section 4.2.11.1), inhalation of fugitive dust would not result in any significant radiological dose (NRC, 2009) and diesel emissions would be readily dispersed into the atmosphere. Therefore, construction would be expected to have a SMALL impact on workers and general public.

4.1.11.2 Operation Phase

4.1.11.2.1 Radiological Impacts to Public and Occupational Health and Safety From Normal Operations

All licensees are required to implement radiological monitoring and safety programs that comply with 10 CFR Part 20 requirements to protect the health and safety of workers and the public. NRC periodically inspects those programs to ensure compliance. Therefore, the following evaluation assumes that operations are controlled by the provisions of the license and that the comprehensive radiological safety program ensures that worker and public doses are below limits and are maintained as low as is reasonably achievable as required by the license.

Radionuclides can be released to the environment during ISL facility operation. Uranium One provides an evaluation of potential consequences of radiological emissions in Section 4.12.2 of the ER (Uranium One, 2008), which indicates the source of radiological releases and locations where radioactive waste is generated. Uranium One plans to dry yellowcake using a rotary vacuum dryer. As stated in the GEIS (Section 4.2.11.2.1), radon gas is emitted from ISR well fields and processing facilities during operations and is the only radiological airborne effluent for those facilities that use vacuum dryer technology during normal operations. Therefore, the impact on public health is limited to an evaluation of the dose to the general public from radon.

It is expected that worker doses from ISR facilities would be similar regardless of the facility's location because workers are expected to be involved in similar activities regardless of geographic location. The GEIS (Section 4.2.11.2.1) provides example doses to workers at a facility that is assumed to be representative of an operating ISR facility because of its many years of operating history. The results of the analysis in the GEIS show that the expected worker doses during normal operations would be a small fraction of the worker dose limits. Similarly, the GEIS provided average and maximum radon progeny exposure levels to workers and demonstrated that these exposures were a small fraction of the occupational exposure limit of 4 working-level months. Therefore, radiological doses to workers from normal operations are expected to have a SMALL impact on the workers.

Section 4.12.2 of the ER (Uranium One, 2008) describes the use of the computer code MILDOS-Area that was used to model radiological impacts on human and environmental receptors (e.g., air and soil) using site-specific data including Radon-222 release estimates, meteorological and population data, and other parameters. The estimated radiological impacts

resulting from routine site activities were compared to applicable public dose limits as well as background dose levels. Additional information on MILDOS-Area is provided in GEIS Section 4.2.11.2.1.

The NRC review of the ER verified that Uranium One modeled appropriate exposure pathways and used input parameters that were reasonable. Uranium One also listed the origin of the input parameters and provided justification for their use. Uranium One described the source terms, and the NRC staff's review indicated that the source terms represented operation at full capacity and consisted of releases from a well field and a stack at the JAB site and releases from two well fields and a stack at the Antelope site. Uranium One calculated the total effective dose equivalent (TEDE) at 16 different compass locations at the site boundary.

Results of Uranium One's modeling indicated that the maximum TEDE was 0.0053 mSv/y [0.53 mrem/y] at the south-southeast boundary of the Antelope site. This represents 0.53 percent of the public dose limit of 1 mSv/y [100 mrem/yr]. Because the nearest resident to the site is located 20 km [12 mi] to the east in the town of Bairoil, the TEDE to the residents of Bairoil would be much less. In addition, the maximum percentage of effluent concentration for Radon-222 with daughters present is 0.02 (Uranium One, 2008).

Because Radon-222 is the only radionuclide emitted during normal operations, the public dose requirements in 40 CFR Part 190 and the 0.1 mSv [10 mrem/yr] dose constraint on air emissions in 10 CFR 20.1101 do not apply. According to Uranium One, even if 100 percent of the Radon-222 contained in production fluids that were released to the atmosphere (instead of 10 percent), the TEDE and Radon-222 air concentrations at directional receptor locations surrounding the facility would be less than the 1 mSv [100 mrem] annual public dose limit and the Radon-222 effluent concentration, respectively as discussed in Section 3.11. Because of the distance to offsite receptors, radiological doses to the public from normal operations are expected to have a SMALL impact on the general public.

4.1.11.2.2 Radiological Impacts to Public and Occupational Health and Safety From Accidents

GEIS Section 4.2.11.2.2 describes and evaluates numerous accident scenarios that could result in impacts to public health and safety and identifies mitigation items for each accident scenario. In addition to the mitigation items, the GEIS states that additional measures would be in place to protect workers and members of the public. Employee personnel dosimetry programs are required. As part of worker protection, respiratory protection programs are in place as well as bioassay programs that detect uranium intake in employees. Contamination control programs involve surveying personnel, clothing, and equipment prior to their removal to an unrestricted area.

The analysis described in the GEIS included accidents involving tank failure or pipe break that spills thickener, a pipe or valve failure at the IX columns used in ISR processing facilities that releases Radon-222, and an explosion in the yellowcake dryer that releases uranium powder. The GEIS concluded that, for these accidents, in the unlikely event of an unmitigated accident, doses to the workers could have a MODERATE impact depending on the type of accident, but doses to the general public would have only a SMALL impact.

In Section 4.12.2.10.1 of the ER, Uranium One described an accident involving a process tank failure (Uranium One, 2008). Uranium One indicated that the plants will be designed to control and confine liquid spills from tanks should they occur. The central plant building structure and

concrete curb are designed to contain the liquid spills from the leakage or rupture of a process vessel and will direct any spilled solution to a floor sump. The floor sump system is designed to direct any spilled solutions back into the plant process circuit or to the waste disposal system. Bermed areas, tank containments, and/or double-walled tanks are designed to perform a similar function for any process chemical vessels located outside the central plant building. However, Uranium One did not perform analyze the likelihood and measures for preventing or containing a multiple tank failure from a single event such as might occur if one failed tank fell into an adjacent tank. Therefore, Uranium One did not include the results of any analysis for a tank failure that was based on other assumptions and an evaluation of the occupational health effects cannot be completed.

Based on the information in the ER and in the GEIS, in the unlikely event of an unmitigated accident and depending on the type of accident, doses to the workers could result in a MODERATE impact to occupational health and safety. However, doses to the general public would result in only a SMALL impact on public health and safety. [Additional information provided by Uranium One may require modification of the severity of the impact on occupational health and safety.]

4.1.11.2.3 Nonradiological Impacts to Public and Occupational Health and Safety From Normal Operations

While hazardous chemicals are used at the proposed Antelope and JAB facilities (Section 2.1.5.2), small risks would be expected in the use and handling of these chemicals during normal operations, provided Uranium One implements all license conditions and administrative and process safety controls. Therefore, impacts from normal operations would be SMALL. However, accidental releases of hazardous chemicals can produce significant consequences and impact public and occupational health and safety. Such hazards and potential risks for impacts are analyzed in the following section.

4.1.11.2.4 Nonradiological Impacts to Public and Occupational Health and Safety From Accidents

In the proposed Antelope and JAB facilities, various chemicals will be used to extract uranium, process wastewater, and restore groundwater quality. These processes are described in Sections 2.3, 2.4, and 2.5 of the ER. The chemicals to be used include strong acids (sulfuric acid and hydrochloric acid), bases (sodium hydroxide and/or ammonia), oxidizers (oxygen and hydrogen peroxide), and various other hazardous chemicals such as hydrogen sulfide, sodium sulfide, and carbon dioxide. In addition to being hazardous, many of these chemicals can react violently if they come into contact with each other and therefore must remain separated at all times. The use of hazardous chemicals at ISR facilities is not regulated by NRC, but rather by other government agencies such as the Mine Safety and Health Administration, the Occupational Safety and Health Administration, and the U.S. Environmental Protection Agency. Applicable regulations that govern the use and handling of these chemicals include

- 40 CFR Part 68, Chemical Accident Prevention Provisions
- 29 CFR 1910.119, Occupational Safety and Health Administration Standards—Process Safety Management of Highly Hazardous Chemicals
- 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response

- 40 CFR Part 355, Emergency Planning and Notification

- 40 CFR 302.4, Designation, Reportable Quantities, and Notification—Designation of Hazardous Substances

Unplanned releases of these chemicals during normal operation is considered unlikely (see Section 4.1.12.3), an accidental release can produce significant consequences and impact public and occupational safety and health. An accident analysis of these chemicals is provided in GEIS Appendix E and will be applicable to the proposed project. Sections 2.3, 2.4, and 2.5 of the ER describe the processes, chemical storage, equipment, materials, and instrumentation to be used in the proposed project facilities. However, specific details are not provided, for example, on the location of storage tanks relative to the facility buildings, the regulations or guidelines to be followed during operation and storage, and the process safety controls to be implemented when handling these chemicals **[RAI HS-3 to provide an expanded description of administrative and process safety controls to be implemented during operation of the proposed facilities]**. This information is needed to evaluate the effectiveness of the proposed safety precautions. Compliance with the necessary safety requirements would reduce the likelihood of a release. Offsite impacts from accidental releases of hazardous chemicals would be SMALL. However, workers involved in emergency response and cleanup could receive MODERATE impacts that would be mitigated by establishing procedures and personnel training requirements.

4.1.11.3 Aquifer Restoration Phase

As stated in the GEIS (Section 4.2.11.3), because some activities during aquifer restoration are similar to operational activities, including operation of well fields and wastewater treatment and disposal, the potential for impacts on public and occupational health and safety is expected to be similar to operational impacts. The reduction of other operational activities, including yellowcake production and drying and remote IX, further limits the relative magnitude of potential worker and public health and safety hazards. Therefore, aquifer restoration is expected to have a SMALL impact on workers (primarily from radon gas) and the general public.

4.1.11.4 Decommissioning Phase

Activities that could lead to environmental impacts during ISR facility decommissioning would be similar to those during aquifer restoration and would be expected to decrease as hazards are removed or reduced, surface soils and structures are decontaminated, and disturbed lands are reclaimed.

To ensure the safety of workers and the public during decommissioning, the NRC requires licensed facilities submit a decommissioning plan for review. The decommissioning plan includes details of how a 10 CFR Part 20-compliant radiation safety program would be implemented during decommissioning to maintain safety of workers and the public and ensure compliance with applicable safety regulations. NRC staff review and approve the decommissioning plan prior to the initiation of decommissioning activities, including the application of site-specific license conditions where necessary. Further, NRC inspection and enforcement activities ensure compliance with radiation safety requirements. These actions constrain the magnitude of potential public and occupational health impacts from ISR facility decommissioning actions. Thus, the impacts on public and occupational health and safety during decommissioning activities are expected to be SMALL.

4.1.11.5 References

NRC. NUREG–1910. "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Washington, DC: NRC. May 2009.

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4.1.12 Waste Management Impacts

The proposed Antelope and JAB Uranium Project facilities would generate radiological and nonradiological liquid and solid wastes that must be handled and disposed properly. This section assesses the potential environmental impacts from waste generation and disposal associated with the proposed project. Uranium One would maintain radiation safety associated with collecting, handling, and storing waste materials, implementing an NRC-approved radiation safety program compliant with the requirements at 10 CFR Part 20 (Section 2.1.10). Transportation impacts associated with waste management are addressed in Sections 4.1.2, 4.2.2, 4.3.2, and 4.4.2 of this report. The impacts from release of airborne effluents are addressed as public and occupational health impacts (Sections 4.1.11, 4.2.11, 4.3.11, and 4.4.11) for radiological effluents and as air quality impacts (Sections 4.1.6, 4.2.6, 4.3.6, and 4.4.6) for nonradiological effluents.

Quantities and compositions of wastes and the waste management practices applicable to the proposed project are described in Section 2.1.8 of this report. Liquid wastes including eluant bleed, production bleed, restoration wastes (including reverse osmosis brine), and collected water (e.g., spills) are proposed to be disposed by deep well injection. Common liquid sewage wastes would be disposed using a septic system. Solid wastes, including spent IX resin, filters, pipes and fittings, and domestic trash, would be segregated as radioactive 11e.(2) byproduct material or noncontaminated solid waste. Soils contaminated above release limits by spills and leaks would also be considered byproduct material **[RAI WM-1 to clarify that soil would be included as byproduct waste]**. All 11e.(2) byproduct material would be packaged and transported to an NRC-licensed facility for disposal. Approximately 380 m^3 [500 yd^3] of solid 11e.(2) byproduct material is estimated to be generated annually by the proposed project (Uranium One, 2008). Approximately 3,060 m^3 [4,000 yd^3] of nonradioactive solid waste would be disposed of at a sanitary landfill permitted by WDEQ. Less than 100 kg [220 lbs] of hazardous waste is expected to be produced (Uranium One, 2008). This hazardous waste would be disposed of at a WDEQ-licensed facility for hazardous waste **[RAI WM-2 to clarify disposal for hazardous wastes]**.

The GEIS evaluated waste management impacts of licensing ISR facilities (NRC, 2009). The waste management activities described in the GEIS, including the types and characteristics of generated waste and the methods used for managing the wastes, are consistent with the site-specific descriptions summarized in Section 2.1.8. An exception is the amount of municipal solid waste evaluated in the GEIS, which is much lower than the estimate of 3,060 m^3 [4,000 yd^3] presented in the ER. The approach and magnitude of the ISR processing activities evaluated in the GEIS are also consistent with the activities included in the proposed project. In particular, the GEIS evaluated facilities that use an alkaline lixiviant based on sodium carbonate-bicarbonate as the complexing agent; apply a standardized approach to IX, elution, precipitation, and drying and packaging; and represent a range of annual uranium production rates up to 2.5 million kg/yr [5.5 million lb/yr] (GEIS Section 2.1.3). The GEIS also evaluated

waste management activities for liquid wastes, including reverse osmosis and deep well injection, and for solid wastes, segregation based on waste characteristics into byproduct, hazardous Resource Conservation and Recovery Act wastes, and ordinary trash categories for disposal.

For the waste management activities and characteristics of the proposed project that are consistent with the activities and characteristics evaluated in the GEIS, the staff conclude the GEIS impact analysis is applicable to the proposed project and therefore the GEIS impact conclusions can be tiered from the GEIS to this site-specific environmental review. The generation of solid wastes from the proposed project are, however, estimated to be much higher than evaluated in the GEIS, therefore, potential solid waste impacts are also evaluated in this review. The following sections summarize the GEIS impact analyses and conclusions from each of the four project phases. These evaluations incorporate additional site-specific details applicable to the proposed project, as needed, to support the site-specific impact conclusions.

4.1.12.1 Construction Phase

The relatively small scale of construction activities (Section 2.1.4) and incremental development of well fields at the proposed project facilities are expected to generate low volumes of construction waste. GEIS Table 2.7-1 lists engine-driven equipment needed to construct a satellite ISR facility, providing insight into the magnitude of well field construction activities. As a result of the limited volumes of construction waste that would be generated during construction of a new ISR facility, waste management impacts from construction would be SMALL. **[RAI WM-3 to provide estimate of construction waste volumes]**.

4.1.12.2 Operation Phase

As discussed in Section 2.1.8, operational wastes are primarily liquid waste streams consisting of process bleed (0.5 to 1.5 percent of the process flow rate) and aquifer restoration water. Wastes would also be generated from well development, flushing of depleted eluant to limit impurities, resin transfer wash, filter washing, uranium precipitation process wastes (brine), and plant washdown water. The methods used for handling and processing these wastes include deep well injection for the process bleed and water treatment (reverse osmosis or electrodialysis reversal) for aquifer restoration waters and maintenance water, followed by deep well injection of the resulting treatment waste and reinjection or deep injection of the treated permeate. The treatment methods are effective at separating wastes to reduce waste volumes destined for deep well disposal and can limit the total amount of water removed from the aquifer. State permitting actions, NRC license conditions, and NRC inspections ensure the proper practices would be used to comply with safety requirements to protect workers and the public.

Deep well injection is a disposal method that requires an UIC permit from WDEQ designed to limit potential impacts to either surface or ground waters. Uranium One must obtain a UIC permit from WDEQ in addition to NRC approval of the license application (GEIS Section 1.7.2) before the proposed project facilities can begin operations. The NRC safety review of the Antelope and JAB Uranium Project license application has also verified Uranium One's plans include sufficient deep well disposal capacity to support the planned processing rate for the operational phase **[Note: must verify this with safety review before final publication].** The National Pollutant Discharge Elimination System permitting process (GEIS Section 1.8) would approve surface discharge of plant runoff to ephemeral stream channels would be approved by.

These permit approval processes provide confidence that potential environmental impacts would be limited.

Solid wastes generated from operations that are classified as 11e.(2) byproduct material would be sent to a licensed facility for disposal. Materials and equipment contaminated with byproduct material would be similarly disposed or decontaminated and released for unrestricted use according to NRC requirements. Before operations could begin, Uranium One would need to have an agreement in place with a licensed disposal facility to accept 11e.(2) byproduct material from facility operations (as well as byproduct materials from aquifer restoration and decommissioning discussed in Sections 4.1.12.3 and 4.1.12.4). NRC regulations (10 CFR Part 40, Appendix A, Criterion 2) require that 11e.(2) byproduct material be disposed at existing disposal sites unless such offsite disposal is impractical or the benefits of onsite disposal clearly outweigh those of reducing the number of waste disposal sites. Having a waste disposal agreement in place before operations begin ensures sufficient disposal capacity for 11e.(2) byproduct material is available throughout the life of the facility.

Nonradioactive hazardous wastes would be segregated and disposed of at a hazardous waste disposal facility. Based on the low estimated volume of hazardous waste, the impacts from disposal of the hazardous wastes would be small.

Nonradioactive, nonhazardous solid wastes are disposed of as ordinary solid waste at a municipal solid waste facility. The municipal solid waste landfill that serves the region where the Antelope and JAB Uranium Project areas are located is in Wamsutter, Wyoming. Reported annual solid waste generation estimates for the district served by this landfill are approximately 500 metric tons/yr [550 tons/yr] (Wyoming State Forestry Division, 2007), while the proposed project estimate is 3,060 m^3/yr [4,000 yd^3/yr] or approximately 1,450 metric tons/yr [1,600 tons/yr], assuming 480 kg/m^3 [800 lb/yd^3] (Wyoming State Forestry Division, 2007) or approximately 3 times the estimated generation rate for the region that the facility serves. Demand for industrial solid waste disposal in the region has used up available capacity at that facility which stopped accepting nonhousehold waste shipments in 2008 (Casper Star Tribune, 2008). Additional solid waste disposal capacity is available in Rock Springs, Wyoming, approximately 110 km [70 mi] farther to the west. The Rock Springs landfill serves a district that is estimated to generate 28,600 metric tons/yr [31,500 tons/yr] (Wyoming State Forestry Division, 2007). The estimated annual solid waste from the proposed project would be about 5 percent of the annual waste accepted at that facility. Therefore, while local disposal capacity is limited, the larger regional area has sufficient capacity to dispose of the proposed wastes.

Overall, operational waste management impacts from the proposed project would be SMALL based on the use of deep well injection for liquid wastes that would require WDEQ permit approval, the waste handling and processing safety measures that comply with an NRC-approved radiation protection plan, the use of required preoperational disposal agreements with licensed facilities for byproduct wastes, the generation of limited quantities of hazardous wastes, and the available landfill capacity for disposal of municipal solid wastes.

4.1.12.3 Aquifer Restoration Phase

Waste management activities during aquifer restoration utilize the same treatment and disposal options implemented for operations; therefore, impacts associated with aquifer restoration would be similar to the operational impacts discussed in Section 4.1.12.2. Additional wastewater volume and the associated volume of water treatment wastes may be generated during aquifer restoration; however, this would be partially offset by reduction in production capacity by

removing a well field from production activities. The NRC safety review of the Antelope and JAB Uranium Project license application has verified Uranium One's plans include sufficient water treatment and deep well disposal capacity to support the planned aquifer restoration activities. **[Note: must verify this with safety review before final publication].** As a result, waste management impacts from aquifer restoration would be SMALL.

4.1.12.4 Decommissioning Phase

There can be small environmental impacts during decommissioning of the Antelope and JAB Uranium Project facilities, even though the overall goal is to reduce impacts by removing facilities and restoring disturbed lands to preoperational conditions.

Waste disposal is an unavoidable impact associated with decommissioning. The 11e.(2) byproduct material from decommissioning the project facilities (including contaminated excavated soil and process equipment) would be disposed at a licensed facility. Having a waste disposal agreement in place before operations begin (as discussed in Section 4.1.12.2) ensures sufficient disposal capacity is available for 11e.(2) byproduct material generated during decommissioning activities.

NRC requires Uranium One to submit a decommissioning plan for NRC review (Section 2.1.7) prior to starting decommissioning activities; this ensures safe handling, storage, and disposal of decommissioning wastes. The decommissioning plan would include details of how Uranium One would implement a 10 CFR Part 20-compliant radiation safety program (Section 2.1.10) during decommissioning to ensure safety of workers and the public is maintained and applicable safety regulations are complied with. Both NRC and Uranium One's actions provide assurance that potential radiation safety impacts associated with waste management during decommissioning are minimized. These actions include (i) Uranium One conducts decommissioning in accordance with an NRC-approved plan; (ii) Uranium One complies with site-specific NRC license conditions, as needed; and (iii) regular NRC inspection activities are performed to determine compliance with the appropriate radiation safety regulations and requirements.

The estimated volume of decommissioning wastes for the proposed Antelope and JAB Uranium Project facilities is provided in Section 2.1.7 of this report. The total volume of estimated byproduct material is approximately [enter number] or about [enter number] truckloads **[RAI WM-3 to provide estimate of decommissioning phase waste volumes to fill in blanks in this section]**. To state this estimate another way, the volume of waste would occupy a hypothetical cube that is approximately [enter number] on each side. This waste would be generated in 2-year phases throughout the project duration as individual well fields are restored and decommissioned. The analyses of transportation impacts (Sections 4.1.2, 4.2.2, 4.3.2, and 4.4.2) address potential impacts from transportation of waste materials. Nonradioactive, nonhazasrdous solid wastes are planned to be reused or disposed of as municipal waste. The total volume of solid municipal decommissioning wastes for the proposed project facilities is approximately [enter number] {e.g., this volume would occupy a hypothetical cube that is approximately [enter number] on each side} or about [enter number] truckloads. The nature of potential impacts associated with disposal of municipal solid wastes from decommissioning would be similar to that described for operations in Section 4.1.12.2 because the waste management practices are the same. The magnitude of municipal solid wastes from decommissioning is [enter larger/smaller] than comparable operational waste volumes but [would/would not] present any unique problems regarding available disposal capacity. The required preoperational agreement for disposal of byproduct material and the [insert small/large

here] volume of solid municipal waste generated for offsite disposal in relation to the disposal capacity suggest the waste management impacts would be SMALL. Related transportation impacts are discussed separately in Sections 4.1.2, 4.2.2, 4.3.2, and 4.4.2.

4.1.12.5 References

Casper Star Tribune. "Wamsutter Landfill Being Strained by Boom." January 16, 2008. <http://www.trib.com/news/state-and-regional/article_711a9c03-df75-5c3b-af10-04cdc2b4fec3.html> (6 October 2009).

NRC. NUREG–1910, "Generic Environmental Impact Statement for *In-Situ* Leach Uranium Milling Facilities." Final Report. Washington, DC: NRC. May 2009.

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Wyoming State Forestry Division. "Wyoming Biomass Inventory: Animal Waste, Crop Residue, Wood Residue, and Municipal Solid Waste." Cheyenne, Wyoming: Office of State Lands and Investments, Wyoming State Forestry Division. March 2007.

4.1.13 Cumulative Effects
4.1.13.1 Concurrent Actions
4.1.13.2 Legacy Mining Activities
4.1.13.3 Reasonably Foreseeable Future Actions
4.1.13.4 References

4.2 Alternative 1 (No Action Alternative)
4.2.1 Land Use Impacts
4.2.1.1 Construction Phase
4.2.1.2 Operation Phase
4.2.1.3 Aquifer Restoration Phase
4.2.1.4 Decommissioning Phase
4.2.1.5 References

4.2.2 Transportation Impacts
4.2.2.1 Construction Phase
4.2.2.2 Operation Phase
4.2.2.3 Aquifer Restoration Phase
4.2.2.4 Decommissioning Phase
4.2.2.5 References

4.2.3 Geology and Soils Impacts
4.2.3.1 Construction Phase
4.2.3.2 Operation Phase
4.2.3.3 Aquifer Restoration Phase
4.2.3.4 Decommissioning Phase
4.2.4.5 References

4.2.4 Water Resources Impacts
4.2.4.1 Surface Water Impacts
4.2.4.1.1 Construction Phase
4.2.4.1.2 Operation Phase
4.2.4.1.3 Aquifer Restoration Phase
4.2.4.1.4 Decommissioning Phase
4.2.4.1.5 References
4.2.4.2 Groundwater Impacts
4.2.4.2.1 Construction Phase
4.2.4.2.2 Operation Phase
4.2.4.2.3 Aquifer Restoration Phase
4.2.4.2.4 Decommissioning Phase
4.2.4.2.5 References

4.2.5 Ecological Resources Impacts
4.2.5.1 Construction Phase
4.2.5.2 Operation Phase
4.2.5.3 Aquifer Restoration Phase
4.2.5.4 Decommissioning Phase
4.2.5.5 References

4.2.6 Air Quality Impacts
4.2.6.1 Construction Phase
4.2.6.2 Operation Phase
4.2.6.3 Aquifer Restoration Phase
4.2.6.4 Decommissioning Phase
4.2.6.5 References

4.2.7 Noise Impacts
4.2.7.1 Construction Phase
4.2.7.2 Operation Phase
4.2.7.3 Aquifer Restoration Phase
4.2.7.4 Decommissioning Phase
4.2.7.5 References

4.2.8 Historical and Cultural Resources Impacts
4.2.8.1 Construction Phase
4.2.8.2 Operation Phase
4.2.8.3 Aquifer Restoration Phase
4.2.8.4 Decommissioning Phase
4.2.8.5 References

4.2.9 Visual/Scenic Resources Impacts
4.2.9.1 Construction Phase
4.2.9.2 Operation Phase
4.2.9.3 Aquifer Restoration Phase
4.2.9.4 Decommissioning Phase
4.2.9.5 References

4.2.10 Socioeconomic Impacts
4.2.10.1 Construction Phase
4.2.10.2 Operation Phase
4.2.10.3 Aquifer Restoration Phase
4.2.10.4 Decommissioning Phase
4.2.10.5 References

4.2.11 Public and Occupational Health and Safety Impacts
4.2.11.1 Construction Phase
4.2.11.2 Operation Phase
4.2.11.3 Aquifer Restoration Phase
4.2.11.4 Decommissioning Phase
4.2.11.5 References

4.2.12 Waste Management Impacts
4.2.12.1 Construction Phase
4.2.12.2 Operation Phase
4.2.12.3 Aquifer Restoration Phase
4.2.12.4 Decommissioning Phase
4.2.12.5 References

4.2.13 Cumulative Effects
4.2.13.1 Concurrent Actions
4.2.13.2 Legacy Mining Activities
4.2.13.3 Reasonably Foreseeable Future Actions
4.2.13.4 References

4.3 Alternative 2 (Applicant-Defined Alternative)
4.3.1 Land Use Impacts
4.3.1.1 Construction Phase
4.3.1.2 Operation Phase
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4.3.1.4 Decommissioning Phase
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4.3.2 Transportation Impacts
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4.3.2.2 Operation Phase
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4.3.3 Geology and Soils Impacts
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4.3.3.3 Aquifer Restoration Phase
4.3.3.4 Decommissioning Phase
4.3.3.5 References

4.3.4 Water Resources Impacts
4.3.4.1 Surface Water Impacts
4.3.4.1.1 Construction Phase
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4.3.4.2 Groundwater Impacts
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4.3.4.2.2 Operation Phase
4.3.4.2.3 Aquifer Restoration Phase
4.3.4.2.4 Decommissioning Phase
4.3.4.2.5 References

4.3.5 Ecological Resources Impacts
4.3.5.1 Construction Phase
4.3.5.2 Operation Phase
4.3.5.3 Aquifer Restoration Phase
4.3.5.4 Decommissioning Phase
4.3.5.5 References

4.3.6 Air Quality Impacts
4.3.6.1 Construction Phase
4.3.6.2 Operation Phase
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4.3.6.4 Decommissioning Phase
4.3.6.5 References

4.3.7 Noise Impacts
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4.3.7.3 Aquifer Restoration Phase
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4.3.8 Historical and Cultural Resources Impacts
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4.3.8.3 Aquifer Restoration Phase
4.3.8.4 Decommissioning Phase
4.3.8.5 References

4.3.9 Visual/Scenic Resources Impacts
4.3.9.1 Construction Phase
4.3.9.2 Operation Phase
4.3.9.3 Aquifer Restoration Phase
4.3.9.4 Decommissioning Phase
4.3.9.5 References

4.3.10 Socioeconomic Impacts
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4.3.10.2 Operation Phase
4.3.10.3 Aquifer Restoration Phase
4.3.10.4 Decommissioning Phase
4.3.10.5 References

4.3.11 Public and Occupational Health and Safety Impacts
4.3.11.1 Construction Phase
4.3.11.2 Operation Phase
4.3.11.3 Aquifer Restoration Phase
4.3.11.4 Decommissioning Phase
4.3.11.5 References

4.3.12 Waste Management Impacts
4.3.12.1 Construction Phase
4.3.12.2 Operation Phase
4.3.12.3 Aquifer Restoration Phase
4.3.12.4 Decommissioning Phase
4.3.12.5 References

4.3.13 Cumulative Effects
4.3.13.1 Concurrent Actions
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4.4 Alternative 3 (NRC-Preferred Alternative)

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4.4.1.2 Operation Phase
4.3.1.3 Aquifer Restoration Phase
4.3.1.4 Decommissioning Phase
4.3.1.5 References

4.4.2 Transportation Impacts
4.4.2.1 Construction Phase
4.4.2.2 Operation Phase
4.4.2.3 Aquifer Restoration Phase
4.4.2.4 Decommissioning Phase
4.4.2.5 References

4.4.3 Geology and Soils Impacts
4.4.3.1 Construction Phase
4.4.3.2 Operation Phase
4.4.3.3 Aquifer Restoration Phase
4.4.3.4 Decommissioning Phase
4.4.3.5 References

4.4.4 Water Resources Impacts
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4.4.4.1.3 Aquifer Restoration Phase
4.4.3.1.4 Decommissioning Phase
4.4.3.1.5 References
4.4.4.2 Groundwater Impacts
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4.4.3.2.5 References

4.4.5 Ecological Resource Impacts
4.4.5.1 Construction Phase
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4.4.5.3 Aquifer Restoration Phase
4.4.5.4 Decommissioning Phase
4.4.5.5 References

4.4.6 Air Quality Impacts
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4.4.6.3 Aquifer Restoration Phase
4.4.6.4 Decommissioning Phase
4.4.6.5 References

4.4.7 Noise Impacts
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4.4.7.4 Decommissioning Phase
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4.4.8 Historical and Cultural Resources Impacts
4.4.8.1 Construction Phase
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4.4.8.3 Aquifer Restoration Phase
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4.4.8.5 References

4.4.9 Visual/Scenic Resources Impacts
4.4.9.1 Construction Phase
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4.4.10 Socioeconomic Impacts
4.4.10.1 Construction Phase
4.4.10.2 Operation Phase
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4.4.11 Public and Occupational Health and Safety Impacts
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4.4.12.3 Aquifer Restoration Phase
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4.4.13 Cumulative Effects
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4.4.13.2 Legacy Mining Activities
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4.4.13.4 References

5 ENVIRONMENTAL JUSTICE

6 COST-BENEFIT ANALYSIS

7 CONSULTATIONS

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

9 LIST OF PREPARERS

9.1 U.S. Nuclear Regulatory Commission Contributors

Johari Moore: Project Manager B.S., Physics, Florida A&M University, (b)(6) M.S., Nuclear Engineering and Radiological Sciences, University of Michigan, 2005, 4 yrs of experience

9.2 Southwest Research Institute and Center for Nuclear Waste Regulatory Analyses (CNWRA) Contributors

Darius Daruwalla: Analyst—Occupational Health and Safety (Nonradiological) M.S., Chemical Engineering, State University of New York at Buffalo, 1974 B.S., Chemical Engineering, State University of New York at Buffalo, (b)(6) Years of Experience: 38

James Durham: Analyst—Occupational Health and Safety (Radiological) Ph.D., Nuclear Engineering, University of Illinois, Urbana, 1987 M.S., Nuclear Engineering, University of Illinois, Urbana, 1984 B.S., Nuclear Engineering, University of Illinois, Urbana, (b)(6) Years of Experience: 29

Amy Glovan: Analyst—Ecological Resource, Noise, Visual/Scenic Resources B.A., Environmental Studies, University of Kansas, (b)(6) Years of Experience: 11

Patrick LaPlante: Analyst—Land Use, Transportation and Waste Management M.S., Biostatistics and Epidemiology, Georgetown University, 1994 B.S., Environmental Studies, Western Washington University, (b)(6) Years of Experience: 21

Olufemi Osidele: Principal Investigator Analyst—Surface/Groundwater Ph.D., Environmental Systems Analysis, University of Georgia, 2001 M.Sc., Hydrology, University of London, England, 1992 B.Sc., Civil Engineering, University of Ife, Nigeria, (b)(6) Years of Experience: 22

Marla Roberts: Analyst—Geology and Soils M.S., Geology, University of Texas at San Antonio, 2007 B.A., Geology, Vanderbilt University (b)(6) Years of Experience: 8

John Stamatakos: Project Manager Ph.D., Geology, Lehigh University, 1990 M.S., Geology, Lehigh University, 1988 B.S., Geology, Franklin and Marshall College, (b)(6) Years of Experience: 28

Bradley Werling: Analyst—Air Quality M.S., Environmental Science, University of Texas at San Antonio, 2000 B.S., Chemistry, Southwest Texas State University, 1999 B.A., Engineering Physics, Westmont College, Santa Barbara, (b)(6) Years of Experience: 24

9.3 CNWRA Subcontractors

Susan Courage: Analyst—Socioeconomics and Environmental Justice M.S., Environmental Science, University of San Antonio at San Antonio, 2003 B.S., Biology, University of San Antonio at San Antonio, (b)(6) Years of Experience: 10

Pollyanna Held: Analyst—Cultural and Historic Resources M.A., Anthropology, University of Mississippi, Oxford, 2004 A.B., Anthropology, Princeton University, (b)(6) Years of Experience: 17

Brian Strye: Analyst—Cumulative Impacts M.S., Environmental Sciences, University of Texas at San Antonio, 2001 B.S., Biology, University of Texas at San Antonio (b)(6) Years of Experience: 13

10 GLOSSARY