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LOST CREEK ISR, LLC

November 17, 2009

Mr. Mark Moxley
State of Wyoming
Department of Environmental Quality
Land Quality Division
510 Meadowview Drive
Lander, WY 82520

Re: Responses to June 22, 2009 Comments Regarding the Lost Creek ISR Application
TFN 4 6/268

Dear Mr. Moxley,

Please find behind this cover the responses to the WDEQ-LQD's June 22, 2009 comments regarding the Lost Creek ISR, LLC Permit to Mine Application. The responses also include updates to the permit application and an index sheet describing the necessary insertions and removals.

A duplicate of this submittal has been forwarded to the WDEQ-LQD office in Cheyenne. If you have any questions regarding this submittal please feel free to contact me at the Casper Office.

Sincerely,
Lost Creek ISR, LLC
By: Ur-Energy USA Inc., Manager

John W. Cash
Manager EHS and Regulatory Affairs

Enclosures: As Stated

Cc: Mrs. Nancy Fitzsimons, Ur-Energy USA, Inc.
Ms. Ramona Christensen, LQD Records Manager, Cheyenne WDEQ Office
Mr. Mark Newman, Project Manager, Rawlins Field Office of the Bureau of Land Management
Ms. Tanya Oxenberg, PhD., U.S. NRC

RESPONSES to
WDEQ/LQD 2nd ROUND REVIEW
of
APPENDICES D5 andD6

for the
LOST CREEK PROJECT
Wyoming

November 2009

The responses are organized as follows:

If a comment was resolved with the 1st round response, that comment is no longer included; or

If a comment was not resolved with the 1st round response, then the complete series of comment and response text is included.

Section D-5 Geology

2. LQD (8/08) - *Figure D5-1 is a Regional Geologic Map. This map indicates the faults in the area, but does not indicate the Lost Creek Fault within the permit area. This is a significant and well documented feature within the permit area, and should be indicated on the Figure.*

   LC ISR, LLC (4/09) - Only major regional faults, such as those illustrated on the State of Wyoming geologic map or regional maps, are illustrated on Figure D5-1, "Regional Geologic Map". Some of the faults illustrated on the regional map have displacements of 5,000 feet or more. In contrast, the Lost Creek fault zone is a minor fault system with throws from zero feet to a maximum of 80 feet; therefore, it is not illustrated on the regional map. It is, however, illustrated on the property-scale maps (e.g., Figure D6-13), and more detail about any faulting within the Permit Area that could impact the in situ operations will be provide with the mine unit packages.

   LQD (6/09) - Figure D5-1 is only intended to depict major regional faults. Since the Lost Creek Fault zone is a minor fault system, it is not illustrated on the regional map. It is, however, illustrated on the property-scale maps. **The legend on Figure D5-1 should be changed to read "Major regional faults".**

   LC ISR, LLC (11/09) - The legend on Figure D5-1 has been changed as requested.

4. LQD (8/08) - *Plates D5-1 a -D5-1e. These plates provide one generalized and several detailed geologic cross sections down the centerline of the ore body, and across the centerline of the ore body. In addition, Figure D5-2a provides a very generalized geologic cross section across the northern portion of the permit area. LQD Non-Coal Rules, Chapter 11, Section 3(a)(viii) requires cross sections that show geologic features within the entire permit area, and how they relate to the production zone. Extending cross sections F, G, and H to the boundaries of the permit area with any available drill hole data, will help to provide this information:*

LC ISR, LLC (4/09) - The cross sections have been updated with the information from new borings and wells completed in 2008. As noted on the Index Sheet for the changes to Appendix D-5, Plates D5-1b through D5-1e have been replaced, and two new plates (Plates D5-1f and D5-1g) have been added. The references in the text to these plates have also been updated.

LQD (6/09) -The cross sections have been updated with the information from new borings and wells completed in 2008. Plates D5-1b through D5-1e have been replaced and two new plates have been added (D5-1f and D5-1g). The references in the text to these plates have also been updated.

a) **The northern (left) edge of cross section F-F', presented on Plate D5-1e appears to have 880 feet of extrapolation. What boring provides data for the northern extent of this cross section?**

   LC ISR, LLC (11/09) - An explanation of the projection and extrapolation of the geologic data from the borings to north-south and east-west planes has been added to Section D5.2 (Site Geology).

b) **The piezometric surfaces are indicated for the DE, LFG, HJ and UKM aquifers, though it is not clear if there are any monitoring wells on the cross sections from which the water tables were derived. Please designate any monitoring wells on the cross section, and indicate their screened intervals and water levels with date.**

   LC ISR, LLC (11/09) - A reference to the cross-sections and an explanation of how the potentiometric surfaces were projected onto the cross-sections has been added to D6.5.2.2 (Potentiometric Surface, Groundwater Flow Direction and Hydraulic Gradient).

c) **Additional faults are indicated on the north/south trending cross sections. Please add these faults to the map key, as well as within the discussion of Section D5.2.2 the permit document. In addition, these faults should be indicated on all maps where the Lost Creek Fault is included, if they fall within the scale of the map.**

   LC ISR, LLC (11/09) - The text in Section D5.2.2 (Structure) has been replaced to discuss the newly identified faults, and the location of all the faults are illustrated on a new map as Plate D5-3 (General Location Map - Geology).

d) **Section D5.2.1 Stratigraphy. Paragraph 3 references trends in stratigraphy relative to "the Fault". This wording needs to be changed since it is now apparent that there are many faults within the permit area. Please specifically state the Lost Creek fault.**

LC ISR, LLC (11/09) - The references to the "Fault" in Appendices D5 and D6 have been changed to the Lost Creek Fault as follows:

- In the last sentence in Section 5.1.2;
- In the 2nd and 3rd sentences in the 3rd paragraph in Section 5.2.1;
- At the end of the last sentence in the next to last paragraph in Section 5.2.4.1;
- Under the FG Horizon heading in Section 6.2.2.1; and
- Throughout Sections D6.2.2.2, D6.2.2.3, D6.5.2.2, D6.5.2.3, and D6.5.2.5..

e) **No cross section has been provided for Section 16, which represents approximately 1/6 of the permit area. What is known about this section? Do the stratigraphic units extend to this part of the permit area? Are there any faults? Is there any potential mineral reserve? If not, why is this section included within the permit area? An additional cross section, which includes Section 16 should be added.**

LC ISR, LLC (11/09) - As noted in the October 2009 Response to Comment V1, #1, the selection of the permit boundary is dependent on factors (e.g., claim block boundaries) in addition to mineral location. LC ISR, LLC's current knowledge of the mineral trend indicates that it extends into Section 16; but there are only a few, widely-spaced drill holes in this section (approximately 20 in total) which are not sufficient to allow for detailed evaluation. Because of the limited data and because no mine units are currently planned in Section 16, cross-sections were not prepared for this section.

6. LQD (8/08) - *Several of the Plates, beginning with Plate D5-1a indicate the mine unit boundaries, yet the proximity of Mine Unit 6 to the eastern boundary of the proposed permit area, will need to be changed to allow for the monitor well ring and aquifer exemption boundary to be within the permit boundary.*

LC ISR, LLC (4/09) - As noted in Section OP3.2 of the Operations Plan, the specifics of each mine unit will depend upon the ore distribution, the hydrogeologic conditions specific to each mine unit, and "development requirements", such as access concerns and boundary limitations. The mine unit boundaries displayed on the figures and plates are conceptual and are not intended to indicate the specific extent of either the 'pattern area' (i.e. the production and injection wells), the monitor well ring, or the aquifer exemption area for a given mine unit. For example, the boundary of Mine Unit 5 on Plate 5-1a extends west beyond the most concentrated portion of the ore trend because of the possibility for developing the more isolated ore occurrences on the western end of the ore trend. Similarly, part of the ore trend extends northeast outside Mine Unit 6 because the entire ore trend cannot be encompassed with the current permit boundaries. The risks associated with mine unit development near the permit boundary, such as the potential for an off-site excursion, are understood and will be taken into account in designing the actual pattern area and monitor ring. As discussed during the September 22, 2008 meeting between LQD and Ur-Energy, Inc. personnel at the LQD Lander Office, the maps submitted with each mine unit application will show the definitive boundaries, based on the specific physical conditions for that mine unit.

LQD (6/09) - The mine unit boundaries displayed on the figures and plates are conceptual and not intended to indicate the specific extent of either the "pattern area", monitor well ring, or aquifer exemption area for a given mine unit. The maps LC sends with each mine unit application will show the definitive boundaries, based on the specific physical conditions for that mine unit. **A comment explaining the conceptual nature of the mine unit boundaries must be added to the plates which indicate the conceptual boundaries. In addition, a disclaimer which states, "In order for the mine unit No.6 boundary to be located as depicted, a permit boundary revision would be necessary."**

LC ISR, LLC (11/09) - A sentence has been added in the last paragraph of Section OP1.1 to indicate that the mine unit boundaries are considered conceptual until the mine unit packages are submitted.

7. LQD (8/08) - *Section D5.3.5 discusses the Short-Term Probabilistic Hazard Analysis, yet does not explain how the potential estimated accelerations would affect the well structure, pipelines or buildings on site. Please add this information to the text.*

LC ISR, LLC (4/09) - The following sentences have been added almost at the end of Section D5.3.5 to explain the potential impacts:

> These accelerations (3.9 – 9.2 percent g) are roughly comparable to intensity V earthquakes which can result in cracked plaster and broken dishes, but minor or no construction damages (Case, 2002). All facilities, including the processing plant, pipelines and well structures, at Lost Creek will be designed and constructed to sustain an intensity V earthquake. In addition, the observations of injection, production, and pipeline pressures and associated

monitor well measurements, necessary for the in situ operation, will provide short-term information about any unanticipated seismic impacts. Text was added near the end of Section D5.3.5 to explain the potential impacts. The added text explains how facility structures, pipelines, and well structures will be designed to sustain an intensity V earthquake. The added text also explains that observations of injection, production, and pipeline pressures and associated monitor well measurements, necessary for the in situ operation, will provide short term information about any unanticipated seismic impacts.

LQD (6/09) - Text was added near the end of Section D5.3.5 to explain the potential impacts. The added text explains how facility structures, pipelines, and well structures will be designed to sustain an intensity V earthquake. The added text also explains that observations of injection, production, and pipeline pressures and associated monitor well measurements, necessary for the in situ operation, will provide short term information about any unanticipated seismic impacts. **The text in this section must also include a discussion of reporting protocol that will be followed if such a seismic event occurs. The protocol should include inspection of all buildings, equipment pipelines and injection, production and monitoring wells, including monitoring well measurements. How soon after the seismic event such inspections and measurements will be made and how soon a report would be sent to LQD should be stated.**

LC ISR, LLC (11/09) - Section OP 2.9 has been revised to include a commitment to design facilities to withstand the worst case credible scenarios and to immediately report all upset conditions that may result in a release of mining solutions or chemicals to the environment. LC ISR, LLC also commits in this section to shut down any portion of operations that may have been impacted by an upset condition. Affected facilities will not be restarted until they have been adequately inspected and tested if conditions warrant.

8. LQD (8/08) - *Section D5.2.2, Structure. This section discusses there being one minor fault, the Lost Creek Fault, within the permit area, yet the maps in this section indicate a second fault to the west of the Lost Creek fault, yet within the permit area. This fault should be discussed in detail.*

LC ISR, LLC (4/09) - As additional subsurface data has become available from on-going exploration drilling, the information on the fault system has been refined. The text in Section 5.2.2 has been updated to reflect the current information. Pursuant to the discussion during the September 22, 2008 meeting of LQD and Ur-Energy, Inc. personnel at the LQD Lander Office, as additional information about this fault system is collected in the vicinity of a given Mine Unit, that information will be provided with the relevant Mine Unit Package.

LQD (6/09) - The text in Section 5.2.2 has been updated to reflect the most current information (2008 exploration drilling). As additional information about the fault system is collected in the vicinity of a given Mine Unit, that information will be provided with the relevant Mine Unit Package. **Given that LQD is requiring Mine Unit 1 to be included in the application, it is expected that this information be provided for Mine Unit 1 at this time (prior to permit approval). It will be acceptable to submit fault information for future mine units (i.e. Mine Units 2 through 6) with the relevant mine unit packages. However, information that is currently known about other faults within the permit area, should be discussed within Section D5.2.2. (See comment 4(c)).**

LC ISR, LLC (11/09) - Please see the above Response to Comment D5, #4(c).

11. LQD (8/08) - *Plates D5-1b through D5-1e. Plates D5-1b – D5-1e show many places where the Sage Brush Shale has mineralized zones of ore, e.g. TG19-20, TG68-20, TG12-20, TG58-20, TG2-10, TG9-17, TG10-17, and TG11-17. The presence of mineralized zones within the Sage Brush Shale brings to question the ability of this unit to act as an adequate aquitard between the LHJ and UKM sands. The Sage Brush Shale is defined as a fine sand and shale unit. How fine is the sand if it had enough transmissivity to be a receiving unit for the Uranium? The overlying Lost Creek Shale also has some minimal mineralization within it. What is the likelihood that these shales could leach out Uranium altering the integrity of the unit. It is requested that the MKM be fully characterized for baseline, north and south of the fault, as it may end up being the underlying aquifer that needs to be protected during mining of both the HJ horizon and potentially the UKM horizon.*

LC ISR, LLC (4/09) - Aquifers in the Battle Spring Formation typically consist of thick sequences of multiple, medium to coarse-grained, fluvial channel-fill sands. *Mapable* sand units (for example: the UHJ Sand) may range from five to 50 feet in composite thickness, and typically consist of multiple stacked channel-fill sands. *Aquifers*, in turn, typically consist of multiple stacked sand units. Sand units are commonly separated vertically by locally thick beds of mudstone, claystone, siltstone or fine-grained sands. These interbeds represent local aquitards and aquicludes which can be considered internal to the regional aquifer. Total composite thickness of an aquifer (for example: the HJ Horizon) is commonly in excess of 100 feet.

Aquicludes and aquitards (for example: the LCS or SBS Shales) represent quiescent floodplain and overbank sedimentary environments between channel fill sequences. Generally referred to as 'shales' they are, in essence, sedimentary sequences dominated by mudstone and claystone lithology; but also may include substantial amounts of siltstone and fine-grained sands. These lithologies can exhibit considerable lateral facies changes and interfingering, and are often transitional to the aquifers above or below. As a result, dramatic thickening and thinning of the aquicludes can occur locally. In addition, their upper and lower boundaries are often gradational. Aquicludes may even exhibit localized occurrences of mineralization in the vicinity of lithologic interfingering and facies changes with mineralized sands.

The attached figure (Illustration of the Character of Aquifers and Aquicludes at the Lost Creek Project) details the lithologic changes over a 400-foot section in the central portion of Mine Unit One. Because of the depositional variability of the sediments, one purpose of the more detailed assessments of the geologic and hydrologic conditions in the Mine Units is to provide information that could affect operating and monitoring conditions, e.g., positioning of an overlying monitoring well where the overlying shale is thin. Given the extremely low concentration of uranium mineralization in the shale, even if the uranium were removed through mining, it would not result in any noticeable alteration of the shale's integrity. Also, the uranium mineralization is epigenetic so the structural integrity of the shale was developed before emplacement of the uranium and is therefore independent of the uranium. The shale layers in question are strongly reduced which will largely prevent the oxidation and subsequent dissolution of uranium mineralization even if mining solutions were to come into contact with the uranium.

LQD (6/09) - Given the nature of the Battle Spring Formation LC maintains that aquicludes and aquitards (e.g. the Lost Creek or Sage Brush Shales) have lithologies dominated by mudstones and claystones; but may also include substantial amounts of siltstone and fine-grained sands. Given the extremely low concentration of uranium mineralization in the shale, even if the uranium were removed through mining, it would not result in any noticeable alteration of the shale's integrity. Also, the uranium mineralization is epigenetic so the structural integrity of the shale was established prior to the emplacement of uranium and is therefore independent of the uranium. The shale layers in question are strongly reduced which will largely prevent the oxidation and subsequent of dissolution of uranium mineralization even if mining solutions were to come in contact with the uranium [in the shales]. The response provides greater detail in describing that the 'lithologies provide considerable lateral facies changes and interfingering, and are often transitional to the aquifers above or below. As a result, dramatic thickening and thinning of the aquicludes can occur locally. In addition, their upper and lower boundaries are often gradational. Aquicludes may even exhibit localized occurrences of mineralization in the vicinity of lithologic interfingering and facies changes with mineralized sands." **The description in the response about the gradational and interfingering characteristics of the aquitards and aquicludes, as well as the cross section illustrating the character of the aquitards and aquicludes, provides a more detailed description of the nature of the stratigraphy at the site. Please incorporate this information into Section D5.2 Site Geology. In addition, it is understood that due to the epigenetic nature of the mineralized zones the structural integrity of the strata will not be impacted, yet a discussion of how mining will affect the storativity and transmissivity of the mineralized zones within the aquitards needs to be presented.**

LC ISR, LLC (11/09) - The text from the April 2009 response has been added to Section D5.2.1, and the figure from the April 2009 response has been incorporated into the permit as Figure D5-2c - Stratigraphic Illustration of Battle Spring Aquifers and Aquicludes.

Discussions with individuals who operated other in situ facilities, including Crow Butte, Smith Ranch, Highland, Iragaray, and Christensen Ranch, revealed that there were no discernable changes in aquifer characteristics, such as storativity or transmissivity, due to mining impacts. Unfortunately, no comparative post-mining pumping tests supporting this conclusion have been made public. While pattern-wide changes to aquifer characteristics are not likely, it is common to experience declines in injection capacity due to the development of skin damage at the well bore. The skin damage is generally the result of chemical precipitates, such as carbonates, due to 'flash' precipitation resulting from rapid pressure changes. The skin damage can usually be satisfactorily corrected by using mechanical methods to clean the well bore, such as swabbing, airlifting, and jetting. LC ISR, LLC intends to use slip stream RO treatment during operations which will further minimize the buildup of scale at the injection wellbore. Skin damage on production well bores is uncommon and not expected to be an issue for the Lost Creek Project due to the relatively low TDS of the native water and lixiviant.

12. LQD (8/08) - *Plate D5-2a, and D5-2c Isopach Maps of the Lost Creek Shale and Sagebrush Shale (respectively). For areas where the isopachs indicate the unit thickness is less than ten feet thick, please indicate at specific drill hole sites, what the thickness is at that location, so the reviewer knows how much less than ten feet in thickness the aquitard is at a given location.*

LC ISR, LLC (4/09) - Isopach maps have been updated with the information from new borings and wells completed in 2008, and the actual unit thicknesses have been added where the thicknesses are less than 10 feet.

LQD (6/09) - Isopach maps have been updated with the information from new borings and wells completed in 2008, and the actual unit thicknesses have been added where the thicknesses are less than 10 feet. **There are a number of borings within the <10 ft. zone where no data is provided, in addition, the footage and the drill hole location overlap in many places on Plate D5-2c making them un-readable. Also, a statement should be added to Section D5.2.1 Stratigraphy, regarding the minimum known thickness of each of these aquitards. Please revise accordingly.**

LC ISR, LLC (11/09) - Plate D5-2c has been revised to be more legible. The thicknesses of the Lost Creek and Sage Brush Shales are discussed in Section D5.2.1 as revised in response to the previous comment.

13. LQD (8/08) - *Section D5.2.4 Historic Uranium Exploration Activities, and Plate AD5-2a-c Location Map of Historical Drill Holes. It is stated that there are at least 560 exploration holes in the area, and Attachment D5-2 lists the holes northing and easting, year drilled and ID. Please also include depth* of *hole and discuss further the efforts made to locate the old drill holes, and whether or not it was confirmed that the hole had been properly abandoned. If the hole was abandoned through recent efforts, the plugging procedure and date should be indicated as well. The map should be updated to indicate the status of each drill hole location. Once operations commence, it is important that these historic drill holes do not provide a pathway for production fluids to migrate to underlying or overlying aquifers.*

LC ISR, LLC (4/09) - Section D5.2.4 has been renamed (Subsurface Exploration Activities) because more than just historic uranium exploration is discussed in the section. It has also been divided into two subsections, the first of which describes uranium exploration and the second of which summarizes other exploration. The discussion in the first subsection has also been expanded to include: the results of efforts to obtain information about the known historic holes, including hole depths; descriptions of re-abandonment efforts that have been needed to date; and steps that will be taken to identify any improperly abandoned drill holes in the mine units. Table D5-2 (Abandonment Information for Historic Exploration Holes) and Attachment D5-3 (Communication with WDEQ LQD related to Drill Hole Abandonment) have been also been added.

LQD (6/09) - Section D5.2.4 has been renamed (Subsurface Exploration Activities) because more than just historic uranium exploration is discussed in the section. It has also been divided into two subsections. The first subsection describes uranium exploration and the second summarizes other exploration. The first subsection has been further expanded to include: The results of efforts to obtain information about the known historic holes,

including hole depths; descriptions of re-abandonment efforts that have been needed to date; and steps that will be taken to identify any improperly abandoned drill holes in the mine units. Table D5-2 (Abandonment Information for Historic Exploration Holes and Attachment D5-3
(Communication with WDEQ LQD related to Drill Hole Abandonment) have also been added.

Attachment D5-3 and the updating of Table D5-2 are welcome additions to the permit document.

However, essential to LQD's review is an understanding of the location of historic drill holes and their status as related to the location of proposed mine units. For this reason, Plates ADS-2a, AD5-2b, and AD5-2c (in Attachment D5-2) must include the location of the proposed mine units, a topographic layer, and the status of each known hole via a legend.

The efforts made by Tg in the early 80's were extensive, yet many holes were unlocatable, many holes had caps which had fallen downhole, and were therefore not probed, and the majority of holes probed had standing water. Yet, only those holes found with 200 ft or more of water above the mud seal, were re-sealed.

The information in Attachment D5-3 presented for the Tg NOV illustrates the significance of the problem created by historic drill holes. Due to the site conditions the majority of the drill holes were not sealed to the surface, and were also not sealed to a point above the first aquifer.

Texasgulf drill hole summary in response to LQD NOV

	No. of holes inspected	No. of holes recapped	No. of holes w/ standing water	No. of dry holes	Holes resealed	No. of holes unable to locate	Holes with cap slipped down hole, unable to probe
1982	79	79	79				
1983	269	111		21	10	noted but not tallied	?
1984	427	371	213	72	27	56 (13%)	86 (20%)
TOTAL	775	561 (72%)					

- 775 Total holes exceeds total Tg holes reported in Table D5.2, possibly due to holes outside the Lost Creek proposed permit area.

Dry holes could indicate that hole was properly abandoned above uppermost aquifer, or hole had caved or bridged

As previously stated, the Division will require that these holes be located and sealed to the surface, as per ASTM D-5299-99 standards, in order to ensure that these historic holes do not compromise the confinement of the production zone during mining.

In order to clarify which historic holes are located in or near which mine units, a column should be added to Table D5-2 that indicates which proposed mine unit (if any) each historic drill hole is located in. This approach would eliminate confusion and provide clarity to the efforts LC has made in addressing historic drill holes at the site. Attachment D5-2 Plates AD5-2a, 2b, and 2c should be cross referenced to the Table, and need to include topography, the mine unit boundaries, and the proposed permit boundary.

LC ISR, LLC (11/09) - Each mine unit data package will contain a map showing the location of all historic drill holes located within the respective mine unit patterns. Additional discussion of abandoned drill holes was included in LC ISR, LLC's October 2009 Response to Comment V5, OP #84.

Plates AD5-2a, 2b, and 2c in Attachment D5-2 have been revised to show topography, conceptual mine unit boundaries and the permit boundary.

Section D-6 Hydrology

14. LQD (8/08) - *Section D-6. Detailed stratigraphic and well completion logs should be provided within the permit document for all monitoring wells. It is preferable if this information can be compiled on one log form. Notation of each horizon within the stratigraphic column would also be helpful. LQD Guideline* 8, *Appendix* 5 *describes the information to be included for each well.*

LC ISR, LLC (4/09) - A new attachment has been added with the well completion logs for the permit area monitoring wells. The existing Attachment D6-3 (Groundwater Quality Laboratory Results) has been renumbered to Attachment D6-4, and the title page and CD changed. Attachment D6-3 is now titled Well Completion Logs. A list of the wells for which logs are included in the attachment is at the beginning of the attachment.

Cross references to the new attachment have been added at the end of Section D6.2.2 and in Attachment D6-2a (Comment #44). Because of the size of the new Attachment D6-3 (Well Completion Logs), Volume 3 of the application has been separated into Volume

3a, which contains all of Appendix D6 through Attachment D6-2b, and Volume 3b, which contains Attachments D6-3 and D6-4.

LQD (6/09) - A new attachment has been added with the well completion logs for the permit area monitoring wells. Existing Attachment D6-3 has been renumbered to D6-4 and Attachment D6-3 now contains Well Completion Logs. Cross references have been added to Section D6.2.2 of the text in Attachment D6-2a. Because of the size of the new Attachment (D6-3, Well Completion Logs), Volume 3 of the application has been divided into two binders; Volumes 3a and 3b. **The following comments have been generated from a review of the well logs:**

a. **Volume 3b of 5, which now contains the well completion logs, needs to be added to the Table of Contents for each volume.**

   LC ISR, LLC (11/09) - The Table of Contents for each volume was corrected in the October 2009 Revision.

b. **Figure D6-9, Lost Creek Monitoring Wells, should include all monitoring well locations. There are 85 monitoring wells included in Attachment D6-3, and listed on Table D6-5, Monitoring Well Data, yet Figure D6-9 only has 46 monitoring wells shown. All 85 monitoring wells should be shown. Figure D6-9 should also be at a scale so that all well locations are clearly defined.**

   LC ISR, LLC (11/09) - The new Plate D5-3 shows the locations of all 85 monitoring wells, and the last paragraph in Section D6.2.2 has been revised to include a cross-reference to Plate D5-3. The M-25-92 series of wells are not included on that plate. Due to the proximity of some of the wells, the locations had to be shown on a plate rather than a figure for legibility. Rather than remove Figure D6-9, the last paragraph in Section D6.2.2 has also been updated to indicate that Figure D6-9 shows the locations of historic M-25-92 wells, i.e., the Conoco (or Texasgulf) wells mentioned in Section D6.4.2.1, and the existing monitor wells that were used for collection of the baseline groundwater quality data and in the LC16M and LC19M aquifer tests. Figure D6-9 has been updated to show five additional wells (HJMP-113, HJMP-114, UKMO-101, UKMO-102, and UKMO-103) which were used in the LC16M and LC19M pump tests.

c. **Figure D6-9 includes 1982 monitoring wells with the designation M-25-92-181S. These wells were abandoned by Tg in 1985, and should not be included in a Figure titled 'Lost Creek Monitoring 'Wells'.**

   LC ISR, LLC (11/09) - Please see response to the above comment.

d. **Well Completion Log HJIVIU-104 is incorrectly labeled as HMJU-I04.**

LC ISR, LLC (11/09) - The well completion log has been corrected.

e. **A number of wells indicate no well development efforts, yet there is water in the hole. (e.g. LC29M, LC31M, LC21M, LC25M, LC27M...) Chapter 11, Section 6(t) requires that the wells be developed and LQD Guideline 8, Appendix 5 discusses efficiency testing during well development. Development of these wells should be documented and submitted as part of the application.**

LC ISR, LLC (11/09) - All monitor wells are airlifted with the drill rig after placement of the screen. Before sampling, each monitor well is swabbed to provide further development. Finally, wells are purged of at least three casing volume prior to collecting a baseline sample. This information has been added to the notes at the beginning of Attachment D6-3.

f. **If airlifting produced poor yields, were any additional efforts made to develop these wells?**

LC ISR, LLC (11/09) - Please see response to previous comment.

g. **Wells MB01, MB07 and MB10 all state there was no water, and the well was not logged, yet the log indicates 67 ft, 17 ft, and 22 ft of water respectively, and the wells were airlifted with poor yield. Please explain.**

LC ISR, LLC (11/09) - Wells MB01, MB07, and MB10 were drilled with air into the DE aquifer which produced virtually no water at the time the hole would have been logged. Resistivity and Spontaneous Potential logging equipment does not function in dry hole, and there was no water truck on location with which to fill the hole with water. Subsequent seepage resulted in the eventual water table as recorded on the Well Completion Logs. It was not considered necessary to log these holes as they are very close (within 50 to 100 feet) to other, deeper monitor wells which had already been logged. The change in stratigraphy and lithology with such a short lateral distance is minimal. The completion design of the subject wells was determined from examination of the drill cuttings from these drill holes and from examination of the logs from the adjacent deeper wells.

h. **Wells MB01, MB07, and MB10 have substitute wellogs with the well construction diagram superimposed on it. If these wells were logged for stratigraphy, then it would be clearer to show the well construction with the**

stratigraphy for that hole, as opposed to superimposing another hole. The proximity of these superimposed drill holes is not noted.

LC ISR, LLC (11/09) - As noted in the previous response, Wells MB-1, MB07, and MB10 were not logged due to the lack of water in the holes and the proximity of deeper wells which were previously logged. The name of the substitute holes is listed on each completion log. Each of the substitute holes is within 100 feet (or less) of the well it is replacing (Plate D5-3 and Figure D6-9).

i. **There are many wells where there is additional footage between the base of the well screen and the bottom of the hole, yet it is not indicated on the well diagram (e.g. LC29M, MBO1, MB07, MB1O, HJMO-I05, HJMO-106, HJMO-112, HJMO-I13, MB-02, MB-O5, MB-O8, HJMP-101, HJMP-I02, HJMP-I09, HJT-I02, MB-06, MB-09, HJIMU-105, HJMU-113, HJMU-114, UKMP-I02, UKMP-103, MB-04, UKMU-I01, UKMU-103). Please indicate on the schematic if the boring caved into this level, if there is a sump below the screen, or if it is an open hole.**

LC ISR, LLC (11/09) - Notes on the well completion logs have been added at the beginning of Attachment D6-3.

j. **There are a number of holes where the bottom of the well screen (or under reamed interval) is deeper than the total depth recorded for the drill hole. (e.g. HJMP-105, UKMO-101, UKMO-103, HJMU-10l, HJMU-104, HJMU-107, UKMP-101). Please correct the well logs accordingly.**

LC ISR, LLC (11/09) - Notes on the well completion logs have been added at the beginning of Attachment D6-3.

k. **When well screen was used, it was placed below a K-packer, and telescoped from the SDR17 4.5" ID to a 3" Screen. This narrow a screen may preclude the use of a pump within the screened interval for required bailing. LQD Non-Coal Chapter 11, Section 6(d) requires that the monitoring well casing be designed to allow for sampling.**

LC ISR, LLC (11/09) - In a few rare instances, specifically on the margins of the uppermost aquifer (the DE Horizon), the water level is so low that it does not extend above the completed interval. In these cases the wells generally produce very little water and are difficult to sample because very little water is available, regardless of the screen size. The three-inch inside diameter j-collar and screen used by LC ISR, LLC is of sufficient diameter to allow the installation of a small diameter pump into the screened interval. However, it is generally accepted practice that pumps should not be installed inside the screened portion of a well unless absolutely necessary. A larger screen could have been used so a full-size pump could be installed, however, such a large pump would evacuate the screened interval within seconds. The smaller diameter pump, or bailer, will evacuate the casing more gently and provide better quality results. A more significant problem with wells having extremely low recharge rates is the difficulty in well development. The telescoping screens are used because they can be removed so the completion interval can be adequately developed.

16. LQD (8/08) - *Figure D6-27a, Piper Diagram -Average Water Quality at Individual Monitoring Wells. The legend designates which well is represented by which symbol, and the wells are grouped by color, yet it does not indicate which horizon the wells are monitoring. Please add the horizon noted by each color. (The colors are not consistent with which formation they represent, i. e. other Figures use green to indicate the DE horizon wells, whereas the Piper diagrams use red).*

LC ISR, LLC (4/09) - The figure has been revised to clearly indicate which horizon each well is monitoring.

LQD (6/09) - The figure has been revised to clearly indicate which horizon each well is monitoring. **There are 27 baseline monitoring wells, yet the two Piper Diagrams are only based on data from 17 wells. Please add the additional baseline information to the diagram, or provide an explanation as to why certain wells were not included.**

LC ISR, LLC (11/09) - Data from the MB wells is still being collected so the Piper Diagrams have not been updated. The first round of sampling results from the MB wells have been received and inserted into Table D6-15a. Once all of the data is received the Piper Diagrams will be updated.

18. LQD (8/08) - *Figures D6-11a through D6-11c. The potentiometric surface maps are limited in scope and only represent a small portion of the permit area. The potentiometric surface maps should be representative of the entire permit area. Also given the barrier nature of the fault, both sides of the fault need to be adequately characterized. Additional baseline groundwater monitoring wells with adequate distribution across the permit area will need to be installed for this purpose.*

LC ISR, LLC (4/09) - Ten additional baseline groundwater monitoring wells were installed in the fall of 2008. The new wells are identified by the prefix MB in the well name. The locations of the new wells are shown on revised Figures D6-9 and D6-24, and

Table D6-5 has been revised to include the new well completion information. The wells were drilled as clusters so each of the horizons of interest (DE, LFG, HJ and UKM) is monitored across the permit area and on both sides of the Lost Creek Fault. Water levels measured in December 2008 from the new wells and the previously existing baseline wells were used to generate potentiometric surface maps of the DE, LFG, HJ and UKM horizons (Figures D6-11e through D6-11h). These maps are discussed in Section D6.5.2.2. The original potentiometric surface maps (Figures D6-11a through D6-11c) are retained in the permit application to provide better resolution in the vicinity of proposed Mine Unit 1 and are discussed in Section D6.2.2.2

LQD (6/09) - Ten additional baseline ground water monitoring wells were installed in the fall of 2008. The new wells are identified by the prefix MB in the well name. The locations of the new wells are shown on revised Figures D6-9 and D6-24, and Table D6-5 has been revised to include the new well completion information. The water levels were measured in the new wells in December 2008 and that information was used to generate potentiometric surface maps of the DE, LFG, JG and UKM horizons (Figures D6-11 e through D6-11h). These maps are discussed in Section D6.5.2.2 of the text. **The potentiometric maps for UKM, HJ, LFG, and DE are based on data from 6 -7 monitoring points. According to the new monitoring well information, presented in Table D6-5, Monitoring Well Data, and Attachment D6-3, Well Completion Logs, there is water level data available for 24 monitoring wells in the UKM aquifer, 29 monitoring wells in the HJ aquifer, 19 monitoring wells in the LFG aquifer (plus 2 in the FG), and 8 monitoring wells in the DE aquifer. These additional data points should be used to provide a more detailed map of the potentiometric surface for these aquifers.**

LC ISR, LLC (11/09) - Figures D6-11e through D6-11h are potentiometric surface maps developed for the DE, LFG, HJ and UKM Horizons across the entire Permit Area as requested by WDEQ. The scale of those figures is 1 inch = 2000 feet. Figures D6-11a through D6-11c are potentiometric surface maps (at a scale of 1 inch = 250 feet) that focus on the area around Mine Unit One, where the majority of the monitor wells are located. These maps show greater detail in the potentiometric surface of the LFG, HJ and UKM Horizons. Including all of the wells completed in the LFG, HJ and UKM Horizons on the potentiometric maps for the entire Permit Area would result in a cluster of wells in a very small portion of the permit area that would add little to the clarity of the map. Because detailed maps were already included with the high density of data in the vicinity of Mine Unit One (Figures D6-11a, b and c), the decision was made to only include wells in the vicinity of Mine Unit One **that representative of the potentiometric surface on each side of the fault for the permit area potentiometric surface maps.**

Comparing the localized and permit-wide potentiometric surface maps for the LFG Horizon (D6-11b and D6-11f), the HJ Horizon (D6-11a and D6-11g), and the UKM Horizon (D6-11c and D6-11h) does not reveal any substantial differences in the groundwater flow directions at the different scales, but does provide more information on the greater influence of the fault in the shallower LFG and HJ Horizons. As noted in the following comment, the text in Section D6.2.2.2 has been updated with comparison of the localized and permit-wide information.

22. LQD (8/08) - *Section D6.2.2.2, Potentiometric Surface, Groundwater Flow Direction and Hydraulic Gradient, page D6-14. Although hydraulic gradient is the change in head over distance between wells, for the sake of the permit application, the hydraulic gradient across the potentiometric surface needs to be determined. As stated in comments18 and 19, the potentiometric surface of each aquifer needs to be established, on both sides of the fault, and then the hydraulic gradient of this surface calculated with a minimum of three wells.*

    The potentiometric surface should be representative of the permit area, and not just the area in the center of the permit area, adjacent to the fault zone. It seems possible that the gradient may be more generally to the south, yet when the fault zone is encountered, it changes to parallel this hydrologic barrier. Additional groundwater monitoring wells will need to be installed to obtain this information.

    LC ISR, LLC (4/09) - As described in the response to Comments 18 and 19, additional monitor wells were installed in the fall of 2008 that provide more complete coverage across the permit area. Potentiometric surface maps were generated from water level data collected from the new and previously existing baseline monitor wells. Hydraulic and vertical hydraulic gradients have been calculated from the new data and are included in revised Tables D6-7 and D6-8, which have been renumbered Tables D6-7a and D6-7b.

    LQD (6/09) - The new monitoring wells installed in the fall of 2008 provide more complete coverage across the permit area. Potentiometric surface maps were generated from water level data obtained from the new wells and previously existing baseline wells. Hydraulic and vertical hydraulic gradients have been calculated from the 1982 Conoco well data and the 2006-2007 data and are included in revised Tables D6-7 and D6-8, which have been renumber as Tables D6-7a and D6-7b. The additional well locations confirm that the predominant ground water flow direction is to the southwest, generally parallel to the Lost Creek Fault System. **If the potentiometric surface maps change significantly, then the horizontal gradient calculations (Table D6-7a, page 3 of 3) will need to be revised accordingly.**

LC ISR, LLC (11/09) - No significant differences in the direction or gradient of groundwater flow were apparent when the permit-wide potentiometric surface maps were updated; however the text in Section D6.2.2.2 has been updated with the most recent information.

24. LQD (8/08) - *There are 14 potentiallly6 active groundwater wells within 0.5 miles of the permit area, and many more historic groundwater wells within the permit boundary or 0.5 mile perimeter with abandoned or canceled permits. What* is *the status of the abandoned and cancelled wells? Is their proper abandonment documented? If not, are there well completion logs for these wells to indicate if they have a specific screened interval? The current status of these wells needs to be clearly defined to ensure that they are not a potential pathway between aquifers.*

    LC ISR, LLC (4/09) - Please see the responses to Comments #13, #25, #30, and #33.

    LQD (6/09) - Responses to Comments #13, #25, #30, and #33 address this comment. Refer to responses for Comment 13, 15, and 30.

    LC ISR, LLC (11/09) - Please see the responses to Comments #13, #25, and #30

25. LQD (8/08) - *Section D6.3, Table D6-12a. There are numerous Kennecott, Tg and BLM/Tg groundwater permits within or adjacent to the permit area. The status is listed as adjudicated, abandoned, or cancelled. Further discussion regarding the status of these permits needs to be included in Section D6.* 3 *and Table D6-12a. Were wells drilled under all of the permits listed? Are there abandonment records for any of the wells? Has any effort been made to locate these wells and verify their status? There needs to be assurances that these wells will not act as a potential conduit for the movement of production fluids between aquifers.*

    LC ISR, LLC (4/09) - In response to this comment, Tables D6-12a and D6-12b (and the associated Plates D6-1a and D6-1b) were modified for clarity, as outlined below. However, the responses to Comments #13 and #30 address the concerns about efforts to locate drill holes and wells and the potential for wells outside the Permit Area to act as conduits for movement of production fluid, respectively.

    The formatting of Tables D6-12a and D6-12b was modified to distinguish between a well and a point of use, and Plates D6-1a and D6-1b were modified accordingly. All of the wells have at least one associated point of use. According to W.S. §41-3-930(a), "Any person who intends to acquire the right to beneficial use of any underground water in the state of Wyoming, shall," . . . "file with the state engineer an application for a permit to make the appropriation" . . . "The application shall contain" . . . "the location by legal subdivision of the proposed well or other means of obtaining the underground water" and "the location by legal subdivision of the area or point of use". Therefore, WSEO maintains records of permitted wells with associated point(s) of use. The tables present wells *and* the points of use associated with the wells, which may be difficult to observe with the previous formatting. During this modification, it was notable that certain points of use were within the area of interest but their associated wells were outside of that area. To accommodate any questions that may arise, these wells *not* within the area of interest were included in the table and highlighted to differentiate them from the wells within that area.

LQD (6/09) - Tables D6-12a and D6-12b have been modified (as well as the associated Plates D6-1a and D6-1b) for clarification between a well and a point of use. Additionally, LC's responses to Comments #13 and #30 address the concerns about efforts to locate drill holes and wells and the potential for wells outside the Permit Area to act as conduits for movement of production fluid.

a. **Plate D6-la does not have a location for well ID 1.**

   LC ISR, LLC (11/09) - A note has been added to Plate D6-1a and Table D6-12a indicating that the well is five miles from the Project, but there are 'points of use' associated with the well that are closer to the Project.

b. **Well ID 21 is shown on Plate D6-1a, but is not listed in Table D6-12a.**

   LC ISR, LLC (11/09) - The Well ID 20 was incorrectly labeled Well ID 21 on Plate D6-1a, which has been corrected.

c. **The addition of Well 6b to Table D6-12a, seems to have resulted in the following errors:**
   - **Plate D6-1a shows well ID 7 as a potentially active permit in T25N R92W, Section 30, yet Table D6-12a lists it as an abandoned well in Section 20.**
   - **Well ID 20 is shown on Plate D6-1a in T25N R93W, Section 24, yet is listed on Table D6-12a as being in T25N R93W, Section 13.**
   - **Well ID 10 is shown on Plate D6-1a as being in T25N R92W, Section 20, yet on Table D6-12a the location is T25N R92VV Section 19.**
   - **Well ID 13 is shown on Plate D6-1a as being in T25N R92W, Section 19, yet on Table D6-12a the location is T25N R92W, Section 18.**
   -

- **Well ID 16 is shown on Plate D6-1a as being in T25N R92W, Section 18, yet on Table D6-12a the location is T25N R92W, Section 17.**
- **Well ID 19 is shown on Plate D6-la as being in T25N R92W, Section**
- **17, yet on Table D6-12a the location is T25N, R92W, Section 24.**

LC ISR; LLC (11/09) - The SEO permits for the above Well IDs have been compared to the table and plate. The information in the table corresponded to the SEO permits, and Plate D6-1a has been corrected.

d. Wells shown at one location have overlapping symbols. They need to be designated differently on Plate D6-1a and Plate D6-1b so that their status can be ascertained.

LC ISR, LLC (11/09) - The symbols have been modified to avoid overlap.

26. LQD (8/08) - *Section D6.3, Page D6-21. Will the public and private wells near the permit area be impacted by mining operations? Will they be within the zone of influence of the pumping operations? If they are within or near the zone of influence, and the completion details of the well are unknown, these wells should be replaced by the operator, prior to mining. Otherwise these wells could become a conduit for the movement of production water between aquifers.*

LC ISR, LLC (/09) - Please see Response to Comment #30.

LQD (6/09) - **Refer to response to Comment #30.**

LC ISR, LLC (11/09) - Please see Response to Comment #30 below.

28. LQD (8/08) - *In addition to Table D6-14, the permit application must provide the Groundwater Monitoring Program for the site. It should include a list of the monitoring wells, sampling frequency, sampling protocol, QA / QC procedures etc. As new monitoring wells are added in the future, the permit will be revised by a Non-Significant revision to the permit to add or drop monitoring wells.*

LC ISR, LLC (4/09) - A copy of the Groundwater Monitoring Program is attached. Rather than incorporate this into the baseline portion of the permit application, LC ISR, LLC will incorporate it into the Operations Plan, which is currently being revised in response to LQD comments of January 2009.

LQD (6/09) - A copy of the Groundwater Monitoring Program is attached. Rather than incorporate it into the baseline portion of the permit application, LC will incorporate it into the Operations Plan, which is currently being revised in response to LQD comments of January 2009. **LQD will review the Groundwater Monitoring Program with LC's forthcoming responses to LQD's January 2009 technical comments.**

LC ISR, LLC (11/09) -. The Groundwater Monitoring Program included with the April 2009 Response to Comments was incorporated into the permit as Attachment OP-8 in the October 16, 2009 Revision.

30. LQD (8/08) - *Section D6.3, Page D6-21, last paragraph states that throughout the phases of the project the operator will correspond with BLM to ensure the wells that provide stock water are not adversely impacted. Since it is not clear where any of these wells are screened [Well 4775 (at 280 ft. depth), and 4777 (at 200 ft. depth), 4451 at 900ft. depth, and the Eagles Nest Draw well (at 370ft. depth)). it may be necessary to replace these water supplies prior to mining operations, to ensure that they are clearly isolated from any mining influence.*

LC ISR, LLC (4/09) - This response addresses general concerns with respect to water levels and water quality and then addresses the BLM wells specifically.

The in situ mining of the HJ Horizon will impact the water levels and water quality of that horizon; however, the water level impacts will extend laterally much farther than the water quality impacts. With respect to water levels, if any of the public or private wells near the Permit Area are screened within the HJ Horizon, then they could be impacted by drawdown resulting from ISR operations, depending on their proximity to those operations, as discussed in Section 3.6.3.3 of the Operation Plan. In contrast, with respect to water quality, the impacts must be contained within the mine unit for efficient mining and as required by environmental regulation. The mining solutions used to recover uranium are maintained within the mine unit through the implementation of a hydrologic bleed. To ensure the hydrologic bleed is adequate, a comprehensive system of monitor wells is installed around each mine unit and in overlying and underlying zones. Identification of an excursion would result in corrective action to prevent further migration outside the mine unit.

There are no public or private wells, other than those installed by LC ISR, LLC within the Permit Area. The four BLM wells are the closest wells to the Permit Area. A geologic review of these wells indicates that two of the wells, the Battle Spring Draw Well No. 4777 and the East Eagle's Nest Draw Well, are too shallow to be completed within the HJ Horizon. The other two wells, the Boundary Well No. 4775 and Battle

Spring Draw No. 4451, are of sufficient depth that they could intersect the HJ Horizon. However, as a precaution, all of the BLM wells will be periodically monitored to determine if mining from the proposed ISR has impacted the wells.

The technically sound and legally mandated safeguards of installing a monitor ring for excursion detection and of excursion control are sufficient to ensure the wells noted by the reviewer are not impacted by mining lixiviant. Pursuant to the discussion during the September 22, 2008 meeting with WDEQ LQD in Lander, these wells will not need to be preemptively replaced.

LQD (6/09) As a precaution the BLM wells will be periodically monitored to determine if mining from the proposed ISR has impacted the wells. The technically sound and legally mandated safeguards of installing a monitor ling for excursion detection and of excursion control are sufficient to ensure the wells noted by the reviewer are not impacted by mining lixiviant. Pursuant to the discussion during the September 22, 2008 meeting with WDEQ LQD in Lander, these wells will not need to be preemptively replaced. **Monitoring of the BLM wells must be included in the permit's Groundwater Monitoring Plan. In addition, please add a statement to the last paragraph of Section D6.3 that if the mining operations adversely impact these wells, that Lost Creek ISR, LLC, will work with the BLM and replace the wells if required. LQD understands LC plans to submit the Groundwater Monitoring Plan with the responses to LQD's January 2009 comments.**

LC ISR, LLC (11/09) - "The Groundwater Monitoring Program included with the April 2009 Response to Comments was incorporated into the permit as Attachment OP-8 in the October 16, 2009 Response to Comments. The Program specifically discusses the sampling of BLM wells. A statement has been added to Section D6.3 confirming LC ISR, LLC's commitment to work with BLM to replace the water from any wells that are rendered unusable due to LC ISR LLC's mining activities.

34. LQD (8/08) - *Table D6-13 Lost Creek Project Groundwater Permits. In addition to this table, a separate table should be presented which is the comprehensive groundwater monitoring network wells. If viable information is available from historic monitoring wells (e.g. the Conoco wells), i.e. the screened interval is known, then these wells can be presented as a subset of the table. If the water supply wells are going to be sampled they should also be included.*

LC ISR, LLC (4/09) - Table D6-13, as originally submitted, included all of the LC ISR, LLC wells in the comprehensive groundwater network; however, the table has been re-arranged for clarity. All those permits for which wells have been drilled, including monitoring and supply wells, are included at the beginning of the table. Those permits for which wells have not yet been drilled are included at the end of the table. Future information about wells will be included in the mine unit applications.

As noted in the response to Comment #33, the information about the Conoco wells is included in Table D6-12a. The information about the LC ISR, LLC permit (Table D6-13) was purposely separated from the information about permits granted to other entities because LC ISR, LLC has control over the content and quality of the information and construction related to its permits, but does not have similar control over information or construction related to other permits.

LQD (6/09) - Table D6-13, as originally submitted, included all of the LC wells in the comprehensive ground water network; however, the table has been re-arranged for clarity. All those permits for which wells have been drilled, including monitoring and supply wells, are included at the beginning of the table. Those permits for which wells have not yet been drilled are included at the end of the table. Future information about wells will be included in the mine unit applications. As noted in the response to Comment #33, the information about the Conoco wells is included in Table D6-12a. The information about the LC permit (Table D6-13) was purposely separated from the information about permits granted to other entities because LC has control over the content and quality of the information and construction related to its permits, but does not have similar control over information or construction related to other permits. **The response states that permits that have yet to be drilled are listed at the end of the Table. These wells appear to be on Page 8 of 8 under the subheading of 'Other Wells and have 'Priority dates' of 2008. Please add a subheading for the wells that have permits but have not been installed. In addition, pertinent well information for Mine Unit 1 is expected to be submitted prior to permit approval.**

LC ISR, LLC (11/09) - The vast majority of the wells listed on Page 8 of 8 of Table D6-13 are being installed for Mine Unit One. LC ISR, LLC plans to have a table very similar to Table D6-13 in each mine unit application, which will include the pertinent well information for that mine unit. LC ISR, LLC also plans to include a cross-reference to the mine unit applications in Table D6-13. Rather than remove the Mine Unit One wells from Table D6-13 at this time, LC ISR, LLC will update Table D6-13 in conjunction with the Mine Unit One application.

The first page of Table D6-13 (2nd line of the table) has been updated to include a cross-reference to Plate D5-3, as well as Figure D6-9, for well locations.

35. LQD (8/08) - *Section D6.4.2 Site Groundwater Quality. The majority of the baseline groundwater monitoring wells are located within the footprint of the mineralized zone and the mine units. Additional baseline groundwater monitoring wells need to be established outside the mine unit, up gradient and downgradient of the mine units, and north and south of the fault(s).*

LC ISR, LLC (4/09) - Additional baseline water quality monitor wells have been installed, as described in the responses to Comments #18, #19 and #22. The new wells will be sampled for the same constituents as the previously installed baseline monitor wells. At least four sampling events will be conducted at each well. Results of the sampling events will be provided when available.

As suggested, an additional 10 regional monitor wells were installed to collect data outside the mineralized zone; Wells MB-01 through MB-10. The installation of these wells brings the total number of regional wells to 27. The revised data included in this response includes the hydrologic information gained from the additional wells. Pumps will be installed in the wells this spring so baseline water quality may also be determined over the course of a year. As discussed during the September 22, 2008 meeting with WDEQ-LQD in Lander, the results of sampling will be provided to LQD upon completion of the sampling program.

LQD (6/09) - Additional baseline water quality wells have been installed, as described in the responses to Comments #18, #19, and #22. The new wells will be sampled for the same constituents as the previously installed baseline monitor wells. At least four sampling events will be conducted at each well. Results of the sampling events will be provided when available. As suggested [by LQD] 10 additional regional monitor wells were installed to collect data outside the mineralized zone; Wells MB-01 through MB-10. The installation of these wells brings the total number of regional wells to 27. The revised data included in this response includes the hydrologic information gained from the additional wells. Pumps will be installed this spring so baseline water quality may also be determined over the course of a year. As discussed during the September 22, 2008 meeting with WDEQ-LQD and LC personnel, the results of sampling will be provided to LQD upon completion of the sampling program. **Table D6-15a will be updated with the additional baseline well monitoring data once it becomes available. This comment will remain until the Table is revised.**

LC ISR, LLC (11/09) - Please see above Response to Comment D6, #16.

36. LQD (8/08) - *Section D6.4.2.2 Groundwater Quality Sampling Results. Page D6-26, paragraph 3 states that "there is no significant difference in major water chemistry between the production zone and overlying and underlying aquifers". The next paragraph explains some constituents that exceeded WQD Class I standards at individual wells. Please provide a separate section for each aquifer (similar to Section D6.2.2.1) which discusses their individual water quality, based on the baseline monitoring.*

    LC ISR, LLC (4/09) - A separate section discussing the water quality of the production zone and overlying and underlying aquifers has been prepared and is included in Section D6.4.2.2.

    LQD (6/09) - A separate section discussing the water quality of the production zone and overlying and underlying aquifers has been prepared and is included in Section D6.4.2.2. **Once the additional data is obtained from the 2009 sampling of the MB wells, this section may need to be revised to include the information from the additional baseline data.**

    LC ISR, LLC (11/09) - Please see above Response to Comment D6, #16.

37. LQD (8/08) - *Table D6-15. Analytical Results of Baseline Monitoring. If an analyte has exceeded the WQD Class I standard please flag that value within the table, noting the designation with a footnote.*

    LC ISR, LLC (4/09) - Table D6-15 has been replaced with Tables D6-15a and D6-15b. Table D6-15a includes the analytical results, with flags to indicate which concentrations exceeded WQD and/or EPA criteria, and Table D6-15b lists the WQD and EPA criteria. The references in the text to Table D6-15 have also been updated to include both Table D6-15a and D6-15b.

    LQD (6/09) - Table D6-15 has been replaced with Tables D6-15a and D6-15b. Table D6-15a includes the analytical results, with the flags to indicate which concentrations exceeded WQD and/or EPA criteria, and Table D6-15b lists the WQD and EPA criteria. The references in the text to Table D6-15 have also been updated to include both Table D6-15a and D6-15b. **When the 2009 analytical data for the MB wells becomes available, Table D6-15a will need to be revised.**

    LC ISR, LLC (11/09) - Please see above Response to Comment D6, #16.

39. LQD (8/08) - *Section D6.5.2.2 Potentiometric Surface and Hydraulic Gradients. Paragraph one provides the hydraulic gradient for the HJ Horizon. As mentioned in previous comments, the Division is requesting that both sides of the fault be characterized separately.*

LC ISR, LLC (4/09) - Horizontal and vertical hydraulic gradients have been calculated for both sides of the fault and are included in revised Tables D6-7a and D6-8. The text in this section of the permit application has also been revised with the updated gradient information. Tables D6-7a and D6-7b were previously numbered Tables D6-7 and D6-8, but were renumbered to allow for addition of Table D6-11 (in response to Comment #38) without renumbering all the tables in the section. Tables D6-9, D6-10a and D6-10b, and D6-11a and D6-11b were also renumbered to D6-8, D6-9a and D6-9b, and D10a and D6-10b, respectively.

LQD (6/09) - Horizontal and vertical hydraulic gradients have been calculated for both sides of the fault and are included in revised Tables D6-7a and D6-8. The text in this section of the permit application has also been revised with the updated gradient information. Tables D6-7a and D6-7b were previously numbered Tables D6-7 and D6-8, but were renumbered to allow for addition of Table D6-1 without renumbering all the tables in the section. Tables D6-9, D6-10a, and D6-10b, and D6-11a and D6-11b were also renumbered to D6-8, D6-9a and D6-9b, and D6-10a and D6-10b, respectively.

a. **Table D6-9b and Table D6-10b are both titled '2007 LC16M Long Term Pump Test Monitor Wells'. The top and bottom of the underreamed zone in the Table D6-9b version do not correspond to the well completion log data, though the Table D6-10b version appears to be correct. Please determine the correct version, and address the change in an Index Sheet.**

   LC ISR, LLC (11/09) - The information on the underreamed zone in Tables D6-9a, D6-9b, D6-10a, and D6-10b was compared to the well logs in Attachment D6-3 and corrected where necessary. For clarity, the titles of Tables D6-10a and D6-10b were updated to include the word "results". Some information for Well UKMO-102 that was inadvertently omitted from earlier versions of Table D6-10a (but included in Attachment D6-2a) has been added to the table.

b. **Table D6-11b, 2007 LC16M Long Term Pump Test Results (from the original submittal) seems to have been inadvertently eliminated with the second version of LC16M Long Term Pump Test Monitoring Wells. Please resubmit the LC16M Pump Test Results.**

   LC ISR, LLC (11/09) - Please see response to above comment.

40. LQD (4/09) - *Section D.5.2.2 Potentiometric Surface and Hydraulic Gradients. Paragraph one states that from the pump tests the communication between the HJ aquifer and the overlying and underlying aquifers may be through historic boreholes that were improperly abandoned, leakage through the confining shale units, or contact of sands juxtaposed across the fault. All work done to relocate and either verify proper abandonment or re-abandon old drill holes should be included within the permit application. Any additional work completed to better define the cause for the communication must be submitted as a revision to the permit document.*

LC ISR, LLC (4/09) - Section D5.2.2 discusses structure and not hydrologic connectivity. However, the concern is understood and addressed with the following response.

In response to this comment and Comment #13 (on Appendix D5), Table D5-2 was generated for inclusion in the application. The table summarizes the work performed by LC ISR LLC and previous operators to locate and re-abandon historic holes. Additional pumping tests, such as mine unit tests, will be performed in the future to further characterize ore zone confinement. Test results will be submitted to WDEQ-LQD for review.

The following sentence have been added at the end of the third paragraph of section D6.5.2.2 to provide a cross-reference to the discussion in Section D5.2.4.1 about abandonment work:

> More detail about abandonment work is provided in Section D5.4.2.1. In particular, Table D5-2 is a summary of efforts to relocate and re-abandon historic holes, and Attachment D5-3 includes historic memos regarding previous operators attempts to relocate and re-abandon holes.

LQD (6/09) - Table D5-2 was generated for inclusion into the application in response to this comment as well as Comment #13. The table summarizes the re-abandonment work conducted by LC of historic holes. Additional pump tests will be performed in the future to further characterize ore zone confinement. Text has been added to Section D6.5.2.2 to provide a cross-reference to the discussion in Section D5.2.4.1 about abandonment work. **Mine Unit 1 characterization and demonstration of ore zone confinement is required prior to approval of the application. Additionally, Table D5-2 must include a column indicating which Mine Unit (MU-l, MU-2 ...), if any, a given Abandoned Drill Hole is located within. The addition of Table D5-1 and Attachment D5-3 are welcome additions to the permit application, yet does not address the need to re-abandon historic drill holes in order to obtain confinement of the production zone.**

LC ISR, LLC (11/09) - Please see Response to Comment D5, #13.

41. LQD (8/08) - *Section D6.5.2.3 Aquifer Properties. The second paragraph states that additional long term multi-well pump tests were to be performed in the fall of 2007. These tests would provide more data on overlying and underlying aquifer characteristics. If this information is now available, it should be submitted for review as part of the permit application.*

LC ISR, LLC (4/09) - The pump test in question was used to further characterize the UKM aquifer and therefore, pursuant to discussions at the September 22, 2008 meeting with WDEQ-LQD in Lander, is not required for permitting of the HJ aquifer.

LQD (6/09) - The pump test in question was used to further characterize the UKM aquifer and therefore, pursuant to discussions at the September 22, 2008 meeting with WDEQ-LQD and LC personnel, is not required for permitting of the HJ aquifer. **The Section referenced by LQD (D6.5.2.3) was incorrect on the first review and has been corrected. The last sentence of the second paragraph states, "Long-term multi-well pump tests will be performed in the fall of 2007 to collect additional data regarding aquifer properties of the overlying and underlying aquifers" This seems to be referring to the Petrotek pump tests of LC16 and LC19 and should therefore state that, and cross reference Attachments D6-2a and D6-2b.**

LC ISR, LLC (11/09) - The last sentence in the second paragraph of Section D6.5.2.3 has been revised to clarify what information the LC16M and LC19M pump tests provided about the overlying and underlying aquifers, and cross-references to the respective attachments were included.

45. LQD (6/09) - **Section D.5.l Structure. The newly submitted north/south trending cross sections FF', G-G', and H-H' (Plates D5-1e through D5-1g) indicate additional faults north and south of the Lost Creek Fault. These faults need to be discussed within this section of the permit application. The extent of the faults, displacement, relative age, and any potential groundwater communication across them should be presented.**

LC ISR, LLC (11/09) - Please see above Responses to Comments D5, #4c and #8.

46. LQD (6/09) - **Section D.5.2 Site Geology. The last sentence of the paragraph states that Attachment D5-1 contains copies of typical geophysical logs from the permit area. Please also reference Attachment D6-3 which contains the geophysical logs for all the monitoring wells.**

LC ISR, LLC (11/09) - A cross-reference to Attachment D6-3 has been added to the last sentence in Section D5.2.

INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

Date: 11/18/2009
TFN: 4 6/268

MINE COMPANY Lost Creek ISR, LLC MINE NAME: Lost Creek ISR Project PERMIT NO.: N/A

Statement: I, John W. Cash, an authorized representative of Lost Creek ISR, LLC declare that only the items listed on this and all consecutively numbered Index Sheets are intended as revisions to the current permit document. In the event that other changes inadvertently occurred due to this revision, those unintentional alterations will not be considered approved. Please initial and date. JWC 11/18/09

NOTES: 1) Include all revision or change elements and a brief description of or reason for each revision element.
2) List all revision or change elements in sequence by volume number; number index sheets sequentially as needed.

VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
1 of 5 Adj File	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
2 of 5 Apps D1-D5	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
	Pages D5-i & 5-ii; D5-1 through D5-14	Pages D5-i & D5-ii; D5-1 through D5-16	Updated D5 Table of Contents & text in response to WDEQ-LQD comments. While all pages of Appendix D5 were resubmitted due to pagination changes, the only changes to the text are those outlined in the responses.
	Figure D5-1	Figure D5-1	Updated legend in response to WDEQ-LQD comment.
	--	Figure 5-2c	New figure created in response to WDEQ-LQD comments.
	Plate D5-2c	Plate D5-2c	Updated plate in response to WDEQ-LQD comments.
	--	Plate D5-3	New plate created in response to WDEQ-LQD comments.
	Attachment D5-2 Plates AD5-2a, 2b, and 2c	Attachment D5-2 Plates AD5-2a, 2b, and 2c	Updated plates in response to WDEQ-LQD comment.

INDEX SHEET FOR MINE PERMIT AMENDMENTS OR REVISIONS

Date: **11/18/2009**
TFN: **4 6/268**

MINE COMPANY **Lost Creek ISR, LLC** MINE NAME: **Lost Creek ISR Project** PERMIT NO.: **N/A**

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
3a of 5 App D6 through Attach D6-2b	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
	Pages D6-i - D6-iii; D6-1 through D6-36	Pages D6-i - D6-iii; D6-1 through D6-38	Updated D6 Table of Contents & text in response to WDEQ-LQD comments. While all pages of Appendix D6 were resubmitted due to pagination changes, the only changes to the text are those outlined in the responses.
	Tables D6-9a, 9b, 10a, 10b & 12a	Tables D6-9a, 9b, 10a, 10b & 12a	Updated in response to WDEQ-LQD comments.
	Table D6-15a	Table D6-15a	Added 1st round sampling results from MB Wells to the table.
	Plates D6-1a & 1b	Plates D6-1a & 1b	Updated in response to WDEQ-LQD comments.
3b of 5 Attach D6-3 & D6-4	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
	--	Attachment D6-3 Notes	Added a Notes pages at the beginning of the attachment (after List of Well Completion Logs).
	Attachment D6-3 Log for Well HJMP-104	Attachment D6-3 Log for Well HJMP-104	Corrected underreamed interval.
	Attachment D6-3 Log for Well HJMU-104	Attachment D6-3 Log for Well HJMU-104	Corrected log number.

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VOLUME NUMBER	PAGE, MAP OR OTHER PERMIT ENTRY TO BE REMOVED	PAGE, MAP OR OTHER PERMIT ENTRY TO BE ADDED	DESCRIPTION OF CHANGE
4 of 5 Apps D7 - D11; App D References; & App D E&W Roads	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
5 of 5 Ops Plan & Rec Plan	Pages iv, v, xii, xxiv & xxv	Pages iv, v, xii, xxiv & xxv	Updated Detailed Table of Contents.
	Page OP-3	Page OP-3	Updated text in response to WDEQ-LQD comment.
	Pages OP-16 & OP-17	Pages OP-16, OP-16a, & OP-17	Updated text in response to WDEQ-LQD comment.

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TOC
Replacement Pages

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MINE PERMIT VOLUME 2 of 5: Appendix D - Main Permit Area (D1 to D5) continued

MINE PERMIT VOLUME 3a of 5: Appendix D - Main Permit Area (D6)

TABLE OF CONTENTS – Detailed (continued)

MINE PERMIT VOLUME 3a of 5: Appendix D - Main Permit Area (D6) continued

MINE PERMIT VOLUME 3b of 5: Appendix D - Main Permit Area (D6)

No Text - See List of Attachments

MINE PERMIT VOLUME 4 of 5: Appendix D - Main Permit Area (D7 to D11) and Appendix D - East and West Roads

TABLE OF CONTENTS – Detailed (continued)

FIGURES

TABLE OF CONTENTS – Detailed (continued)

PLATES

PLATES (continued)

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TOC & Appendix D5 (Geology)

Replacement Pages

TABLE OF CONTENTS – Detailed (continued)

MINE PERMIT VOLUME 2 of 5: Appendix D - Main Permit Area (D1 to D5) continued

MINE PERMIT VOLUME 3a of 5: Appendix D - Main Permit Area (D6)

TABLE OF CONTENTS – Detailed (continued)

MINE PERMIT VOLUME 3a of 5: Appendix D - Main Permit Area (D6) continued

MINE PERMIT VOLUME 3b of 5: Appendix D - Main Permit Area (D6)

No Text - See List of Attachments

MINE PERMIT VOLUME 4 of 5: Appendix D - Main Permit Area (D7 to D11) and Appendix D - East and West Roads

TABLE OF CONTENTS – Detailed (continued)

FIGURES

TABLE OF CONTENTS – Detailed (continued)

PLATES

TABLE OF CONTENTS – Detailed (continued)

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ATTACHMENTS

D5 GEOLOGY

D5.1 Regional Geology

The Great Divide Basin (Basin) is an oval-shaped structural depression, encompassing some 3,500 square miles in south-central Wyoming. The Basin is bounded on the north by the Wind River Range and Granite Mountains, on the east by the Rawlins Uplift, on the south by the Wamsutter Arch and on the west by the Rock Springs Uplift. The regional geologic map is shown in **Figure D5-1**. Geologic development of the Basin began in the Late Cretaceous and continued through much of the Early Eocene.

D5.1.1 Stratigraphy

The earliest sedimentation in the Basin was the Paleocene (Early Tertiary) Fort Union Formation, which was unconformably deposited on the Lance Formation of Late Cretaceous age. The Fort Union Formation consists mostly of lacustrine shales, siltstones, and thin sandstones, which locally contain lignite beds. The thickness of the Fort Union Formation varies from place to place in the Basin, and it is approximately 4,650 feet thick in the Permit Area.

The Fort Union Formation is unconformably overlain by sediments of Eocene age, making up about 6,200 feet of basin fill. The western and southern portions of the Basin are covered by the Wasatch Group, which consists of sandstone, siltstone, limestone, conglomerate and lignite beds. The rocks in the Wasatch Group are believed to be of fluvial-lacustrine origin. Towards the north and northeast, the Wasatch Group rapidly grades into and inter-tongues with the equally thick, fine- to coarse-grained arkosic sandstones and conglomerates of the Battle Spring Formation, a typical alluvial fan complex. The source of the Battle Spring sediments is believed to be the ancestral Granite Mountains to the north. Pliocene pediment deposits and recent alluvium cover large areas of the surface in the Basin. **Table D5-1** and **Figure D5-2a** show the general stratigraphy of the Basin.

The upper portion of the Battle Spring Formation is the host to the uranium mineralization in the Permit Area. In the Permit Area, the top 700 feet of the Battle Spring Formation is divided into at least five horizons marked from top to bottom as BC, DE, FG, HJ, and KM. These horizons are separated from one another by various thicknesses of shale, mudstone and siltstone (**Figure D5-2b**).

D5.1.2 Structure

The present physiographic feature of the Basin was generated by the Laramide Orogeny. During the Late Cretaceous and Early Tertiary, the structures surrounding the Basin were either rejuvenated or were formed, transforming the area into a bowl-shaped geological structure, the Basin. During this upheaval, the Wind River Mountains and Granite Mountains were uplifted on the north side of the Basin. The Rawlins Uplift formed to the east; the Wamsutter Arch formed to the south; and the Rock Spring Uplift formed to the west. All of these highs formed a ring around the Basin, turning the Basin into a bowl-like structure with drainage being inward. The Continental Divide, extending from the south, splits into two and forms half circles on the east and west sides of the Basin, joining again as one topographic high on the north side of the Basin.

The Basin is asymmetrical with its major axis trending west-northwest. Several anticlines and synclines have been mapped within the Basin, and some of these features are oil-bearing (at much deeper levels than the uranium-bearing formations). Noteworthy among these structures is the Lost Soldier anticline in the northeastern part of the Basin, approximately 15 miles northeast of the Permit Area. The Battle Spring and Fort Union formations, as well as older rocks crop out in the anticline; and the formations on the southwestern flank of the anticline dip 20 to 25 degrees to the southwest. The dip gradually becomes gentler, and, at the Permit Area, it is merely three degrees to the west.

Contemporaneous with the uplift of the mountains surrounding the Basin, there were episodes of normal and thrust faulting within and around the Basin. Most of the major faults are located in the northern part of the Basin, with displacement ranging from a few feet to over 3,000 feet. But, toward the center of the Basin near the Permit Area, faulting seems to be only on a minor scale. For example, the displacement at the Lost Creek Fault which traverses the mineralized area from west-southwest to east-northeast is zero to about 80 feet. More details about the Lost Creek Fault are given in **Section D5.2.2**.

D5.2 Site Geology

The Permit Area is located near the north-central part of the Basin, where the Basin fills are predominantly the Eocene Battle Spring Formation and the Paleocene Fort Union Formation. Geological cross sections throughout the Permit Area are presented in **Plates D5-1a**, **b**, **c**, **d**, **e**, **f**, and **g**, and thickness (isopach) maps of the major sands and shales are presented in **Plates 5-2a**, **b**, **c**, and **d**. The locations of the cross sections are illustrated in **Plate D5-3** (General Location Map-Geology) and also on insets within each cross section. These cross sections display stratigraphic and structural relationships interpreted from drill hole log data and projected onto true north-south or east-west planes. The true distance between drill holes are annotated near the top of each section. Endpoints of each cross-section are projected to the permit boundaries. The cross sections also illustrate the piezometric surfaces for the DE, LFG, HJ and UKM horizons. Depiction of these surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with potentiometric contours plotted for the given horizons (**Plates D6-11a to D6-11d**). **Attachment D5-1** contains copies of typical geophysical logs from the Permit Area, and **Attachment D6-3** contains copies of the geophysical logs from the baseline monitoring wells.

D5.2.1 Stratigraphy

The entire Permit Area is covered by the upper part of the Battle Spring Formation, which is the host to uranium mineralization. Generally, in the Basin, Battle Spring and Wasatch formations, which are time equivalent, interfinger with one another. In the Permit Area, the upper half of the lithologic units consists of Battle Spring Formation and the lower half is made up of Wasatch Formation. The total thickness of the Battle Spring and Wasatch formations under the Permit Area is about 6,200 feet. The Fort Union Formation is 4,650 feet thick beneath the Permit Area and unconformably underlies the Battle Spring/Wasatch formations. Deeper in the Basin and lying unconformably are various Cretaceous, Jurassic, Triassic, Paleozoic, and Precambrian basement lithologic units (**Table D5-1**). A schematic geologic cross section across the Permit Area is shown in **Figure D5-2a**, depicting all lithologic units present under the Permit Area.

The Battle Spring Formation in the Permit Area is part of a major alluvial system, consisting of thick beds of very fine- to coarse-grained arkosic sandstones separated by various layers of mudstones and siltstones. Conglomerate beds may exist locally. Economic uranium mineralization is generally associated with medium to coarse-grained sandstone, which may contain minor organic matter locally. At least five horizons with various amounts of mineralization have been identified in and near the Permit Area.

Aquifers in the Battle Spring Formation typically consist of thick sequences of multiple, medium to coarse-grained, fluvial channel-fill sands. *Mapable sand units* (for example: the UHJ Sand) may range from five to 50 feet in composite thickness, and typically consist of multiple stacked channel-fill sands. *Aquifers*, in turn, typically consist of multiple stacked sand units. Sand units are commonly separated vertically by locally thick beds of mudstone, claystone, siltstone or fine-grained sands. These interbeds represent local aquitards and aquicludes which can be considered internal to the regional aquifer. Total composite thickness of an aquifer (for example: the HJ Horizon) is commonly in excess of 100 feet.

Aquiclides and aquitards (for example: the Lost Creek Shale or Sage Brush Shale) represent quiescent floodplain and overbank sedimentary environments between channel fill sequences. Generally referred to as 'shales' they are, in essence, sedimentary sequences dominated by mudstone and claystone lithology; but also may include substantial amounts of siltsone and fine-grained sands. These lithologies can exhibit considerable lateral facies changes and interfingering, and are often transitional to the aquifers above or below. As a result, dramatic thickening and thinning of the aquicludes can occur locally. Thicknesses of the Lost Creek and Sagebrush Shales are commonly in excess of 25 feet. The thinnest observed occurrences of these units are approximately five feet thick.

Aquicludes may locally include occurrences of mineralization in the vicinity of lithologic interfingering and facies changes with mineralized sands. Mineralization in this setting will not be targeted for mining and thus will experience minimal, if any, contact with production lixiviant. Given the very low concentrations of uranium within the shales (0.05% or less), the structural integrity and confinement characteristics of the shales will remain unchanged, even if uranium in the shales were incidentally contacted and removed through mining.

Figure D5-2c provides a detailed illustration of the lithologic changes over a 400-foot section in the central portion of the ore-body in the Permit Area. The five mineralized horizons in the Permit Area are designated, from the surface down: the BC, DE, FG, HJ, and KM Horizons. The two horizons with the most mineralization are HJ and KM, which have been further divided into upper, middle and lower sub-units of sandstones (UHJ Sand, MHJ Sand, and LHJ Sand; and UKM Sand, MKM Sand, and LKM Sand). Geological cross sections through the mineralized zones in the Permit Area are presented in **Plates D5-1a**, **b**, **c**, **d**, **e**, **f**, and **g**. Thickness (isopach) maps of the HJ Horizon and UKM Sand, as well as the shales above the HJ Horizon (Lost Creek Shale) and below the HJ Horizon (Sage Brush Shale), are presented in **Plates D5-2a**, **b**, **c**, and **d**.

The HJ Horizon is 110 to 130 feet thick, averaging about 120 feet. The thinner part of HJ is generally south of the Lost Creek Fault. A thicker part of the HJ Horizon runs parallel to the Lost Creek Fault, trending in a west-southwest to east-northeasterly direction. The mineralization is mostly concentrated in the middle part of the HJ Horizon and occurs as both roll front and tabular deposits. The subdivided sand units within the HJ Horizon are separated by discontinuous shale, siltstone and mudstones. The shales overlying and underlying the the HJ Horizon are the Lost Creek and Sage Brush Shales, which range from five to over 25 feet thick. The UKM Sand lies under the Sage Brush Shale and is 20 to more than 60 feet thick, averaging about 40 feet. In the eastern part of the Permit Area, the unit is 20 to 50 feet thick; whereas the sand unit in the western portion of the permit area is 40 to more than 60 feet thick, indicating the development of a major paleo-channel. The mineralization occurs as both roll front and tabular deposits.

D5.2.2 Structure

Geologic structural features in the Permit Area are illustrated on: the cross sections (**Plates D5-1a** to **D5-1e**); the isopach maps (**Plates D5-2a** to **D5-2d**; and on **Plate D5-3** (General Location Map). In the Permit Area, the Battle Spring Formation is nearly flat-lying, dipping gently to the northwest at roughly three degrees. This pattern is slightly modified locally due to displacement by normal faulting which is post-mineralization in relative time. The genesis of these faults is not certain, however, they may be the product of regional basin unloading. They are not considered to be currently active.

Three faults have been identified. The primary fault is referred to as the Lost Creek Fault. It is centrally located sub-parallel with the mineral trend. It was initially interpreted to be a scissor fault, with reversal of displacement direction in the western third of the Permit Area. Recent interpretation has revealed that it is, instead, a sequence of sub-parallel faults with opposite displacement occurring in an en-echelon configuration.

The 'main' Lost Creek Fault trends east to west and dissects the eastern two-thirds of the Permit Area. Downward displacement occurs on the south block. Throw is approximately 70 to 80 feet in the eastern portion of the Permit Area, decreasing to the west, and eventually losing identity in the western one-third of the Permit Area. In addition, a minor 'splinter' fault has been identified close to the 'main' fault in the west-central portion of the mineral trend. Maximum displacement on this fault is roughly 20 feet.

A subsidiary, sub-parallel fault becomes apparent south of the 'main' Lost Creek Fault in the general vicinity where the 'main' fault loses identity. This portion of the Lost Creek Fault sequence continues west to the western edge of the Permit Area. Direction of throw on this fault is opposite to the 'main' fault; i.e., downthrown to the north. Displacement ranges from approximately 40 to 50 feet in the east, decreasing to 20 to 30 feet to the west.

Recent activity has identified the presence of additional faulting. A second fault (the North Fault) occurs in the northwestern portions of the Permit Area. Limited data indicates that the maximum displacement is approximately 70 feet, with the downthrown block to the north. Likewise, a third fault (the South Fault) is found in the south-central portion of the Permit Area. Maximum displacement is roughly 40 feet, with the downthrown block to the north. Both of these faults are oriented sub-parallel to the Lost Creek Fault sequence. Also, both are located outside of anticipated production areas.

D5.2.3 Ore Mineralogy and Geochemistry

The age of mineralization in the Battle Spring Formation is considered to be between 35 and 26 million years before present. Uranium mineralization in the Basin generally occurs either as tabular or C-shaped roll-front deposits. Oxygen-rich surface water, carrying dissolved uranium, entered various sandstones in the Basin. The water percolated down dip, oxidizing the sandstones on its way down dip. Upon reaching sites rich in organic matter, the water lost its oxidizing potential and deposited the uranium, forming the two types of mineralization mentioned above.

Tabular deposits may form at the interface between oxidizing and reducing conditions (the redox front), where oxidation, for all practical purposes, stops. Localized tabular deposits may also form up-dip from the redox front in an entirely oxidized zone, where carbonaceous materials have gathered and formed locally reducing conditions.

The C-shaped roll-front deposits normally form just at the redox front, where the water loses its oxidizing potential. The uranium precipitates and accumulates in a "C"-shaped deposit, with the concave side facing up-dip toward the oxidized sand. Uranium usually accumulates in finer-grained sandstones that carry various amounts of organic matter, which provides a reducing condition.

The alteration process not only changes the color, but also alters the mineralogy of the host sandstones. The color of unaltered, reduced sandstone is light to dark grey, with carbon trash, dark accessories, and traces of pyrite. Altered, oxidized, sandstone contains iron oxide staining (where former carbonaceous matter and pyrite were present), kaolinized feldspar, and has a pink to tan-buff, greenish-grey to bleached appearance. The presence of pyrite and carbonaceous material appear to be the major controlling factors for the precipitation of uranium mineralization. Thinning of sandstones and diminishing grain size probably slowed the advance of the uranium-bearing solutions and further enhanced the chances of precipitation.

The main uranium minerals are uraninite, a uranium oxide, and coffinite, a uranium silicate. Russell Honea (1979) and John V. Heyse (1979) studied several core samples by scanning electron microprobe (SEM), polished section and thin section. Their conclusions were that the host sands are fine- to coarse-grained, poorly sorted arkose. The uranium mineralization is of sub-microscopic size and can be seen only in SEM magnification. They are associated and at times intergrown with round pyrite particles. The uranium minerals identified are mostly uraninite and, possibly, coffinite. The uranium, besides occurring with pyrite, also occurs as a coating around sand grains and as filling of voids between grains. It also occurs as minute particles within larger clay particles.

The most recent study of the lithology and mineralogy was conducted by Hazen Research under the guidance of Dr. Nick Ferris, Ur-E geologist (Ferris, 2007, company report). He concluded that the rocks, represented by a core sample from a depth of 506 to 507 feet of Hole Number LC-64C, are composed of medium- to coarse-grained sand with interstitial clay and silt. Uranium occurrences are very fine-grained and micron-sized, and are mainly dispersed throughout some of the interstitial clays, and occur similarly in some of the interstitial pyrite as well. Because of the size of uranium mineral particles, it was not certain whether the uranium mineral was coffinite or uraninite. The sample tested, comes from the Upper KM Sand unit and may or may not be representative of the majority of the mineralization in the overlying HJ Horizon within the Permit Area.

Known mineralized intervals are found at depths ranging from near surface down to 1,150 feet below the surface in the Permit Area. It is possible that deeper mineralization may exist as well. The main mineralization horizons trend in an east-northeast direction for at least three miles, and are up to 2,000 feet wide. The thickness of individual mineralized beds at the Permit Area ranges from five to 28 feet and averages about 16 feet. The mineralization grade ranges from 0.03 percent to more than 0.20 percent equivalent uranium oxide (eU_3O_8). Four main mineralized horizons, from depths of 300 to 700 feet, have been identified. The richest mineralized zone occurs in the middle part of the HJ Horizon (MHJ Sand) and it is about 30 feet thick, 400 to 450 feet deep, and is believed to contain more than 50 percent of the total resource under the Permit Area.

D5.2.4 Exploration and Production Activities

D5.2.4.1 Uranium

Historic and current uranium explorations exist in several areas of the Basin; however, uranium mining has been limited. The closest production was at the Kennecott Uranium Project, located about five miles south-southwest of the center of the Project, with about two miles separating the permit boundaries. (NRC License No. SUA-1350; WDEQ-LQD Permit No. 481). The project includes the Sweetwater Mill, a conventional mill which is currently on stand-by, a mill tailings disposal area, and reclaimed surface mining areas.

There has been no uranium production within the Permit Area. Historic exploration activities in the Permit Area can be summarized as follows:

- Pre-1976: Numerous companies held the property; uranium mineralization was discovered by Climax Uranium and Conoco.
- 1976: Texasgulf optioned property from Valley Development Inc.

- 1977 through 1979: Texasgulf optioned property from Valley Development Inc., delineated the main trend of the mineralization, obtained a 50-percent interest in the Conoco claims on the trend to the east, and exercised its option with Valley Development Inc.
- 1986: Power Nuclear Corporation acquired the properties.
- 2000: Power Nuclear Corporation sold its Lost Creek properties to New Frontiers Uranium, LLC.
- 2005: New Frontiers Uranium, LLC transferred its Wyoming properties and data including its Lost Creek property to NFU.
- 2005: Ur-Energy USA Inc. purchased NFU from New Frontiers Uranium, LLC on terms.
- 2007: Ur-Energy USA Inc. completes the acquisition of NFU from New Frontiers Uranium, LLC, and maintains NFU as a wholly owned subsidiary.
- 2007: Ur-Energy USA Inc. forms Lost Creek ISR, LLC (LC ISR, LLC) to develop the Lost Creek property into an ISR facility and transfers the Lost Creek property from NFU to LC ISR, LLC.

At least 560 uranium exploration holes had been drilled in Permit Area prior to 2000. The plates and table in **Attachment D5-2** present the locations and total depths of all the known historic drill holes drilled in the Permit Area. The information that LC ISR LLC has pertaining to historic drill hole abandonment and re-plugging is provided in **Table D5-2**, including total depths of holes.

There have been continuing efforts over the years to ensure that drill holes are properly abandoned. In the early 1980s, the Conoco/Texasgulf Joint Venture worked to correct a WDEQ LQD violation resulting from incorrect surface capping and hole abandonment. Copies of the memos to WDEQ LQD explaining the work are included as **Attachment D5-3**. WDEQ-LQD subsequently approved the hole abandonment and released the bond.

In 2006, LC ISR, LLC re-located and re-abandoned twelve historic holes (**Table D5-2**). A drill rig was placed on each hole, and the hole was reamed/washed to 650 fbs A mixture of BH Thermal Grout, exceeding WDEQ-LQD Rules and Regulations Chapter 8 requirements, was pumped into the hole as the drill stem was retrieved. No effort was made to determine the depth of historic drill mud but the rig did have to ream/wash out mud from each hole. The upper 25 feet of each hole was plugged with cement. An attempt to relocate three additional holes was unsuccessful. LC ISR, LLC supplied this information to WDEQ-LQD in a letter dated January 15, 2007 (**Attachment D5-3**). In 2008, geologists discovered four historic holes with failed surface caps (Holes TT31, TT80, TT96, and TT141). Drill rigs were put on each of the four holes so they could be re-plugged. In each case, the drill stem was lowered between 180 and 220 fbs before hitting significant resistance. The holes were washed out and re-plugged to surface using grout. Each hole was also re-capped. **Table D5-2** contains information pertaining to the re-abandonment of these four holes.

Some pumping tests have shown very minor communication between the overlying and underlying aquifers and the HJ horizon (**Section 6.2.2.3**). There are several possible reasons for this communication, one of which is leakage through an improperly abandoned drill hole(s). However, the consistent nature of the response, regardless of distance from the pumping well, suggests that leakage through an improperly abandoned hole(s) is not the most likely cause of communication. Other more likely causes are: pumping from other wells in the area; regional communication between aquifers; background trends; or leakage through the juxtaposed aquifers across the Lost Creek Fault.

If additional, improperly abandoned drill holes are found in the future, LC ISR, LLC will plug the holes as described above. In particular, before operations begin in a mine unit, a field inspection will be performed to locate any historic holes with surface capping issues. If the inspection identifies any capping problems, the hole will be re-entered with a drill rig or tremie pipe and re-plugged with grout. A new cement surface cap will also be installed. Aquifer testing of the mine unit prior to operation will also help identify any improperly abandoned holes that could interfere with mine unit operation.

D5.2.4.2 Other Minerals

Historic and current oil and gas exploration drilling are also in the region. There are no current oil and gas activities within the Basin that are completed in the same horizons as those discussed for ISR production in this application. The nearest significant gas fields are approximately ten miles to the southwest; therefore, no interference is anticipated between oil and gas production activities and ISR activities. There is no exploration of coal bed methane or other mineral resources within the Permit Area and the nearby region.

D5.3 Seismology

The discussion of the seismology of the Permit Area and surrounding areas includes: an analysis of historic seismicity; an analysis of the Uniform Building Code (UBC); a deterministic analysis of nearby faults; an analysis of the maximum credible "floating earthquake;" and a discussion of the existing short- and long-term probabilistic seismic hazard analysis. The materials presented here are mainly based on the seismologic characterization of Sweetwater, Carbon, Fremont, and Natrona Counties by James C.

Case and others from the Wyoming State Geological Survey (Case et al., 2002a, 2002b, 2002c and 2003).

D5.3.1 Historic Seismicity

The Permit Area is located in the north-eastern portion of the Basin, in south-central Wyoming. Historically, south-central Wyoming has had a low to moderate level of seismicity compared to the rest of the State of Wyoming. As shown in **Figure D5-3**, most of the historical earthquakes occurred in the west-northwest portion of Wyoming. Significant historical earthquakes adjacent to the Permit Area are described below, and are organized by areas in which they occurred.

D5.3.1.1 Town of Bairoil Area

Bairoil is located about 15 miles northeast of the Permit Area. Historically, there have been only a few earthquakes that have occurred within 20 miles of Bairoil. On August 11, 1916, a non-damaging intensity III earthquake occurred approximately 17 miles northwest of Bairoil. On June 1, 1993, a non-damaging magnitude 3.8, intensity III earthquake occurred four miles north of Bairoil, and was felt by some residents. On December 10, 1996, a non-damaging magnitude 2.6 earthquake occurred approximately ten miles northwest of Bairoil. A few residents also felt that event.

Two recent earthquakes were recorded near Bairoil in 2000. On May 26, 2000, a magnitude 4.0 earthquake occurred, followed by another (magnitude 2.8) four days later, on May 30, 2000. Both earthquakes were located about 3.5 miles southwest of Bairoil. Most residents in Bairoil felt the first earthquake. No significant damage was associated with either seismic event (Cook, 2000).

D5.3.1.2 City of Rawlins Area

Rawlins is approximately 38 miles southeast of the Permit Area. The first recorded earthquake that was felt and reported immediately southwest of Rawlins occurred on March 28, 1896. The intensity IV earthquake shook for about two seconds. On March 10, 1917, an earthquake (intensity IV) was recorded approximately one mile northeast of Rawlins. The earthquake was felt as a distinct shock that caused wooden buildings to noticeably vibrate. Stone buildings were not affected by the event (*Rawlins Republican*, 1917).

On September 10, 1964, a magnitude 4.1 earthquake occurred approximately 30 miles west of Rawlins. One Rawlins resident reported that the earthquake caused a crack in the basement of his home in Happy Hollow. No other damage was reported (*Daily Times*, 1964).

Small earthquakes were detected, on April 13, 1973, May 30, 1973, and June 1, 1973, approximately six miles west of Hanna. No one reported feeling these events. On July 11, 1975, Rawlins residents felt an earthquake (intensity II) event. On January 27, 1976, an earthquake (magnitude 2.3, intensity V) occurred approximately 12 miles north of Rawlins. Several people reported that they were thrown out of bed (*Daily Times*, 1976). On March 3, 1977, an earthquake (intensity V) was reported approximately 18.5 miles west-northwest of Encampment. Doors and dishes were rattled in southern Carbon County homes; but no significant damage was reported (*Laramie Daily Boomerang*, 1977).

On April 13, 1991 and April 19, 1991, magnitude 3.2 and magnitude 2.9 earthquakes, respectively, occurred near the center of the Seminoe Reservoir. A magnitude 3.1 earthquake occurred on December 18, 1991, southwest of the Seminoe Reservoir, approximately 15 miles northeast of Sinclair. No one reported feeling these Seminoe-Reservoir-area earthquakes. On August 6, 1998, a magnitude 3.6 earthquake occurred approximately 13 miles north of Rawlins. Residents in Rawlins reported hearing a sound and then feeling a jolt. On April, 1999, a magnitude 4.3 earthquake occurred approximately 29 miles north-northwest of Baggs. It was felt in Rawlins; and residents reported that pictures fell off the walls.

D5.3.1.3 City of Rock Springs Area

Rock Springs is located approximately 80 miles southwest of the Permit Area. The first recorded earthquake that was felt in Sweetwater County occurred on April 28, 1888. This intensity IV earthquake, which originated near Rock Springs, did not cause any appreciable damage. On July 25, 1910, an intensity V earthquake occurred at the same time that the Union Pacific Number One Mine in Rock Springs partially collapsed. On July 28, 1930, an intensity IV earthquake, with an epicenter near Rock Springs, was felt in Rock Springs and Reliance (*Casper Daily Tribune*, 1930). The earthquake awakened many residents; and some merchandise fell off of store shelves.

On March 21, 1942, a non-damaging, intensity III earthquake was felt in the Rock Springs area. This event was followed, on September 14, 1946, by an intensity IV earthquake. On October 25, 1947, a small earthquake with no assigned intensity or magnitude occurred southeast of Rock Springs. Two intensity IV earthquakes occurred in the Rock Springs area on September 24, 1948. The events rattled dishes in parts of Rock Springs.

A magnitude 3.9 event was recorded on January 5, 1964, approximately 23 miles south of Rock Springs. The University of Utah Seismograph Stations detected a non-damaging, magnitude 2.4 earthquake on March 19, 1968. This event was centered approximately 17 miles southeast of Rock Springs. A magnitude 3.2 event occurred on May 29, 1975, approximately 13 miles northeast of Superior. A week later, on June 6, 1975, a magnitude 3.7 earthquake was recorded in the same area. No damage was associated with any of the 1975 events.

The University of Utah Seismograph Stations recorded a non-damaging magnitude 2.7 earthquake on June 5, 1986. This event was located approximately 14 miles southwest of Green River, Wyoming.

On February 1, 1992, the University of Utah Seismograph Stations recorded a non-damaging magnitude 2.3 earthquake, approximately seven miles north of Rock Springs.

D5.3.1.4 City of Lander Area

Lander is about 70 miles northwest of the Permit Area. A number of earthquakes have occurred in the Lander area. The first reported earthquake occurred on January 22, 1889, and had an intensity of III to IV. This was followed by an intensity IV event on November 21, 1895, during which houses were jarred and dishes rattled. On November 23, 1934, an intensity V earthquake was centered approximately 20 miles northwest of Lander. For a radius of ten miles around Lander, residents reported that dishes were thrown from cupboards, and that pictures fell down from the walls. Cracks were found in buildings along two business blocks; and the brick chimney of the Fremont County Courthouse was separated by two inches from the building. The earthquake was felt at Rock Springs and Green River, Wyoming (*Casper Tribune-Herald*, 1934).

There were a series of earthquakes in the Lander area in the 1950s that caused little damage. On August 17, 1950, there was an intensity IV earthquake that caused loose objects to rattle and buildings to creak. On January 12, 1954, there was an intensity II event; and on December 13, 1955, there was an intensity IV event near Lander, with no damage reported.

On June 14, 1973, a small earthquake was reported about eight miles east-northeast of Lander. The earthquake has been recently interpreted as a probable explosion. On January 31, 1992, a non-damaging magnitude 2.8 earthquake occurred approximately 20 miles northwest of Lander. This event was followed, on October 10, 1992, by a magnitude 4.0, intensity III earthquake centered approximately 22 miles east of Lander.

D5.3.1.5 City of Casper Area

Casper is located about 90 miles northeast of the Permit Area. Two of the earliest recorded earthquakes in Wyoming occurred near Casper. The first was on June 25, 1894, and had an estimated intensity of V. In residences on Casper Mountain, dishes rattled and fell on the floor and people were thrown from their beds. Water in the Platte River changed from fairly clear to reddish, and became thick with mud, due to the river banks slumping into the river during the earthquake. On November 14, 1897, an even larger event was felt. An intensity VI to VII earthquake, one of the largest recorded in central and eastern Wyoming, caused considerable damage to a few buildings. As a result of the earthquake, a portion of the Grand Central Hotel was cracked from the first to the third story. Some of the ceilings in the Grand Central Hotel were also severely damaged.

On October 25, 1922, an intensity IV earthquake was reported in the Casper area. The event was felt in Casper; at Salt Creek, 50 miles north of Casper; and at Bucknum, 22 miles west of Casper. Dishes were rattled and hanging pictures were tilted near Salt Creek. No significant damage was reported in Casper (*Casper Daily Tribune*, 1922). On December 11, 1942, an intensity IV earthquake was recorded north of Casper. Although no damage was reported, the event was felt in Casper, Salt Creek, and Glenrock (*Casper Tribune-Herald*, 1941). On August 2, 1948, another intensity IV earthquake was reported in the Casper area. No damage was reported (*Casper Tribune-Herald*, 1948). In the 1950s, two earthquakes caused some concern among Casper residents. On January 24, 1954, an intensity IV earthquake near Alcova did not result in any reported damage (*Casper Tribune-Herald*, 1954). On August 19, 1959, an intensity IV earthquake was felt in Casper. Most recently, on October 19, 1996, a magnitude 4.2 earthquake was recorded approximately 15 miles north-northeast of Casper. No damage was reported.

D5.3.2 Uniform Building Code

With safety in mind, the UBC provides Seismic Zone Maps to help identify which building design factors are critical to specific areas of the country. Five UBC seismic zones are recognized, ranging from Zone 0 to Zone 4. These seismic zones are, in part, defined by the probability of having a certain level of ground shaking (horizontal acceleration) in 50 years. The criteria used for defining boundaries on the Seismic Zone Map were established by the Seismology Committee of the Structural Engineers Association of California (SEAOC, 1986). The criteria they developed are as follows:

- Zone 4: ≥ 30 percent gravity (g) effective peak acceleration;
- Zone 3: 20 to ≤ 30 percent g effective peak acceleration;
- Zone 2: 10 to ≤ 20 percent g effective peak acceleration;
- Zone 1: 5 to ≤ 10 percent g effective peak acceleration; and
- Zone 0: ≤ 5 percent g effective peak acceleration.

The Seismology Committee of the Structural Engineers Association of California assumed that there was a 90 percent probability that the above values would not be exceeded in 50 years, or a 100 percent probability that the values would be exceeded in 475 years.

Figure D5-4 shows the delineation of UBC seismic zones in Wyoming. The Permit Area is located in Seismic Zone 1. Since effective peak accelerations (90 percent chance of non-exceedance in 50 years) can range from five to ten percent g in Zone 1, it may be reasonable to assume that an average peak acceleration of 7.5 percent g could be applied to the design of a non-critical facility located near the center of Zone 1.

D5.3.3 Deterministic Analysis of Active Fault Systems

There are two active fault systems in the vicinity of the Permit Area, the Chicken Springs Fault System and the South Granite Mountain Fault System (**Figure D5-5**).

The Chicken Springs Fault System, located six miles east of the Permit Area, is composed of a series of east-west trending segments. In 1996, the Wyoming State Geological Survey investigated this fault system, and determined that the most recent activity on the system appears to be Holocene in age. Reconnaissance-level studies indicated that the fault system is capable of generating a magnitude 6.5 earthquake (Case et al., 2002a). A magnitude 6.5 earthquake on the Chicken Springs Fault System would generate peak horizontal accelerations of approximately 4.8 percent g at Rawlins (Case et al., 2002a). These accelerations would be roughly equivalent to an intensity V earthquake, which may cause some light damage. Bairoil, however, would be subjected to a peak horizontal acceleration of approximately 23 percent g, or an intensity VII earthquake (Case et al., 2002a). Intensity VII events have the potential to cause moderate damage.

The South Granite Mountain Fault System is located about 14 miles northeast of the Permit Area. This fault system is composed of several northwest-southeast trending normal and thrust faults in southeastern Fremont County and northwestern Carbon County. The active segments of the system have been assigned a maximum magnitude of 6.75, which could generate peak horizontal accelerations of approximately 20 percent g at Bairoil and 6.1 percent g at the Rawlins (Case et al., 2002a). These accelerations would be roughly equivalent to an intensity VII earthquake at the Bairoil and an intensity V earthquake at Rawlins. Bairoil could sustain moderate damage; whereas minor or no damage could occur at Rawlins.

D5.3.4 Maximum Tectonic Province Earthquake "Floating Earthquake" Seismogenic Source

Tectonic provinces are regions with a uniform potential for the occurrence of earthquakes that are tied to buried faults with no surface expression. Within a tectonic province, earthquakes associated with buried faults are assumed to occur randomly, and, as a result, can theoretically occur anywhere within that area of uniform earthquake potential. In reality, that random distribution may not be the case, as most earthquakes are associated with specific faults. If all buried faults have not been identified, however, the distribution has to be considered random. "Floating earthquakes" are earthquakes that are considered to occur randomly in a tectonic province.

The US Geological Survey (USGS) identified tectonic provinces in a report titled "Probabilistic Estimates of Maximum Acceleration and Velocity in Rock in the Contiguous United States" (Algermissen et al., 1982). In that report, Sweetwater County was classified as being in a tectonic province with a "floating earthquake" maximum magnitude of 6.1. Geomatrix (1988) suggested using a more extensive regional tectonic province, called the "Wyoming Foreland Structural Province," which is approximately defined by the Idaho-Wyoming Thrust Belt on the west, 104 degrees West longitude on the east, 40 degrees North latitude on the south, and 45 degrees North latitude on the north. Geomatrix (1988) estimated that the largest "floating earthquake" in the "Wyoming Foreland Structural Province" would have a magnitude in the 6.0 to 6.5 range, with an average value of magnitude 6.25.

D5.3.5 Short-Term Probabilistic Seismic Hazard Analysis

The USGS publishes probabilistic acceleration maps for 500-; 1,000-; and 2,500-year time frames. The maps show what accelerations may be met or exceeded in those time frames by expressing the probability that the accelerations will be met or exceeded in a shorter time frame. For example, a ten percent probability that acceleration may be met or exceeded in 50 years is roughly equivalent to a 100 percent probability of exceedance in 500 years.

The 500-year map provides accelerations that are comparable to those derived from the UBC and from the deterministic analysis on the Green Mountain Segment of the South Granite Mountain Fault System. It was often used for planning purposes for average structures. Based on the 500-year map (ten percent probability of exceedance in 50 years), the estimated peak horizontal acceleration in the Permit Area is approximately 6.5 percent g, which is comparable to the acceleration expected in Seismic Zone 1 of the UBC (**Figure D5-6**). These accelerations (3.9 – 9.2 percent g) are roughly comparable to intensity V earthquakes which can result in cracked plaster and broken dishes, but minor or no construction damages (Case, 2002). All facilities, including the processing plant, pipelines and well structures, at Lost Creek will be designed and constructed to sustain an intensity V earthquake. In addition, the observations of injection, production, and pipeline pressures and associated monitor well measurements, necessary for the in situ operation, will provide short-term information about any unanticipated seismic impacts. The estimated acceleration in the Permit Area is 20 percent g on the 2,500 year map.

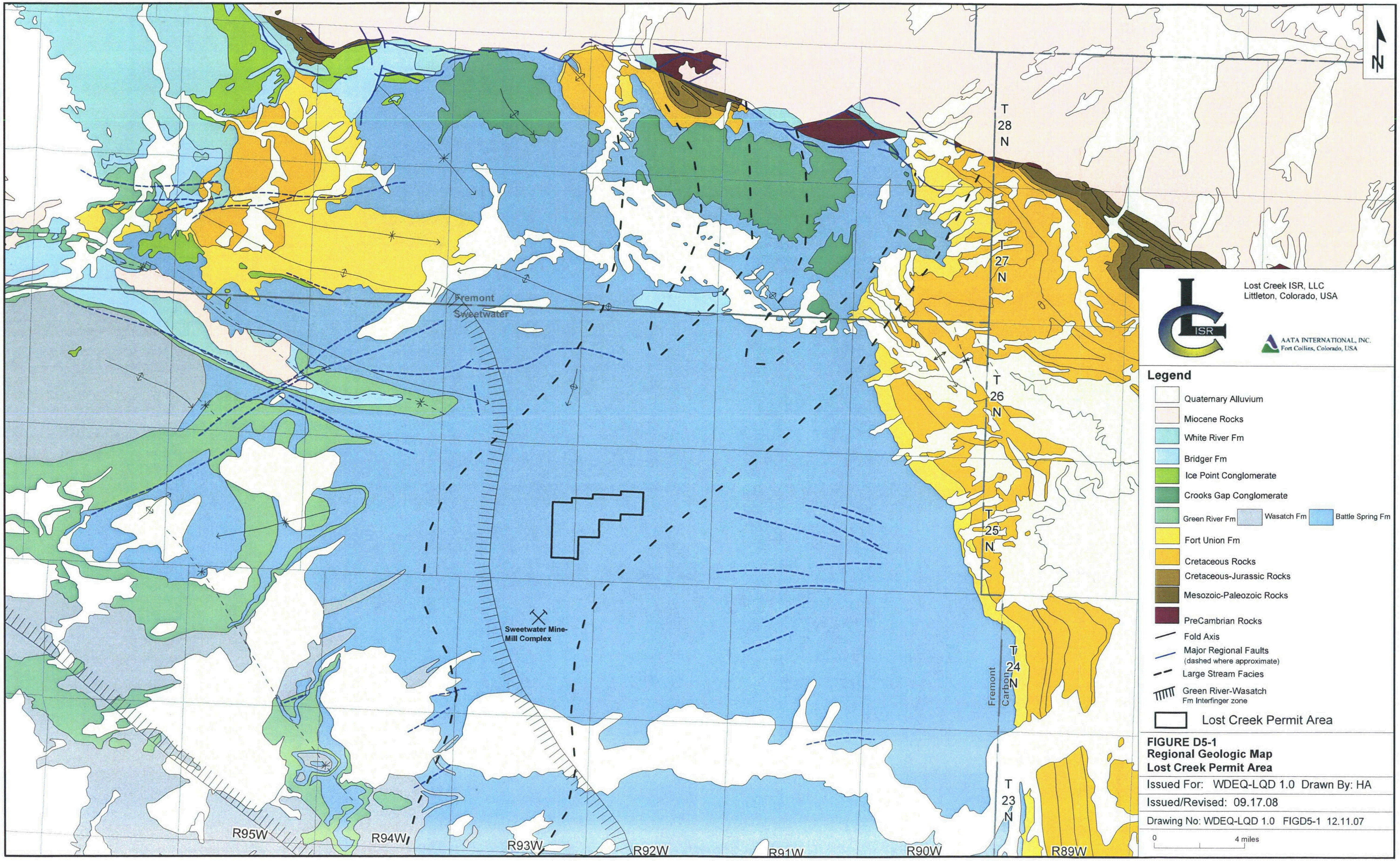
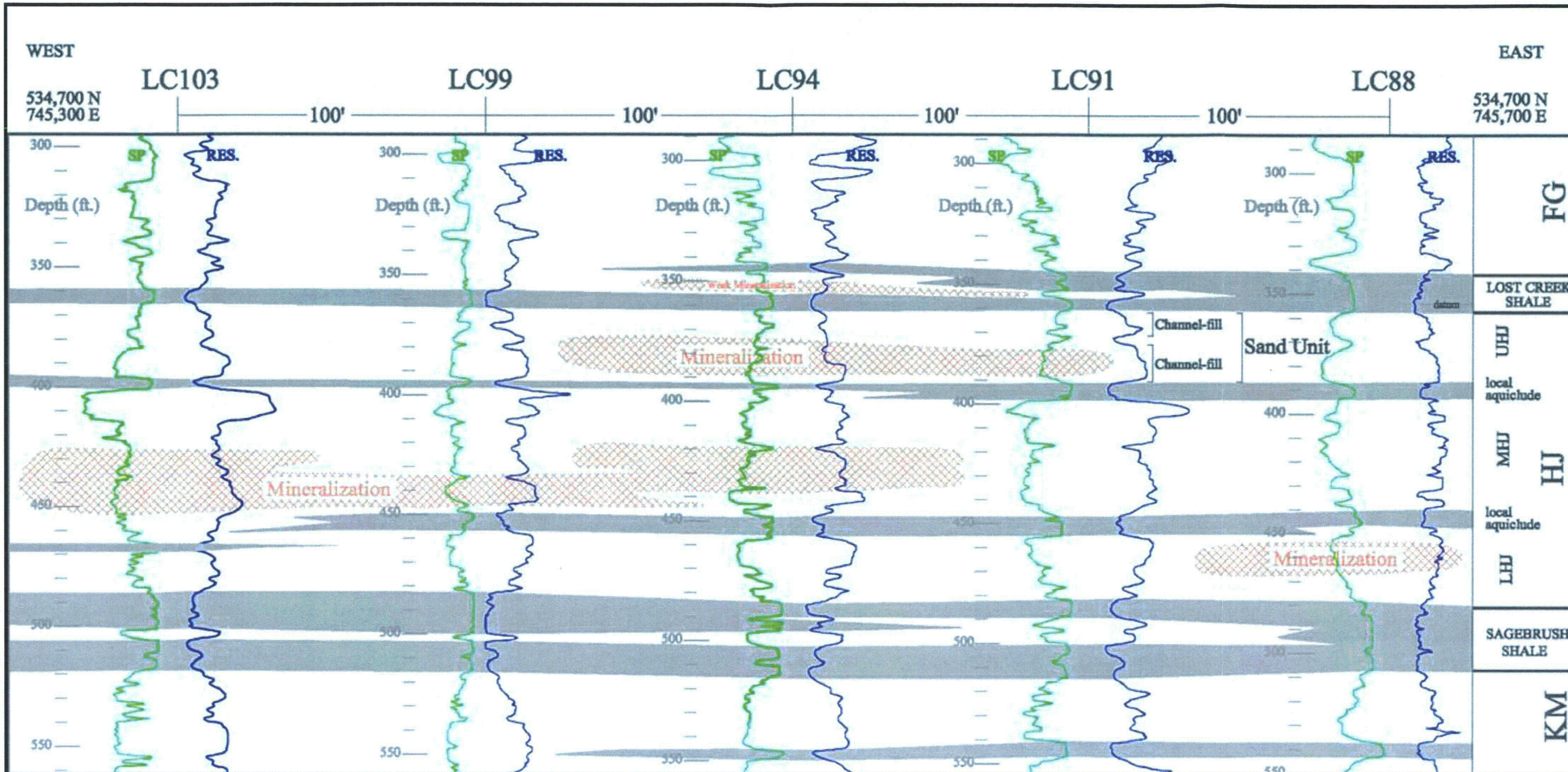


FIGURE D5-1
Regional Geologic Map
Lost Creek Permit Area

Issued For: WDEQ-LQD 1.0	Drawn By: HA
Issued/Revised: 09.17.08	
Drawing No: WDEQ-LQD 1.0 FIGD5-1 12.11.07	



Sand

Mudstone, Claystone, Siltstone

Mineralized Sand

Lost Creek ISR, LLC
Littleton, Colorado, USA

FIGURE D5-2c

Stratigraphic Illustration of Battle Spring Aquifer and Aquicludes

Lost Creek Permit Area

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Issued/Revised: 4.28.09 Drawn By: CVH

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PLATE D5-2c

"Isopach Map of the Sagebrush Shale Lost Creek Permit Area"

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PLATE AD5-2a

"Location Map of Historical Drill Holes-West Lost Creek Permit Area"

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PLATE AD5-2b

"Location Map of Historical Drill Holes-Central Lost Creek Permit Area"

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PLATE AD5-2c
"Location Map of Historical Drill Holes-East Lost Creek Permit Area"

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Plate D6-1a
"Groundwater Permits Within 0.5 Miles Of the Permit Area"

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D-05

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TOC & Appendix D-6 (Hydrology)
Replacement Pages

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MINE PERMIT VOLUME 3b of 5: Appendix D - Main Permit Area (D6)

No Text - See List of Attachments

MINE PERMIT VOLUME 4 of 5: Appendix D - Main Permit Area (D7 to D11) and Appendix D - East and West Roads

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D6 HYDROLOGY

This appendix addresses surface water drainage characteristics and use (**Sections D6.1.1 and D6.1.2**), surface water quality (**Section D6.1.3**), regional and site hydrogeology (**Sections D6.2.1** and **D6.2.2**), groundwater use (**Section D6.3**), regional and site groundwater quality (**Sections D6.4.1** and **D6.4.2**), and the regional and site hydrologic conceptual models (**Sections D6.5.1** and **D6.5.2**). Potential hydrologic impacts, mitigation, and monitoring are presented in the **Operations Plan** and **Reclamation Plan**.

D6.1 Surface Water

D6.1.1 Drainage Characteristics

The Permit Area is located in the Great Divide Basin, a topographically closed system which drains internally due to a divergence in the Continental Divide. Most of the surface water is runoff from precipitation or snowmelt, and most runoff quickly infiltrates, recharging shallow groundwater, evaporates, or is consumed by plants through evapotranspiration. Based on the loam and sandy-loam soils found at the site, the steady-state saturated infiltration rate under laboratory conditions is estimated at 0.2 to 0.8 in/hr (Hillel, 1980). However, the practical infiltration rate is likely much higher because saturated conditions are rare, and more macropores are present under field conditions and at large scales. Infiltration-excess (Hortonian) overland flow has not been observed at the site, except on the compacted soils found in existing 2-track roads.

Alluvial deposits, if any, along drainages are not extensive, and the shallow aquifer, Battle Spring, is typically under confined conditions, although locally unconfined conditions exist. The variation from unconfined to confined conditions is due to the interfingering of sands and shales throughout the Battle Spring Formation (see, e.g., Section 5.2.1 (Stratigraphy)). The shallow water table is typically 150 to 200 feet below ground surface (ft bgs). There are no perennial or intermittent streams within the Permit Area or on adjacent lands. The only officially named drainage within the Permit Area is Battle Spring Draw, which is dry for the majority of the year (**Figure D6-1**).

A 1:24,000 USGS topographic map was imported into GIS, and used to conduct the drainage network analyses described in this section. Three primary watersheds drain ninety-nine percent of the Permit Area. These watersheds have been named Western Draw, West Battle Spring Draw, and East Battle Spring Draw for the purposes of this application. The Western Draw watershed covers 2.9 mi^2, of which 2.4 mi^2 are within the

Permit Area; the West Battle Spring Draw watershed cover 7.0 mi^2, of which 3.1 mi^2 are within the Permit Area; the East Battle Spring Draw watershed covers 5.1 mi^2, of which 1.0 mi^2 is within the Permit Area. The entire Permit Area drains into the Battle Spring Flat, approximately nine miles southwest of the Permit Area. Much of the water conveyed through the ephemeral channels does not reach Battle Spring Flat. Instead, it infiltrates into the alluvium and recharges the Battle Spring aquifer.

Figure D6-2 shows a longitudinal profile of the main channel in each of the primary watersheds within the Permit Area, and the endpoints are shown in **Figure D6-1**. Within the Permit Area, the average slope of the main channel in the Western Draw, West Battle Spring Draw, and East Battle Spring Draw watersheds is 1.4, 1.2, and 1.1 percent, respectively. The sinuosity (channel length divided by valley length) of the main channels in each watershed is 1.24, 1.10, and 1.03, respectively. The drainage density in each watershed is 3.0, 4.2, and 5.0 mi/mi^2, respectively.

The existing drainages are incised, and have u-shaped trapezoidal cross-sectional morphologies. Vertical and slumping banks exist where active erosion is occurring. The channels near the downstream boundary of the Permit Area are incised three to six feet and are ten to 15 feet wide. The channel side-slopes range in slope from 1:1 to approximately 2.5:1. The bed material in the larger draws is sandy textured and non-cohesive. Draws around the Permit Area are typically vegetated with sagebrush.

Annual runoff in the Permit Area is very low due to the high infiltration capacity and low annual precipitation. The channels are dry for the majority of the year. Drainages in the Permit Area are naturally ephemeral and primarily flow during spring snowmelt as saturated overland flow when soil moisture is at a maximum. The quantity of spring runoff is variable, depending on the amount of winter snowfall accumulation. Peak runoff from high intensity rain events can be significant; but surface flow is generally short-lived. Storm-water runoff after high intensity rain events is very rare because surface water infiltrates very rapidly or evaporates. Some intermittent and localized flow can occur near a small number of springs; but no surface runoff has been observed from springs within the Permit Area.

Runoff data are limited for the ephemeral and intermittent streams in the Great Divide Basin. There are two USGS streamflow gaging stations within 40 miles of the Permit Area, but they are on perennial streams and are not representative of drainages in the Permit Area. On April 6, 1976, the USGS measured the instantaneous discharge of Lost Soldier Creek, approximately 14.5 miles northeast of the Permit Area. The measurement of 0.2 cubic feet per second was taken during spring runoff so the source of water was predominantly snowmelt (USGS, 2006).

A method for estimating peak stream discharge in ungaged watersheds in response to storms with recurrence intervals from two to 100 years has been developed by Miller (2003). Miller analyzed streamflow data for hundreds of gaged watersheds in Wyoming ranging from one to 1,200 square miles, and developed regional regression relationships based upon basin characteristics (drainage area, geographic factors, elevation, etc.). The most significant independent variables in Sweetwater County were drainage area and latitude. The equations used for each calculation as well as the associated percent errors are summarized in **Table D6-1a**. **Table D6-1b** shows the calculated peak discharge at the downstream boundary of the three principal watersheds, delineated as Points A2, B4, and C2 in **Figure D6-1**. Due to the incised nature and the width of the channels, flows from the 100-year flood would likely remain mostly within the channels.

One small (less than one-quarter acre) detention pond exists in the Permit Area, which acts as an off-channel storage area for stock watering. This is Crooked Well Reservoir which is shown in **Figure D6-3a**. This pond is dry for the majority of the year and typically fills from spring snowmelt during the months of March and April. Wetland vegetation has not been observed around this impoundment. This detention pond is not included in the active surface water rights in the area.

D6.1.2 Surface Water Use

Surface-water permits with legal descriptions inside and within three miles of the Permit Area were queried using the Wyoming State Engineers Office (WSEO) Water Rights Database (WSEO, 2006). **Table D6-2** lists the thirteen surface water permits that exist within the three-mile study area, and **Figure D6-3b** displays the locations of these surface water permits. None of these locations are within one-half mile of the Permit Area. All of the surface water permits, with one exception, are related to mining operations.

As noted in **Section D6.3**, there are four BLM wells within one mile of the Permit Area. These wells have stock ponds associated with them, although with the exception of one pond that is currently in use, it is not clear how recently the ponds have been used. The water-use permits for these ponds are associated with the wells that supply the ponds, i.e., they are not associated with any surface-water-use permits. Also, as noted in the previous section, the Crooked Well Reservoir (**Figure D6-3a**) is located in the Permit Area. However, it is a small off-channel detention pond, less than one-quarter acre in size, and there is no water-use permit associated with it.

D6.1.3 Surface Water Quality

Under the WDEQ Water Quality Division (WQD) Classification, Battle Spring Draw is listed as a Class 3B water body. Beneficial uses for Class 3B waters can include recreation, wildlife, "other aquatic life," agriculture, industry, and scenic value, but do not include drinking water, game fish, non-game fish, and fish consumption.

Background historic surface water quality within the study area was characterized using water quality data from 1974 and 1975 that were collected as part of the environmental report for the Sweetwater Uranium permit application (Shepard Miller Inc., 1994). Samples were collected at Battle Spring, which is seven miles southwest of the Permit Area. The historic dataset is small, and more representative of groundwater quality than surface water quality so are not directly comparable to expected surface water conditions within the Permit Area. The water-quality data for the historic sampling at Battle Spring are summarized in **Table D6-3**. Historic sampling of Battle Spring in July 1974 showed that pH was highly alkaline at 9.5. Uranium concentrations ranged from 0.006 to 0.95 milligrams per liter (mg/L).

Nalgene Storm Water Samplers (**Figure D6-4**) were installed to collect 0.26 gallon (1 L) grab samples of first flush streamflow during runoff events. These samplers were installed at 12 locations in the Permit Area (**Figure D6-5a**) in April 2006. In April 2007, an additional sampler was added to represent an area in the southeastern corner that was added to the Permit Area in the summer of 2006. Three samplers were installed to capture runoff as it enters the Permit Area from the upstream side, and the others capture runoff within the Permit Area or at the downstream boundary. The water samples were collected to characterize the quality of ephemeral surface runoff. The sampling locations were selected based on their topographic potential to concentrate ephemeral surface flow.

Seven samplers collected full, one-liter samples from snowmelt runoff in March and April 2007. These samples were retrieved on April 17, 2007, and **Figure D6-5b** shows snowmelt discharge in one of the stream channels in the Permit Area on that date. Due to the lag between the first runoff flush and sample retrieval, the wetted perimeter of the channels during first flush is not known. In the absence of wetted perimeter or cross-sectional area, discharge cannot be estimated using typical empirically-based approximations such as Manning's or Limerino's equations. When present, surface water discharge at the Lost Creek Permit Area has always been estimated by qualified personnel as less than 0.5 cfs, so it is believed that the discharge was less than 1 cfs when the samples were collected.

The water quality data for the seven surface water samples are summarized in **Table D6-4**. **Attachment D6-1** presents the raw water quality data from the laboratory. Ionic strength was low in all samples, which is probably due to the majority of the sample being snowmelt water that did not come into contact with the underlying soil. For all samples, the dissolved and total concentrations of trace metals were near or below the detection limit. Radiometric parameters, including uranium, lead-210, polonium-210, and thorium-230, were generally below detection with the exception of dissolved uranium, which was detected at very low concentrations (0.0003 to 0.0004 mg/L) in two samples, suspended uranium (0.0003 to 0.0009 mg/L) in two samples, and total uranium (0.0003 to 0.0009 mg/L) in four samples. Total radium-226 was detected at a low concentration (0.5 picoCuries per liter [pCi/L]) in one sample. This was the LC2 location in the center of the Permit Area in one of the larger channels. Gross alpha was also detected in small amounts (1.1 to 3.6 pCi/L) in six samples. The highest concentration of 3.6 pCi/L was again from the LC2 location. The pH of the sites was slightly acidic to neutral ranging from 6.39 to 7.12. Conductivity was low with less than 100 microSiemens per centimeter for all samples.

In general, the quality of water was very good for all samples. The radiometric parameters detected in the LC2 correlate well with the radiological scans of the Permit Area. This central area has the highest radioactive activity, as indicated by the results from the radiological surveys. Still, the levels are well below all Wyoming agricultural and drinking water standards.

D6.2 Groundwater Occurrence

This section describes the regional and local groundwater hydrology including hydrostratigraphy, groundwater flow patterns, hydraulic gradient and aquifer parameters. The discussion is based on information from investigations performed within the Great Divide Basin, data presented in previous applications/reports for the Permit Area, and the geologic information presented in **Appendix D5** of this report. Regional and site hydrogeology are discussed in **Sections D6.2.1** and **D6.2.2**; groundwater use in **Section D6.3**; regional and site groundwater quality in **Sections D6.4.1** and **D6.4.2**; and the regional and site hydrologic conceptual models in **Sections D6.5.1** and **D6.5.2**.

D6.2.1 Regional Hydrogeology

The Project is located within the northeastern portion of the Great Divide Basin. The basin is topographically closed with all surface water draining to the interior of the basin (**Figure D6-1**). Available data suggest that groundwater flow within the basin is predominately toward the interior of the basin (Collentine, 1981; Welder, 1966; and Mason, 2005). A generalized potentiometric surface map of the Battle Spring/Wasatch Formations, prepared by Welder and McGreevey (1966), indicates groundwater movement toward the center of the basin (**Figure D6-6**). Fisk (1967) suggests that aquifers within the Great Divide Basin may be in communication with aquifers in the Washakie Basin to the south and that groundwater may potentially move across the Wamsutter Arch between the basins.

The topographically elevated area known as the Green Mountains (Townships 26 and 27 North, between Ranges 90 to 94 West) was identified by Fisk as a major recharge area to aquifers within the northeastern portion of the Great Divide Basin (1967). The Rawlins Uplift, Rock Springs Uplift, and Creston Junction, located east, southwest and southeast, respectively, from the Permit Area, were also identified as major recharge areas for aquifers within the Great Divide Basin (Fisk, 1967). The main discharge area for the Battle Spring/Wasatch aquifer system is to a series of lakes, springs and playa lakes beds near the center of the basin. Groundwater potentiometric elevations within the Tertiary aquifer system in the central portion of the basin are generally close to the land surface.

The Battle Spring Formation crops out over most of the northeastern portion of the Great Divide Basin, including much of the Permit Area. The Battle Spring Formation is considered part of the Tertiary aquifer system by Collentine et al. (1981). The Tertiary aquifer system is identified as "the most important and most extensively distributed and accessible groundwater source in the study area" (Collentine et al., 1981). This aquifer system includes the laterally equivalent Wasatch Formation (to the west and south) and the underlying Fort Union and Lance Formations. The base of the Tertiary aquifer system is marked by the occurrence of the Lewis Shale. The Lewis Shale is generally considered a regional aquitard, although this unit does produce limited amounts of water from sandstone lenses at various locations within the Great Divide Basin and to the south in the Washakie Basin.

Shallower aquifer systems that can be significant water supply aquifers within the Great Divide Basin include the Quaternary and Upper Tertiary aquifer systems. However, as previously stated, the Battle Spring Formation of the Tertiary aquifer system crops out over most of the northeast part of the basin; and the Quaternary and Upper Tertiary aquifer systems are absent or minimal in extent. The shallower aquifer systems are only important sources of groundwater in localized areas, typically along the margin of the basin where the Battle Spring Formation is absent. Aquifer systems beneath the Tertiary include the Mesaverde, Frontier, Cloverly, Sundance-Nugget, and Paleozoic aquifer systems (Collentine et al., 1981). In the northeast Great Divide Basin, these aquifer systems are only important sources of water in the vicinity of outcrops near structural highs, such as the Rawlins Uplift.

For purposes of this application, only hydrogeologic units younger than and including the Lewis Shale (Upper Cretaceous age) are described, with respect to general hydrologic properties and potential for groundwater supply. The Lewis Shale is an aquitard and is considered the base of the hydrogeologic sequence of interest within the Great Divide Basin. Units deeper than the Lewis Shale, the top of which is about 14,000 ft bgs in the Permit Area, are generally too deep to economically develop for water supply or have elevated total dissolved solid (TDS) concentration that renders them unusable for human consumption. Exceptions to this can be found along the very eastern edge of the basin, tens of miles from the Permit Area, where some Lower Cretaceous and older units provide relatively good quality water from shallow depths. Hydrologic units of interest within the northeast Great Divide Basin are shown on the stratigraphic column in **Figure D6-7** and further described below, from deepest to shallowest:

- Lewis Shale (aquitard between Tertiary and Mesaverde aquifer systems);
- Fox Hills Formation (Cretaceous);
- Lance Formation (Tertiary aquifer system);
- Fort Union Formation (Tertiary aquifer system);
- Battle Spring Formation-Wasatch Formation (Tertiary aquifer system);
- Undifferentiated Tertiary Formations (Upper Tertiary aquifer system, including Bridger, Uinta, Bishop Conglomerate, Browns Park, and South Pass); and
- Undifferentiated Quaternary Deposits (Quaternary aquifer system).

Discussion of the regional characteristics for each of these hydrostratigraphic units is provided below.

D6.2.1.1 Lewis Shale

The Lewis Shale underlies the Fox Hills Formation and is generally considered an aquitard in the Great Divide Basin. This unit is described by Welder and McGreevey (1966) as light to dark gray, carbonaceous shale with beds of siltstone and very fine-grained sandstone. The Lewis Shale is up to 2,700 feet thick, generally increasing in thickness toward the east side of the basin. In the Permit Area, the Lewis Shale is 1,200 feet thick. Small quantities of water may be available from the thin sandstone beds within this unit near the margins of the basin. The Lewis Shale acts as the confining unit between the Tertiary and Mesaverde aquifer systems.

D6.2.1.2 Fox Hills Formation

Fox Hills Formation overlies the Lewis Shale and consists of very fine-grained sandstone, siltstone and coal beds. It is not considered to be an important aquifer in the Permit Area.

D6.2.1.3 Lance Formation

Overlying the Fox Hills Formation is the Lance Formation, consisting predominately of very fine-to fine-grained lenticular, clayey, calcareous sandstone. Shale, coal and lignite beds are present within the formation, which reaches a maximum thickness of approximately 4,500 feet (Welder, 1966). In the Permit Area, the Lance Formation is approximately 3,000 feet thick.

Collentine et al. (1981) include the Lance Formation (Aquifer) as the lower-most aquifer within the Tertiary aquifer system. However, the Lance Aquifer is included as part of the Mesaverde aquifer system by Freethey and Cordy (1991). Several stock wells, located along the eastern outcrop area of the basin, are completed in the Lance Aquifer. The stock wells have estimated yields of five to 30 gallons per minute (gpm). Hydraulic conductivity for the Mesaverde aquifer system reported by Freethey and Cordy (1991) (which, by the authors' designation, includes the Fox Hills Sandstone, Lewis Shale, and Mesaverde Group, in addition to the Lance Aquifer) is reported to range from 0.0003 to 2.2 feet per day (ft/d). Because of the limited number of wells completed within the Lance Aquifer in the Great Divide Basin, there are insufficient data to develop representative potentiometric surface maps for this hydrologic unit. However the potentiometric surface is most likely similar in orientation to that seen in the overlying Fort Union and Battle Spring/Wasatch aquifers, with inferred groundwater movement generally toward the center of the basin. No regionally extensive aquitards between the

Fort Union and Lance Formation were identified or reported in the hydrologic studies, investigations, and reports reviewed for this permit application.

D6.2.1.4 Fort Union Formation

The Paleocene-age Fort Union Formation is between the Lance Formation and the overlying Wasatch and Battle Spring Formations, reaching a maximum thickness of approximately 6,000 feet within the Great Divide/Washakie Basin area. In the Permit Area, it is approximately 4,650 feet thick. The Fort Union Formation is present at or near land surface in a band around the Rock Springs Uplift and in the northeastern corner of the Great Divide Basin (Mason, 2005). The Fort Union Formation is described as a fine- to coarse-grained sandstone with coal and carbonaceous shale. Siltstone and claystone are present in the upper part of the formation (Welder, 1966).

A potentiometric surface map, prepared by Natftz (1996) that groups the Fort Union aquifer with the Battle Spring/Wasatch aquifers, shows inferred movement of groundwater toward the basin center (**Figure D6-8**).

The Fort Union aquifer is largely undeveloped and unknown as a source of groundwater supply except in areas where it occurs at shallow depths along the margins of the basin. Well yields from the Fort Union aquifer within the Great Divide and Washakie Basins range from three to 300 gpm. Estimates of transmissivity for the Fort Union aquifer are highly variable. Ahern (1981) estimated transmissivity of less than three square feet per day (ft^2/d) for ten Fort Union Formation oil fields in the Green River Basin. Collentine et al. (1981) reported transmissivity of the Fort Union aquifer as characteristically less than 325 ft^2/d from oil well data.

Water quality for the Fort Union aquifer is described in **Section D6.4**.

D6.2.1.5 Battle Spring Formation- Wasatch Formation

The most important water-bearing aquifers within the Great Divide Basin are in the Wasatch Formation and the Battle Spring Formation. The Wasatch and Green River Formations grade into the Battle Spring Formation in the northeastern portion of the basin. The Battle Spring Formation is absent along the eastern margin of the Great Divide Basin near the county line between Sweetwater and Carbon Counties. The termination of the Battle Spring Formation to the east and north is abrupt, controlled largely by structural features, including the Rawlins Uplift to the east and the Green Mountains to the north. A dry oil test in Section 14, Township 24 North, Range 90 West, located within a few miles of the eastern limit of the Battle Spring Formation, had a reported thickness of over 6,000 feet of fine- to coarse-grained sandstone that was interpreted by the American Stratigraphic Company as the Battle Spring Formation. Within the Permit Area, the Battle Spring Formation is over 6,200 feet thick

The Battle Spring Formation is described as an arkosic fine- to coarse-grained sandstone with claystone and minor conglomerates. There are typically several water-bearing sands within the Battle Spring Formation. The Battle Spring aquifers are included in the Tertiary aquifer system, as defined by Collentine et al. (1981).

Groundwater within the Battle Spring aquifers is typically under confined conditions, although locally unconfined conditions exist. The potentiometric surface within the Battle Spring aquifers is usually within 200 feet of the ground surface (Welder, 1966). Most wells drilled for water supply in this unit are less than 1,000 feet deep. The potentiometric surface map of Wasatch and Battle Spring aquifers (**Figure D6-6**) indicates groundwater movement toward the center of the basin (Welder, 1966). From the Permit Area, the potentiometric surface dips to the southwest at approximately 50 feet per mile (ft/mi) (a hydraulic gradient of 0.01 foot per foot [ft/ft]). The hydraulic gradient becomes steeper near the margins of the basin, where recharge to the aquifer is occurring.

Collentine et al. (1981) report that wells completed in the Battle Spring aquifers typically yield 30 to 40 gpm; but yields as high as 150 gpm are possible. Collentine et al. (1981) also reported that pump tests conducted on 26 wells completed within the Battle Spring aquifers resulted in transmissivity values ranging from 3.9 to 423 ft^2/d, although most wells were less than 67 ft^2/d. Specific capacity was less than one gallon per minute per foot for 23 of 26 wells tested.

Water quality for the Wasatch/Battle Spring aquifers is described in **Section D6.4**.

D6.2.1.6 Undifferentiated Tertiary and Quaternary Sediments

Undifferentiated Tertiary and Quaternary units above the Battle Spring/Wasatch Formations can be sources of water supply; but wells in the northeastern part of the Great Divide Basin are rare and generally limited to the margins of the basin where the Battle Spring Formation is not present. Commonly, along the margins of the basin, hydrostratigraphic units younger than the Battle Spring/Wasatch have been deposited on rocks of Cretaceous age or older. Water supply wells along the margins of the basin are often completed in both the older hydrostratigraphic units and Tertiary and Quaternary sediments. Water quality within these units tends to be variable and available resources of good quality water are limited.

The undifferentiated Tertiary units consist of interbedded claystone, sandstone and conglomerate with the coarser grained facies providing suitable groundwater resources where present. The undifferentiated Tertiary units are absent within the Permit Area and are not discussed further.

The undifferentiated Quaternary units consist of clay, silt, sand, gravel and conglomerates that are poorly consolidated to unconsolidated (Welder, 1966). These units represent windblown, alluvial and lake deposits. Where present, these deposits can provide acceptable yields of groundwater of relatively good quality. Thin deposits of Quaternary sediments are present within surface drainages in the Permit Area but are usually above the water table and unsaturated. Therefore, Quaternary sediments are not an important groundwater source in the vicinity of the Project and are not described further.

D6.2.2 Site Hydrogeology

LC ISR, LLC has been collecting lithologic, water level, water quality, and pump test data as part of its ongoing evaluation of hydrologic conditions at the Project. In addition to recent data acquisition, historic data collected for Conoco (Hydro-Search, Inc., 1982) were used to support this evaluation. Drilling and installation of borings and monitor wells is ongoing to provide additional data to further refine the site hydrologic conceptual model. Water level measurements, both historic and recent, provide data to assess potentiometric surface, hydraulic gradients and inferred groundwater flow directions for the aquifers of interest at the Project. Two recently completed long-term pump tests (**Attachments D6-2a** and **D6-2b**) and several shorter-term pump tests (Hydro-Engineering, 2007), as well as the pump tests conducted for Conoco (Hydro-Search, Inc., 1982), were used to evaluate hydrologic properties of the aquifers of interest, to assess hydraulic characteristics of the confining units, and to evaluate impacts to the hydrologic system of the Lost Creek Fault (Fault) through the Permit Area (**Section D5.2.2**). Results of Permit Area water quality sampling and analysis are presented in **Section D6.4.2**.

Plate D5-3 shows the locations of all the existing monitor wells in the Permit Area. **Table D6-5** provides completion data for the monitor wells currently in use, and **Attachment D6-3** includes well completion logs for those wells. **Figure D6-9** shows the locations of the historic Conoco (or Texasgulf) monitor wells (the M-25-92 series), and it shows the locations of the exising monitor wells that were used for baseline data collection and in the LC16M and LC19M pump tests.

D6.2.2.1 Hydrostratigraphic Units

LC ISR, LLC has employed the following nomenclature for the hydrostratigraphic units of interest within the Project. The primary uranium production zone is identified as the HJ Horizon. The HJ Horizon is subdivided into the Upper (UHJ), Middle (MHJ) and

Lower (LHJ) Sands. The HJ Horizon is bounded above and below by aerially extensive confining units identified as the Lost Creek Shale and the Sage Brush Shale, respectively. Overlying the Lost Creek Shale is the FG Horizon. The deepest sand in the FG Horizon, the Lower FG (LFG) Sand, is the overlying aquifer to the HJ Horizon. Beneath the Sage Brush Shale is the KM Horizon. The uppermost sand within the KM Horizon, designated the Upper KM (UKM) sand, is a secondary production zone and also the underlying aquifer to the HJ Horizon. The No Name Shale unit separates the UKM and Middle KM (MKM) Sand. The MKM Sand is the underlying aquifer to the UKM Sand. The shallowest occurrence of groundwater within the Permit Area occurs within the DE Horizon, which is above the FG Horizon. **Figure D6-10** depicts the hydrostratigraphic relationship of these units.

A brief description of each hydrostratigraphic unit follows, from shallowest to deepest.

DE Horizon

The DE Horizon is the shallowest occurrence of groundwater within the Permit Area, although the horizon is not saturated in all portions of the Permit Area. The DE Horizon consists of a sequence of sands and discontinuous clay/shale units. In the southern part of the Permit Area, sands of the DE Horizon coalesce with sands of the FG Horizon. The top of the unit ranges from 100 to 200 ft bgs.

FG Horizon

The top of the FG Horizon occurs at depths of approximately 250 to 300 ft bgs on the north side of the Lost Creek Fault and 275 to 350 ft bgs on the south side of the Lost Creek Fault within the Permit Area (**Section D5.2.2**). The FG Horizon is subdivided into the Upper (UFG), Middle (MFG) and Lower (LFG) Sands. The total thickness of the FG Horizon is approximately 100 feet. The basal unit in the FG Horizon, the LFG Sand, ranges from 20 to 50 feet thick within the Permit Area. The LFG Sand is designated as the overlying aquifer for the HJ Horizon.

Lost Creek Shale

Underlying the FG Sands is the Lost Creek Shale. The Lost Creek Shale appears continuous across the Permit Area, ranging from five to 45 feet in thickness. Typically, this unit has a thickness of ten to 25 feet (**Figure D6-10**). The Lost Creek Shale is the confining unit between the overlying aquifer (LFG Sand) and the HJ Horizon. The confining characteristics of the Lost Creek Shale have been demonstrated with a pump test, as described later in this application.

HJ Horizon

The HJ Horizon is the primary target for uranium production at the Lost Creek Project. For purposes of uranium ISR operations, the HJ Horizon has been subdivided into three Sands: the Upper HJ (UHJ), Middle HJ (MHJ) and the Lower (LHJ) Sand. These sands are generally composed of coarse-grained arkosic sands with thin lenticular intervals of fine sand, mudstone and siltstone. The bulk of the uranium mineralization is present in the MHJ Sand. The total thickness of the HJ Horizon ranges from 100 to 160 feet, averaging approximately 120 feet (**Figure D6-10**). The top of the HJ Horizon ranges from approximately 300 to 450 ft bgs within the Permit Area. The three sands are generally separated by thin clayey units that are not laterally extensive and, based on pump test results, do not act as confining units to prevent groundwater movement vertically between the HJ Sands. The underlying aquifer to the HJ Horizon is the UKM Sand, which is also a potential uranium production zone. Therefore, the deepest sand within the HJ Horizon, the LHJ Sand, is also designated as the overlying aquifer to the UKM Sand.

Sage Brush Shale

Beneath the HJ Horizon is the Sage Brush Shale, at depths ranging from 450 to 550 ft bgs. The Sage Brush Shale is laterally extensive and ranges from five to 75 feet in thickness (**Figure D6-10**). The Sage Brush Shale is the lower confining unit to the HJ Production Zone. The confining characteristics of this unit have been demonstrated through pumping tests, as described in later sections of this application.

UKM Sand

The UKM Sand is present beneath the Sage Brush Shale. The UKM Sand is the upper member of the KM Horizon and is generally a massive coarse sandstone with lenticular fine sandstone intervals. The UKM Sand is the underlying aquifer to the HJ Horizon but is also a potential production zone within the Permit Area. The UKM Sand is typically 30 to 60 feet thick but can reach over 75 feet in thickness (**Figure D6-10**). The top of the UKM Sand is usually between 450 and 600 ft bgs within the Permit Area. The decision to proceed with a permit revision for production of the UKM Sand will depend on the results of additional delineation drilling and characterization of the lower confining unit and underlying aquifer that are described below.

No Name Shale

The No Name Shale at the base of the UKM Sand has not yet been fully characterized. The top of the unit is approximately 480 to 650 ft bgs. This unit is generally ten to 30 feet thick. This shale would be the lower confining unit to the UKM Sand, if LC ISR, LLC decides to request a permit revision to include the UKM Sand in the Lost Creek Project. Additional drilling is being conducted. The pump test in the fall of 2007 provided additional information on the confining characteristics of this unit, and if LC ISR, LLC proceeds with a revision for production of the UKM Sand, this data will be included in the revision.

MKM Sand

The MKM Sand is the underlying aquifer to the UKM Sand. Information on the MKM Sand is limited at this time. Additional borings are being drilled to evaluate the geologic and hydrologic characteristics of this sand. The pump test in the fall of 2007 provided additional information on the hydrologic relationship between the UKM and MKM Sands in the fall of 2007.

D6.2.2.2 Potentiometric Surface, Groundwater Flow Direction and Hydraulic Gradient

Potentiometric surfaces for the DE, LFG, HJ, and UKM Horizons are illustrated as contour maps in **Figures D6-11a to D6-11h** and also on cross sections in **Plates D5-1a to D5-1g**. Depiction of these surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with the potentiometric contours for the given horizons.

The LC ISR, LLC hydrologic evaluation of the Project included measurement of water levels in monitor wells completed in the HJ aquifer, the overlying aquifers (DE and LFG) and the underlying aquifer (UKM) to assess the potentiometric surface, groundwater flow direction and hydraulic gradient of those units. Additional historic water level data were available from the Conoco hydrologic evaluation of the site (Hydro-Search Inc., 1982). **Table D6-6** lists static water level data recorded in 1982, 2006, 2007, and 2008.

The potentiometric surface for the HJ Horizon in the vicinity of the Lost Creek Fault is shown on **Figure D6-11a**. The water level data were collected in November 2007 well after the completion of all drilling and pump test activity. Water levels from this period represent a comprehensive data set under static conditions around the Lost Creek Fault. From the figure, it is evident that the Lost Creek Fault provides a significant hydraulic barrier to groundwater flow. The potentiometric surface on the north side of the Lost Creek Fault is five to 15 feet higher than on the south side. Wells located approximately 100 feet apart on either side of the Lost Creek Fault (Wells HJT104 and HJMP107) show a difference of 13.6 feet with the higher elevation on the north side of the Fault. The difference in hydraulic head across the Lost Creek Fault becomes less to the northeast.

The steep gradient observed in the potentiometric surface from the north to the south side of the Lost Creek Fault is most likely a manifestation of a lower permeability transition area associated with a fault smear zone and/or secondary faulting and fracturing near the Fault. This is consistent with regional groundwater flow impacted by lower permeability zones studied and modeled by Freeze (1969). Although limited groundwater leakage occurs across the Lost Creek Fault (as demonstrated during the long term pump tests that are described later in this report), the majority of groundwater flow on both sides of the Fault appears to be generally parallel to the Fault, to the west-southwest. Based on the potentiometric surface map, groundwater is inferred to flow to the west-southwest, generally consistent with the regional flow system.

Potentiometric surface data for the overlying (LFG) aquifer for November 2007 is shown on **Figure D6-11b**. The data indicate a similar groundwater flow direction as in the HJ aquifer (toward the west-southwest). The barrier effect of the Lost Creek Fault is also evident within this shallower hydrostratigraphic unit with an observed difference of six to eight feet of hydraulic head across the Fault.

Potentiometric surface data for the underlying (UKM) aquifer for November 2007 is shown on **Figure D6-11c**. The data for this deeper horizon also indicate a generally west-southwest direction of groundwater flow. However, the impacts of the Lost Creek Fault are not as evident in this hydrostratigraphic unit, with little if any difference in hydraulic head across the fault.

HJ Horizon water level data from 1982 and 2006 are shown on **Figure D6-11d**. There are an insufficient number of data points to accurately represent the potentiometric surface for those measurement periods. However, the data illustrate the difference in water levels within the HJ Horizon across the Lost Creek Fault.

Potentiometric surface maps were also developed using data distributed across the entire permit area. Additional monitoring wells were installed in the fall of 2008, enabling better definition of the potentiometric surfaces out to the limits of the permit area. Data collected in December 2008 were used to construct potentiometric surface maps for the DE, LFG, HJ and UKM aquifers (**Figures D6-11e** through **D6-11**h, respectively). The maps show that the hydraulic gradient and groundwater flow direction across the permit area are similar to that seen in the vicinity of the Lost Creek Fault.

The horizontal hydraulic gradient for the HJ aquifer in the vicinity of the Lost Creek Fault, determined from water level data from 1982, 2006 and 2007, ranged from 0.0034 to 0.0056 ft/ft (18.0 to 29.6 ft/mi). Horizontal hydraulic gradients were also estimated from the December 2008 permit area potentiometic map (**Figure D6-11g**). **Table D6-7a** summarizes the hydraulic gradients determined from the water level data. The horizontal hydraulic gradient across the permit area is similar on both side of the Lost Creek Fault at around 0.005 ft/ft on the north side and 0.006 ft/ft on the south side.

The horizontal hydraulic gradient for the DE sand was initially calculated from only two wells on the south side of the Lost Creek Fault at 0.0064 ft/ft (33.0 ft/mi) (**Table D6-7**). Additional DE monitor wells were installed in the fall of 2008. Based on water levels collected in 2008, the horizontal hydraulic gradient across the permit area in the DE aquifer is approximately 0.007 ft/ft on both sides of the Lost Creek Fault (**Figure D6-11e**).

Horizontal hydraulic gradients for the LFG aquifer in the area of the Lost Creek Fault range from 0.0046 to 0.0058 ft/ft (24.3 to 30.6 ft/mi) (**Table D6-7a**). Across the permit area, the horizontal hydraulic gradient ranged from 0.005 ft/ft north of the Lost Creek Fault to 0.007 ft/ft south of the Fault (**Figure D6-11f**). Horizontal hydraulic gradients calculated for the UKM aquifer near the Lost Creek Fault ranged from 0.0038 to 0.0063 ft/ft (20.1 to 33.3 ft/mi) (**Table D6-7a**). The horizontal hydraulic gradient across the permit area in the UKM sand ranged from 0.005 ft/ft on the north side of the Lost Creek Fault to 0.006 ft/ft on the south side of the Fault (**Figure D6-11h**). The average hydraulic gradient within the HJ, LFG and UKM aquifers is approximately 0.005 ft/ft (26.4 ft/mi).

Vertical hydraulic gradients were determined by measuring water levels in closely grouped wells completed in different hydrostratigraphic units. **Figure D6-12** shows the location of the well groups used for the assessment of vertical hydraulic gradients. **Table D6-7b** summarizes the calculated vertical gradients between the DE, LFG, HJ and UKM aquifers. Vertical hydraulic gradients range from -0.04 to 0.37 ft/ft between the DE, LFG, HJ and UKM aquifers and consistently indicate decreasing hydraulic head with depth. Of the nine well groups evaluated, the only places where a downward potential is not evident between the DE and LFG aquifers is in the west, southwest, and west central portions of the Permit Area. This is consistent with earlier observations that the DE and LFG sands coalesce in places within the Permit Area. The vertical gradients indicate the potential for groundwater flow is downward. A downward potential is indicative of an area of recharge, as opposed to an upward potential that is normally indicative of an area of groundwater discharge. A downward gradient is consistent with the structural and stratigraphic location of the Project with regard to Great Divide Basin.

D6.2.2.3 Aquifer Properties

Aquifer properties for the Battle Spring aquifers within the Permit Area have been estimated from historic and recent pump tests. Transmissivity, storativity, and hydraulic conductivity were evaluated from short term and long term pump tests. Description of the results and analyses of the pump tests are provided below.

1982 Pump Tests

Hydro-Search Inc. performed a hydrologic evaluation in 1982 to determine the feasibility of in situ production of the Conoco uranium orebody at Lost Creek. Hydro-Search Inc conducted two 25-hour tests within the HJ Horizon. Both pump tests were conducted at a rate of 30 gpm and on the south side of the Lost Creek Fault. The locations of the pumping wells and monitor wells are shown in **Figure D6-13**. The results of the tests were variable, with one test indicating a transmissivity of approximately 95 ft^2/d (700 gallons per day per foot [gpd/ft]) and the other indicating a value of 270 ft^2/d (2,000 gpd/ft). The storativity calculated from the first test averaged 5×10^{-4}. There was no reported response in the HJ aquifer north of the Lost Creek Fault. Monitor wells in the overlying (LFG) and underlying (UKM) aquifers did not show any effects from the pump test as reported by Hydro-Search Inc. (1982). Results of the pump tests are summarized in **Table D6-8**.

2006 Pump Tests

Hydro-Engineering, Inc. (2007) conducted several short-term single well pump tests and three longer multi-well pump tests in October 2006. The single well tests ranged from 30 minutes to five hours in duration at rates from 0.67 to 14 gpm. The long-term tests were from 20 to 45 hours long at rates of 15 to 19 gpm. Each of the long-term tests was conducted in HJ well completions. The locations of the wells included in the pump test program are shown on **Figure D6-13**. Results of the pump test are summarized in **Table D6-8**.

The range of transmissivity calculated by Hydro-Engineering for the HJ aquifer was from 44 to 400 ft^2/d (330 to 3,000 gpd/ft). None of the HJ tests indicated significant communication with the overlying or underlying aquifers. There was also no indication of hydraulic communication across the Lost Creek Fault in any of the pump tests. Hydro-Engineering concluded that the Lost Creek Fault acts as a hydraulic barrier (2007).

The Hydro-Engineering data suggest that the transmissivity of the LFG aquifer, calculated from four tested wells, was generally much lower than the values estimated for the HJ aquifer. The range of transmissivity for the LFG aquifer was 4.4 to 40 ft^2/d (33 to 303 gpd/ft). Transmissivity for the UKM aquifer, estimated from single well tests at four wells, was similar to but lower than the HJ aquifer, ranging from 26 to 115 ft^2/d (195 to 858 gpd/ft). Three DE well completions were tested, with resulting transmissivity of 1.3 to 130 ft^2/d (10 to 1,000 gpd/ft).

2007 Pump Tests

Between June to November 2007, two long-term pump tests were conducted by Petrotek Engineering Corp. in the HJ aquifer at Wells LC19M and LC16M (**Attachments D6-2a** and **D6-2b**). Both wells had been previously tested by Hydro-Engineering (2007). LC19M is located on the north side of the Lost Creek Fault and LC16M is located south of the Fault. The objectives of the tests were to further develop aquifer characteristics of the HJ Horizon, to evaluate the hydraulic impacts of the Lost Creek Fault, and to demonstrate confinement of the production zone (HJ Horizon) aquifer. HJ monitor wells on both sides of the Lost Creek Fault and within distances likely to be impacted by the pump tests were included as observation wells. Observation wells in the overlying (LFG) and underlying (UKM) aquifers near the pumping wells and across the Lost Creek Fault were also monitored during the tests. **Tables D6-9a** and **D6-9b** list the data for monitor wells included in the LC19M and LC16M pump tests, respectively. **Figures D6-14a** and **D6-14b** include the locations of the pumping wells and all observation wells included in the LC19M and LC16M tests, respectively. Pre-pumping monitoring was performed several days in advance of the tests to establish baseline conditions and to evaluate barometric effects.

The first pump test was conducted using Well LC19M to evaluate aquifer properties on the north side of the Lost Creek Fault. A step-rate test was performed on pumping Well LC19M June 23, 2007 to determine a suitable pumping rate for the long-term test. The long-term test for LC19M was started at 17:20 hours on June 27, 2007 and was terminated on July 3, 2007 at 10:51 hours. The total duration of the test was 5.7 days (8,251 minutes). The average pumping rate during the test was 42.9 gpm. Maximum drawdown in the pumping well was 93.3 feet. Monitoring was continued after pump shut-in to record recovery from the LC19M test.

The transmissivity calculated from five wells completed in the HJ aquifer on the north side of the Lost Creek Fault (including the pumping well LC19M) were similar, ranging from 30.0 to 75.5 ft^2/d and averaging 68.3 ft^2/d. The average hydraulic conductivity calculated for the five wells, assuming an aquifer thickness of 120 feet, was 0.57 ft/d. Storativity calculated from those wells (with the exception of the pumping well) ranged from 6.6×10^{-5} to 1.5×10^{-4} and averaged 1.1×10^{-4}. **Table D6-10a** summarizes the analyses of the LC19M pump test. Drawdown at the end of the test in the HJ aquifer is shown on **Figure D6-15**.

Minor responses were observed across the Lost Creek Fault during the LC19M pump test (e.g., approximately 0.3 to 0.7 feet of drawdown in Well HJMP107 and other wells south of the Fault). Responses in observation wells across the Lost Creek Fault were negligible relative to the magnitude of drawdown observed in monitor wells located on the same side of the Fault as the pumping well. The impact of the Lost Creek Fault on groundwater flow can be clearly seen from the responses recorded in a pair of observation wells that were placed on either side of the Fault, within 100 feet of each other. Well HJT104, located on the north side of the Fault and completed in the HJ Horizon, had a maximum drawdown of 40.5 feet at the end of the LC19M test. Well HJMP107 (south of the Fault) in the HJ Horizon had a net decrease of 1.4 feet from the beginning of the test to the end of pumping at LC19M. At least a portion of that change is attributable to a declining trend in water levels that was observed in all monitor wells prior to the start of the test. The reason for the background trend observed has not been identified; however, it might be a result of offset pumping (e.g., LC ISR, LLC's first two water supply wells that are screened over multiple sands).

At the beginning of the LC19M test, the water level at HJT104 was at 6,770.68 feet above mean sea level (ft amsl) and the water level at HJMP107 was at 6,754.85 ft amsl, a head difference of almost 15 feet with the higher head north of the Lost Creek Fault. At the end of the pump test the water levels for HJT104 and HJMP107 were 6,730.14 ft amsl and 6753.47 ft amsl, respectively. At the termination of pumping at LC19M, the water level difference between HJT104 and HJMP107 was 23 feet with the higher head south of the Fault. Minor responses to pumping were observed across the Fault during the LC19M test. Based on the pump test results, the Fault, while not entirely sealing, significantly impedes groundwater flow, even under considerable hydraulic stress.

The response of the overlying and underlying aquifers during the LC19M pump test was small (e.g., on the order of 0.2 to 0.5 feet); but the water level responses did correspond to the start and stop of pumping from LC19M in the HJ Horizon. The underlying/overlying responses appear to be relatively consistent, regardless of distance from the pumping well, the hydrostratigraphic interval monitored, or the location relative to the Lost Creek Fault. These water level changes suggest potential impacts from off-site pumping or background trends that, because of distance from the monitor wells, are manifested at multiple locations at the same or similar times. As previously stated, a declining trend in water level elevations was observed prior to the start of the test. Most of the wells showed an initial inverted response (increase in water level) at the start of the test and then resumed a gradual downward trend during the test. This phenomenon was also observed and noted by Hydro-Engineering during the 2006 pump tests. It is possible that some of the drawdown response could be caused by: (1) pumping in the drilling water well (LC1) which is completed in both the DE and FG Horizons; (2) communication across multiple sands due to the scissors nature of the Lost Creek Fault distant from the pumping well location; (3) communication due to juxtapositioning of hydrostratigraphic units across the Fault; or (4) leakage through the confining shale, or any combination of these. While LC ISR, LLC has aggressively pursued re-plugging of historic wells, it is also possible that some of the communication could be related to abandoned wells. Additional discussion regarding the results of the testing are included in **Attachment D6-2a**.

A second long term pump test was conducted to evaluate aquifer properties on the south side of the Lost Creek Fault using LC16M as the pumping well. A step-rate test was performed on pumping well LC16M October 7, 2007 to determine a suitable pumping rate for the long-term test. The long-term test for LC16M was started at 14:10 hours on October 22, 2007 and was terminated on October 28, 2007 at 01:00 hours when the generator used in the test failed. However, the HJ aquifer had been sufficiently stressed at that point and the pumping portion of the test was terminated. The total duration of the test was 5.5 days (7,850 minutes). The average pumping rate during the test was 37.4 gpm. Maximum drawdown in the pumping well was 69.3 feet. Monitoring was continued after pump shut-in to record recovery from the LC16M test.

The transmissivity calculated from six wells completed in the HJ aquifer on the south side of the Lost Creek Fault (including the pumping well LC16M) were similar, ranging from 56.7 to 110.0 ft^2/d and averaging 77.7 ft^2/d. The average hydraulic conductivity calculated for the six wells, assuming an aquifer thickness of 120 feet, was 0.65 ft/d. Storativity calculated from four of the monitoring wells ranged from 3.5×10^{-5} to 1.4×10^{-4} and averaged 7.3×10^{-5}. Well HJT105 had a calculated storativity of 9.1×10^{-5} which appears anomalously high and was not included in the average. Storativity was not, nor could be, calculated from the pumping well. **Table D6-10b** summarizes the analyses of the LC16M pump test. Drawdown near the end of the test in the HJ aquifer is shown on **Figure D6-16**.

The drawdown resulting from pumping LC16M shows a cone of depression developed around the pumping well that is elongated roughly parallel to the Lost Creek Fault (**Figure D6-16**). There is also drawdown within the HJ aquifer north of the Fault, although it is relatively minor. The same wells located about 100 feet apart and across the Fault from one another, Wells HJMP107 and HJT104, that were evaluated during the LC19M test were evaluated during the LQ16M test. Well HJMP107, located on the same side of the Fault as the pumping well, had nearly 25 feet of drawdown near the end of the test. Well HJT104, located approximately 100 feet north of Well HJMP107 and north of the Fault, had approximately 2.2 feet of drawdown at the end of pumping. The data from the LC16M pump test appear consistent with the LC19M pump test, showing that the Lost Creek Fault, while not impermeable, is a significant barrier to groundwater flow.

As in the LC19M pump test, the response of the overlying and underlying aquifers during the LC16M pump test was small (e.g., less than one foot in the LFG and less than two feet in the UKM); but the water level responses were coincident with the start and stop of pumping from LC16M (**Figure D6-16**). The response was slightly more pronounced in the UKM and occurred on both sides of the Lost Creek Fault. There were no observation points in the LFG aquifer across the Fault in the LC16M test. Similar to the LC19M pump test, results from the LC16M test indicate limited hydraulic communication between the HJ aquifer and the overlying LFG and underlying UKM aquifers. Additional discussion regarding the results of the testing are included in **Attachment D6-2b**.

As previously described, hydraulic communication between the HJ aquifer and overlying and underlying aquifers may be through historic boreholes that were improperly abandoned and have not yet been located, leakage through the confining shale units, or contact of sands juxtaposed across the Lost Creek Fault. Additional investigation will be completed prior to production of any mine units to isolate the cause of hydraulic communication between the production zone aquifer and the overlying and underlying aquifers.

It should be noted that although some minor hydraulic communication exists between the hydrostratigraphic units of interest, the hydraulic response only becomes apparent when large stresses (head differences) are applied to the aquifers. Under normal ISR production operations and those proposed for this project, flows are generally balanced so that a net bleed of approximately one percent is maintained within a mine unit/well pattern. Those typical operating conditions will not stress the aquifers to the extent of the recently completed pump tests. Therefore, it is anticipated that any hydraulic response in the overlying and underlying aquifers will be even less than the already negligible responses observed during the LC19M and LC16M pump test.

Detailed mine unit pump tests will be conducted during development of each future mine unit. As such, additional investigations will be performed to assess the background trends observed, characteristics of the Lost Creek Fault and potential communication between the sands monitored for the 2007 test. Based on testing results to date, it is anticipated that any minor communication between the HJ Horizon and the overlying and underlying sands can be managed through operational practices, detailed monitoring, and engineering operations. In this regard, the potential communication observed at Lost Creek is much lower (e.g., five to ten times less) than has been observed in other ISR operations where engineering practices were successfully implemented to isolate lixiviant from overlying and underlying aquifers. **Figure D6-17** summarizes the results of the Hydro-Search, Inc. (1982), Hydro-Engineering (2007), and Petrotek Engineering Corporation pump test results (**Attachments D6-2a** and **D6-2b**). **Table D6-11** summarizes the aquifer characteristics calculated from the pump test data and related field observations.

The 2007 pump test data support the following conclusions:

- the pump test results provide sufficient aquifer characterization of the HJ Horizon;
- the HJ Horizon has sufficient transmissivity such that mining operations can be conducted consistent with the Operations Plan (see Operations Plan contained with this application);
- the HJ Horizon is sufficiently isolated from the overlying and underlying sands by the Lost Creek and Sage Brush Shales;
- hydraulic continuity of the HJ Horizon has been demonstrated over a large scale (e.g., more than 1,000 feet) such that mine planning (e.g., mine unit and monitor well layout) can proceed;
- the hydraulic properties of the Lost Creek Fault have been defined over the test area to an extent such that mine planning can be achieved; and
- test data indicate that the Lost Creek Fault significantly restricts flow in the HJ Horizon.

D6.3 Groundwater Use

Groundwater permits with legal descriptions inside and within three miles of the Permit Area were queried using the WSEO Water Rights Database (WSEO, 2006). **Tables D6-12a** and **D6-12b** list the permits, including potentially active permits as well as abandoned and cancelled permits, which were issued by WSEO to parties other than LC ISR, LLC or its affiliates. The permit information includes, but is not limited to, location, uses, priority dates, status, yield, total depth, and static water depth. **Table D6-12a** lists permits within one-half mile of the Permit Area; this table correlates with **Plate D6-1a**. **Table D6-12b** lists permits within three miles of the Permit Area; these locations are shown on **Plate D6-1b**.

The majority of the groundwater-use permits filed in the vicinity of the Permit Area is for monitoring or miscellaneous mining-related purposes. Many of those permits are associated with the Kennecott Sweetwater Mine (formerly owned by Minerals Exploration Co.), which is in reclamation. This mine was an open-pit operation, and a number of the permits were for the dewatering and monitoring wells associated with the open pit. These wells were at shallower depths than those proposed for ISR at Lost Creek. Construction of the mine began in 1979, and dewatering in advance of mining was completed in 1983. A number of the permits are for monitoring and remediation of the tailings impoundment at the Sweetwater Mill, adjacent to the mine; and the more recent permits are for monitoring associated with surface facilities at the mine.

Table D6-13 is a list of the permits issued by the WSEO to LC ISR, LLC or its affiliates (Ur-E and NFU Wyoming, LLC). At this time, there are three water supply wells and 75 monitor wells permitted and bonded by WDEQ to LC ISR, LLC and its affiliates. Installation of these wells is on-going, and locations of wells currently used for water quality sampling, pump tests, and water supply are shown on figures which are discussed in other sections of **Appendix D6**. Currently, the Project consumes a negligible amount of groundwater for well development, monitoring, testing, and miscellaneous purposes related to uranium exploration. Projected water use once ISR begins and the impacts of that use are discussed in the Operations Plan included with this application.

The groundwater permits within one mile unrelated to mining are those of the BLM. In 1968 and 1980, the BLM Rawlins District was granted three permits by the WSEO (13834, 55112, and 55113). Each of these permits is associated with a well that supplies a stock pond (or tank). These wells and associated stock ponds are located outside of the Permit Area (**Figure D6-18**). In addition, there is a fourth BLM well, supplying a stock pond, for which no water-use permit was found. The permit numbers and names of these four BLM wells are:

SEO Permit 13834 - Battle Spring Draw Well No. 4451;
SEO Permit 55112 - Boundary Well No. 4775;
SEO Permit 55113 - Battle Spring Well No. 4777; and
No SEO Permit - East Eagle Nest Draw Well.

Battle Spring Draw Well No. 4451, which pumps water into a stock tank east of the Permit Area (Township 25 North, Range 92 West, Section 21, NW¼, NE¼, NE¼). In 1968, a uranium exploration hole was drilled at this location; when water was encountered, plastic casing was installed and the well was developed. The well depth is 900 feet, with a static water level of 104 feet. A yield of 19 gallons per minute is permitted. The screened interval is unknown, but given the well depth, it may be significantly deeper than the sands targeted by LC ISR, LLC under this permit. In No vember 2007, this well did not appear to have been used in some time (**Figure D6-19**); however, in April 2009, the well had apparently been recently put back into use, as discussed in **Section D11.3 (Figure D11-4)**.

Boundary Well No. 4775 and Battle Spring Well No. 4777 were drilled as stock wells in 1981 to a depth of approximately 280 feet and 220 feet, respectively. These wells are shallower than the sands targeted by LC ISR, LLC under this permit. A water use of 25 gpm is permitted at each of these wells. According to aerial photographs, Boundary Well No. 4775 is located northeast of the Permit Area, in Township 25 North, Range 92 West, Section 10, SE¼, NE¼, SW¼. Battle Spring Well No. 4777 is situated southeast of the Permit Area, in Township 25 North, Range 92 West, Section 30, SE¼, NW¼. Boundary Well No. 4775 has apparently not been used in some time (**Figure D6-20**), and the windmill on the Battle Spring Well No. 4777 was not in working order in June 2007 (**Figure D6-21**).

In June and July of 2007, LC ISR, LLC contacted BLM to identify the status of these groundwater-use permits. These groundwater-use permits are still considered active (BLM, 2007a). In addition to these wells, BLM identified another active stock well, the East Eagle Nest Draw Well.

The East Eagle Nest Draw Well is located north of the Permit Area, in the NW¼, NW¼, NW¼ of Section 13, Township 25 North and Range 93 West. From mid-May through mid-September, an electric submersible pump in the well is used to pump water into a livestock watering pond at an average rate of five gallons per minute for six to eight hours each day (**Figure D6-22**). The total depth of this well is 370 feet, with a static water level of 269 feet.

Throughout the phases of the Project, LC ISR, LLC will correspond with BLM to ensure that the stock reservoirs and wells are not impacted in a manner that restricts the intended use, and LC ISR, LLC will work with BLM to replace the water source if any wells are rendered unusable due to LC ISR's mining activities.

D6.4 Groundwater Quality

This section describes the regional and local groundwater quality based on information from investigations performed within the Great Divide Basin, data presented in previous applications/reports for the Permit Area, and recent data collected in the Permit Area.

D6.4.1 Regional Groundwater Quality

Water quality within the Great Divide Basin ranges from very poor to excellent. Groundwater in the near surface, more permeable aquifers is generally of better quality than groundwater in deeper and less permeable aquifers. Groundwater with TDS less than 3,000 mg/L can generally be found at depths less than 1,500 feet within the Tertiary aquifer system, which includes the Battle Spring/Wasatch, Fort Union and Lance aquifers (Collentine et al., 1981).

Water quality for the Great Divide Basin is available from a large number of sources including the USGS National Water Information System (NWIS) database, the University of Wyoming Water Resources Data System (WRDS) and the USGS Produced Waters Database. Much of these data are tabulated in "Water Resources of Sweetwater County, Wyoming", a USGS Scientific Investigation Report by Mason and Miller (2005).

However the quality and accuracy of much of the data are difficult to assess. This section of the permit application describes general water quality of the Great Divide Basin, primarily by reference to these sources.

Mason and Miller (2005) noted that water quality in Sweetwater County is highly variable within even a single hydrogeologic unit; and that water quality tends to be better near outcrop areas, where recharge occurs. They also noted that groundwater quality samples from the Quaternary and Tertiary aquifers are most likely biased toward better water quality and do not necessarily represent a random sampling, for the following reasons. Wells and springs that do not produce useable water usually are abandoned or not developed. Deeper portions of the aquifers typically are not exploited as a groundwater resource because a shallower water supply may be available. As a result, these water sources do not become part of the sampled network of wells and springs that ultimately make up the available groundwater database. Groundwater quality samples from deeper Mesozoic and Paleozoic hydrostratigraphic units are often available where oil and gas production or exploration has occurred. Therefore, groundwater samples from older geologic units may have less bias in representing ambient groundwater quality than samples collected from Quaternary and Tertiary aquifers.

Water quality within the shallow Tertiary aquifers generally represents sodium-bicarbonate to sodium-sulfate water types. TDS levels within the Wasatch aquifer in the west and south parts of the Great Divide Basin tend to be high relative to the U.S. EPA's Secondary Drinking Water Standard (SDWS) of 500 mg/L, even within the shallow aquifers. TDS levels within the Battle Spring/Wasatch aquifers are generally below 500 mg/L along the northern flank of the Great Divide Basin (which includes the Permit Area). Elevated TDS levels (greater than 3,000 mg/L) are present within the Wasatch aquifer along the eastern edge of the Washakie Basin and within the Fort Union and Lance aquifers along the east side of the Rock Springs uplift. Elsewhere within the Great Divide and Washakie Basins, TDS levels in the Tertiary aquifer system are typically between 1,000 and 3,000 mg/L (Collentine et al., 1981).

Low-TDS waters within the Battle Spring aquifer are predominately sodium-bicarbonate type waters. With increasing salinity, the water type tends to become more calcium-sulfate dominated. However, this trend is not exhibited in the Wasatch, Fort Union and Lance aquifers within the Great Divide and Washakie Basins. The Wasatch and Lance aquifers are characterized by predominately sodium-sulfate type waters, particularly near outcrop areas. The Fort Union is more variable in composition.

Water quality data for Tertiary aquifers away from the outcrop areas are sparse, but available data indicate that TDS levels increase rapidly away from the basin margins. Water samples collected from a Lance pump test in Section 14, Township 23 North, Range 99 West had reported TDS levels in excess of 35,000 mg/L. A Fort Union test in

Section 25, Township 13 North, Range 95 West had TDS levels in excess of 60,000 mg/L, based on resistivity logs (Collentine et al., 1981). Water quality samples from produced water in the Wasatch and Fort Union Formations from an average depth of 3,500 feet had TDS values ranging from 1,050 to 153,000 mg/L with a median value of 13,900 mg/L (Mason and Miller, 2005). TDS from four wells completed in the Fort Union Formation located along the margins of the basin ranged from 800 to 3,400 mg/L (Welder and McGreevy, 1966).

A graph of TDS versus sampling depth for produced water samples from the Wasatch Formation in Sweetwater County prepared by Mason and Miller (2005) shows that a depths greater than 3,000 feet, TDS values are typically above 10,000 mg/L. It is noted that the Mason and Miller data set is small for a large area and may be biased by data from the southern part of the Great Divide Basin; few site-specific data directly applicable to the Project are available.

Water quality within the Battle Spring aquifer is generally good in the northeast portion of the basin with TDS levels usually less than 1,000 mg/L and frequently less than 200 mg/L. Water type within the Battle Spring aquifer is typically sodium bicarbonate to sodium sulfate. Mason and Miller (2005) reviewed eighteen groundwater samples collected from the Battle Spring aquifer and observed that those samples represented some of the best overall quality of those studied in Sweetwater County. Sulfate levels can be elevated in Tertiary aquifers, but are generally low in the shallow aquifers of the Battle Spring Formation. Out of 18 samples included in the Mason and Miller (2005) study, only one sample exceeded the WDEQ Class I Drinking Water Standard for sulfate of 250 mg/L. Most of the samples were also below the WDEQ TDS Class I Drinking Water Standard of 500 mg/L. Nitrate, fluoride and arsenic levels were below WDEQ and EPA standards for all of the samples.

Notable exceptions to the relatively good water quality included waters with elevated radionuclides. Uranium and radium-226 (Ra-226) concentrations exceeded their respective EPA Maximum Contaminant Levels (MCLs) of 0.03 mg/L and 5 pCi/L in some of the samples; radon-222 (Rn-222) concentrations were also relatively high in some samples (Mason and Miller, 2005). The presence of high levels of uranium in Tertiary sediments and groundwater of the Great Divide Basin has been well documented. The Lost Creek Shroeckingerite deposit located northwest of the Permit Area is noted for high uranium levels in groundwater. Uranium-bearing coals are also present in Great Divide Basin. Sediments of the Battle Spring Formation were derived from the Granite Mountains and contain from 0.0005 to 0.001 percent uranium (Masursky, 1962). Based on historical exploration results, certain areas of the Battle Spring Formation (e.g., Lost Creek) contain much higher uranium concentrations.

Water quality for aquifer systems deeper than the Tertiary (such as the Mesaverde aquifer system) are not described in this report; because they are several thousands of feet deep in the vicinity of the Project and are separated from the Tertiary aquifer system by the Lewis Shale, a regional aquitard. The deeper aquifer systems of the Great Divide Basin will not impact nor be impacted by ISR activities at the Project.

D6.4.2 Site Groundwater Quality

Information regarding site water quality is primarily derived from reconnaissance studies conducted by Conoco (Hydro-Search, Inc., 1982) and ongoing exploration and delineation of the Project by LC ISR, LLC.

D6.4.2.1 Groundwater Monitoring Network and Parameters

Conoco installed 12 wells, separated into four groups, to evaluate aquifer properties and water quality of the uranium ore-bearing sands and overlying and underlying aquifers within the Permit Area. Three of the groups included wells completed within the HJ Horizon aquifer and the overlying (LFG) and underlying (UKM) aquifers. The fourth group included three wells completed within the HJ Horizon aquifer. The location of the wells is shown on **Figure D6-23**. The Conoco wells were sampled for the parameters listed in **Table D6-14**. These 12 wells were installed as part of a joint venture between Conoco and Texasgulf Inc. The wells, permit numbers P61528W thru P61539W, are shown in **Table D6-12a** as being drilled by Texasgulf Inc. Each of the twelve wells was abandoned as documented in a September 16, 1987 letter from Texasgulf Inc. to the State Engineer's office (**Attachment D5-3**).

LC ISR, LLC installed wells in 2006 completed in the DE, LFG, HJ and UKM aquifers and initiated baseline sampling for the same constituents as Conoco, with the addition of alkalinity (as calcium carbonate [$CaCO_3$]), gross alpha, gross beta and radium-228. Four quarters of sampling have been completed for several of the wells that were installed in 2006. Additional wells have been installed in 2007 and are being incorporated into the groundwater monitoring network. The locations of the LC ISR, LLC monitor wells that have been sampled for water quality are indicated on **Figure D6-24**.

In addition to the wells discussed above, per WDEQ-LQD's request, LC ISR, LLC installed ten additional monitor wells to further characterize the regional geochemistry of the potentially effected aquifers. The locations of these wells, designated with an MB prefix, are also shown on **Figure D6-24**.

D6.4.2.2 Groundwater Quality Sampling Results

Historic Results

Ten of the 12 monitor wells installed by Conoco were sampled in August 1982. Hydro-Search, Inc. reported that there were no major differences in water quality between the HJ Horizon aquifer and the overlying and underlying aquifers (1982). The predominant ions were calcium and sulfate. TDS values were all below the WDEQ Class I Standard of 500, ranging from 200 to 490 mg/L (**Figure D6-25a**). The pH of the waters ranged from 7.1 to 8.5, indicating slightly alkaline conditions. Chloride levels were very low, ranging from seven to 18 mg/L.

One of the sampled wells had an obstruction in the well and elevated pH (11.1) and potassium (54 mg/L) values. It was determined that the sampling results from that well were not representative of the site aquifers and that the well was possibly contaminated with cement.

Most trace constituents were below the detection limits. Selenium was present in two samples at 0.023 mg/L, which was above the WDEQ and EPA drinking water standards at that time (0.01 mg/l). The WDEQ Class I Standard and the EPA MCL are currently 0.05 mg/L. Radium-226 was detected in all of the samples, with a range of 2.5 to 300 pCi/L. Only two samples, one collected from the overlying aquifer and one from the underlying aquifer, were below the WDEQ Class I Standard and EPA MCL for radium-226 (5.0 pCi/L). **Figure D6-25b** depicts the distribution of Ra-226 from the 1982 sampling round. Elevated Ra-226 groundwater concentrations are common within and around uranium orebodies. Uranium levels ranged from below detection (less than 0.005 mg/L) to 0.48 mg/L. Six of the ten samples exceeded the current EPA MCL for uranium (0.03 mg/L) (**Figure D6-25c**).

Baseline Sampling

LC ISR, LLC began baseline sampling in September 2006. The baseline sampling round included the following seventeen locations:

- DE Monitor Wells: LC29M, LC30M and LC31M
- LFG Monitor Wells: LC15M, LC18M, LC21M, and LC25M
- HJ Monitor Wells: LC16M, LC19M, LC22M, LC26M; and
- UKM Monitor Wells: LC17M, LC20M, LC23M, LC27M, LC28M, and LC24M.

The second sampling round was conducted in November 2006. The third sampling round was conducted in February and March 2007. The fourth sampling round was conducted in May 2007. All 17 of the wells listed above were included in each sampling event (**Figure D6-26a**). In addition to the baseline sampling program, LC ISR, LLC has also sampled two of the water supply wells, LC1 and LC2. Ten additional baseline monitoring wells were drilled and installed in the fall of 2008 to provide more extensive coverage of the entire permit area. Those wells will be sampled four times each for the same constituents as the initial baseline wells (listed in **Table D6-14**).

Results of the LC ISR, LLC baseline monitoring program are summarized in **Table D6-15a**. The raw laboratory data are presented in **Attachment D6-4**. In **Table D6-15a**, those analytical results which exceed specific WDEQ WQD or EPA criteria are highlighted, and the WQD and EPA criteria used for the comparison are included in **Table D6-15b**. The table shows that the WDEQ TDS Class I standard is exceeded at one well in each of the DE, HJ and UKM aquifers, Wells LC31M, LC26M, and LC23M, respectively. Fourteen out of the 17 wells have TDS levels below the Class I Standard. The distribution of TDS (averaged from the four sampling events) is shown in **Figure D6-26a**. Sulfate exceeds the WDEQ Class I Standard (250 mg/L) in one DE monitor well (LC31M) and one HJ monitor well (LC26M). The distribution of sulfate, averaged from September 2006 to May 2007, is shown in **Figure D6-26b**. As with the Conoco monitoring results, chloride values are low with all but one sample at ten mg/L or lower (**Table D6-15a**).

Piper diagrams have been developed to compare groundwater quality between individual wells (**Figure D6-27a**) and between different aquifers (**Figure D6-27b**). The individual well comparison plots the average value for each of the wells for all of the samples analyzed. The piper diagram comparing different aquifers represents the average water quality for all wells sampled within individual aquifers (DE, LFG, HJ and UKM). Groundwater within the shallow Battle Springs aquifers beneath the Permit Area is a calcium sulfate to calcium bicarbonate type water. There is some variability in water chemistry when the wells are compared individually.

The trace constituents, boron, cadmium, chromium, copper, mercury, molybdenum, nickel, vanadium, and zinc were at or below detection limits for all samples. Ammonia exceeded the WDEQ Class I Standard (0.5 mg/l) in one DE monitor well (LC29M) and one UKM monitor well (LC23M). Selenium exceeded the WDEQ Class I Standard and EPA MCL (0.05 mg/L) in one DE monitor well (LC31M). Iron exceeded the WDEQ Class I Standard and EPA MCL (0.3 mg/L) in one DE monitor well (LC29M), two LFG monitor wells (LC18M and LC21M) and one UKM monitor well (LC24M). Manganese was above the WDEQ Class I Standard and EPA MCL (0.05 mg/L) in seven of the 12 samples collected from DE monitor wells but did not exceed those standards in any other sampled aquifer.

With the exception of UKM monitor wells LC27M and LC28M, every uranium analysis exceeded the EPA MCL of (0.03 mg/L). The average uranium concentration of all samples collected in the baseline monitoring program (0.296 mg/L) is over an order of magnitude greater than the MCL. The average distribution of uranium at individual wells from September 2006 to May 2007 is shown on **Figure D6-28a**.

The average distribution of radium-226+228 is shown on **Figure D6-28b**. The WDEQ Class I Standard and EPA MCL for radium-226+228 is 5.0 pCi/L. **Table D6-16** summarizes the number of wells in each aquifer that exceed the EPA MCL.

A summary of the water quality for each of the four hydrostratigraphic units of interest (DE, LFG, HJ and UKM) is presented below. All metal concentrations are reported as dissolved.

DE Sand Water Quality

Three wells completed in the DE Sand were included in the baseline sampling program (LC29M, LC30M and LC31M). An additional three DE monitor wells (MB-1, MB-7 and MB-10) have been installed and will be sampled in 2009. The results of the newer sampling will be reported in an updated groundwater baseline sampling summary report. Sample results from the existing baseline monitor wells are included in **Table D6-15a**.

Results of the baseline sampling indicate that two of the DE monitor wells (LC29M and LC30M) are calcium bicarbonate water, whereas the third is a calcium sulfate type (LC31M). Both sulfate and TDS levels in LC31M exceed the WDEQ Class I Standards (250 mg/l and 500 mg/l, respectively). Chloride levels in all three wells are low (10 mg/l or less).

Manganese exceeded the WDEQ Class I Standard (0.05 mg/L) in seven of the 12 samples collected from DE monitor wells. The average manganese value was 0.10 mg/l for the DE monitor wells. The average selenium concentration at well LC31M was 0.172 mg/l, exceeding the WDEQ Class I Standard of 0.05 mg/l.

Iron exceeded the WDEQ Class I Standard (0.3 mg/L) in two of the four samples from one DE monitor well (LC29M). The average value for the four samples from LC29M was below the standard. Similarly the average ammonia concentration was below the WDEQ Class I Standard (0.5 mg/l) at well LC29M, although two of the four samples exceeded the standard.

Uranium levels exceeded the EPA MCL in every sample collected from the DE monitor wells. The average U concentration for the twelve samples collected was 0.742 mg/l.

Radium 226 exceeded the EPA MCL of 5.0 pCi/l in two samples. Combined radium 226+228 exceeded the standard in four of the samples. However the average radium 226+228 activity for each of the DE monitor wells was below the WDEQ Class I Standard.

LFG Sand Water Quality

Four wells completed in the LFG Sand were included in the baseline sampling program (LC15M, LC18M, LC21M, and LC25M). An additional three LFG monitor wells (MB-2, MB-5 and MB-8) have been installed and will be sampled in 2009. The results of the newer sampling will be reported in an updated groundwater baseline sampling summary report. Sample results from the existing baseline monitor wells are included in **Table D6-15a**.

Results of the baseline sampling indicate that the LFG monitor wells are calcium-bicarbonate to calcium-sulfate water. TDS and sulfate levels are below the WDEQ Class I Standards (500 mg/l and 250 mg/l, respectively) and chloride levels in all four wells are low (10 mg/l or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the LFG samples. Iron exceeded the WDEQ Class I Standard in three out of four samples at LC18M and one out of four samples at LC25M.

Uranium levels exceeded the EPA MCL in every sample collected from the LFG monitor wells. The average U concentration for the LFG samples was 0.411 mg/l. Radium levels were widely distributed. Samples from LFG wells LC15M, LC18M and LC21M exceeded the WDEQ Class I Standard for radium 226+228.

HJ Horizon Water Quality

Four wells completed in the HJ Horizon were included in the baseline sampling program (LC16M, LC19M, LC22M, and LC26M). An additional three HJ monitor wells (MB-3, MB-6 and MB-9) have been installed and will be sampled in 2009. The results of the newer sampling will be reported in an updated groundwater baseline sampling summary report. Sample results from the existing baseline monitor wells are included in **Table D6-15a**.

Results of the baseline sampling indicate that the HJ monitor wells are calcium-bicarbonate to calcium-sulfate water. Both sulfate and TDS levels in LC26M exceed the WDEQ Class I Standards (250 mg/l and 500 mg/l, respectively). Chloride levels in all four wells are low (10 mg/l or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the HJ samples.

Uranium levels exceeded the EPA MCL in every sample collected from the HJ monitor wells. The average U concentration for the HJ samples was 0.245 mg/l.

UKM Sand Water Quality

Six wells completed in the UKM Sand were included in the baseline sampling program (LC17M, LC20M, LC23M, LC24M, LC27M, and LC28M). Two of the wells were originally thought to be completed in the HJ Horizon (LC27M and LC28M) but were later reinterpreted as UKM completions. One UKM monitor well (MB-4 has been installed and will be sampled in 2009. The results of the newer sampling will be reported in an updated groundwater baseline sampling summary report. Sample results from the existing baseline monitor wells are included in **Table D6-15a**.

Results of the baseline sampling indicate that the UKM monitor wells are calcium-bicarbonate to calcium-sulfate water. TDS and sulfate levels are below the WDEQ Class I Standards (500 mg/l and 250 mg/l, respectively) and chloride levels in all six wells are low (10 mg/l or less).

Manganese and selenium were below the respective WDEQ Class I Standards in all the UKM samples.

Uranium levels exceeded the EPA MCL in most of the samples collected from the UKM monitor wells. The exceptions were at wells LC27M and LC28M. The average U concentration for the UKM samples was 0.030 mg/l.

Average radium 226+228 levels exceeded the WDEQ Class I Standard in each of the UKM monitor wells.

Summary of Site Groundwater Quality

General water quality in the shallow Battle Spring aquifers within the Permit Area tends to be relatively good, with the exception of the presence of radionuclides. TDS and sulfate values are relatively low, with occasional exceedances of WDEQ Class I standards. Manganese is elevated above state and federal standards in the water table aquifer (DE) but is below standards in deeper confined aquifers in the vicinity of the uranium orebodies. Radium-226+228 exceeds the EPA MCL in over two thirds of the samples collected and the average uranium concentration is an order of magnitude greater than the EPA MCL for that constituent. Elevated concentration of these constituents is consistent with the presence of uranium orebodies.

D6.5 Hydrologic Conceptual Model

A hydrologic conceptual model of the Project and surrounding area has been developed to provide a framework that allows LC ISR, LLC to make decisions regarding optimal methods for extracting uranium from mineralized zones, and to minimize environmental and safety concerns caused by ISR operations.

LC ISR, LLC will use ISR technology at the Project to extract uranium from permeable uranium-bearing sandstones within the upper portion of the Battle Spring Formation, at depths ranging from 350 to 900 feet. A conceptual hydrologic model of the Project is summarized below.

D6.5.1 Regional Groundwater Conceptual Model

The Project is located within the northeastern portion of the Great Divide Basin. The Eocene Battle Spring Formation crops out over most of the northeastern portion of the Great Divide Basin, including the Permit Area. The total thickness of the Battle Spring Formation in the vicinity of the Permit Area is approximately 6,200 feet. The Battle Spring Formation contains multiple aquifers that are a part of the Tertiary aquifer system. Groundwater flow within the Battle Spring aquifers is primarily toward the interior of the basin, southwest of the Project. Recharge to the Battle Springs aquifers within the Project area is mostly the result of infiltration of precipitation to the north and northeast in the Green Mountains and Ferris Mountains. Based on available information, discharge from the Battle Spring aquifers is predominately to a series of lakes, springs and playa lake beds near the center of the basin. Some groundwater from the Battle Spring aquifers is discharged through pumping for stock watering, irrigation, industrial and domestic use.

The Battle Spring Formation is described as an arkosic fine- to coarse-grained sandstone with claystone and conglomerates. Groundwater within the Battle Spring aquifers is typically under confined (artesian) conditions, although locally unconfined conditions exist. The potentiometric surface within the Battle Spring aquifers is usually within 200 feet of the ground surface. Most wells drilled for water supply in this unit are less than 1,000 feet deep. Wells completed in the Battle Spring aquifers typically yield 30 to 40 gpm but yields as high as 150 gpm are possible.

Water quality within the shallow Tertiary aquifers generally represents sodium-bicarbonate to sodium-sulfate water types. TDS levels within the Battle Spring aquifers are generally below 500 mg/L along the northern flank of the Great Divide Basin near areas of outcrop. Low TDS waters within the Battle Springs aquifer are predominately sodium-bicarbonate type waters. With increasing salinity, the water type tends to become more calcium-sulfate dominated. Notable exceptions to the relatively good water quality include waters with elevated radionuclides (uranium, Ra-226 and Ra-228). High levels of uranium are common in Tertiary sediments and groundwater of the Great Divide Basin. The Lost Creek Shroeckingerite deposit located northwest of the Project is noted for high uranium levels in groundwater. Uranium-bearing coals are present in the Wasatch Formation in the central part of the Great Divide Basin.

As described previously, the Battle Spring Formation crops out over most of the Permit Area. The Battle Spring is the shallowest occurrence of groundwater within the Permit Area. Water-bearing Quaternary and Tertiary units younger than the Battle Spring Formation are present several miles to the north and east and are hydraulically up-gradient of the Permit Area. Therefore, ISR operations conducted at the Project will have no impact on those shallower hydrostratigraphic units.

D6.5.2 Site Groundwater Conceptual Model

D6.5.2.1 Hydrostratigraphic Units

The hydrostratigraphic units of interest within the Battle Spring Formation, with respect to the Project include, from shallowest to deepest:

- DE Horizon (shallowest occurrence of groundwater):
  - sands and discontinuous clay/shale units, top of unit 100 to 200 ft bgs;
  - coalesces with underlying FG Horizon to the south; and
  - water levels in the DE Sand are typically 140 to 200 ft bgs;
- Upper No Name Shale (upper confining unit to the FG Horizon):
  - zero to 50 feet thick;
- FG Horizon (includes overlying aquifer to HJ Horizon):
  - subdivided into UFG, MFG and LFG Sands;
  - total thickness of horizon is 100 feet;
  - top of unit is 200 to 350 ft bgs;
  - LFG Sand the overlying aquifer to HJ Horizon;
  - LFG Sand is 20 to 50 feet thick; and
  - water levels in the LFG Sand are typically 160 to 200 ft bgs;
- Lost Creek Shale (upper confining unit to the HJ Horizon):
  - laterally continuous across Permit Area;
  - five to 45 feet thick; and
  - confining properties demonstrated from water levels and pump test;

- HJ Horizon (contains the primary production zone):
  - subdivided into UHJ, MHJ and LHJ Sands, although sands are hydraulically connected;
  - coarse-grained arkosic sands with thin lenticular intervals of fine sand, mudstone and siltstone;
  - averages 120 feet thick;
  - top of unit is 300 to 450 ft bgs; and
  - water levels in the HJ Horizon range from 150 to 200 ft bgs;
- Sage Brush Shale (lower confining unit to the HJ Horizon and upper confining unit to the UKM Horizon):
  - laterally continuous across Permit Area;
  - five to 75 feet thick;
  - top of unit 450 to 550 ft bgs; and
  - confining properties demonstrated from water levels and pump test;
- KM Horizon (includes possible secondary production zone, lower confining units and underlying aquifers):
  - subdivided into UKM, MKM and LKM Sands;
  - massive coarse sandstones with thin lenticular fine sandstone intervals;
  - top of unit is 450 to 600 ft bgs;
  - UKM Sand is a possible secondary production zone and first underlying aquifer;
  - UKM Sand is 30 to 60 ft thick;
  - water levels in the UKM Sand are generally 185 to 220 ft bgs;
  - No Name Shale is the lower confining unit to the UKM Sand;
  - No Name Shale is ten to 30 feet thick and laterally extensive but will require additional characterization; and
  - MKM is the underlying aquifer to the UKM Sand but will require additional characterization.

D6.5.2.2 Potentiometric Surface and Hydraulic Gradients

Potentiometric surfaces for the DE, LFG, HJ, and UKM Horizons are illustrated as contour maps in **Figures D6-11a to D6-11h** and also on Cross Sections in **Plates D5-1a to D5-1g**. Depiction of these surfaces on the cross sections were generated by tracking the intersection of the plane of the cross section profile with the potentiometric contours for the given horizons.

Potentiometric surface of the HJ Horizon indicates that groundwater flow across the permit area is to the west-southwest under a hydraulic gradient of 0.005 to 0.006 ft/ft (15.8 to 31.6 ft/mi), generally consistent with the regional flow system. The Lost Creek Fault acts as a hydraulic barrier to groundwater flow as demonstrated from water level differences of 15 feet across the Fault within the HJ Horizon and the pump test results.

However, the Fault does not appear to strongly affect either the direction of flow or the hydraulic gradient within the HJ Horizon. **Figure D6-11g** shows that the groundwater flow direction across the permit area, based on the potentiometric surface, is toward the west southwest on both sides of the Fault. The reason for the minimal impact of the Fault on groundwater flow direction within the permit area is because the Fault is only present across a small portion of the permit area, dying out to the east-northeast and west-southwest. The hydraulic gradient north of the Fault is approximately 0.005 ft/ft whereas on the south side of the Fault the hydraulic gradient is approximately 0.006 ft/ft. The pump tests indicate minor leakage of groundwater across the Fault when large head differences exist within the HJ aquifer across the Fault.

Groundwater flow direction and hydraulic gradients for the overlying (DE and FG) and underlying aquifers (UKM) are generally similar to that of the HJ Horizon. Groundwater flow on both sides of the Lost Creek Fault is toward the west-southwest at hydraulic gradients between 0.005 ft/ft to 0.007 ft/ft as shown in the potentiometric maps for the DE, LFG and UKM Sands (**Figures D6-11e**, **D6-11f** and **D6-11h**, respectively). The potentiometric heads decrease with depth. Differences in water level elevations between the LFG, HJ and UKM aquifers indicate that confining units are present between these hydrostratigraphic units.

Pump tests indicate the presence of confining units between the LFG and HJ aquifers and between the HJ and UKM aquifers, although some minor hydraulic communication exists between those units. The hydraulic communication only becomes apparent when large stresses (head differences) are applied to the aquifers through pumping. Hydraulic communication between the HJ aquifer and overlying and underlying aquifers may be through historic boreholes that were improperly abandoned, leakage through the confining shale units, or contact of sands juxtaposed across the Lost Creek Fault. Additional investigation will be completed prior to production of any mine units. More detail about abandonment work is provided in **Section D5.4.2.1**. In particular, **Table D5-2** is a summary of efforts to relocate and re-abandon historic holes, and **Attachment D5-3** includes historic memos regarding previous operator's attempts to relocate and re-abandon holes.

Vertical hydraulic gradients range from -0.020 to 0.37 ft/ft between the LFG, HJ and UKM aquifers and consistently indicate decreasing hydraulic head with depth. The vertical gradients indicate the potential for groundwater flow is predominately downward. The vertical gradients also support the confining nature of the Lost Creek and Sage Brush Shale. The vertical gradient between the DE and LFG aquifers is minimal, consistent with observations that those hydrostratigraphic units coalesce in places within the Permit Area. An exception to this occurs in the eastern portion of the site where the vertical gradient between the DE and LFG aquifers is 0.28, indicating a strong downward potential.

D6.5.2.3 Aquifer Properties

Transmissivity for the HJ Horizon ranges from 35 to 400 ft^2/d (260 to 3,000 gpd/ft). Based on long-term pump tests, the estimated "effective" transmissivity (because of the impacts of the Lost Creek Fault) is 60 to 80 ft^2/d (450 to 600 gpd/ft) on both sides of the Fault. Because of the boundary effect of the Fault (e.g., the system is not an infinite-acting aquifer), the actual transmissivity of the aquifer, without impacts from the Fault, would be higher. Using the effective transmissivity and an average thickness of 120 feet, the "effective" hydraulic conductivity of the HJ Horizon is in the range of 0.5 to 0.67 ft/d. The actual hydraulic conductivity of the aquifer is probably between one and 1.5 ft/d. Storativity of the HJ Horizon ranges from 5.0×10^{-5} to 5.0×10^{-4}.

Based on more limited testing, the transmissivity of the LFG aquifer is lower than for the HJ Horizon ranging from 4.4 to 40 ft^2/d (30 to 300 gpd/ft). The range of transmissivity of the UKM aquifer is similar to but slightly lower than the HJ aquifer, from 26 to 115 ft^2/d (195 to 860 gpd/ft). Transmissivity of the DE Horizon is variable, ranging from 1.3 to 130 ft^2/d (10 to 1,000 gpd/ft). Storativity values have not been determined for the overlying and underlying aquifers at this time because no multi-well pump tests have been conducted within those aquifers. However, it is expected that storativity values in the FG and KM Horizons will be similar to the range observed in the HJ Horizon. The DE Horizon is at least partially under unconfined conditions and therefore will have a specific yield instead of a storage coefficient. As discussed in the previous section, the long-term multi-well pump tests performed in the fall of 2007 (the LC19M and LC16M tests described in Attachments D6-2a and D6-2b, respectively) provided data on the degree of connnection between the overlying and underlying aquifers relative to the HJ Horizon.

D6.5.2.4 Water Quality

Water quality within the hydrostratigraphic units of interest (the production zones and overlying and underlying aquifers) is generally good with respect to major chemistry. TDS and sulfate levels are typically below respective WDEQ Class I Standards and EPA SDWS, although occasionally, regulatory standards are exceeded. Chloride levels are low, (typically less than ten mg/L) making this parameter a good indicator for excursion monitoring.

Trace metals generally are below WDEQ Class I Standards and EPA MCLs in the production zone, overlying and underlying aquifers. Ammonia, arsenic, iron and selenium occasionally exceed the respective standards. Manganese is present above the regulatory standards in over half of the samples collected from the DE Horizon. Manganese was below the WDEQ Class I Standards and EPA MCL in all samples from other hydrostratigraphic units.

Uranium is present in nearly all of the wells at levels exceeding the EPA MCL of 0.03 mg/L. The average uranium concentration for all of the hydrostratigraphic units of interest is 0.30 mg/L, an order of magnitude greater than the EPA MCL. Radium-226+228 levels exceed the EPA MCL and WDEQ Class I Standard (five pCi/L) in two-thirds of the samples collected. The percentage of wells that exceed radium-226+228 standards is greater for the HJ and UKM Production Zone aquifers than for the FG and DE Horizons. Dissolved radionuclide levels are commonly elevated in groundwater associated with uranium-bearing sandstones.

D6.5.2.5 Summary

The uranium bearing sandstones within the upper Battle Spring Formation appear to be suitable targets for ISR operations. The primary production zone aquifer (HJ Horizon) is bounded by laterally extensive upper and lower confining units, as demonstrated by static water level differences and responses to pump tests. Aquifer properties (transmissivity, hydraulic conductivity and storativity) are within the ranges observed at other ISR operations that have successfully extracted uranium reserves. Water quality is generally consistent throughout the hydrostratigraphic units of interest. Elevated radionuclides are present in the groundwater, but this is consistent with the presence of uranium ore deposits within the sandstones. The Lost Creek Fault acts as a hydraulic barrier to flow and will need to be accounted for in mine unit design and operation.

Table D6-9a 2007 LC19M Long Term Pump Test Monitor Wells

Well ID	Type of Well	Completion Zone	Ground Surface Elevation (ft amsl) [1]	Top of Casing Elevation (ft amsl) [1]	Top of Underreamed Zone (ft bgs)	Bottom of Underreamed Zone (ft bgs)	Distance from Pumping Well (feet)	Same Side of Fault as Pumping Well?	Initial Depth to Water (ft bgs)	Static Water Level Elevation (ft amsl)
LC19M	Pumping	HJ	6949.32	6950.52	412	463	0	Yes	180.08	6770.44
HJT-104	Production Zone Monitor	HJ	6938.78	6940.11	410	463	501	Yes	169.51	6770.60
HJMP-104	Production Zone Monitor	HJ	6939.76	6941.01	402	430	638	Yes	171.81	6769.20
HJMP-110	Production Zone Monitor	HJ	6945.95	6947.14	431	476	338	Yes	174.89	6772.25
HJMP-111	Production Zone Monitor	HJ	6948.98	6950.32	393	440	470	Yes	176.94	6773.38
HJMP-107	Production Zone Monitor	HJ	6937.13	6938.40	423	460	606	No	183.61	6754.79
LC16M	Production Zone Monitor	HJ	6934.76	6936.38	410	467	1284	No	178.14	6758.24
LC20M	Underlying Monitor	UKM	6949.27	6950.64	511	543	14	Yes	202.36	6748.28
UKMP-102	Underlying Monitor	UKM	6940.87	6942.03	485	505	785	Yes	190.68	6751.35
UKMP-101	Underlying Monitor	UKM	6940.26	6941.75	547	575	815	No	192.13	6749.62
LC18M	Overlying Monitor	LFG	6948.43	6949.03	290	332	15	Yes	168.04	6780.99
LC25M	Overlying Monitor	LFG	6935.00	6936.52	316	349	697	No	167.05	6769.47

Table D6-9b 2007 LC16M Long Term Pump Test Monitor Wells (Page 1 of 4)

Well ID	Type Well	Completion Zone	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Distance from Pumping Well (ft)	Same Side of Fault as Pumping Well?	Top Underreamed Zone (ft bgs)	Bottom Underreamed Zone (ft bgs)	Measurement Method [1]	Static Depth to Water (11/21/07) (ft bgs)	Static Water Level Elevation (11/21/07) (ft amsl)
LC16M	Pumping Well	HJ	6,934.73	6,936.15	0	Yes	410	467	Transducer	178.78	6,757.37
HJMP-101	Prod. Zone Monitoring Well	HJ	6,903.70	6,904.58	1,276	No	438	465	Hand Tag	181.10	6,723.48
HJMP-102	Prod. Zone Monitoring Well	HJ	6,934.15	6,936.15	1,996	No	405	435	Hand Tag	175.67	6,760.48
HJMP-103	Prod. Zone Monitoring Well	HJ	6,935.08	6,936.49	1,920	No	392	432	Hand Tag	170.60	6,765.89
HJMP-104	Prod. Zone Monitoring Well	HJ	6,939.04	6,941.04	1,666	No	402	430	Hand Tag	175.21	6,765.83
HJMP-105	Prod. Zone Monitoring Well	HJ	6,936.84	6,937.38	1,603	No	435	463	Hand Tag	170.85	6,766.53
HJMP-106	Prod. Zone Monitoring Well	HJ	6,940.20	6,941.29	1,452	No	430	480	Hand Tag	173.07	6,768.22
HJMP-107	Prod. Zone Monitoring Well	HJ	6,936.81	6,938.45	866	Yes	423	460	Transducer	183.94	6,754.51
HJMP-108	Prod. Zone Monitoring Well	HJ	6,951.12	6,952.20	1,186	No	400	434	Hand Tag	183.10	6,769.10
HJMP-109	Prod. Zone Monitoring Well	HJ	6,937.89	6,939.10	650	Yes	478	512	Hand Tag	185.25	6,753.85

Table D6-9b 2007 LC16M Long Term Pump Test Monitor Wells (Page 2 of 4)

Well ID	Type Well	Completion Zone	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Distance from Pumping Well (ft)	Same Side of Fault as Pumping Well?	Top Underreamed Zone (ft bgs)	Bottom Underreamed Zone (ft bgs)	Measurement Method [1]	Static Depth to Water (11/21/07) (ft bgs)	Static Water Level Elevation (11/21/07) (ft amsl)
HJMP-110	Prod. Zone Monitoring Well	HJ	6,945.81	6,947.01	936	No	431	476	Transducer	177.44	6,769.57
HJMP-111	Prod. Zone Monitoring Well	HJ	6,948.99	6,949.49	896	No	393	440	Hand Tag	178.55	6,770.94
HJMP-112	Prod. Zone Monitoring Well	HJ	6,934.32	6,935.48	221	Yes	370	400	Hand Tag	178.24	6,757.24
HJMP-113	Prod. Zone Monitoring Well	HJ	6,935.26	6,937.26	276	Yes	416	462	Transducer	180.84	6,756.42
HJMP-114	Prod. Zone Monitoring Well	HJ	6,940.18	6,941.01	448	Yes	408	460	Transducer	180.37	6,760.64
HJT-101	Prod. Zone Monitoring Well	HJ	6,937.12	6,937.56	2,002	No	437	477	Hand Tag	176.04	6,761.52
HJT-102	Prod. Zone Monitoring Well	HJ	6,937.82	6,939.15	1,665	No	390	417	Hand Tag	173.55	6,765.60
HJT-103	Prod. Zone Monitoring Well	HJ	6,937.56	6,938.22	1,375	Yes	423	450	Hand Tag	190.28	6,747.94
HJT-104	Prod. Zone Monitoring Well	HJ	6,937.48	6,940.15	898	No	410	463	Transducer	172.08	6,768.07
HJT-105	Prod. Zone Monitoring Well	HJ	6,937.45	6,938.87	236	Yes	407	438	Transducer	171.68	6,767.19

Table D6-9b 2007 LC16M Long Term Pump Test Monitor Wells (Page 3 of 4)

Well ID	Type Well	Completion Zone	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Distance from Pumping Well (ft)	Same Side of Fault as Pumping Well?	Top Underreamed Zone (ft bgs)	Bottom Underreamed Zone (ft bgs)	Measurement Method [1]	Static Depth to Water (11/21/07) (ft bgs)	Static Water Level Elevation (11/21/07) (ft amsl)
UKMO-101	Prod. Zone Monitoring Well	HJ	6,940.19	6,942.28	479	Yes	465	487	Transducer	179.00	6,763.28
UKMO-102	Prod. Zone Monitoring Well	HJ	6,940.24	6,940.79	466	No	377	408	Transducer	167.52	6,773.27
UKMO-103	Prod. Zone Monitoring Well	HJ	6,949.28	6,950.53	741	No	409	430	Transducer	176.02	6,774.51
HJMO-112	Overlying Monitoring Well	LFG	6,933.76	6,935.51	225	Yes	305	350	Hand Tag	157.29	6,778.22
HJMO-113	Overlying Monitoring Well	LFG	6,936.06	6,936.97	284	Yes	318	356	Hand Tag	159.63	6,777.34
HJMO-114	Overlying Monitoring Well	LFG	6,939.09	6,940.75	454	Yes	324	360	Hand Tag	161.60	6,779.15
LC15M	Overlying Monitoring Well	LFG	6,935.13	6,936.55	17	Yes	286	340	Transducer	157.94	6,778.61
HJMU-112	Underlying Monitoring Well	UKM	6,934.18	6,935.35	215	Yes	525	560	Hand Tag	184.81	6,750.54
HJMU-113	Underlying Monitoring Well	UKM	6,935.16	6,936.99	273	Yes	524	555	Hand Tag	187.48	6,749.51

Table D6-9b 2007 LC16M Long Term Pump Test Monitor Wells (Page 4 of 4)

Well ID	Type Well	Completion Zone	Ground Surface Elevation (ft amsl)	Top of Casing Elevation (ft amsl)	Distance from Pumping Well (ft)	Same Side of Fault as Pumping Well?	Top Underreamed Zone (ft bgs)	Bottom Underreamed Zone (ft bgs)	Measurement Method [1]	Static Depth to Water (11/21/07) (ft bgs)	Static Water Level Elevation (11/21/07) (ft amsl)
HJMU-114	Underlying Monitoring Well	UKM	6,939.10	6,940.43	440	Yes	525	553	Hand Tag	189.47	6,750.96
LC17M	Underlying Monitoring Well	UKM	6,935.32	6,936.90	22	Yes	529	565	Transducer	186.96	6,749.94
LC24M	Underlying Monitoring Well	UKM	6,942.33	6,944.33	383	No	478	531	Hand Tag	193.68	6,750.65
UKMP-101	Underlying Monitoring Well	UKM	6,940.18	6,941.74	473	Yes	547	575	Hand Tag	194.09	6,747.65
UKMP-102	Underlying Monitoring Well	UKM	6,940.51	6,942.10	475	No	485	505	Hand Tag	192.81	6,749.29

[1] Transducer - Continuous measurement with In-Situ vented LevelTROLL 300; Hand Tag-Periodic measurement with electronic water level meter

[2] The elevations shown may not be exactly the same as the elevations shown on the well logs in Attachment D6-3 because the wells were resurveyed. The elevations shown here were the ones used in the pump test evaluations.

Table D6-10a 2007 LC19M Long Term Pump Test Results

Well ID	Type Well	Underreamed interval (feet)	Distance from pumping well (feet)	Same side of fault as pumping well?	Drawdown at End of Pumping	Transmissivity (ft^2/d)			Storage Coefficient	Hydraulic Conductivity (ft/d)[1]
						Theis	Theis Recovery	Average		
LC19M	Pumping	51	0	Yes	93.3	-	56.7	56.7	-	0.47
HJT-104	Prod. Zone Monitor	50	501	Yes	40.5	30.0	56.9	43.5	9.60E-05	0.36
HJMP-104	Prod. Zone Monitor	25	638	Yes	36.5	61.3	56.8	59.1	6.60E-05	0.49
HJMP-110	Prod. Zone Monitor	45	338	Yes	40.5	66.4	63.0	64.7	1.30E-04	0.54
HJMP-111	Prod. Zone Monitor	47	470	Yes	35.6	69.8	64.1	67.0	9.10E-05	0.56
UKMO-102	Prod. Zone Monitor	31	783	Yes	21.5	75.5	76.9	76.2	1.50E-04	0.64
	Average	42	-	-	-	60.6	62.4	61.2	1.07E-04	0.51
HJMP-107	Prod. Zone Monitor	37	606	No	1.4	NA[3]	NA	NA	NA	NA
LC16M	Prod. Zone Monitor	57	1284	No	1.2	NA	NA	NA	NA	NA
LC20M	Underlying Monitor	32	14	Yes	-0.7	NA	NA	NA	NA	NA
UKMP-102	Underlying Monitor	20	785	Yes	1.2	NA	NA	NA	NA	NA
UKMP-101	Underlying Monitor	28	815	No	2.6[2]	NA	NA	NA	NA	NA
LC18M	Overlying Monitor	42	15	Yes	1.1	NA	NA	NA	NA	NA
LC25M	Overlying Monitor	33	697	No	1.6	NA	NA	NA	NA	NA

[1] Hydraulic Conductivity Calculated from Average Transmissivity and Estimated Aquifer Thickness of 120 feet.
[2] Value shifted abruptly downward 2.7 feet between consecutive measure points one hour prior to end of test.
[3] NA - Not analyzed because of insufficient response

Table D6-10b 2007 LC16M Long Term Pump Test Results

Well ID	Type Well	Underreamed interval (feet)	Distance from pumping well (feet)	Same side of fault as pumping well?	Drawdown at End of Pumping	Transmissivity (ft^2/d)			Storage Coefficient	Hydraulic Conductivity (ft/d) [1]
						Theis	Theis Recovery	Average		
LC16M	Pumping	57	Pumping well	Yes	69.3		58.9	58.9	-	4.9E-01
HJMP-107	Prod. Zone Monitor	37	866	Yes	27.4	71.8	56.7	64.3	3.5E-05	5.4E-01
HJMP-113	Prod. Zone Monitor	46	276	Yes	37.7	84.7	57.4	71.1	5.2E-05	5.9E-01
HJMP-114	Prod. Zone Monitor	52	448	Yes	30.0	83.8	60.9	72.4	6.4E-05	6.0E-01
HJT-105	Prod. Zone Monitor	31	236	Yes	17.5	110.0	90.9	100.5	9.1E-04	8.4E-01
UKMO-101	Prod. Zone Monitor	22	479	Yes	21.0	99.1	80.9	90.0	4.1E-04	7.5E-01
HJMP-110	Prod. Zone Monitor	45	936	No	1.9	NA [2]	NA	NA	NA	NA
HJT-104	Prod. Zone Monitor	50	898	No	3.0	NA	NA	NA	NA	NA
UKMO-102	Prod. Zone Monitor	31	466	No	1.6	NA	NA	NA	NA	NA
UKMO-103	Prod. Zone Monitor	21	741	No	1.3	NA	NA	NA	NA	NA
LC17M	Underlying Monitor	36	22	Yes	2.0	NA	NA	NA	NA	NA
LC15M	Overlying Monitor	54	17	Yes	1.0	NA	NA	NA	NA	NA

[1] Hydraulic Conductivity Calculated from Average Transmissivity Saturated thickness of Aquifer (HJ = 120 ft)

[2] NA - Not analyzed because of insufficient response

Table D6-12a Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008 (Page 1 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
1	Well[5]	P9742W	Kennecott Uranium Company	24 N	94 W	34	NENE	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1	25	170	104
1a	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	12	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1b	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	13	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1c	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	14	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1d	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	23	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1e	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	24	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1f	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	25	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1g	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	26	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1h	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	35	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
1i	Use Point	P9742W	Kennecott Uranium Company	25 N	93 W	36	INP	Stock, Industrial	7/15/1971	Adjudicated	J E S No. 1			
2	Well	P13834P	USDI BLM, Rawlins District	25 N	92 W	21	NENW	Stock	9/21/1968	Good Standing	Battle Spring Draw Well No. 4451	19	900	104
2a	Use Point	P13834P	USDI BLM, Rawlins District	25 N	92 W	21	NENW	Stock	9/21/1968	Good Standing	Battle Spring Draw Well No. 4451			
3	Well	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3a	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3b	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3c	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3d	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3e	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3f	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3g	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3h	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			

Table D6-12a Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008 (Page 2 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
3i	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3j	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3k	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3l	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3m	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3n	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3o	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3p	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3q	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3r	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3s	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NESE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3t	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NWSE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3u	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3v	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3w	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3x	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			

Table D6-12a Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008 (Page 3 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
3y	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3z	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3aa	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3ab	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3ac	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3ad	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENW	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3ae	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
3af	Use Point	P35721W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNE	Stock, Miscellaneous	12/8/1976	Abandoned	TE 24			
4	Well	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENW	Miscellaneous	5/5/1977	Cancelled	TE 38	25	380	220
4a	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4b	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4c	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4d	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4e	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4f	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4g	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4h	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4i	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4j	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4k	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4l	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4m	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4n	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4o	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			

Table D6-12a Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008 (Page 4 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
4p	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4q	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4r	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SWSE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4s	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4t	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NESE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4u	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4v	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4w	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4x	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4y	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4z	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4aa	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4ab	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4ac	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4ad	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENW	Miscellaneous	5/5/1977	Cancelled	TE 38			
4ae	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENE	Miscellaneous	5/5/1977	Cancelled	TE 38			
4af	Use Point	P37637W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNE	Miscellaneous	5/5/1977	Cancelled	TE 38			
5	Well	P39744W	USDI, BLM -- Apexco Inc.	25 N	93 W	22	SWNE	Miscellaneous	8/26/1977	Cancelled	Battle Springs No. 1	25	640	60
5a	Use Point	P39744W	USDI, BLM -- Apexco Inc.	25 N	93 W	22	SWNE	Miscellaneous	8/26/1977	Cancelled	Battle Springs No. 1			
6	Well	P55112W	USDI BLM, Rawlins District	25 N	92 W	10	SESE	Stock	12/24/1980	Good Standing	Boundary	5	280	155
6a	Use Point	P55112W	USDI BLM, Rawlins District	25 N	92 W	10	SESE	Stock	12/24/1980	Good Standing	Boundary			
6b	Well	P55113W	USDI BLM, Rawlins District	25 N	92 W	30	NWSE	Stock	12/24/1980	Good Standing	Battle Springs	5	220	109
6c	Use Point	P55113W	USDI BLM, Rawlins District	25 N	92 W	30	NWSE	Stock	12/24/1980	Good Standing	Battle Springs			
7	Well	P61528W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1S	0	355	155.8
7a	Use Point	P61528W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1S			
8	Well	P61529W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1M	0	440	173.8
8a	Use Point	P61529W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1M			
9	Well	P61530W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1D	0	534	181.2
9a	Use Point	P61530W	Texasgulf Inc.	25 N	92 W	20	NWNW	Monitoring	6/11/1982	Abandoned	M25 92 20 1D			
10	Well	P61531W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 3M	0	460	176.5
10a	Use Point	P61531W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 3M			

Table D6-12a **Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008** (Page 5 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
11	Well	P61532W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 2M	0	460	175.9
11a	Use Point	P61532W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 2M			
12	Well	P61533W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 1M	0	460	174.4
12a	Use Point	P61533W	Texasgulf Inc.	25 N	92 W	19	NENE	Monitoring	6/11/1982	Abandoned	M25 92 19 1M			
13	Well	P61534W	Texasgulf Inc.	25 N	92 W	18	SESE	Monitoring	6/11/1982	Abandoned	M25 19 18 1M	0	465	166.7
13a	Use Point	P61534W	Texasgulf Inc.	25 N	92 W	18	SWSE	Monitoring	6/11/1982	Abandoned	M25 19 18 1M			
14	Well	P61535W	Texasgulf Inc.	25 N	92 W	18	SESE	Monitoring	6/11/1982	Abandoned	M25 19 18 1S	0	355	159.5
14a	Use Point	P61535W	Texasgulf Inc.	25 N	92 W	18	SESE	Monitoring	6/11/1982	Abandoned	M25 19 18 1S			
15	Well	P61536W	Texasgulf Inc.	25 N	92 W	18	SESE	Monitoring	6/11/1982	Abandoned	M25 92 18 1D	0	615	195.7
15a	Use Point	P61536W	Texasgulf Inc.	25 N	92 W	18	SESE	Monitoring	6/11/1982	Abandoned	M25 92 18 1D			
16	Well	P61537W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1S	0	340	170.53
16a	Use Point	P61537W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1S			
17	Well	P61538W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1M	0	480	182.7
17a	Use Point	P61538W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1M			
18	Well	P61539W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1D	0	529	204.5
18a	Use Point	P61539W	Texasgulf Inc.	25 N	92 W	17	SESW	Monitoring	6/11/1982	Abandoned	M25 92 17 1D			
19	Well	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENW	Miscellaneous	8/10/1984	Cancelled	TE 38	25	380	220
19a	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19b	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19c	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	NWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19d	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	12	SWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19e	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19f	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19g	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SESW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19h	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19i	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19j	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NESW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19k	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWSW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19l	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWSW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19m	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			

Table D6-12a Groundwater Use Permits within 0.5 Mile Radius - Wyoming State Engineer Records December 2008 (Page 6 of 6)

ID [1]	Well or Use Point	Permit Number	Applicant [2]	Township	Range	Section	¼ of the ¼ [3]	Uses	Priority	Status	Permit Facility Name	Yield [4] (gpm)	Well Depth (ft)	Static Well Depth (ft)
19n	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19o	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	SENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19p	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	13	NENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19q	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19r	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SWSE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19s	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	SESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19t	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	14	NESE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19u	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19v	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19w	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	NWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19x	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	23	SWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19y	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19z	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19aa	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19ab	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19ac	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENW	Miscellaneous	8/10/1984	Cancelled	TE 38			
19ad	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NENE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19ae	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	NWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			
19af	Use Point	P68449W	USDI, BLM -- Texasgulf Inc.	25 N	93 W	24	SWNE	Miscellaneous	8/10/1984	Cancelled	TE 38			
20	Well	[6]	USDI BLM, Rawlins District	25 N	93 W	13	NWNW	Stock			East Eagle Nest Draw Well	5	370	269

[1] Each number represents a well. Well locations are shown on Plate D6-1a. A number followed by a letter(s) is a point of use related to the well.

(yellow box) = Actual Well Location

(white box) = Point of Use Location

[2] USDI BLM = United States Department of Interior's Bureau of Land Management; WSBLC = Wyoming State Board of Land Commissioners.

[3] INP = Information not provided by the online WSEO database.

[4] LCS = Part of the on-going Lost Creek Project study. Information will be provided when it becomes available.

[5] Well 1 is more than 5 miles southwest of the permit area; however, it has points of use within 0.5 miles of the Permit Area

[6] This well does not currently have an associated WSEO permit number.

Table D6-15a Analytical Results of Baseline Monitoring (Page 1 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC29M	DE	9/20/06	26.0	2.0	57.0	4.0	6.0	137.0	ND	108.0	12.0	ND
LC29M	DE	11/26/06	26.0	3.0	64.0	4.0	4.0	98.0	ND	131.0	17.2	ND
LC29M	DE	3/1/07	24.0	2.0	57.0	3.0	4.0	205.0	ND	54.0	18.1	ND
LC29M	DE	5/4/07	27.0	2.0	47.0	3.0	10.0	183.0	ND	21.0	15.3	0.90
LC30M	DE	9/20/06	29.0	2.0	33.0	2.0	6.0	122.0	ND	31.0	14.7	1.40
LC30M	DE	11/26/06	25.0	1.0	31.0	2.0	5.0	124.0	ND	26.0	13.7	1.20
LC30M	DE	3/1/07	51.0	2.0	33.0	2.0	6.0	156.0	ND	51.0	17.4	0.60
LC30M	DE	5/3/07	62.0	2.0	28.0	2.0	6.0	176.0	ND	55.0	17.7	ND
LC31M	DE	9/21/06	40.0	3.0	140.0	9.0	7.0	140.0	ND	**316.0**	15.0	0.80
LC31M	DE	11/26/06	39.0	3.0	120.0	8.0	7.0	145.0	ND	**280.0**	13.9	0.40
LC31M	DE	2/28/07	64.0	3.0	108.0	7.0	8.0	156.0	ND	**277.0**	17.0	0.30
LC31M	DE	5/3/07	71.0	3.0	99.0	6.0	6.0	159.0	ND	**279.0**	15.9	0.20
MB-1	DE	8/27/09	22.0	3.0	10.0	ND	12.0	ND	18.0	22.0	15.7	1.55
MB-7	DE	8/26/09	Insufficient water to sample.									
MB-10	DE	8/26/09	Insufficient water to sample.									

Table D6-15a Analytical Results of Baseline Monitoring (Page 2 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC29M	DE	9/20/06	283.0			112.0	**328.0**	142.0	1.9	ND	1.9	**0.499**
LC29M	DE	11/26/06	298.0	491.0	7.68	80.0	**158.0**	54.0	1.7	4.7	**6.4**	**0.246**
LC29M	DE	3/1/07	265.0	385.0	7.77		**265.0**	86.1	4.0	ND	4.0	**0.318**
LC29M	DE	5/4/07	219.0	356.0	7.75		**200.0**	84.6	3.0	ND	3.0	**0.251**
LC30M	DE	9/20/06	184.0			100.0	**129.0**	41.5	1.0	ND	1.0	**0.141**
LC30M	DE	11/26/06	170.0	288.0	7.33	102.0	**107.0**	32.3	0.9	1.6	2.5	**0.154**
LC30M	DE	3/1/07	241.0	393.0	8.02		**108.0**	31.9	5.7	ND	**5.7**	**0.162**
LC30M	DE	5/3/07	260.0	440.0	8.07		**109.0**	40.0	2.1	ND	2.1	**0.130**
LC31M	DE	9/21/06	**602.0**	800.0	7.85	114.0	**1120.0**	405.0	2.0	1.7	3.7	**1.890**
LC31M	DE	11/26/06	**528.0**	838.0	7.79	119.0	**1430.0**	395.0	2.6	3.2	**5.8**	**2.100**
LC31M	DE	2/28/07	**563.0**	817.0	7.94		**967.0**	262.0	7.2	1.0	**8.2**	**1.400**
LC31M	DE	5/3/07	**559.0**	860.0	7.79		**1030.0**	319.0	1.9	2.4	4.3	**1.610**
MB-1	DE	8/27/09	121.0	186.0	**10.10**		**21.4**	10.1	0.7	0.9	1.6	0.011
MB-7	DE	8/26/09	Insufficient water to sample.									
MB-10	DE	8/26/09	Insufficient water to sample.									

Table D6-15a Analytical Results of Baseline Monitoring (Page 3 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC29M	DE	9/20/06	ND	**1.07**	0.002	ND	ND	ND	ND	ND	0.30
LC29M	DE	11/26/06	ND	**0.57**	0.003	ND	ND	ND	ND	ND	0.30
LC29M	DE	3/1/07	ND	0.26	0.005	ND	ND	ND	ND	ND	0.20
LC29M	DE	5/4/07	ND	0.18	ND	ND	ND	ND	ND	ND	0.20
LC30M	DE	9/20/06	ND	0.11	0.002	ND	ND	ND	ND	ND	0.50
LC30M	DE	11/26/06	ND	0.08	0.002	ND	ND	ND	ND	ND	0.50
LC30M	DE	3/1/07	ND	0.07	0.004	ND	ND	ND	ND	ND	0.50
LC30M	DE	5/3/07	ND	0.06	0.007	ND	ND	ND	ND	ND	0.50
LC31M	DE	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC31M	DE	11/26/06	ND	0.07	ND	ND	ND	ND	ND	ND	0.20
LC31M	DE	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC31M	DE	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-1	DE	8/27/09	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-7	DE	8/26/09	Insufficient water to sample.								
MB-10	DE	8/26/09	Insufficient water to sample.								

Table D6-15a Analytical Results of Baseline Monitoring (Page 4 of 17)

Trace Parameters (Dissolved unless otherwise noted.)														
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC29M	DE	9/20/06	0.09	0.09	ND	**0.12**	**0.11**	ND	ND	ND	0.002	ND	ND
LC29M	DE	11/26/06	**0.67**	**0.46**	ND	**0.48**	**0.32**	ND	ND	ND	ND	ND	ND
LC29M	DE	3/1/07	**0.40**	**0.40**	ND	**0.24**	**0.24**	ND	ND	ND	ND	ND	ND
LC29M	DE	5/4/07	0.14	0.14	ND	0.04	0.04	ND	ND	ND	ND	ND	ND
LC30M	DE	9/20/06	ND	ND	ND	0.01	ND	ND	ND	ND	0.016	ND	ND
LC30M	DE	11/26/06	ND	ND	ND	0.01	0.01	ND	ND	ND	0.016	ND	ND
LC30M	DE	3/1/07	0.11	0.11	ND	**0.08**	**0.08**	ND	ND	ND	0.006	ND	ND
LC30M	DE	5/3/07	0.09	0.09	ND	**0.07**	**0.07**	ND	ND	ND	0.003	ND	ND
LC31M	DE	9/21/06	ND	ND	ND	0.01	ND	ND	ND	ND	0.215	ND	ND
LC31M	DE	11/26/06	ND	ND	ND	**0.06**	0.05	ND	ND	ND	0.211	ND	ND
LC31M	DE	2/28/07	0.10	0.10	ND	**0.10**	**0.10**	ND	ND	ND	0.151	ND	ND
LC31M	DE	5/3/07	0.07	0.07	ND	0.02	0.02	ND	ND	ND	0.111	ND	ND
MB-1	DE	8/27/09	0.40	0.42	ND	ND	ND	ND	ND	ND	0.003	ND	ND
MB-7	DE	8/26/09	Insufficient water to sample										
MB-10	DE	8/26/09	Insufficient water to sample										

Table D6-15a Analytical Results of Baseline Monitoring (Page 5 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC15M	LFG	9/12/06	31.0	4.0	86.0	4.0	8.0	127.0	ND	180.0	16.0	ND
LC15M	LFG	11/26/06	31.0	2.0	84.0	4.0	6.0	134.0	ND	157.0	14.3	ND
LC15M	LFG	3/1/07	33.0	3.0	89.0	5.0	1.0	130.0	ND	180.0	14.8	0.20
LC15M	LFG	5/4/07	34.0	9.0	46.0	3.0	6.0	85.0	ND	142.0	13.0	0.40
LC18M	LFG	9/20/06	35.0	3.0	61.0	3.0	5.0	122.0	ND	122.0	13.2	ND
LC18M	LFG	11/22/06	31.0	2.0	55.0	3.0	5.0	117.0	ND	117.0	12.4	ND
LC18M	LFG	3/1/07	33.0	2.0	60.0	3.0	5.0	120.0	ND	120.0	13.6	ND
LC18M	LFG	5/4/07	30.0	3.0	49.0	3.0	5.0	112.0	ND	119.0	12.6	ND
LC21M	LFG	9/20/06	33.0	2.0	46.0	3.0	6.0	121.0	5.0	62.0	15.8	1.00
LC21M	LFG	11/26/06	30.0	2.0	41.0	3.0	5.0	132.0	ND	59.0	13.9	0.80
LC21M	LFG	2/28/07	31.0	3.0	35.0	3.0	5.0	120.0	ND	60.0	15.2	1.00
LC21M	LFG	5/3/07	30.0	2.0	41.0	3.0	5.0	124.0	ND	58.0	13.7	1.00
LC25M	LFG	9/21/06	35.0	4.0	73.0	2.0	6.0	100.0	2.0	146.0	14.1	0.30
LC25M	LFG	11/17/06	34.0	2.0	70.0	4.0	6.0	120.0	ND	139.0	14.6	0.20
LC25M	LFG	3/1/07	32.0	2.0	72.0	4.0	6.0	126.0	ND	150.0	14.7	0.20
LC25M	LFG	5/3/07	34.0	4.0	34.0	3.0	4.0	36.0	ND	133.0	13.5	ND
MB-2	LFG	8/27/09	29.0	2.0	37.0	3.0	8.0	121.0	ND	53.0	16.1	1.2
MB-5	LFG	8/27/09	24.0	3.0	63.0	3.0	6.0	132.0	ND	105.0	17.2	ND
MB-8	LFG	8/26/09	24.0	3.0	70.0	4.0	5.0	159.0	ND	121.0	16.9	0.0

Table D6-15a Analytical Results of Baseline Monitoring (Page 6 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC15M	LFG	9/12/06	390.0				**263.0**	83.3	5.3	0.9	**6.2**	**0.489**
LC15M	LFG	11/26/06	370.0	605.0	7.84	110.0	**334.0**	116.0	3.8	4.8	**8.6**	**0.472**
LC15M	LFG	3/1/07	390.0	587.0	7.32		**374.0**	92.7	6.0	3.5	**9.5**	**0.467**
LC15M	LFG	5/4/07	296.0	492.0	8.27		**236.0**	92.1	3.6	ND	3.6	**0.358**
LC18M	LFG	9/20/06	303.0			100.0	**518.0**	192.0	43.0	2.8	**45.8**	**0.523**
LC18M	LFG	11/22/06	277.0	461.0	8.33	98.0	**490.0**	199.0	63.5	3.9	**67.4**	**0.546**
LC18M	LFG	3/1/07	296.0	460.0	7.86		**439.0**	148.0	ND	ND	0.0	**0.533**
LC18M	LFG	5/4/07	277.0	467.0	8.09		**385.0**	115.0	26.4	ND	**26.4**	**0.419**
LC21M	LFG	9/20/06	233.0			106.0	**219.0**	70.3	1.6	1.2	2.8	**0.251**
LC21M	LFG	11/26/06	219.0	373.0	8.17	108.0	**205.0**	49.2	1.2	12.0	**13.2**	**0.278**
LC21M	LFG	2/28/07	214.0	333.0	8.25		**815.0**	62.6	230.0	ND	**230.0**	**0.270**
LC21M	LFG	5/3/07	219.0	371.0	8.17		**202.0**	65.2	3.7	ND	3.7	**0.236**
LC25M	LFG	9/21/06	336.0	452.0	8.37	91.0	**353.0**	124.0	3.1	3.3	**6.4**	**0.465**
LC25M	LFG	11/17/06	330.0	516.0	8.28		**301.0**	138.0	3.1	ND	3.1	**0.460**
LC25M	LFG	3/1/07	344.0	519.0	7.97		**369.0**	107.0	2.3	2.3	4.6	**0.517**
LC25M	LFG	5/3/07	244.0	390.0	**8.57**		**194.0**	72.5	2.9	ND	2.9	**0.289**
MB-2	LFG	8/27/09	220.0	337.0	8.17		**223.0**	61.4	1.7	2.0	3.7	**0.164**
MB-5	LFG	8/27/09	295.0	438.0	7.99		**80.9**	28.4	32.0	3.3	**35.3**	0.017
MB-8	LFG	8/26/09	333.0	487.0	7.91		**204.0**	54.9	3.2	2.4	**5.6**	**0.152**

Table D6-15a Analytical Results of Baseline Monitoring (Page 7 of 17)

Trace Parameters (Dissolved unless otherwise noted.)												
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC15M	LFG	9/12/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC15M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC18M	LFG	9/20/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC18M	LFG	11/22/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC18M	LFG	3/1/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC18M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC21M	LFG	9/20/06	ND	0.08	ND	ND	ND	ND	ND	ND	0.30
LC21M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.30
LC21M	LFG	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC21M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	9/21/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC25M	LFG	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC25M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-2	LFG	8/27/09	ND	0.14	0.00	ND	ND	ND	ND	ND	ND
MB-5	LFG	8/27/09	ND	0.08	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	8/26/09	ND	0.13	ND	ND	ND	ND	ND	ND	ND

Table D6-15a Analytical Results of Baseline Monitoring (Page 8 of 17)

Trace Parameters (Dissolved unless otherwise noted.)														
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC15M	LFG	9/12/06	0.03	ND	ND	ND	ND	ND	ND	ND	0.019	ND	ND
LC15M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.016	ND	ND
LC15M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.017	ND	ND
LC15M	LFG	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.010	ND	ND
LC18M	LFG	9/20/06	**0.53**	**0.53**	ND	ND	ND	ND	ND	ND	0.024	ND	ND
LC18M	LFG	11/22/06	**0.51**	**0.51**	ND	ND	ND	ND	ND	ND	0.015	ND	ND
LC18M	LFG	3/1/07	**0.67**	**0.67**	ND	ND	ND	ND	ND	ND	0.016	ND	ND
LC18M	LFG	5/4/07	0.10	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC21M	LFG	9/20/06	**0.40**	**0.40**	ND	0.02	0.02	ND	ND	ND	0.040	ND	ND
LC21M	LFG	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.039	ND	ND
LC21M	LFG	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.034	ND	ND
LC21M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.032	ND	ND
LC25M	LFG	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	0.027	ND	ND
LC25M	LFG	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	0.027	ND	ND
LC25M	LFG	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.025	ND	ND
LC25M	LFG	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.015	ND	ND
MB-2	LFG	8/27/09	0.20	ND	ND	ND	ND	ND	ND	ND	0.013	ND	ND
MB-5	LFG	8/27/09	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-8	LFG	8/26/09	0.10	0.42	ND	ND	ND	ND	ND	ND	0.003	ND	0.05

Table D6-15a Analytical Results of Baseline Monitoring (Page 9 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC16M	HJ	9/12/06	27.0	2.0	77.0	4.0	5.0	134.0	ND	144.0	16.0	ND
LC16M	HJ	9/12/06	27.0	2.0	77.0	4.0	5.0	134.0	ND	144.0	16.0	ND
LC16M	HJ	9/12/06	27.0	2.0	77.0	4.0	5.0	134.0	ND	144.0	16.0	ND
LC16M	HJ	11/10/06	29.3	8.0	80.1	3.9	7.0	128.0	ND	136.0		ND
LC16M	HJ	3/1/07	30.0	2.0	74.0	4.0	4.0	132.0	ND	138.0	15.0	ND
LC16M	HJ	5/4/07	29.0	2.0	74.0	4.0	5.0	137.0	ND	139.0	14.8	ND
LC19M	HJ	9/20/06	35.0	3.0	66.0	3.0	6.0	103.0	2.0	139.0		ND
LC19M	HJ	11/3/06	32.8	2.1	72.9	3.2	6.0	132.0	ND	146.0	15.0	ND
LC19M	HJ	3/5/07	40.0	13.0	41.0	3.0	6.0	73.0	ND	124.0	14.5	ND
LC19M	HJ	5/4/07	33.0	8.0	45.0	3.0	5.0	93.0	ND	137.0	14.8	ND
LC19M	HJ	5/4/07	33.0	8.0	46.0	3.0	5.0	96.0	ND	137.0	14.6	ND
LC22M	HJ	9/21/06	40.0	2.0	74.0	3.0	5.0	113.0	ND	170.0	15.0	ND
LC22M	HJ	11/16/06	36.0	2.0	62.0	3.0	4.0	109.0	ND	154.0	12.8	ND
LC22M	HJ	3/1/07	37.0	4.0	60.0	3.0	6.0	110.0	ND	142.0	14.2	ND
LC22M	HJ	5/3/07	35.0	4.0	64.0	3.0	5.0	113.0	ND	137.0	13.0	ND
LC26M	HJ	9/21/06	35.0	4.0	133.0	6.0	6.0	168.0	ND	**269.0**	17.7	ND
LC26M	HJ	11/17/06	33.0	3.0	127.0	5.0	6.0	166.0	ND	**256.0**	17.0	ND
LC26M	HJ	3/1/07	33.0	3.0	125.0	5.0	5.0	159.0	ND	**253.0**	16.2	ND
LC26M	HJ	5/3/07	34.0	8.0	90.0	5.0	5.0	57.0	ND	**259.0**	17.5	ND
MB-3B	HJ	8/27/09	31.0	4.0	37.0	2.0	11.0	108.0	ND	66.0	17.2	0.9
MB-6	HJ	8/27/09	38.0	3.0	38.0	1.0	4.0	77.0	ND	106.0	16.8	ND
MB-9	HJ	8/27/09	24.0	3.0	70.0	4.0	5.0	159.0	ND	121.0	16.9	0.0

Table D6-15a Analytical Results of Baseline Monitoring (Page 10 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC16M	HJ	9/12/06	330.0				**299.0**	109.0	166.0	4.3	**170.3**	**0.164**
LC16M	HJ	9/12/06	330.0				**299.0**	109.0	166.0	4.3	**170.3**	**0.164**
LC16M	HJ	9/12/06	330.0				**299.0**	109.0	166.0	4.3	**170.3**	**0.164**
LC16M	HJ	11/10/06	304.0	517.0			**274.0**	120.0	2.0	78.4	**80.4**	**0.133**
LC16M	HJ	3/1/07	333.0	509.0	7.92		**290.0**	79.7	65.1	3.8	**68.9**	**0.134**
LC16M	HJ	5/4/07	335.0	534.0	8.01		**188.0**	69.2	122.0	3.2	**125.2**	**0.122**
LC19M	HJ	9/20/06	319.0			87.0	**985.0**	540.0	366.0	4.8	**370.8**	**0.336**
LC19M	HJ	11/3/06	328.0	506.0	7.85	108.0	**863.0**	592.0	547.0	4.1	**551.1**	**0.051**
LC19M	HJ	3/5/07	278.0	432.0	8.02		**1220.0**	473.0	316.0	3.4	**319.4**	**0.844**
LC19M	HJ	5/4/07	266.0	482.0	8.11		**1470.0**	603.0	423.0	1.0	**424.0**	**0.762**
LC19M	HJ	5/4/07	264.0	487.0	8.09		**1350.0**	568.0	386.0	1.6	**387.6**	**0.766**
LC22M	HJ	9/21/06	366.0	511.0	8.14	93.0	**810.0**	358.0	261.0	3.2	**264.2**	**0.342**
LC22M	HJ	11/16/06	328.0	531.0	8.15		**597.0**	258.0	247.0	1.9	**248.9**	**0.185**
LC22M	HJ	3/1/07	319.0	483.0	7.87		**86.5**	97.9	1.7	3.6	**5.3**	**0.129**
LC22M	HJ	5/3/07	316.0	513.0	8.11		**576.0**	186.0	308.0	3.8	**311.8**	**0.097**
LC26M	HJ	9/21/06	**554.0**	741.0	8.16	138.0	**306.0**	111.0	87.7	4.6	**92.3**	**0.107**
LC26M	HJ	11/17/06	**528.0**	786.0	8.06		**300.0**	119.0	77.2	3.8	**81.0**	**0.072**
LC26M	HJ	3/1/07	**519.0**	745.0	7.85		**30.5**	46.1	ND	3.6	3.6	**0.045**
LC26M	HJ	5/3/07	449.0	653.0	8.44		**50.2**	23.4	12.4	ND	**12.4**	**0.037**
MB-3	HJ	8/27/09	231.0	353.0	8.29		**255.0**	48.8	1.9	3.1	5.0	**0.179**
MB-6	HJ	8/27/09	256.0	374.0	**8.79**		10.2	8.9	3.4	3.8	**7.2**	0.000
MB-9	HJ	8/27/09	333.0	487.0	7.91		**204.0**	54.9	3.2	2.4	**5.6**	**0.152**

Table D6-15a Analytical Results of Baseline Monitoring (Page 11 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC16M	HJ	9/12/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.10
LC16M	HJ	9/12/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.10
LC16M	HJ	9/12/06	ND	ND	0.002	ND	ND	ND	ND	ND	0.10
LC16M	HJ	11/10/06	ND	ND	ND	ND	ND	ND	ND	ND	0.10
LC16M	HJ	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC16M	HJ	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC19M	HJ	9/20/06	ND	ND	**0.014**	ND	ND	ND	ND	ND	ND
LC19M	HJ	11/3/06	ND	ND	0.002	ND	ND	ND	ND	ND	ND
LC19M	HJ	3/5/07	ND	0.06	0.008	ND	ND	ND	ND	ND	0.20
LC19M	HJ	5/4/07	ND	ND	0.007	ND	ND	ND	ND	ND	ND
LC19M	HJ	5/4/07	ND	ND	0.006	ND	ND	ND	ND	ND	ND
LC22M	HJ	9/21/06	ND	ND	0.005	ND	ND	ND	ND	ND	ND
LC22M	HJ	11/16/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC22M	HJ	3/1/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC22M	HJ	5/3/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC26M	HJ	9/21/06	ND	ND	0.003	ND	ND	ND	ND	ND	ND
LC26M	HJ	11/17/06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC26M	HJ	3/1/07	ND	0.07	ND	ND	ND	ND	ND	ND	ND
LC26M	HJ	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-3	HJ	8/27/09	ND	0.25	0.00	ND	ND	ND	ND	ND	ND
MB-6	HJ	8/27/09	ND	ND	0.00	ND	ND	ND	ND	ND	ND
MB-9	HJ	8/27/09	ND	0.13	ND	ND	ND	ND	ND	ND	ND

Table D6-15a Analytical Results of Baseline Monitoring (Page 12 of 17)

Trace Parameters (Dissolved unless otherwise noted.)														
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC16M	HJ	9/12/06	0.03	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	9/12/06	0.03	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	9/12/06	0.03	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	11/10/06	0.06	0.06	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	3/1/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC16M	HJ	5/4/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC19M	HJ	9/20/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC19M	HJ	11/3/06	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC19M	HJ	3/5/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC19M	HJ	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC19M	HJ	5/4/07	ND	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	11/16/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC22M	HJ	3/1/07	ND	ND	ND	0.02	0.01	ND	ND	ND	ND	ND	ND
LC22M	HJ	5/3/07	ND	0.03	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC26M	HJ	9/21/06	ND	ND	ND	0.02	0.02	ND	ND	ND	ND	ND	ND
LC26M	HJ	11/17/06	0.23	0.23	ND	0.03	0.03	ND	ND	ND	ND	ND	ND
LC26M	HJ	3/1/07	ND	ND	ND	0.02	0.02	ND	ND	ND	ND	ND	ND
LC26M	HJ	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-3	HJ	8/27/09	0.20	ND	ND	ND	ND	ND	ND	ND	0.02	ND	0.01
MB-6	HJ	8/27/09	0.10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
MB-9	HJ	8/27/09	0.10	0.42	ND	ND	ND	ND	ND	ND	0.00	ND	0.05

Table D6-15a Analytical Results of Baseline Monitoring (Page 13 of 17)

Major Cations and Anions												
Well ID	Completion Zone	Sample Date	Na (mg/L)	K (mg/L)	Ca (mg/L)	Mg (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	CO_3 (mg/L)	SO_4 (mg/L)	SiO_2 (mg/L)	NO_3+NO_2 (mg/L)
LC17M	UKM	9/12/06	27.0	4.0	55.0	2.0	4.0	107.0	4.0	107.0	15.2	ND
LC17M	UKM	11/26/06	27.0	2.0	55.0	2.0	5.0	120.0	ND	94.0	15.1	ND
LC17M	UKM	3/1/07	29.0	2.0	62.0	3.0	5.0	124.0	ND	105.0	16.8	ND
LC17M	UKM	5/4/07	27.0	2.0	61.0	3.0	4.0	142.0	ND	108.0	15.9	ND
LC20M	UKM	9/21/06	32.0	3.0	56.0	2.0	6.0	113.0	2.0	102.0	17.2	ND
LC20M	UKM	11/22/06	32.0	5.0	38.0	ND	6.0	63.0	3.0	80.0	12.7	ND
LC20M	UKM	3/1/07	36.0	11.0	15.0	ND	5.0	39.0	ND	95.0	14.6	ND
LC20M	UKM	5/4/07	35.0	11.0	12.0	ND	6.0	34.0	2.0	91.0	14.1	ND
LC23M	UKM	9/21/06	44.0	8.0	58.0	ND	5.0	83.0	6.0	165.0	13.9	ND
LC23M	UKM	11/26/06	41.0	7.0	50.0	2.0	3.0	85.0	ND	150.0	14.1	ND
LC23M	UKM	3/1/07	64.0	48.0	52.0	ND	15.0	7.0	137.0	146.0	10.7	ND
LC23M	UKM	5/3/07	63.0	52.0	86.0	ND	5.0	4.0	66.0	126.0	9.4	ND
LC24M	UKM	9/21/06	32.0	3.0	68.0	4.0	5.0	109.0	ND	138.0	16.1	ND
LC24M	UKM	9/21/06	32.0	3.0	68.0	4.0	5.0	109.0	ND	138.0	16.1	ND
LC24M	UKM	11/26/06	29.0	2.0	66.0	3.0	4.0	126.0	2.0	121.0	14.7	ND
LC24M	UKM	3/1/07	31.0	7.0	43.0	3.0	5.0	73.0	ND	126.0	14.8	ND
LC24M	UKM	5/4/07	31.0	7.0	48.0	3.0	5.0	85.0	ND	126.0	14.6	ND
LC27M	UKM	9/26/06	19.5	4.1	29.5	0.6	4.0	93.0	1.0	29.0	15.3	ND
LC27M	UKM	11/16/06	21.0	4.0	27.0	ND	6.0	82.0	2.0	29.0	15.5	ND
LC27M	UKM	3/1/07	21.0	5.0	11.0	ND	4.0	38.0	ND	39.0	16.4	ND
LC27M	UKM	5/3/07	22.0	5.0	7.0	ND	4.0	33.0	5.0	32.0	17.8	ND
LC28M	UKM	9/21/06	27.0	3.0	60.0	3.0	6.0	125.0	ND	101.0	16.1	ND
LC28M	UKM	11/26/06	24.0	2.0	58.0	3.0	4.0	127.0	ND	88.0	15.7	ND
LC28M	UKM	2/28/07	25.0	2.0	59.0	3.0	6.0	127.0	ND	95.0	16.9	ND
LC28M	UKM	5/3/07	25.0	2.0	62.0	3.0	6.0	130.0	ND	96.0	15.0	ND
MB-4	UKM	8/31/09	32.0	8.0	32.0	ND	10.0	ND	23.0	61.0	19.5	0.5

Table D6-15a Analytical Results of Baseline Monitoring (Page 14 of 17)

			General Water Quality				Radionuclides					
Well ID	Completion Zone	Sample Date	TDS (mg/L)	Specific Conductivity	Lab pH (SU)	Alkalinity (mg/L)	Gross Alpha (pCi/L)	Gross Beta (pCi/L)	Ra-226 (pCi/L)	Ra-228 (pCi/L)	Ra-226 + Ra-228 (pCi/L)	Uranium (mg/L)
LC17M	UKM	9/12/06	262.0				**28.4**	13.7	10.6	1.1	**11.7**	0.0135
LC17M	UKM	11/26/06	262.0	436.0	8.02	98.0	**29.0**	15.5	8.8	12.9	**21.7**	0.010
LC17M	UKM	3/1/07	284.0	433.0	7.88		**26.8**	11.5	5.5	ND	**5.5**	0.011
LC17M	UKM	5/4/07	291.0	467.0	8.11		**17.3**	9.1	7.2	1.5	**8.7**	0.009
LC20M	UKM	9/21/06	274.0	388.0	**8.56**	96.0	**44.4**	24.0	9.6	3.9	**13.5**	**0.036**
LC20M	UKM	11/22/06	216.0	362.0	**8.91**	56.0	**38.7**	19.5	9.3	3.4	**12.7**	0.025
LC20M	UKM	3/1/07	197.0	305.0	7.66		**65.3**	23.9	47.8	ND	**47.8**	0.024
LC20M	UKM	5/4/07	188.0	322.0	**9.04**		**31.9**	23.6	9.2	2.6	**11.8**	0.025
LC23M	UKM	9/21/06	341.0	451.0	**8.87**	76.0	**32.8**	17.5	3.3	ND	3.3	0.023
LC23M	UKM	11/26/06	303.0	498.0	7.97	70.0	**35.0**	14.9	4.7	6.7	**11.4**	0.019
LC23M	UKM	3/1/07	452.0	1180.0	**11.60**		5.3	34.8	1.9	1.0	2.9	0.002
LC23M	UKM	5/3/07	**526.0**	1720.0	**11.60**		**15.1**	44.7	4.7	1.5	**6.2**	0.002
LC24M	UKM	9/21/06	321.0	455.0	8.30	91.0	**107.0**	43.2	6.5	1.5	**8.0**	**0.134**
LC24M	UKM	9/21/06	321.0	455.0	8.30	91.0	**107.0**	43.2	6.5	1.5	**8.0**	**0.134**
LC24M	UKM	11/26/06	302.0	500.0	8.33	105.0	**86.8**	27.6	5.9	5.8	**11.7**	**0.100**
LC24M	UKM	3/1/07	266.0	410.0	7.99		**48.6**	22.6	1.8	2.0	3.8	**0.062**
LC24M	UKM	5/4/07	277.0	452.0	8.08		**49.1**	23.8	8.9	1.5	**10.4**	**0.052**
LC27M	UKM	9/26/06	136.0				10.7	9.7	1.1	0.4	1.5	0.0026
LC27M	UKM	11/16/06	145.0	243.0	**8.66**		6.8	9.4	1.1	3.6	4.7	0.002
LC27M	UKM	3/1/07	117.0	171.0	**8.74**		**77.7**	4.1	26.6	ND	**26.6**	0.001
LC27M	UKM	5/3/07	111.0	178.0	**9.51**		2.9	3.9	0.4	ND	0.4	0.002
LC28M	UKM	9/21/06	276.0	394.0	8.14	103.0	**30.7**	19.4	8.1	3.4	**11.5**	0.017
LC28M	UKM	11/26/06	259.0	435.0	8.00	104.0	**18.1**	14.4	8.4	4.2	**12.6**	0.006
LC28M	UKM	2/28/07	269.0	400.0	8.15		**27.0**	13.0	7.7	2.1	**9.8**	0.007
LC28M	UKM	5/3/07	273.0	440.0	8.01		**19.4**	11.2	7.1	3.7	**10.8**	0.023
MB-4	UKM	8/31/09	209.0	474.0	**11.10**		**49.8**	22.4	0.5	1.7	2.2	0.017

Table D6-15a Analytical Results of Baseline Monitoring (Page 15 of 17)

Trace Parameters (Dissolved unless otherwise noted.)											
Well ID	Completion Zone	Sample Date	Al (mg/L)	NH_3-N (mg/L)	As (mg/L)	Ba (mg/L)	B (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	F (mg/L)
LC17M	UKM	9/12/06	ND	ND	0.006	ND	ND	ND	ND	ND	0.20
LC17M	UKM	11/26/06	ND	ND	0.003	ND	ND	ND	ND	ND	0.20
LC17M	UKM	3/1/07	ND	0.06	0.002	ND	ND	ND	ND	ND	0.20
LC17M	UKM	5/4/07	ND	ND	0.002	ND	ND	ND	ND	ND	0.20
LC20M	UKM	9/21/06	ND	ND	**0.012**	ND	ND	ND	ND	ND	ND
LC20M	UKM	11/22/06	ND	ND	**0.012**	ND	ND	ND	ND	ND	0.20
LC20M	UKM	3/1/07	ND	ND	**0.012**	ND	ND	ND	ND	ND	0.20
LC20M	UKM	5/4/07	ND	ND	**0.011**	ND	ND	ND	ND	ND	0.20
LC23M	UKM	9/21/06	ND	ND	0.009	ND	ND	ND	ND	ND	ND
LC23M	UKM	11/26/06	ND	ND	0.004	ND	ND	ND	ND	ND	0.20
LC23M	UKM	3/1/07	ND	**0.86**	0.003	0.30	ND	ND	ND	ND	0.40
LC23M	UKM	5/3/07	**0.20**	**0.75**	0.002	0.30	ND	ND	ND	ND	0.20
LC24M	UKM	9/21/06	ND	0.13	0.003	ND	ND	ND	ND	ND	ND
LC24M	UKM	9/21/06	ND	0.13	0.003	ND	ND	ND	ND	ND	ND
LC24M	UKM	11/26/06	ND	0.08	ND	ND	ND	ND	ND	ND	0.20
LC24M	UKM	3/1/07	ND	0.08	ND	ND	ND	ND	ND	ND	ND
LC24M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC27M	UKM	9/26/06	ND	ND	0.009	ND	ND	ND	ND	ND	0.20
LC27M	UKM	11/16/06	ND	ND	0.006	ND	ND	ND	ND	ND	0.30
LC27M	UKM	3/1/07	ND	ND	0.007	ND	ND	ND	ND	ND	0.30
LC27M	UKM	5/3/07	ND	ND	0.005	ND	ND	ND	ND	ND	0.30
LC28M	UKM	9/21/06	ND	ND	0.005	ND	ND	ND	ND	ND	ND
LC28M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC28M	UKM	2/28/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
LC28M	UKM	5/3/07	ND	ND	ND	ND	ND	ND	ND	ND	0.20
MB-4	UKM	8/31/09	**0.30**	0.07	0.00	ND	ND	ND	ND	ND	ND

Table D6-15a Analytical Results of Baseline Monitoring (Page 16 of 17)

Trace Parameters (Dissolved unless otherwise noted.)														
Well ID	Completion Zone	Sample Date	Fe (mg/L)		Hg (mg/L)	Mn (mg/L)		Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	V (mg/L)	Zn (mg/L)
			Dissolved	Total		Dissolved	Total						
LC17M	UKM	9/12/06	0.03	0.03	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC17M	UKM	5/4/07	0.05	0.05	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC20M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	11/22/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC20M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC23M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC23M	UKM	11/26/06	ND	ND	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC23M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC23M	UKM	5/3/07	ND	ND	ND	ND	ND	ND	ND	0.002	0.005	ND	ND
LC24M	UKM	9/21/06	0.32	0.32	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC24M	UKM	9/21/06	0.32	0.32	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC24M	UKM	11/26/06	0.16	0.16	ND	ND	ND	ND	ND	ND	0.002	ND	ND
LC24M	UKM	3/1/07	0.06	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC24M	UKM	5/4/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	9/26/06	0.15	0.15	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	11/16/06	0.08	0.08	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	3/1/07	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC27M	UKM	5/3/07	0.04	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC28M	UKM	9/21/06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC28M	UKM	11/26/06	0.04	0.04	ND	ND	ND	ND	ND	ND	ND	ND	ND
LC28M	UKM	2/28/07	ND	ND	ND	ND	0.01	ND	ND	ND	ND	ND	ND
LC28M	UKM	5/3/07	0.05	0.05	ND	ND	0.01	ND	ND	ND	0.002	ND	ND
MB-4	UKM	8/31/09	0.30	ND	ND	ND	ND	ND	ND	ND	0.016	ND	ND

Table D6-15a Analytical Results of Baseline Monitoring (Page 17 of 17)

ND - Concentration was below the laboratory detection limit.

Blank - Sample not analyzed for this parameter.

WQD and EPA criteria listed in Table D6-15b.

Bold	Concentration exceeds WQD Domestic Class-of-Use (Class I).
Bold	Concentration exceeds WQD Agricuture Class-of-Use (Class II).
Bold	Concentration exceeds WQD Livestock Class-of-Use (Class III).
Bold	Concentration exceeds EPA criteria.

Highlight for concentration exceeding WQD criteria is based on the lowest criteria exceeded. If

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

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Plate D6-1b

"Groundwater Permits Within 3 Miles of the Permit Area"

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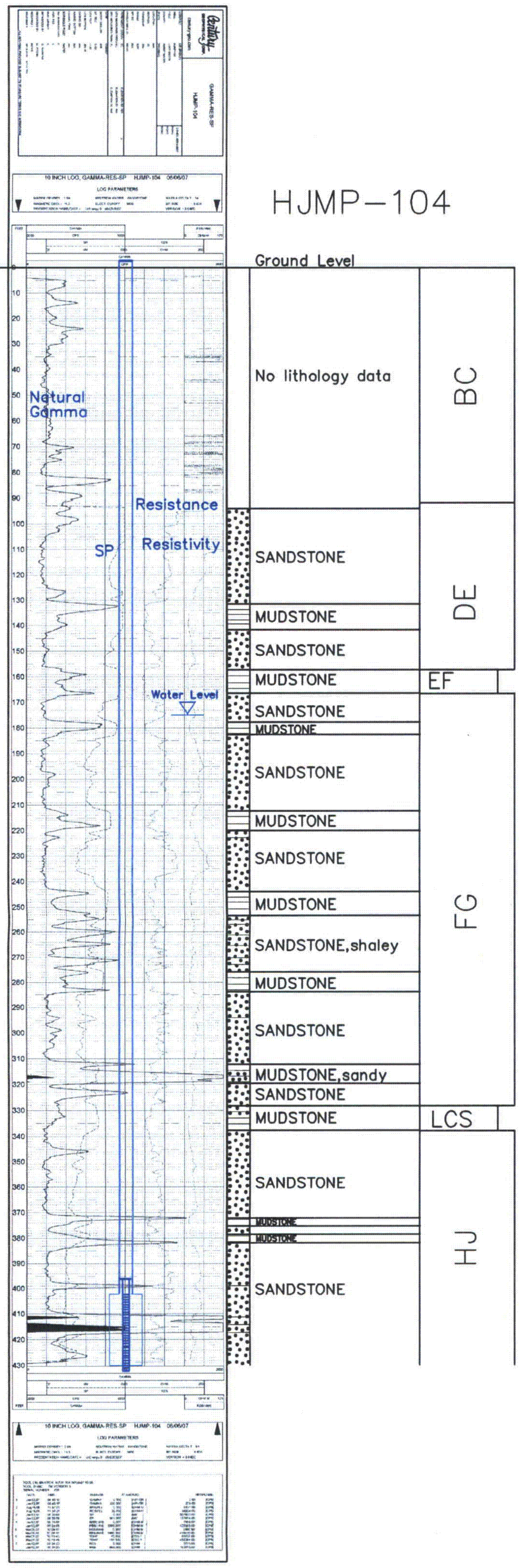
Notes on the Well Completion Logs in Attachment D6-3:

For several wells, the log indicates there is an open hole (or 'rat hole') between the bottom of the screen and the total drilled depth (TD). If there is no record of the rat-hole having been backfilled, it can be assumed the hole below the screen is either open or caved naturally. As long as the TD is still within the target sand for the screened interval, the presence of an open or partially caved 'rat hole' is not of concern. In two of the DE wells (MB-1 and MB-7), the drilling may have penetrated the EF shale below the DE Sand. However, th EF shale is not a true confining shale because it splits in several areas.

For a drill hole or well, the TD that is recorded in the LC ISR, LLC database is the total depth penetrated by the driller when drilling the 'pilot' hole and as recorded on the log header. At the time some of the wells were installed, the field geologists thought that the screen liner had to be landed *right on* the hole bottom. Therefore, it was common for the drillers, just prior to underreaming and screening, to clean out the hole to a depth a few feet deeper than the original TD (but still within the target sand), in case there was any caving into the hole. This results in a discrepancy regarding TD in some holes.

All monitor wells were airlifted with the drill rig after placement of the screen. Before sampling, each monitor well was swabbed to provide further development. Finally, wells were purged of at least three casing volume prior to collecting a baseline sample.



HJMP-104

Lost Creek ISR, LLC

WELL COMPLETION REPORT

WELL # HJMP-104 SEO # 179873 Date Drilled: 7-6-07

Location: E 742,886 / N 534,897 (NAD 27)

Ground Elev: 6939.04' Measure Point Elev: 6941.04'

TD: 432' Hole Dia.: 7-7/8"

CASED to: 402' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: HJ Sand

Static Water Level: Depth 175' Elev: 6766' (avg.)

UNDERREAM: Blade Dia: 10.5"
Intervals: from 402' to 430' /length 28'
from ____ to ____ /length ____

SCREEN LINER ASSEMBLY

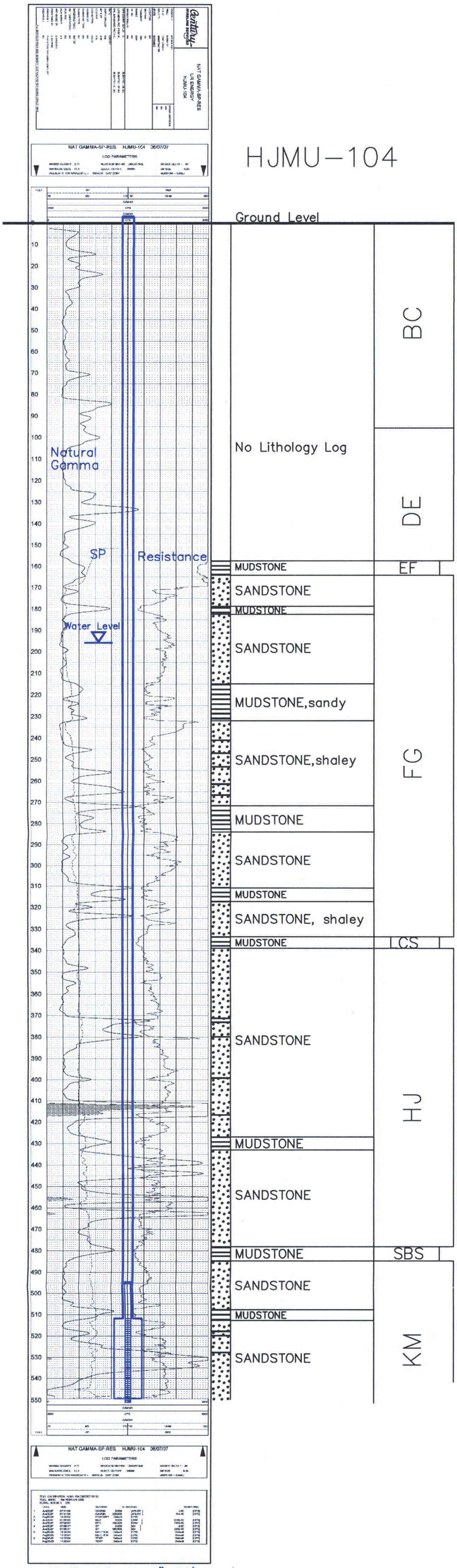
Description	Depth From	Depth To	Elev. From	Elev. To	Length
K-packer		396'		6545'	
Screen	402'	432'	6539'	6509'	30'

SCREEN SPECIFICATIONS:
Slot: 0.030" Composition 3" PVC

FILTER PACKING:
Volume: ____ (bags)(ft^3) Sand Specs. ____
Method: N/A

WELL STIMULATION: Method Airlift
Yield: (Good) / Moderate / Poor

HJMU-104



Vertical Scale: 1"=50'

HJMU-104

Lost Creek ISR, LLC

WELL COMPLETION REPORT

WELL # HJMU-104 SEO # 179872 Date Drilled: 8-7-07

Location: E 742891 / N 534907 (NAD 27)

Ground Elev: 6939.01' Measure Point Elev: 6940.51'

TD: 550' Hole Dia.: 7-7/8"

CASED to: 512' Casing: PVC SDR17 ID: 4.5" OD: 5"

GROUT: Portland Cement – Type I/II
Pumped thru casing, displaced to surface with water

COMPLETION Aquifer: UKM Sand

Static Water Level: Depth 196' Elev: 6745' (avg.)

UNDERREAM: Blade Dia: 10.5"
Intervals: from 512' to 550' /length 38'
from ____ to ____ /length ____

SCREEN LINER ASSEMBLY

Description	Depth From	Depth To	Elev. From	Elev. To	Length
K-packer		495		6446'	
Screen	512'	552'	6429'	6389'	40'

SCREEN SPECIFICATIONS:
Slot: 0.030" Composition 3" PVC

FILTER PACKING:
Volume: ____ (bags)(ft^3) Sand Specs. ____
Method: N/A

WELL STIMULATION: Method Airlift
Yield: (Good) / Moderate / Poor

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No Text - See List of Attachments

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secondary access roads and associated culverts for each mine unit will be constructed prior to and during installation of that mine unit. Secondary access roads and associated culverts for the UIC Class I wells will be constructed prior to installation of those wells. Road design features are shown on **Figure OP-3c** and discussed in more detail in **Section OP 2.6**.

Electrical power will be brought into the site, through an overhead line, from the transmission line located directly west of the site. The overhead line will branch out to transformer poles located throughout the mine units and at the Plant. The overhead power lines will continue from the transformer poles to the service point at the header houses. From the header houses to the production wells, power will be transmitted through underground lines that will be located along the same corridors as the pipelines for fluid transmission to and from the wells.

Six mine units are currently planned for the Lost Creek Project, as shown on **Figure OP-2a**. The boundaries of each mine unit are considered conceptual until a more detailed 'mine unit package' is prepared for that mine unit and submitted to WDEQ-Land Quality Division (LQD). Each mine unit will consist of a reserve block covering about 50 acres, with about nine header houses. Each header house will be designed to accommodate the well controls and distribution plumbing for approximately twenty production wells and the associated injection wells (usually about 40 injection wells). Therefore, each mine unit will consist of about 540 wells. Typically, two or three mine units may be in production at any one time with additional mine units in various states of development and/or restoration.

OP 1.2 Ore Deposits

As described in **Appendix D5** of this permit, the ore deposits in the Permit Area generally occur at depths of 300 to 700 feet below ground surface (ft bgs) in long narrow trends varying from a few hundred to several thousand feet long and 50 to 250 feet wide (**Figure OP-2b**). The depth depends on the local topography, the dip of the formation, and the stratigraphic horizon. The available geologic and hydrologic data presented in **Appendices D5 and D6**, respectively, identify uranium mineralization in several sandstone layers (e.g., from shallow to deeper, the FG, HJ, and KM Horizons).

The three mineralized sandstone layers (Sands) in the HJ Horizon, from 350 to 500 ft bgs, are targeted for this permit application. The richest mineralized zone, locally designated as the Middle HJ (MHJ) Sand, is about 30 feet thick at 400 to 450 ft bgs, and is believed to contain over 50 percent of the total resource. Depending on the location within the Permit Area, only one, two, or three of the mineralized Sands may be present in the HJ Horizon.

OP 2.9 Prevention and Remediation of Accidental Releases

The significant criteria to reduce the potential for accidental releases are: appropriate engineering design, construction, and maintenance; development and implementation of the SWPPP, covering topics such as inspections, notification procedures, and response actions; and on-going employee training in the SWPPP and general health and safety procedures. The facilities which will require specific attention are outlined below.

Facilities will generally be designed to withstand worst case credible upset conditions including but not limited to wind storms, earthquakes, and sheet flooding. In cases where design alone may not be sufficient to withstand such scenarios, continuous monitoring with alarms and/or automatic shutdowns will be used. If an upset condition may result in the release of mining solutions or chemicals to the environment, the affected system(s) will be shut down and thoroughly inspected/tested by an individual familiar with that system before being restarted. Management will verbally notify WDEQ-LQD immediately if an upset condition may result in a release to the environment and cannot be made safe immediately. In such cases, LC ISR, LLC will also submit a written report to WDEQ-LQD within one week detailing the nature, location and cause of the incident, what if any releases to the environment resulted, what efforts were made to correct the problem, and what will be done in the future to prevent or mitigate similar occurrences.

OP 2.9.1 Pipelines, Fittings, Valves, and Tanks

The most common accidental release from ISR operations is from breaks, leaks, or separations in the piping that transfers the lixiviant solutions between the Plant and the mine units. Failures of fittings and valves at the wellheads, in the header houses, at tanks, and other junctions are also a common cause of accidental releases at ISR operations. All the Plant equipment is specified and designed for the life of the Project, and equipment for the mine units is similarly designed. Routine review of functional data for pumps by operational staff will determine the need for maintenance. Visual inspection of pipelines, valve stations, powerlines, header houses, wellheads, fences, roads and culverts is the daily responsibility of all mine site staff. Particularly, it is the responsibility of the mine unit operators to inspect these items on a routine basis.

Pipelines will generally be buried from 48 to 72 inches below surface, minimizing the possibility of freezing in adverse weather and of being damaged by surface traffic. In general, piping to and from the Plant and the mine units and within the mine units will be constructed of high density polyethylene (HDPE) with butt-welded joints or the equivalent.

All pipelines, associated fittings and valves, and any tanks that will be under pressure during operations will be pressure tested before use. Flow through the pipelines will be monitored and will be at a relatively low pressure. Pressurized tanks will also be monitored for performance within specified limits. Sensors wired to automatic alarms and pipeline shutoffs will be installed to detect significant changes in flow rates or pressures in the pipelines and tanks to help prevent significant releases. Section OP 3.6.4 contains additional information about leak detection measures in the mine units.

As per standard industry practice, any spill of mining solution greater than 420 gallons or any spill of mining solution which enters a water of the state will be verbally reported to the WDEQ-LQD and WDEQ-WQD within 24 hours. A written report to both agencies will follow within seven days and explain the size, location, cause of the spill and steps taken to prevent reoccurrence.

Within 24 hours of the discovery of a lixiviant spill, the Radiation Safety Officer, or their trained designee, will characterize the location, size, and potential radiological dose. The lateral extent of the spill will be mapped with the aid of a Global Positioning System (GPS) unit or by hand using reference points if the GPS unit is unavailable. If a spill is mapped by hand it will be remapped using a GPS unit as soon as possible. The GPS map, due to its high level of accuracy, will be used as the permanent record. The vertical extent of the spill will be measured by probe or by digging. The depths will be recorded on the map. The Radiation Safety Officer, or their trained designee, will determine the potential radiological dose to the maximally exposed individual by either taking actual radiological measurements or by performing calculations based on the known radiological content of the lixiviant. The potential dose will be compared against Nuclear Regulatory Commission regulations to determine if site remediation is necessary.

If site remediation is required due to elevated potential radiological dose, the affected soil will be removed and sent to a landfill licensed to receive such material. The Radiation Safety Officer, or their trained designee, will be consulted before any remediation efforts to determine what, if any, radiological issues must be mitigated to ensure protection of the public and employees. Before backfilling the site with soil, the Radiation Safety Officer, or their trained designee, will ensure remediation efforts have been successful. Topsoil will be applied to the area and the area will be smoothed and revegetated.

If SAR values dictate soil remediation, an evaluation will be performed to see if soil amendments can be added to correct the problem. If soil amendments cannot be used to correct the problem then the soil will be removed and sent to a landfill licensed to receive such material. Measurements of the remaining soil will be taken to ensure the remediation was adequate. Upon determining that soil removal is sufficient, the resulting hole will be backfilled with clean soil, covered with topsoil, and revegetated.

Each spill report will be documented in a spill file that will be maintained until the facility is decommissioned and the permit to mine is cancelled. Each annual report submitted to the WDEQ-LQD will contain a map showing the location and date of each reportable spill along with a table characterizing the date, volume, area, depth, contamination level, sampling locations and remediation efforts for each reportable spill.

OP 2.9.2 Wells

Casing and coupling failures in wells, either at the surface or in the subsurface, may release production or injection fluid. Monitoring of well construction, pressures in the

THIS PAGE IS AN OVERSIZED DRAWING OR FIGURE,

THAT CAN BE VIEWED AT THE RECORD TITLED:

PLATE D5-3

"General Location Map-Geology Lost Creek Permit Area"

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D-07X