2.0 PROPOSED ACTION AND ALTERNATIVES

LCI proposes to develop ISR of uranium within the Permit Area. Approving the Proposed Action would result in development of the federal mineral estate and the disturbance and reclamation of public lands administered by the BLM. Under 43 CFR 3809, mining operations that perform more than 'casual use' activities on five or more acres of public lands must submit a Plan of Operations to the BLM for review and approval. A synopsis of the Plan of Operations, NRC License, and the WDEQ-LQD Permit to Mine, including a summary of site facilities, schedule, and operation and reclamation plans, is presented in **Section 2.1**.

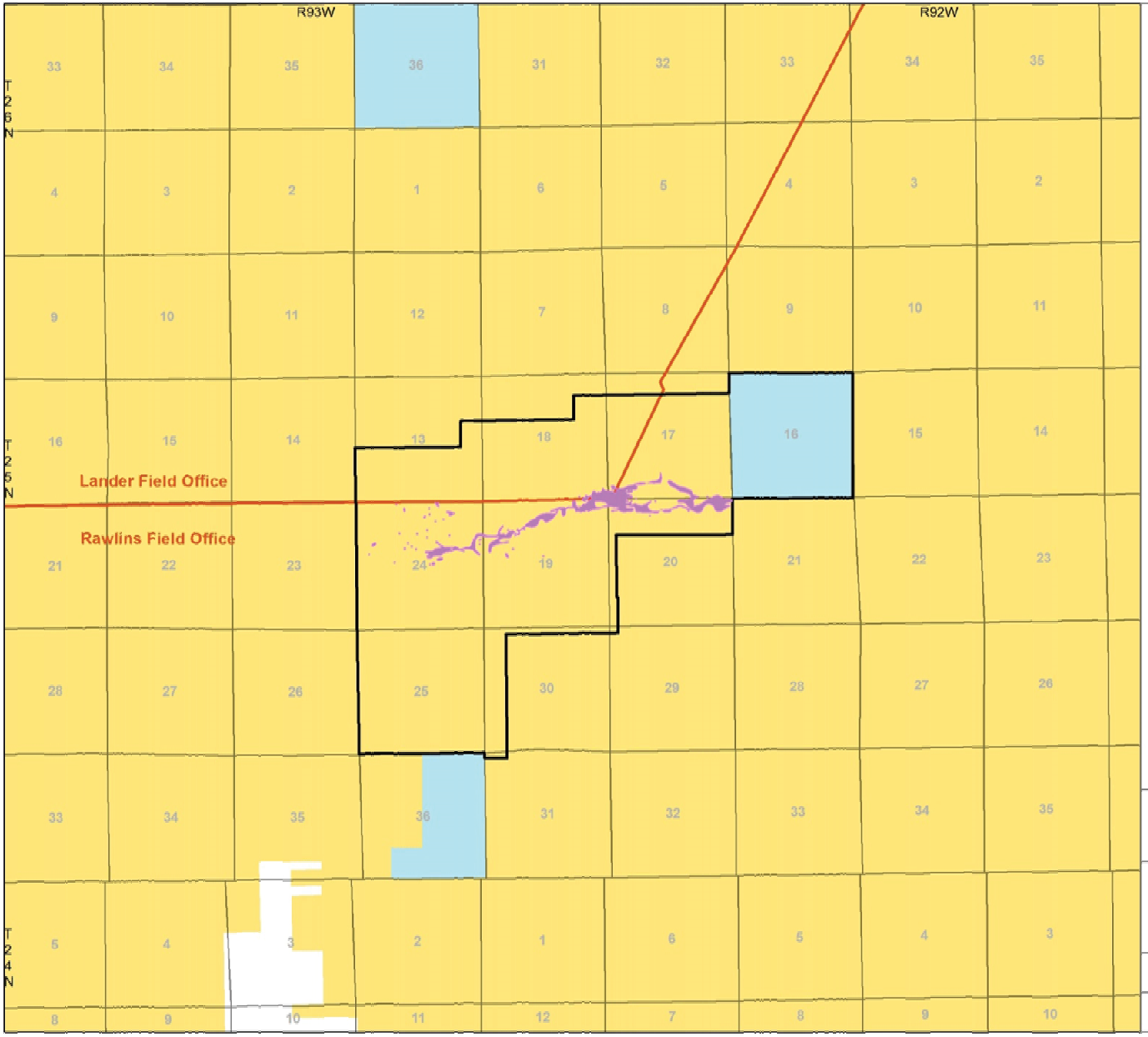
Under the rules and regulations of NRC and WDEQ-LQD, mines are required to collect extensive baseline information and to implement extensive monitoring programs and protective measures. These agency-required measures are considered part of the Proposed Action, as submitted in the Plan of Operations, and the alternatives considered in this document. These measures, and the additional measures required by the BLM, are mentioned in **Section 2.1** and addressed in more detail in **Section 2.2**.

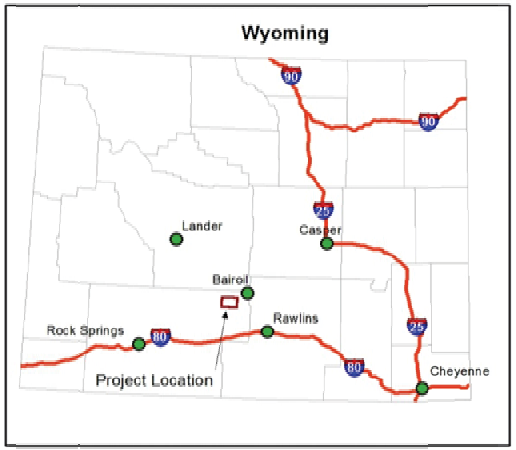
Section 2.3 provides information on alternatives to the Proposed Action, including the No Action Alternative as required under NEPA. Under that alternative, development of the Project on BLM-administered land would not be allowed. **Section 2.3.1** describes the alternatives considered in detail, and **Section 2.3.2** provides a comparative summary of the impacts from those alternatives. The alternatives considered but eliminated from detailed analysis, and the rationale for eliminating them in accordance with 40 CFR 1502.14, are discussed in **Section 2.3.3**.

2.1 Proposed Action

2.1.1 Summary of the Proposed Action

As discussed in **Section 1.0**, the Permit Area contains approximately 4,254 acres, and the surface to be affected by the Project would total approximately 345 acres (see **Section 4.5** for specific disturbance areas). The majority of the surface disturbance would follow the ore trend through the Permit Area (**Figure 2.1-1**). The mine units (following the ore trend), the Lost Creek Plant (Plant), the Storage Ponds, the disposal wells, and the roads are the significant surface features associated with the ISR operation. An illustration of a typical ISR operation, such as the Project, is shown on **Figure 2.1-2**.





Legend

- Ore Trend
- Lost Creek Permit Area
- BLM Field Office Boundary

Surface Land Owner

- BLM - administered
- Private
- State

N

Lost Creek Uranium *In-Situ* Recovery Project

Sweetwater County, WY

Figure 2.1-1
Lost Creek Ore Trend

0 0.5 1 Miles

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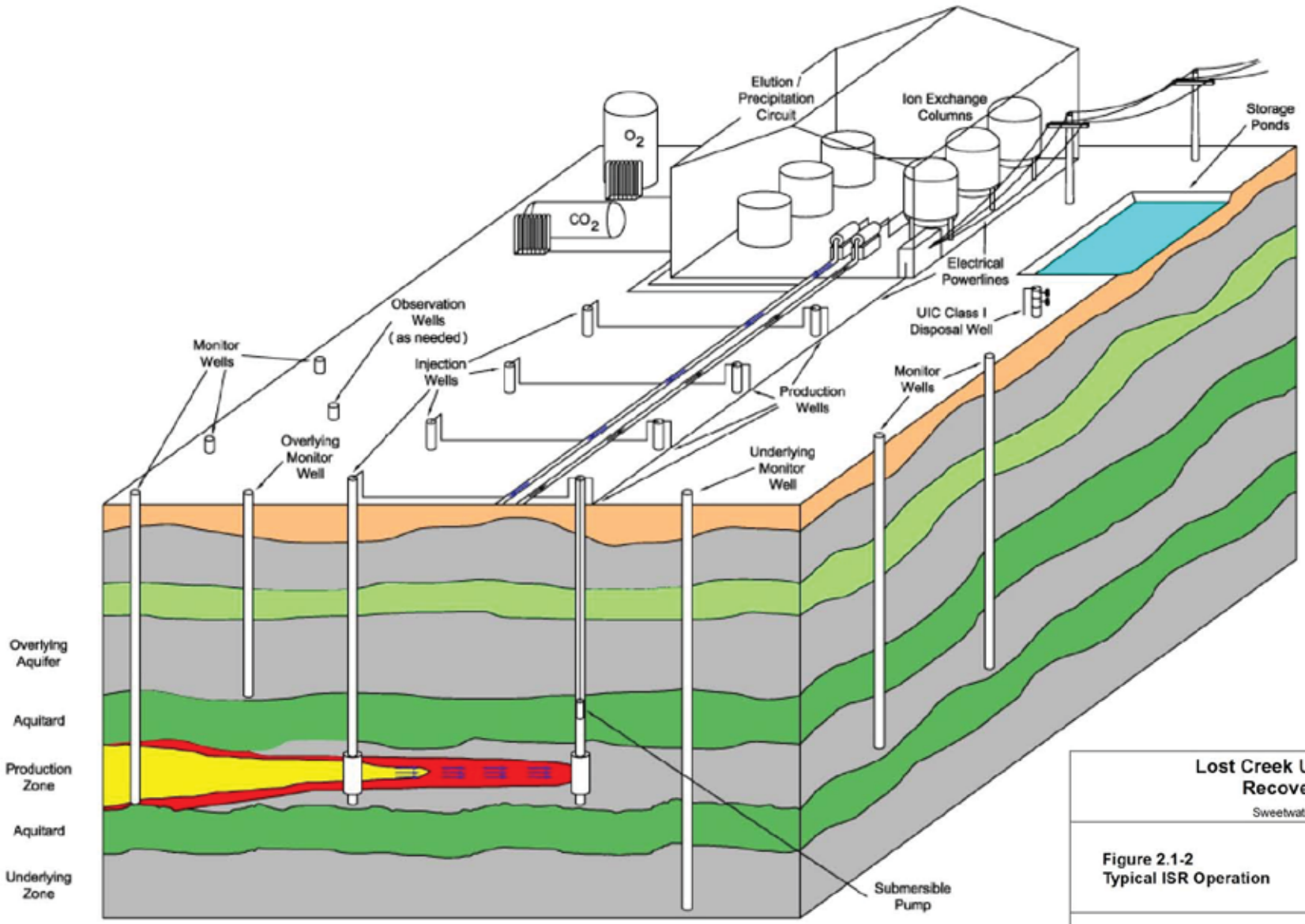

Lost Creek Uranium *In-Situ* Recovery Project

Sweetwater County, WY

Figure 2.1-2
Typical ISR Operation

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A uranium ISR operation extracts the mineral from permeable, uranium-bearing sandstones through a series of mine units. The mine units follow the ore body identified by exploration and delineation drilling. Exploration drilling evaluates host stratigraphic formations and better defines the location and nature of the uranium deposit. A series of exploration holes are drilled on wide-spaced 'fences' to characterize the local geology. These holes are generally hundreds to thousands of feet apart. After the discovery of a mineralized zone, closely-spaced exploration drilling (e.g., drilling with spacing of fifty to a few hundred feet) is conducted to characterize the extent, grade, and amenability of the mineralized zone. If the resource is sufficient and the economics are desirable, the zone would be classified as an ore body. Delineation drilling is generally on closer spacing than exploration drilling and is used to better define the ore resources for design of the mine units. (The ore deposits within the Permit Area generally occur at depths of 300 to 700 feet below the ground surface in long, narrow trends varying from a few hundred to several thousand feet long and 50 to 250 feet wide.)

The scale and number of the mine units for a given ISR operation depend on a variety of factors, including ore distribution, aquifer characteristics, plant capacity design, and operational feasibility. In Wyoming, a Hydrologic Test Proposal for each individual mine unit is submitted to WDEQ-LQD for review and approval prior to installation and operation of a new mine unit. Following completion of the activities described in the proposal, a Hydrologic Test Report is submitted to WDEQ-LQD for review and approval. The Hydrologic Test Proposal and Report detail: subsurface conditions (structural geology and results of the hydrogeologic pump tests); monitor well locations and depths; pattern areas and depths; surface conditions (including mine unit layout, soil, and vegetation); baseline water quality sampling results; the impact of faulting; potential interference; mine unit operations (including upper control limit calculations, historic drill hole locations, and well permit information); and restoration and reclamation.

Each mine unit consists of patterns of production and injection wells (i.e., the pattern area) within a ring of monitor wells. The injection and production well pattern design would be based on conventional five-spot patterns, modified as necessary to fit the characteristics of the ore body. (In the Proposed Action, the injection wells are expected to be spaced 75 to 150 feet apart. The injection and production wells would be installed in the mineralized HJ Horizon, which is about 350 to 500 feet below the ground surface.) Water quality samples would be collected from the ring of monitor wells and analyzed to detect a horizontal excursion (unanticipated movement of lixiviant) in the production zone. (In the Proposed Action, the monitor well ring is anticipated to be spaced about 500 feet from the pattern area. The distance between each monitor well in the ring is anticipated to be about 500 feet, although actual distances would be based on the aquifer characteristics of the mine unit to ensure any excursion can be detected in a timely manner.) Water quality samples would also be collected from monitor wells completed in overlying and underlying aquifers to detect a vertical excursion. (These wells would be located within the mine unit boundary at a

density of about one overlying and one underlying well per four acres, depending on the hydrologic characteristics of each mine unit.) In addition, monitor wells located within the pattern area and completed in the production zone provide information on the mining process and may double as production or injection wells.

A lixiviant is pumped from the Plant through buried pipelines to the injection wells in the operational mine unit(s). The lixiviant oxidizes the uranium mineral, thereby allowing the dissolution of uranium in groundwater. (The Proposed Action applies a carbonate lixiviant.) After circulation through the production zone (i.e., from the injection wells to the production wells), the resulting uranium-laden solution (i.e., pregnant lixiviant) is pumped from the production wells in the mine unit(s) through buried pipelines to the Plant. There, the uranium is recovered by a series of circuits (e.g., ion exchange, elution, precipitation). The lixiviant is then regenerated and pumped back to the mine unit(s) to recover additional uranium. As in the case of the Proposed Action, storage ponds may be used in conjunction with UIC Class I wells for waste water disposal at depths between 6,139 and 9,590 feet below the ground surface.

The Proposed Action would be conducted in phases including Construction, Operation, and Reclamation. During the Initial Construction stage, the Plant and associated utilities would be built, the Storage Ponds and UIC Class I Wells would be installed, and the East and West Access Roads would be upgraded. The Mine Unit Development stage would also be included in the Construction phase, although the development of the mine units would be progressive (so that one mine unit may be in operation while another is being developed). Similarly, Reclamation would include both the progressive reclamation of mine units and the final reclamation of the Plant. Therefore, some of the Construction, Operation, and Reclamation activities would overlap. The major work under each phase is outlined in **Section 2.1.4**.

2.1.2 Site Facilities

2.1.2.1 Process Plant and Utilities

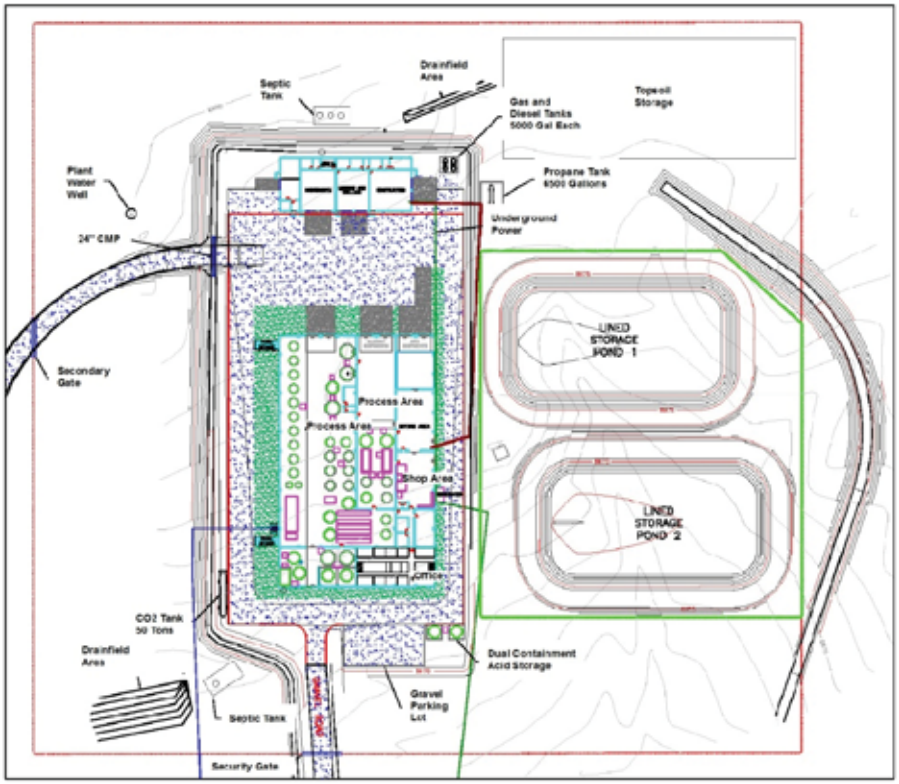
The Plant would be one of the first features to be constructed in the Permit Area. The Plant would house four distinct process circuits: the ion exchange circuit (also called the resin-loading circuit), the elution circuit, the precipitation/filtration circuit; and the dryer circuit. The layout of the Plant is presented in **Figure 2.1-3**. The Plant would be capable of processing 6,000 gallons per minute (around 1.0 million pounds U_3O_8 per year) and normally operate at 90 percent of its designed capacity. Additional details on the Plant processes are available in the documents of the WDEQ-LQD Permit to Mine and the NRC License (LCI, 2010 and 2011b).

Electrical power would be brought into the Permit Area, through the installation of a new overhead line (**Figure 1.2-2**), from the existing transmission line located along the western edge of the Permit Area. The overhead line would branch to transformer poles located throughout the mine units, the UIC Class I wells, and at the Plant. The overhead power lines would continue from the transformer poles to the service points within the mine units (the header houses), where power to the production and injection wells would be transmitted through underground lines (tertiary lines) located along the same corridors as the buried pipelines for fluid transmission to and from the wells. All power lines to the point of transform (from 34,500 volts to 480 volts) would be overhead lines that comply with regional raptor specifications. Additional details on the electrical utility are available in the documents of the WDEQ-LQD Permit to Mine and the NRC License (LCI, 2010 and 2011b).

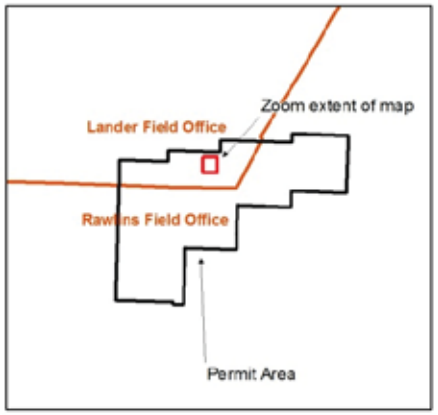
There are two sets of pipelines, one conveys fluids to and from the mine units and the other conveys fluids to the UIC Class I wells. The pipelines to and from the mine units would consist of a main trunk line to the Plant that would be extended to the individual mine units as they are developed. The pipelines to each UIC well would be installed as each well is brought on-line. The pipeline corridors would follow roads wherever possible to minimize disturbance.

2.1.2.2 Storage Ponds

Two fenced 160-by-260-foot Storage Ponds would be constructed adjacent to the Plant as shown on **Figure 2.1-3**. The primary purpose of the Storage Ponds would be to allow for shut down of the UIC Class I wells for maintenance, such as Mechanical Integrity Tests (MITs), or repair while the Plant remains in operation. The total capacity of the Storage Ponds is designed to accommodate two weeks of reduced Plant operation and is redundant, allowing for maintenance of the Storage Ponds in the event of a liner problem. The Storage Ponds would be lined with a double synthetic liner, including a leak detection system, and a series of monitoring wells would be installed to detect leaks into the surrounding sediments. In May 2010, the WSEO granted Permit No. 13595R to LCI for the construction of the two Storage Ponds. In November 2010, LCI submitted an application for approval of the pond construction to EPA to evaluate compliance with the National Emissions Standards for Hazardous Air Pollutants (NESHAP) for radon, and that application was approved in December 2011. A complete description of the Storage Ponds and associated monitoring is provided in Sections OP 2.9.4 and OP 5.2.2.1 of the Operations Plan in the WDEQ-LQD Permit to Mine (LCI, 2011b) and Sections 4.2.5.4 and 5.3.2 of the NRC Technical Report (LCI, 2010).



(Map Not to Scale)



Legend

- Drainage Around Plant
- Finished Ground Contours
- Current Ground Contours
- Gravel Driving Lanes
- Concrete
- Gravel
- Perimeter Fence
- 8' Game Fence
- Powerline
- Underground Propane Line
- Pipeline

N

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Sweetwater County, WY

Figure 2.1-3
Plant and Shop Detail

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