3.8 HISTORIC AND CULTURAL RESOURCES

3.8.1 Historic, Archeological, and Cultural Resources

Beginning in September of 2006 through July 20, 2007, Mr. James A Brunette, dba Frontier Archaeology, conducted a Class III Cultural Resource Inventory of the Moore Ranch Project License area including record searches from the Wyoming State Historic Preservation Office (WSHPO) and field surveys of areas that have not been previously inventoried. Standard pedestrian transects were used to conduct the Class III inventory.

Subsurface tests were not conducted in association with this project. Fieldwork conditions were favorable, with no snow cover, sunny to partly cloudy skies, temperatures ranging from the 40's to the upper 90's, and variable winds. Field notes and other data are on file at the Frontier Archaeology office at 3630 West 46th Street, Casper, Wyoming.

Properties were identified by walking systematic transects spaced no more than 30 meters apart. As required by the standard permit conditions, a property's datum is marked using a large nail, bridge spike or metal stake with an attached metal tag inscribed with the date, temporary site number and recorder's initials. The datum is to be covered with a white PVC pipe to prevent animal damage to the tag and increase the visibility of the datum.

The Class II Cultural Resource Inventory investigations found seven sites, 48CA6691-48CA6697, and 25 Isolate Resources/Artifacts, including artifacts from the Paleo-Indian, Middle Archaic, Late Archaic and Historic periods. Two sites, 48CA6694 and 48CA6696, are considered eligible for nomination to the National Register of Historic Places (NRHP). All sites and artifacts are described in detail in the Class III Inventory Report in Appendix B. Six previously recorded sites were also revisited during this investigation. None of the previously recorded sites have been affected by CBM development or exploratory drilling activities associated with uranium development. Only two sites, 48CA965 and 48CA966, which are listed as not eligible for nomination to the NRHP, are at or near any current development areas (near the monitor well ring). One site, 48CA965, falls close to the current area of potential affect. Apparently, neither the Bureau of Land Management nor the Wyoming State Office of Historic reviewed the report so there was no concurrence by these parties with the recorder's (Wyoming Office of the State Archaeologist) evaluation of the site's ineligibility for listing on the National Register of Historic Places (NRHP). EMC is asking that the Nuclear Regulatory Commission request a review of the Class III report by the Wyoming State Office of Historic Preservation so that a final determination of the site's significance can be made. This will allow all of the interested parties to determine whether or not site 48CA965 will be adversely affected by this undertaking. No sites are located within planned wellfield areas (see report in Appendix B).

None of the sites eligible for nomination are located within areas currently planned for in situ development, and in fact, are located well over a mile away from any planned development. If exploration and development plans are subsequently expanded near those areas, then all associated ground-disturbing activities will avoid impacting sites 48CA6694 and 48CA6696. If avoidance is not feasible, then a testing/data recovery plan will need to be implemented and completed prior to commencement of any ground disturbing activities to mitigate the adverse affects to the eligible sites.

As concluded in the Class III Cultural Resource Inventory Report in Appendix B, the currently proposed Moore Ranch Project will not affect any known significant cultural resources and additional archaeological work is not considered necessary.

The Class III Cultural Resource Inventory in Appendix B contains information that falls under the confidentiality requirement for archeological resources under the National Historic Preservation Act, Section 304 (16 U.S.C. 470w-3(a)). The report, including Wyoming Cultural Resource Forms, has also been submitted to WSHPO for concurrence and the WDEQ-LQD under a separate cover from Frontier Archaeology. The Wyoming Cultural Resource Forms are not included in Appendix B since these forms were not provided to the client due to disclosure restrictions in the NHPA Section 304. Accordingly, disclosure is specifically exempted by statute as specified in 10 CFR §2.390(a)(3). Therefore, EMC requests that all applicable portions of Appendix B remain "CONFIDENTIAL" for the purpose of Public Disclosure of this application. Each page of the protected cultural resource information has been marked as follows:

Confidential Information Submitted under 10 CFR 2.390

The cover page for Appendix B has been marked with a more detailed statement, as follows:

Confidential Information Submitted under 10 CFR 2.390
Disclosure is Limited Under the National Historic Preservation Act, Section 304 (16 U.S.C. 470w-3(a)).

3.9 VISUAL AND SCENIC RESOURCES

The Moore Ranch License Area is on private land and therefore is not managed by any public agency to protect scenic quality. However, it is located in prairie landscape of the Powder River Basin in the vicinity of public lands that are administered by the Buffalo Field Office of the Bureau of Land Management (BLM). The BLM has inventoried the visual resources of all lands within the boundaries of the Buffalo Field Office, including private lands, with the Visual Resource Management (VRM) system.

The VRM system is the basic tool used by the BLM to inventory and manage visual resources on public lands. The VRM inventory process involves rating the visual appeal of a tract of land, measuring public concern for scenic quality, and determining whether the tract of land is visible from travel routes or observation points.

3.9.1 Visual Resource Management Classes

The elements used to determine the visual resource inventory class are the scenic quality, sensitivity levels, variety classes, and distance zones. Each of the elements used to identify the VRM Class is defined below:

Scenic Quality - Scenic quality is a measure of the visual appeal of a tract of land. In the visual resource inventory process, public lands are assigned an A, B, or C rating based on the apparent scenic quality, which is determined using seven key factors: landform, vegetation, water, color, adjacent scenery, scarcity, and cultural modifications. During the rating process, each of these factors is ranked comparatively against similar features within the physiographic province.

Sensitivity Level – A degree or measure of viewer interest in the scenic qualities of the landscape. Factors to consider include 1) type of users; 2) amount of use; 3) public interest; 4) adjacent land uses; and 5) special areas. Three levels of sensitivity have been defined:

- Sensitivity Level 1 – The highest sensitivity level, referring to areas seen from travel routes and use areas with moderate to high use.
- Sensitivity Level 2 – An average sensitivity level, referring to areas seen from travel routes and use areas with low to moderate use.
- Sensitivity Level 3 – The lowest sensitivity level, referring to areas seen from travel routes and use areas with low use.

Distance Zones – Areas of landscapes denoted by specified distances from the observer, particularly on roads, trails, concentrated-use areas, rivers, etc. The three categories are foreground-middleground, background, and seldom seen.

- Foreground-Middleground – The area visible from a travel route, use area, or other observer position to a distance of 3 to 5 miles. The outer boundary of this zone is defined as the point where the texture and form of individual plants are no longer apparent in the landscape and vegetation is apparent only in pattern or outline.

- Background - The viewing area of a distance zone that lies beyond the foreground and middleground. This area usually measures from a minimum of 3 to 5 miles to a maximum of about 15 miles from a travel route, use area, or other observer position. Atmospheric conditions in some areas may limit the maximum to about 8 miles or increase it beyond 15 miles.

- Seldom Seen – The area is screened from view by landforms, buildings, other landscape elements, or distance.

The visual resource inventory classes are used to develop visual resource management classes, which are generally assigned by the BLM through the resource management plan process. VRM objectives are developed to protect scenic public lands, especially those lands that receive the greatest amount of public viewing. The following VRM classes are objectives that outline the amount of disturbance an area can tolerate before it no longer meets the visual quality of that class.

- Class I Objective: To preserve the existing character of the landscape. The level of change to the characteristic landscape should be very low and must not attract attention.

- Class II Objective: To retain the existing character of the landscape. The level of change to the characteristic landscape should be low.

- Class III Objective: To partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate.

- Class IV Objective: To provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

The Scenic Quality, Sensitivity Level, and Distance Zone inventory levels are combined to assign the VRM Class to inventoried lands as shown in the following matrix:

Determining BLM Visual Resource Inventory Classes								
Visual Sensitivity		High			Medium			Low
Special Areas		I	I	I	I	I	I	I
Scenic Quality	A	II	II	II	II	II	II	II
	B	II	III	III/IV	III	IV	IV	IV
	C	III	IV	IV	IV	IV	IV	IV
Distance Zones		f/m	b	ss	f/m	b	ss	ss

f/m = foreground-middleground
b = background
ss – seldom seen

3.9.2 Moore Ranch Visual Resource Management Rating

The BLM has inventoried the landscape within the Moore Ranch License Area and the surrounding 2-mile area and rated the areas as VRM Class IV. The management objective of VRM Class IV is to provide for management activities which require major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high.

The scenic quality inventory was based on methods provided in BLM Manual 8410 – Visual Resource Inventory as well as a review of the factors that contribute to the existing VRM Class IV inventory for the License Area. The key factors of landform, vegetation, water, color, influence of adjacent scenery, scarcity and cultural modifications were evaluated and scored according to the rating criteria. The criteria for each key factor ranged from high to moderate to low quality based on the variety of line, form, color, texture and scale of the factor within the landscape. A score was associated with each rating criteria, with a higher score applied to greater complexity and variety for each factor in the landscape. The results of the inventory and the associated score for each key factor are summarized in Table 3.9-1. According to NUREG-1569, if the visual resource evaluation rating is 19 or less, no further evaluation is required. Based on field reconnaissance conducted in May 2007, the total score of the scenic quality inventory for the Moore Ranch License Area is 4; therefore, no further evaluation of existing scenic resources and any changes to scenic resources from proposed project facilities is required.

Table 3.9-1 Scenic Quality Inventory and Evaluation for the Moore Ranch Permit Area

Key Factor	Rating Criteria	Score
Landform	Flat to rolling terrain with no interesting landscape features	1
Vegetation	Very little variety in vegetation, which consists of grazed grassland with sage and other shrubs.	1
Water	Water is present, but not evident as viewed from residences and roads	0
Color	Vegetation and soil colors are tan (various midtones) throughout most of the year.	1
Influence of adjacent scenery	Adjacent scenery is very similar to Permit Area, and provides no variety in line, form, color, and texture.	0
Scarcity	Landscape is common for the region	1
Cultural modifications	Existing modifications consist of numerous oil and gas production facilities and infrastructure, and grazing activities.	0
	Total Score	**4**

3.10 SOCIOECONOMICS

Information presented in this section concerns those demographic and social characteristics of the counties and communities that may be affected by the proposed development of a uranium in-situ recovery facility at the Moore Ranch Project in Campbell County, Wyoming. Data were obtained through the 1980, 1990, and 2000 U.S. Census of Population, the 2005 and 2006 Census Population Estimates program, and various State of Wyoming government agencies.

3.10.1 Demography

3.10.1.1 Regional Population

The area within an 80-kilometer (km) (50-mile) radius of the Moore Ranch License Area (License Area) includes portions of six counties in northeastern Wyoming (Campbell, Converse, Johnson, Natrona, Weston Counties and a small portion of Niobrara County), as shown on Figure 3.10-1 (all Tables and Figures are included at end of this Section). The proposed Moore Ranch Project is located in southwest Campbell County. The nearest communities are Wright, a small Campbell County incorporated town located northeast on State Highway 387, and the Towns of Edgerton and Midwest, which are located in Natrona County southwest of the Moore Ranch Project on State Highway 387.

Historical and current population trends in counties and communities within an 80 km distance of the Project are shown in Table 3.10-1, which summarize past growth trends in the counties relative to state population trends between 1980 and 2006. The largest growth rates in the six-county region since 2000 occurred in Johnson, Natrona, and Campbell Counties, primarily because of ongoing mineral resource development in the Powder River Basin. Population growth in Campbell, Johnson, and Converse Counties has outpaced state population growth for most years since 1980, with the largest average annual growth rate of 13.7 percent occurring in Converse County during the 1980s. The state population declined during this period, primarily because of declines in historic agricultural economic sectors, while the high growth rates in Campbell, Johnson, and Converse Counties indicated boom years in oil, coal, and gas development. The population in Campbell County grew at a slower rate between 2000 and 2006 than in previous decades, so that growth rates are more in line with the state growth rates. The overall county and state economies are more diverse in the current decade than they were during the 1980s.

3.10.1.2 Population Characteristics

2005 population by age and sex for counties within 80 km of the License Area is shown in Table 3.10-2. Overall, the 40- to 64-year age group (which includes the 'baby boom' cohort) is the largest age group in each of the counties. According to the Wyoming Economic and Demographic Forecast: 2005 to 2014 (Wyoming Economic Analysis Division 2005), the early baby boom population in Wyoming is one of the highest in the nation as a result of the in-migration of workers during the oil boom years in the late 1970s and early 1980s. In contrast, the population in the 27- to 42-year age group is relatively low because there was a high net out-migration (outflow greater than inflow) in this age group between 1995 and 2000 as young adults left the state during a declining economy. The aging population is expected to affect the economy through changes in the labor supply as retiring baby boomers reach retirement age and are replaced by fewer new workers. The older population would also require different types of goods and services, requiring a shift in local economic sectors to accommodate the changing demographics.

In 2005, 96.9 percent of the six-county population was classified as white. Native American and persons of Hispanic origin comprised 1.1 percent and 4.4 percent, respectively, of the total six-county population of 136,541. The populations in all other racial categories account for less than 1 percent of the total population. The racial characteristics of each county were similar to the racial characteristics of the state.

3.10.1.3 Population Projections

The projected populations for selected years by county within the 80 km radius of the proposed License Area are shown in Table 3.10-3. The population projections between 2000 and 2020 anticipate that the relatively stable population trends evident between 2000 and 2006 will continue for the county and the state. The projected population growth in Campbell and Johnson Counties will continue to outpace population growth in the state, in response to ongoing and potential new mineral development projects located in these counties. The populations of Niobrara and Weston Counties will experience very slow growth or declines in population, indicating that these counties are not anticipated to see in-migrations of new residents seeking employment in the mineral development of nearby counties. It is not expected that there will be the large in-migrations of population that were typical of the 1980s.

3.10.1.4 Seasonal Population and Visitors

The proposed License Area consists of private lands in southwest Campbell County. The surrounding area within an 80 km (50-mile) radius contains mostly private lands, but also federal and state lands, which provide open space for a variety of dispersed outdoor recreation opportunities. No developed recreation opportunities are provided on federal and state lands within the 80 km radius. Recreation opportunities offered by the private sector consist of community facilities in urban areas and the infrastructure of tourist services and facilities.

The closest recreational facility that would be a destination for tourists to the License Area is the Bozeman Trail, which crosses State Highway 387 about 1 mile west of the License Area. Visitation statistics are not compiled for the trail. Approximately 41,500 people visited the Edness Kimball Wilkins State Park (55 miles SSW of the License Area and 5 miles east of Casper) in 2005, which was a decrease of 50 percent from the 84,109 people who visited the park in 2001. Visits to the park were the lowest in 2005 for the years 1998 through 2005 (WDAI EAD 2005). Comparison of the park visitor fluctuations over this period with other parks and facilities in northeast Wyoming did not reveal a trend or pattern that would account for the annual fluctuations.

The Thunder Basin National Grassland is 14 miles east of the east boundary of the License Area. The most popular recreation use category is motorized travel/viewing scenery. Hunting and camping are also popular. Recreation use accounted for an average of 64,100 Recreation Visitor Days annually between 1992 and 1996. There are no developed recreation facilities on the Thunder Basin National Grassland.

A primary source of seasonal population in the six-county area is short-term labor for mineral resource development, construction, and service industries engaged in tourism/recreation. A review of reports prepared by the Wyoming Economic Analysis Division indicates that these workers are most likely to relocate temporarily from neighboring counties and states including Montana, Nebraska, Colorado, and South Dakota. The seasonal labor force for these economic sectors is not included in any available population or labor force data for the counties.

3.10.1.5 Schools

The License Area is located within Campbell County School District 1, which serves all of Campbell County. The nearest Campbell County community that provides education services to residents in the vicinity of the License Area is Wright, which is located 22 miles northeast of the License Area on State Highway 387. Two schools are located in Wright. The Cottonwood Elementary School serves kindergarten through grade 6. Total enrollment in these two schools for the 2005-2006 school year was 228 in the elementary school and 228 in the junior – senior high school (Wyoming Department of Education 2007). Enrollment in the elementary school has increased by 30 students since the 2001-2002 school year enrollment of 198 in the elementary school. Enrollment in the high school has decreased by 39 from the 2001-2002 enrollment of 267. The elementary school currently has a student to teacher ratio of 12.5 to 1 while the high school has a ratio of 9.7 to 1.

In Natrona County, the Midwest School provides classes for students from preschool through grade 12. Enrollment for the 2005-2006 school year was 229. The school has a student to teacher ratio of 9.4 to 1.

Families moving into the Natrona and Campbell County school districts as a result of the proposed Moore Ranch License Area operations would not stress the current school system because it is presently under capacity.

3.10.1.6 Sectorial Population

Existing population within the 80 km radius centered on the License Area was estimated for 16 compass sectors, by concentric circles of 1, 2, 3, 4, 5, 10, 20, 30, 40, 50, 60, 70 and 80 km from the center of the proposed License Area, for a total of 208 sectors. Sectorial population was estimated with data from the U.S. Census Bureau's Population Estimates Program. Subtotals by sector and compass points, as well as the total population, are shown in Table 3.10-4.

The most recent available population data were acquired from Geographic Data Technology, Inc., a division of the Environmental Systems Research Institute (ESRI). The data were created using U.S. Census 2000 boundary and demographic information for block groups within the United States, and intercensal population estimates for 2004 from the Population Estimates Program.

ArcInfo Geographic Information System (GIS) was used to extract data from U.S. Census 2004 population estimates for Census Tract Block Groups located wholly or partially within the 80 km radius from the approximate center of the License Area. Urban areas within each county were generally assigned their own block groups. To assign a population to each sector, a percentage area of each sector within one or more block groups was calculated for all of the block groups. The total 2004 population within the 80 km radius from the center of the License Area estimated by this method was 28,092.

The sectorial populations calculated using the percentage areas were modified for the sectors within a 20-mile distance because the GIS calculations are averages that do not accurately reflect the distribution of urban and rural populations within the 20-mile (32 km) radius. In addition, some sectors throughout the 80 km radius contain mostly Bureau of Land Management (BLM)-administered federal lands and do not contain any residents. These sectors were assigned a zero population. Most of the area within the 80 km radius is rural, with the majority of the population residing in the small communities near the License Area or in larger urban areas in the sectors farthest from the License Area center. Urban areas include the towns of Wright, located 22.0 miles (35.4 km) to the northeast of the License Area; Edgerton, located 23.6 miles (38.0 km) to the west-southwest; and Midwest, located 25.0 miles (40.2 km) west-southwest. The City of Glenrock is located in the 70 to 80 km sector south of the License Area.

The Census Designated Places of Antelope Hill and Homa Hills are located to the southwest along I-25, between 60 to 80 km (37.3 to 50 miles). The south part of the City of Gillette that is within the 80 km radius area consists of Census Tract 2, Block Group 2.

The population within 2 miles of the License Area boundary was estimated by locating occupied residences within 2 miles using 2006 aerial photos and field reconnaissance. The U.S. Census 2000 blocks (blocks are subdivisions of block groups) included in this area were reviewed for the total number of people residing within housing units within the blocks. There are no individual block data available for the intercensal years of the U.S. Census Population Estimates Program.

The total population within the 80 km radius was estimated to be 27,987 once individual sectors were modified to better represent the distribution of urban and rural populations within the area (Table 3.10-4). This total varied less than 1 percent (105 people) from the total population of 28,092 people that was calculated using GIS percentage calculations in the unmodified table.

3.10.2 Local Socioeconomic Characteristics

3.10.2.1 Major Economic Sectors

The Moore Ranch License Area is located in Campbell County; however, social and economic characteristics are described for Natrona in addition to Campbell County because communities in Natrona County, primarily the City of Casper, provide a relatively large resident labor force for mineral extraction and construction industries in northeast Wyoming. A substantial portion of the project labor force is likely to be based in Natrona County, primarily residing in the City of Casper. Table 3.10-5 summarizes unemployment rates and employment in Campbell and Natrona Counties.

The economies of Campbell County and Natrona County depend on the energy sector, primarily those that are mineral-based. The largest employment sector in Campbell County is mining, which includes coal mining, oil and gas extraction, crude, petroleum-natural gas, oil and gas field service, and nonmetallic minerals as defined by the U.S. Bureau of Labor Statistics.

A report prepared by the Wyoming Department of Employment, Research and Planning analyzes labor supply in Wyoming by place of residence. The analysis concluded that a portion of the available labor pool in Wyoming consists of non-residents. According to the report, the construction sector is one of the industries most dependent upon seasonal and short-term workers. Of all persons working in heavy construction in 2000, 38.4 percent did not work in Wyoming in 1999.

Table 3.10-5 also shows the labor force characteristics in Campbell and Natrona Counties in 2005. In general, unemployment rates were highest in the early 1990s and have decreased overall by 2005 because of renewed energy development in northeastern Wyoming. Annual fluctuations in unemployment rates are driven primarily by short-term changes in production due to changing prices for coal, oil, and coal bed methane gas.

Per capita personal income is the income that is received by persons from all sources, including wages and other income over the course of 1 year. In 2005, personal income in Campbell County was $37,318, which was 109 percent of the state average of $34,371. The county ranks sixth in per capita annual income out of 23 counties in the state (BEA 2004). Natrona County had a higher per capita income of $41,462, which was 120 percent of the state average and ranked third in the state. Most of the Wyoming counties with the highest per capita personal incomes have strong mineral development economic sectors.

3.10.2.2 Housing

The nearest permanent housing is located in the communities of Wright in Campbell County, and Midwest and Edgerton in Natrona County. According to the U.S. Census 2000 (the most recent year for which housing data were available for communities), there were 544 housing units in Wright. Of these units, the average occupancy rate was 87.3 percent, including 114 renter-occupied housing units. The vacancy rate for all types of housing units was 12.7 percent.

In Natrona County, there were 119 housing units in Edgerton, of which 74 units were occupied. The number of occupied rental units was 17. The vacancy rate was 37.8 percent. In nearby Midwest, 149 of the total 228 housing units were occupied. There were 32 renter-occupied and 79 vacant housing units.

It is likely that current vacancy rates in Wright, Edgerton, and Midwest will decrease as a result of insufficient housing stock and increasing in-migration of workers for employment in ongoing mineral resource development. A rental vacancy survey summarized in the Wyoming Community Development Authority report (2007) shows that rental vacancy rates in Natrona County decreased to 1.67 percent (Table 3.10-6) from a post-U.S. Census 2000 high of 4.49 percent in 2002. A similar decrease in rental vacancy rates occurred in the same time period in Converse County, from a high of 3.66 percent in 2002 to the 2006 rate of 0.42 percent. The influx of population in these counties as a result of economic growth stimulated by coal bed methane gas and coal production has outstripped the available housing supply.

Urban areas within Campbell and Natrona Counties are generally within a 1- to 2-hour commuting distance from the proposed License Area. Rural areas in the counties are sparsely populated, so that most of the housing units characterized in Table 3.10-6 are located within the communities of Gillette (Campbell County), Casper (Natrona County), and other smaller communities located along the I-25 corridor through Natrona County. Table 3.10-6 also includes the total number of housing units in the counties, but focuses on rental characteristics because most of the labor force that would originate from outside of Campbell and Natrona Counties would likely reside in rental units and other temporary lodging.

The household forecast (a household is defined as all the persons who occupy a housing unit) project an increase of 18,171 households in Campbell County from 12,207 in 2000 to 30,378 in 2030. The number of renters in Campbell County is projected to increase from 3,218 in 2000 to 7,271 in 2030. In Natrona County, the number of households is projected to increase by 19,650, from 26,819 in 2000 to 46,469 by 2030. The number of renters is expected to increase from 8,079 in 2000 to 11,831 in 2030.

3.10.2.3 Temporary Housing

Temporary housing options in the vicinity of the License Area include hotels, motels, and campgrounds. Vacancy rates are not currently available for temporary accommodations in Campbell and Natrona Counties. Available local motels/hotels/cabin establishments in the region generally have low vacancy rates during hunting seasons. There is also a high level of occupancy by the coal bed methane gas industry workers. Many motels and recreational vehicle (RV) campgrounds in the region provide accommodation for long-term visits by the week or month.

The temporary lodgings closest to the License Area are in Wright and Edgerton. Accommodations in Wright include a mobile home park, a hotel, an RV park, and one apartment complex (Town of Wright 2007). One motor lodge is located in Edgerton.

Casper and Glenrock, both on the I-25 corridor south of the License Area, provide numerous temporary lodging options (Casper Chamber of Commerce 2007). There are 28 motel/hotels in Casper and nine RV parks/campgrounds in the vicinity of Casper. Glenrock provides lodging in two motels and one RV park.

There are 18 hotels in Gillette, with a total capacity of 1,420 rooms. In addition, the two campgrounds in the Gillette area provide RV hookups and tent sites. The Cam-Plex is funded by Gillette and Campbell County, and may not compete with private enterprise (Barks 2005). The additional 1,821 RV sites at the Cam-Plex are available only for special events and not for the general public.

Temporary lodging is also available in the Town of Kaycee (located approximately 40 miles west of the License Area) in Johnson County and Sundance (located 60 miles east of Gillette) in Crook County. Temporary lodging facilities include two motels and two RV parks, which also provide tent sites and cabin rentals.

Table 3.10-1 1980-2006 Historical and Current Population Change for Counties and Communities within the 80 km Radius of the Moore Ranch License Area

	Year						Average Annual Percent Change				
State/County/City	1980	1990	2000	2002	2004	2006	1980/ 1990	1990/ 2000	2000/ 2002	2002/ 2004	2004/ 2006
State of Wyoming	469,557	453,588	493,782	498,973	505,534	515,004	4.1%	-0.3%	0.9%	0.5%	0.7%
Campbell County	24,367	29,370	33,698	36,142	36,629	38,934	8.8%	2.1%	1.5%	3.6%	0.7%
Gillette city	12,134	17,635	19,646	21,819	22,174	-	6.9%	4.5%	1.1%	5.5%	-
Wright town	-	1,236	1,347	1,426	1,408	-	-	-	0.9%	2.9%	-
Converse County	14,069	11,128	12,052	12,352	12,501	12,866	13.7%	-2.1%	0.8%	1.2%	0.6%
Glenrock town	2,736	2,153	2,231	2,290	2,302	-	8.1%	-2.1%	0.4%	1.3%	-
Rolling Hills town	-	330	449	460	461	-	-	-	3.6%	1.2%	-
Johnson County	6,700	6,145	7,075	7,412	7,609	8,014	2.0%	-0.8%	1.5%	2.4%	1.3%
Kaycee town	271	256	249	261	269	-	0.0%	-0.6%	-0.3%	2.4%	-
Natrona County	71,856	61,226	66,533	67,509	68,989	70,401	4.0%	-1.5%	0.9%	0.7%	1.1%
Bar Nunn town	-	835	936	955	1,139	-	-	-	1.2%	1.0%	-
Edgerton town	510	247	169	170	172	-	4.6%	-5.2%	-3.2%	0.3%	-
Midwest town	638	495	408	411	427	-	-	-2.2%	-1.8%	0.4%	-
Niobrara County	2,924	2,499	2,407	2,266	2,283	2,253	0.0%	-1.5%	-0.4%	-2.9%	0.4%
Weston County	7,106	6,518	6,644	6,616	6,675	6,762	1.3%	-0.8%	0.2%	-0.2%	0.4%

Table 3.10-2 2005 Population by Age and Sex for Wyoming and the Counties within the 80 km Radius of the Moore Ranch License Area

AREA	AGE	MALE	FEMALE	TOTAL	TOTAL % BREAKDOWN
State of Wyoming	Under 5	16,247	14,818	31,065	6.1%
	5 - 19	51,074	48,270	99,344	19.5%
	20 - 39	53,964	49,387	103,351	20.3%
	40 - 64	107,479	106,018	213,497	41.9%
	65+	27,962	34,075	62,037	12.2%
	Total	256,726	252,568	509,294	100.0%
Campbell County	Under 5	1,399	1,184	2,583	6.9%
	5 - 19	4,173	3,849	8,022	21.4%
	20 - 39	4,307	4,006	8,313	22.2%
	40 - 64	8,468	7,932	16,400	43.8%
	65+	953	1,134	2,087	5.6%
	Total	19,300	18,105	37,405	100.0%
Converse County	Under 5	340	323	663	5.2%
	5 - 19	1,351	1,222	2,573	20.2%
	20 - 39	1,072	1,157	2,229	17.5%
	40 - 64	2,880	2,861	5,741	45.0%
	65+	717	843	1,560	12.2%
	Total	6,360	6,406	12,766	100.0%
Johnson County	Under 5	159	155	314	4.1%
	5 - 19	699	675	1,374	17.8%
	20 - 39	692	630	1,322	17.1%
	40 - 64	1,634	1,729	3,363	43.6%
	65+	622	726	1,348	17.5%
	Total	3,806	3,915	7,721	100.0%
Natrona County	Under 5	2,350	2,208	4,558	6.5%
	5 - 19	7,002	6,680	13,682	19.6%
	20 - 39	7,115	6,992	14,107	20.2%
	40 - 64	14,255	14,333	28,588	41.0%
	65+	3,828	5,036	8,864	12.7%
	Total	34,550	35,249	69,799	100.0%
Niobrara County	Under 5	44	49	93	4.1%
	5 - 19	209	178	387	16.9%
	20 - 39	145	189	334	14.6%
	40 - 64	515	524	1,039	45.5%
	65+	200	233	433	18.9%
	Total	1,113	1,173	2,286	100.0%
Weston County	Under 5	156	155	311	4.7%
	5 - 19	571	548	1,119	16.8%
	20 - 39	638	549	1,187	17.8%
	40 - 64	1,546	1,392	2,938	44.0%
	65+	501	615	1,116	16.7%
	Total	3,412	3,259	6,671	100.0%

Source: U.S. Bureau of the Census 2007

Table 3.10-3 2005-2025 Population Projections for Wyoming and the Counties within the 80 km Radius of the Moore Ranch License Area

Area	Census 2000	Projected 2005	Projected 2010	Projected 2015	Projected 2020
State of Wyoming	494,078	506,184	519,595	529,352	533,534
Campbell County	33,981	37,075	39,701	42,414	44,595
Converse County	12,104	12,433	12,882	13,226	13,392
Johnson County	7,108	7,725	8,268	8,789	9,198
Natrona County	66,550	68,965	70,529	71,685	72,151
Niobrara County	2,390	2,185	2,102	1,996	1,892
Weston County	6,642	6,645	6,669	6,627	6,509

Note: Population projections for the years after 2020 are not available.
Source: Wyoming Department of Administration and Information, Economic Analysis Division 2007.

Table 3.10-4 2000 Population within the 80 km Radius of the Moore Ranch License Area

	Radius in km													
Sector	0-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	Total
N	0	0	0	0	0	0	8	33	88	112	137	161	3,682	4,221
NNE	0	0	0	0	0	0	11	5	88	112	147	205	1,901	2,469
NE	0	0	0	0	0	0	3	3	1,408	109	116	624	679	2,942
ENE	0	0	0	0	0	0	0	3	503	113	132	224	3,139	4,114
E	0	0	0	0	0	5	0	0	1,007	113	587	435	1,207	3,354
ESE	0	0	0	0	0	0	3	0	69	91	117	131	107	518
SE	0	0	0	0	0	3	3	5	68	146	263	303	153	944
SSE	0	0	0	0	0	0	0	0	125	242	273	194	1,701	2,535
S	0	0	0	0	0	0	5	5	136	190	188	164	2,763	3,451
SSW	0	0	0	0	0	0	3	0	30	38	67	115	133	386
SW	0	0	0	0	0	0	0	0	29	38	46	177	341	631
WSW	0	0	0	0	0	2	3	0	599	38	53	83	98	876
W	0	0	0	0	0	9	8	3	29	0	33	39	49	170
WNW	0	0	0	0	0	0	0	3	29	38	38	269	37	414
NW	0	0	0	0	0	0	0	0	30	71	110	113	78	402
NNW	0	0	0	0	0	0	0	0	0	112	136	148	164	560
Total	0	0	0	0	0	19	47	60	4,238	1,563	2,443	3,385	16,232	27,987

Notes: Current population living between 10 and 80 km of the mine site were estimated using 2004 census block data. Field reconnaissance was conducted in 2007 to verify data collected within 2 miles (3.22 km). The population between 3 and 30 km was estimated with the average household size in 2000 and aerial photos to count the number of housing units in each sector. See Section 3.10.1. for a detailed description of the methodology.

Table 3.10-5 2005 Annual Average Labor Force Characteristics and Employment in Economic Sectors for State of Wyoming for Campbell and Natrona Counties

	State of Wyoming		Campbell County		Natrona County	
Labor Force	284,538	-	23,679	-	40,164	-
Employment	274,362	-	23,062	-	38,797	-
Unemployment	10,176	-	617	-	1,367	-
Unemployment Rate	**3.6**	**-**	**2.6**	**-**	**3.4**	**-**
Total employment	360,558	100.0%	27,714	100.0%	50,149	100.0%
Farm employment	12,096	3.4%	611	2.2%	433	0.9%
Non-farm employment	348,462	96.6%	27,103	97.8%	49,716	99.1%
Forestry, fishing, related activities, and other 3/	2,780	0.8%	(D)	-	(D)	-
Mining	25,578	7.1%	7,340	26.5%	4,656	9.3%
Utilities	2,422	0.7%	190	0.7%	(D)	
Construction	29,356	8.1%	2,735	9.9%	3,533	7.0%
Manufacturing	11,352	3.1%	632	3.10%	1,979	3.9%
Wholesale trade	8,784	2.4%	1,281	4.6%	2,700	5.4%
Retail trade	40,188	11.1%	2,442	8.8%	6,307	12.6%
Transportation and warehousing	12,842	3.6%	1,209	4.4%	(D)	-
Information	5,088	1.4%	228	0.8%	676	1.3%
Finance and insurance	11,247	3.1%	453	1.6%	1,794	3.6%
Real estate and rental and leasing	13,837	3.8%	441	1.6%	2,267	4.5%
Professional and technical services	16,000	4.4%	939	3.4%	2,383	4.8%
Management of companies and enterprises	970	0.3%	179	0.6%	96	0.2%
Administrative and waste services	11,871	3.3%	853	3.1%	2,343	4.7%
Educational services	2,985	0.8%	60	0.2%	373	0.7%
Health care and social assistance	26,555	7.4%	978	3.5%	5,688	11.3%
Arts, entertainment, and recreation	6,612	1.8%	169	0.6%	919	1.8%
Accommodation and food services	31,964	8.9%	1,748	6.3%	3,480	6.9%
Other services, except public administration	19,524	5.4%	(D)	-	3,013	6.0%
Government and government enterprises	68,507	19.0%	3,911	14.1%	5,797	11.6%
Federal, civilian	7,491	2.1%	86	0.3%	695	1.4%
Military	6,138	1.7%	213	0.8%	396	0.8%
State and local	54,878	15.2%	3,612	13.0%	4,706	9.4%
State government	14,942	4.1%	170	0.6%	736	1.5%
Local government	39,936	11.1%	3,442	12.4%	3,970	7.9%

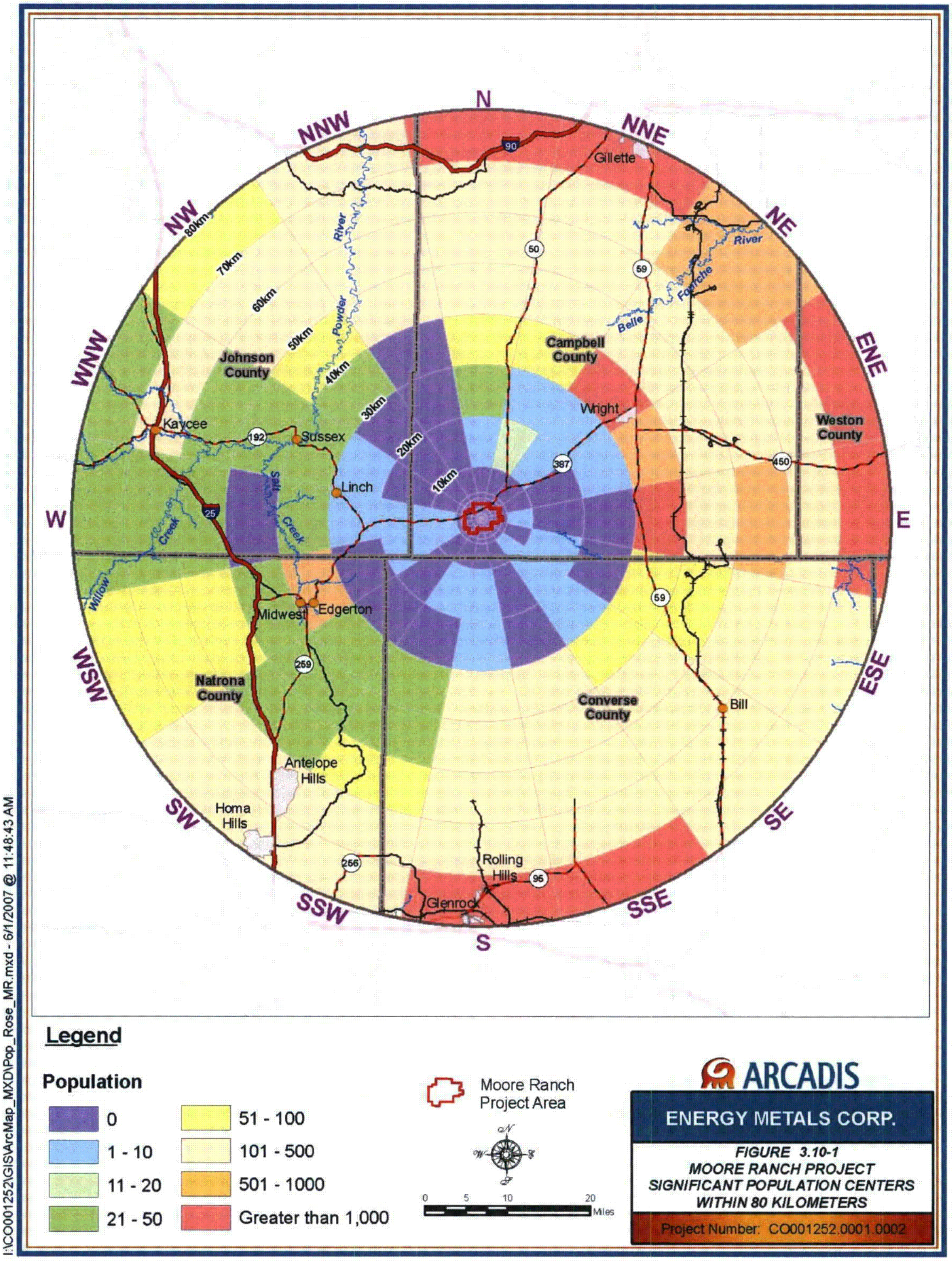
(D) = Not shown to avoid disclosure of confidential information, but the estimates for this item are included in the totals.
- = Not Available

Table 3.10-6 2006 Housing Characteristics for Campbell and Natrona Counties

	Campbell County	Natrona County
Type of Unit	Number of Units	Number of Units
Housing Unit Estimate[1]	14,085	30,668
Rental Housing Costs[2]		
Apartments	$649	$508
House	$867	$767
Mobile Home	$786	$581
Rental Vacancy[3]		
Total Units	1,467	3,226
Vacant Units	6	54
Vacancy Rate	0.4%	1.67%

1 – Intercensal estimate for July 2005
2 – Second quarter 2006
3 – Rental vacancy survey conducted in December 2006
Source: Wyoming Community Development Authority 2007

Figure 3.10-1 Significant Population Centers within an 80 km Radius (50 miles) of the Moore Ranch License Area



3.11 PUBLIC AND OCCUPATIONAL HEALTH

3.11.1 Background Exposure to Ionizing Radiation

Everyone is exposed to a certain level of background radiation from naturally occurring radioactive substances in the ground (terrestrial radiation), radiation from outer space (cosmic radiation), and from naturally occurring radiation in our bodies. These natural radiation sources are commonly referred to as natural background radiation. The combined annual dose from natural background radiation (both external and internal) is thought to average about 3 millisievert [mSv], about 73% of which is due to indoor radon. In addition, people are exposed to manmade sources of radiation from medical procedures, consumer products, and occupational sources. Medical procedures are now estimated to contribute nearly as much dose to the average individual as that from all natural background sources combined.

Levels of natural or background radiation can vary greatly from one location to the next. People residing in Wyoming are exposed to more natural background radiation because of higher levels of cosmic radiation at higher elevations and in some areas, higher levels of terrestrial radiation from soils enriched in naturally occurring radionuclides (uranium, thorium, and/or potassium-40). A map of estimated gamma radiation exposure rates from terrestrial sources across the United States is shown in Figure 3.11-1 (USGS, 1993). In general, the State of Wyoming has higher levels of soil radionuclides relative to many parts of the country, but the range of values varies across the State. Above average levels of naturally occurring uranium or thorium in the soil can result in a higher exposure to radon gas, depending on various factors such as the potential for migration into homes and buildings.

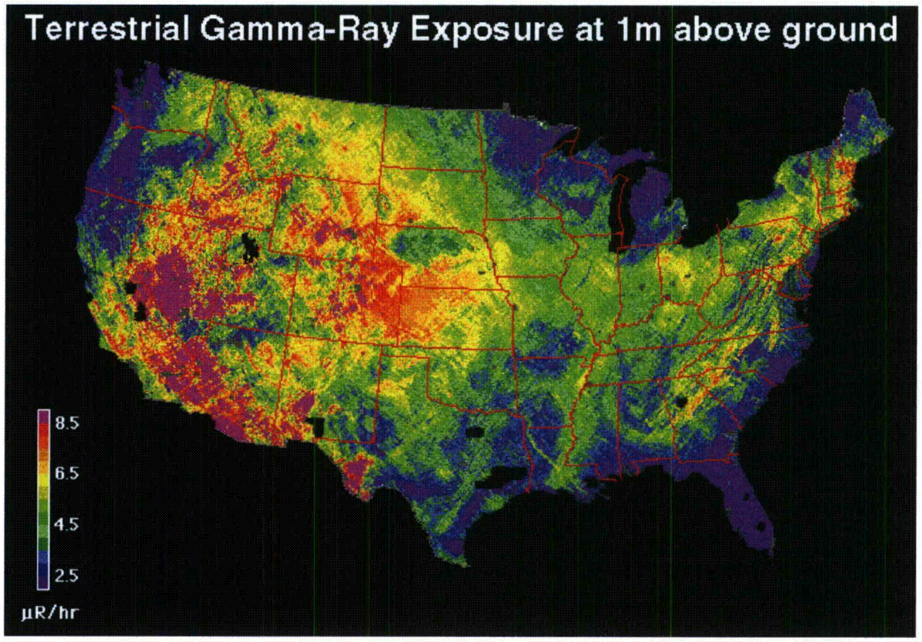


Figure 3.11-1. Gamma exposure rates in microroentgen per hour (µR/hr) from terrestrial sources of background radiation (from NURE aerial surveys, USGS, 1993)

Estimates of total average exposures of the U.S. population to background radiation (both naturally occurring and manmade) have been published by the National Council on Radiation Protection and Measurements (NCRP). The latest estimates are found in NCRP Report Number 160 (NCRP, 2009). The average annual radiation dose for individuals has been increased to 620 mrem/yr (versus an estimate published in the 1980's of 360 mrem/yr), primarily due to a significant increase in the use of ionizing radiation for medical diagnostics and treatment. Shown in the Figure 3.11-2 are the average annual radiation doses received per capita in the United States from naturally occurring and manmade sources of radioactivity. The average total yearly dose per individual is now estimated to be 0.0062 Sv (i.e., 6.2 mSv or 620 mrem).

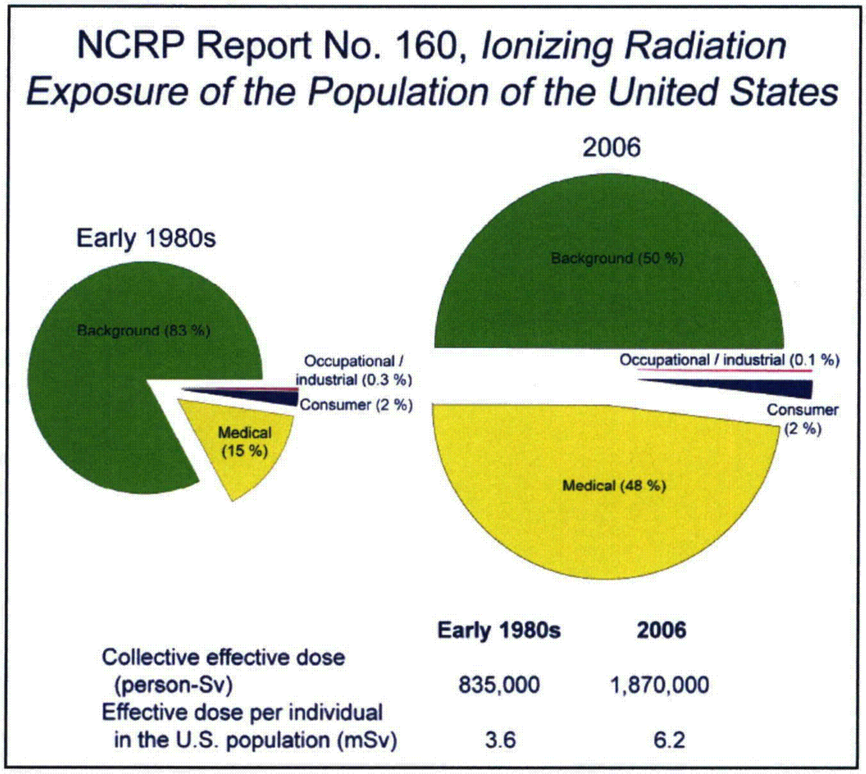


Figure 3.11-2. Average radiation doses to the U.S. population (NCRP, 2009)

Background sources of radiation at the Moore Ranch site are extensively characterized in Section 6 of this Environmental Report for the license application. Site-specific estimates of background sources of radiation at the Moore Ranch site are summarized in Table 3.11-1.

Table 3.11-1. Estimated average levels of naturally occurring sources of background radiation at the Moore Ranch site based on baseline monitoring data.

Natural Background Radiation Source	Mean value	Units
Uranium-238 in soil[1]	1.5	pCi/g
Thorium-232 in soil[1]	1.3	pCi/g
Potassium-40 in soil	20.3	pCi/g
Cosmic radiation[2]	5.1	μR/hr
Terrestrial gamma radiation[3]	9.3 ± 0.9	μR/hr
Mean total exposure rate[3]	14.4 ± 0.9	μR/hr
Average external dose rate[4]	0.015	mrem/hr
Average ambient radon[5]	0.43	pCi/L

Basis of Estimation

[1]Equilibrium assumed across all decay products

[2]Based on elevation (Stone et al., 1998; NCRP, 1987)

[3]Based on gamma survey / soil radionuclide data (includes uncertainty between estimation methods)

[4]Based on environmental dosimeter data

[5]Based on radon monitoring data

As discussed in Section 4.12.2, the maximum total effective dose equivalent (TEDE) calculated by MILDOS-AREA for the Moore Ranch project is 0.8 mrem/yr. This dose is located at the northwest property boundary and represents about a 0.1 percent increase over the annual average total radiation dose received by members of the general public in the United States. The corresponding percent increase in dose at this location relative to an annual baseline dose received by a hypothetical local resident may be slightly less due to higher than average natural background radiation in this region of Wyoming. Because of uncertainties associated with the many assumptions, potential sources and pathways required to model a realistic receptor scenario for baseline doses to a hypothetical local resident, and because there are no residents currently living in the immediate vicinity of the site, average annual baseline dose to a hypothetical local resident was not estimated. MILDOS modeling of potential operational releases resulted in an estimated TEDE of 0.7 mrem/yr for the nearest resident to the Moore Ranch facility, which is 0.7 percent of the regulatory dose limit to the general public from NRC-licensed operations of 100 mrem/yr.

Expressed another way, the maximum radiological effect of the Moore Ranch operation would be to increase the TEDE of the continental population by about 0.000045 percent.

3.11.2 Occupational Health and Safety

Table 3.11-1 contains the incident rates of nonfatal occupational injuries and illnesses for the mining industry in the State of Wyoming for 2007. Incidence rates represent the number of injuries and/or illnesses per 100 full-time workers (10,000 full-time workers for illness rates) and were calculated using the following formula:

$$\left(N/_{EH}\right) \times 200{,}000 \text{ (20,000,000 for illness rates)}$$

Where:

N	=	number of injuries and illnesses
EH	=	total hours worked by all employees during a calendar year
200,000	=	base for 100 equivalent full-time workers
20,000,000	=	base for 10,000 equivalent full-time workers

The incident rates for mining are contained under NAICS code 21 and include mining, and support activities for mining. ISR uranium mining would be included in metal/nonmetal mining.

Table 3.11-1
Number and rate[1] of nonfatal occupational injuries and illnesses for the Mining Industry, Wyoming, 2007

(Numbers in thousands)

Characteristic	Mining (except oil and gas) (code 212)	
	Number	Rate
Injuries and Illnesses		
Total cases	0.3	2.7
Cases with days away from work, job transfer, or restriction	0.2	1.7
Cases with days away from work	0.1	1.2
Cases with job transfer or restriction	0.1	0.6
Other recordable cases	0.1	1.0
Injuries		
Total cases	0.3	2.6
Illnesses		
Total cases	(1)	(1)
Illness categories		
Skin disorders	(1)	(1)
Respiratory conditions	(1)	(1)
Poisoning	(1)	(1)
Hearing loss	(1)	(1)
All other illness cases	(1)	(1)

Source: State of Wyoming, Department of Employment, Number and rate of nonfatal occupational injuries and illnesses by 3-digit NAICS industry, Wyoming, 2007, http://doe.state.wy.us/lmi/OSH/OSH_07/3_digit_07.htm, accessed June 18, 2009.

Notes: 1 Data too small to be displayed

3.12 WASTE MANAGEMENT

There are no current waste generation activities since this is a proposed action for a new facility. Waste management impacts for the proposed action are discussed in Section 4.12.

4 ENVIRONMENTAL IMPACTS

4.1 LAND USE IMPACTS

As discussed in Section 3.1 of this Environmental Report (ER), rangeland is the primary land use within the Moore Ranch License Area and the surrounding 2.0-mile review area. Oil and gas production facilities and infrastructure are also located on rangeland throughout the review area. The review area also contains pastureland to the west. Based on a site reconnaissance conducted in May 2007, a 2006 aerial photo, and ongoing EMC activities at the site since 2007, there are no occupied housing units in the License Area. Figure 3.1-1 depicts land use in the review area.

Construction of the Moore Ranch Central Plant and associated structures will encompass approximately 6 acres. The proposed Central Plant location, wellfields and access roads are shown in Figure 4.2-1. Operation of the Moore Ranch Project will ultimately encompass approximately 150 acres. Use of the land as rangeland will be excluded from this area during the life of the project. Oil and gas production facilities will not be affected. Considering the relatively small size of the area impacted by construction and operation, the exclusion of grazing from this area over the course of the Moore Ranch project will have an insignificant impact on local livestock production.

These impacts to land use are considered temporary and reversible by returning the land to its former grazing use through post-mining surface reclamation. All wellfield roads will be removed at the time of project decommissioning. The newly constructed gravel road that leads to the Central Plant from the main access road (shown in Figure 4.2-1) encompasses less than two acres in surface area and will be left in place for future use. Other than the land use impact of the Central Plant access road, there will be no long-term impacts or institutional controls following decommissioning of the site.

Mitigation measures for the loss of agricultural production over the course of the project are discussed in Section 5.1.

4.2 TRANSPORTATION IMPACTS

4.2.1 Access Road Construction Impacts

State Highway 387 passes through the northern end of the proposed License Area. Delivery of construction materials will access the site on this highway. An existing gravel road accesses the general location selected for construction of the central plant. This existing road may require minor improvements and completion of a short spur road to accommodate access by trucks and heavy equipment during construction and operation.

The environmental impacts of these minor improvements will be insignificant. Access road construction activities will primarily have minor air quality impacts, which are discussed in detail in Section 4.6.

4.2.2 Traffic Impacts

The most heavily used public road segment would be State Highway 387 between I-25 to the west and State Highway 59 to the east. Access to the License Area from Gillette would be from State Highway 59, and from Casper would be from I-25; traffic would converge on the License Area on State Highway 387 from the east and the west. Existing average daily traffic volumes for the local highways in the project area, State Highways 50, 59 and 387 are shown in Table 4.2-1 (WYDOT, 2009). The traffic information includes data from years 1997, 2006 and 2007. Additionally, for the year 2007, the table breaks down the truck traffic by percentage of the total traffic volume recorded. A map of the subject and regional roadways and communities is shown in Figure 4.2-1.

Projected daily truck and auto traffic volume data for the three local State Highways during the construction, operation, restoration and decommissioning phases of the project is also presented in Table 4.2-1. The projected increases of vehicle traffic resulting from the project activities are calculated for each local highway segment being subjected to the total increase in traffic. This vehicle traffic increase calculation allows for the analysis of the maximum amount of traffic that could be expected for each local highway. Truck traffic includes trucks that haul heavy equipment (cranes, bulldozers, graders, track hoes, trenchers, front-end loaders, etc.) to the construction site, and haul the facilities and equipment during the construction phase of the project. During the operational and restoration phases of the project, truck traffic includes yellowcake shipments, radioactive by-product waste and non-radioactive waste shipments, and regular operation deliveries. During the decommissioning phase, truck traffic includes hauling of equipment and facilities, and both radioactive and non-radioactive waste. The average daily estimated increase in auto traffic is based on the workforce level, which varies depending upon the phase of the project. Auto traffic includes passenger vehicles, light duty trucks or other personal or work vehicles used to transport personnel to the project site. During the operational and restoration phases of the project there will be a peak workforce of 24 employees which equates to a maximum average of 48 auto trips per day using the assumption of one employee per vehicle per one-way vehicle trip.

Using these vehicle traffic projections and recent data supplied by WYDOT for the year 2007, the highest levels of project-related traffic would be from the truck traffic occurring during the construction phase of the project, when there could be an increase of 4.8 percent in daily truck traffic. The highest auto (non-truck) traffic increase related to the project may occur during the operational and restoration phases when a 2.5 percent average increase in daily auto trips could occur. The 4.8 percent increase in truck traffic and 2.5 percent increase in average daily auto traffic is well below the 25 percent threshold generally used for predicting significant effects to a transportation system, and the subsequent potential for an impact on wildlife will be minimal.

Transportation of dried yellowcake would be made in exclusive-use transport vehicles to a licensed conversion facility in Metropolis, Illinois for further processing. The proposed annual production rate for the Moore Ranch Project is 4 million pounds of yellowcake. Based on weight limits for legal transport, each shipment will contain approximately 40,000 pounds of yellowcake, resulting in a total of 100 shipments of yellowcake per year, or an average of one shipment every 3.6 days. This level of traffic would not significantly affect the project-related traffic compared to the commuting traffic associated with the project workforce.

Transportation of 11(e).2 byproduct material will be made in exclusive-use transport vehicles to a licensed disposal facility. Although a final disposal agreement is not in place, the preferred alternative disposal site is the Pathfinder Mines Corp. (PMC) Shirley Basin facility due to proximity to the Moore Ranch site. The Shirley Basin facility is located approximately 132 highway miles from the Moore Ranch Project. The expected transport route to the PMC facility will be west on State Highway 387, south on Interstate 25, west on State Highway 220, and south on State Highway 487 to the PMC facility access road. The expected annual byproduct material production rate for the Moore Ranch Project is approximately 100 cubic yards. Based on the use of covered roll-off containers with a nominal capacity of 20 cubic yards, EMC expects five byproduct material shipments per year. This level of traffic would not significantly increase the project-related traffic compared to the estimated commuting and truck traffic associated with the project.

Transportation of nonradioactive solid waste will be made using a contract waste hauling company to a licensed disposal facility. The preferred alternative disposal site is the Midwest-Edgerton No. 2 disposal site located in Midwest, Wyoming due to proximity to the Moore Ranch site. The Midwest-Edgerton No. 2 facility is located approximately 24 highway miles from the Moore Ranch Project. The expected transport route to the Midwest-Edgerton No. 2 disposal facility will be west on State Highway 387 to Midwest. The expected annual nonradioactive solid waste production rate for the Moore Ranch Project is 2,000 cubic yards. Typical contract waste haulage vehicles range in capacity from 20 to 40 cubic yards. Based on a conservative assumption of the use of haulage vehicles with a nominal capacity of 20 cubic yards, EMC expects 100 nonradioactive solid waste shipments per year, or an average of approximately 2 shipments per week. This level of traffic would not significantly increase the project-related traffic compared to the estimated commuting and truck traffic associated with the project.

Equipment needed for construction and installation of the proposed facility would include heavy equipment (cranes, bulldozers, graders, track hoes, trenchers, and front-end loaders), and heavy- and light-duty trucks.

Table 4.2-1 Local Highway Traffic Projections
Moore Ranch Uranium Project

HIGHWAY 50

Route	Dir ^	Section Description	Mile Route Signs: Begin^^ (Mile Marker)	Mile Route Signs: Route	Mile Route Signs: County	1997 All Vehicles	1997 Trucks	2006 All Vehicles	2006 Trucks	2007* All Vehicles	2007* Trucks	2007* All Vehicles Minus Trucks	2007* Truck Percentage
300	B	JCT I 90 (WEST GILLETTE INT)	1.533	WY 50	Campbell	6650	200	13500	720	14000	780	13220	5.6
300	B	GILLETTE CORP LIMITS	1.683	WY 50	Campbell	2400	200	6350	700	6950	760	6190	10.9
300	B	JCT LAKEWAY ROAD	3.04	WY 50	Campbell	1700	170	5950	660	6550	740	5810	11.3
300	B	GILLETTE CORP LIMITS	3.88	WY 50	Campbell	1700	170	5500	610	6100	690	5410	11.3
300	B	JCT 4J ROAD & FORCE ROAD	4.3	WY 50	Campbell	1500	230	5040	560	5640	640	5000	11.3
300	B	GILLETTE SOUTH CORP LIMITS	4.33	WY 50	Campbell	1500	230	3570	540	4160	620	3540	14.9
300	B	GILLETTE SOUTH URBAN LIMITS	6.05	WY 50	Campbell	1300	210	3130	520	3780	560	3220	14.8
300	B	JCT COUNTY ROAD 67 WEST	8.57	WY 50	Campbell	810	160	2060	500	2750	500	2250	18.2
300	B	HPMS SECTION CHANGE	24	WY 50	Campbell	810	160	1860	500	1910	500	1410	26.2
300	B	SAVAGETON	35.328	WY 50	Campbell	470	80	1450	370	1460	370	1090	25.3

Section Description	Construction Phase: Projected Volume Trucks	Construction Phase: Percent Increase Trucks	Construction Phase: Projected Volume Auto Traffic	Construction Phase: Percent Increase Auto Traffic	Operational Phase: Projected Volume Trucks	Operational Phase: Percent Increase Trucks	Operational Phase: Projected Volume Auto Traffic	Operational Phase: Percent Increase Auto Traffic	Aquifer Restoration Phase: Projected Volume Trucks	Aquifer Restoration Phase: Percent Increase Trucks	Aquifer Restoration Phase: Projected Volume Auto Traffic	Aquifer Restoration Phase: Percent Increase Auto Traffic	Decommissioning Phase: Projected Volume Trucks	Decommissioning Phase: Percent Increase Trucks	Decommissioning Phase: Projected Volume Auto Traffic	Decommissioning Phase: Percent Increase Auto Traffic
JCT I 90 (WEST GILLETTE INT)	800	2.5	13252	0.2	781	0.1	13268	0.4	781	0.1	13268	0.4	780	0.0	13230	0.1
GILLETTE CORP LIMITS	780	2.6	6222	0.5	761	0.1	6238	0.8	761	0.1	6238	0.8	760	0.0	6200	0.2
JCT LAKEWAY ROAD	760	2.6	5842	0.5	741	0.2	5858	0.8	741	0.2	5858	0.8	740	0.0	5820	0.2
GILLETTE CORP LIMITS	710	2.8	5442	0.6	691	0.2	5458	0.9	691	0.2	5458	0.9	690	0.0	5420	0.2
JCT 4J ROAD & FORCE ROAD	660	3.0	5032	0.6	641	0.2	5048	1.0	641	0.2	5048	1.0	640	0.0	5010	0.2
GILLETTE SOUTH CORP LIMITS	640	3.1	3572	0.9	621	0.2	3588	1.3	621	0.2	3588	1.3	620	0.0	3550	0.3
GILLETTE SOUTH URBAN LIMITS	580	3.4	3252	1.0	561	0.2	3268	1.5	561	0.2	3268	1.5	560	0.1	3230	0.3
JCT COUNTY ROAD 67 WEST	520	3.8	2282	1.4	501	0.2	2298	2.1	501	0.2	2298	2.1	500	0.1	2260	0.4
HPMS SECTION CHANGE	520	3.8	1442	2.2	501	0.2	1458	3.3	501	0.2	1458	3.3	500	0.1	1420	0.7
SAVAGETON	390	5.1	1122	2.9	371	0.3	1138	4.2	371	0.3	1138	4.2	370	0.1	1100	0.9

HIGHWAY 59

Route	Dir ^	Section Description	Mile Route Signs: Begin^^ (Mile Marker)	Mile Route Signs: Route	Mile Route Signs: County	1997 All Vehicles	1997 Trucks	2006 All Vehicles	2006 Trucks	2007* All Vehicles	2007* Trucks	2007* All Vehicles Minus Trucks	2007* Truck Percentage
43	B	CONVERSE - CAMPBELL COUNTY LINE	56.507	WY 59	Campbell	1200	260	1500	440	1650	340	1310	20.6
43	B	JCT COUNTY ROAD 30 EAST	67.49	WY 59	Campbell	1600	280	2330	450	2470	500	1970	20.2
43	B	JCT ROUTE 2300 (WY 450)	72.393	WY 59	Campbell	2270	380	3920	620	4560	930	3630	20.4
43	B	JCT ROUTE 42 (RENO JCT, WY 387)	75.064	WY 59	Campbell	2530	460	3930	750	4100	820	3280	20.0
43	B	JCT COUNTY ROAD 16 EAST TO LAWVER	81.4	WY 59	Campbell	2450	470	4750	760	4920	830	4090	16.9
43	B	JCT COUNTY ROAD 44 EAST	93.42	WY 59	Campbell	2800	480	4840	720	5010	790	4220	15.8
43	B	JCT COUNTY ROAD 12 EAST	102.37	WY 59	Campbell	3940	550	5830	660	6170	730	5440	11.8
43	B	JCT COUNTY ROAD SOUTHEAST	106.097	WY 59	Campbell	4440	720	6910	680	7260	750	6510	10.3
43	B	GILLETTE SOUTH URBAN LIMITS	106.86	WY 59	Campbell	4550	720	7700	690	8050	750	7300	9.3
43	B	JCT WHITETAIL STREET	106.95	WY 59	Campbell	5230	760	7880	690	8230	750	7480	9.1
43	B	JCT UNION CHAPEL ROAD	107.97	WY 59	Campbell	9600	780	15910	690	16260	750	15510	4.6
43	B	JCT SOUTHERN DRIVE	109.72	WY 59	Campbell	13700	820	15620	740	15970	760	15210	4.8
43	B	GILLETTE SOUTH CORP LIMITS	110.6	WY 59	Campbell	18120	820	20080	760	20440	780	19660	3.8
43	B	JCT LAKEWAY ROAD	111.44	WY 59	Campbell	23450	1020	32070	1000	32430	1020	31410	3.1
43	B	JCT I 90 (WY 59 INT)	112.16	WY 59	Campbell	17700	360	29170	710	29530	730	28800	2.5
43	B	RAMPS 703 & 704	112.24	WY 59	Campbell	17700	360	27170	460	27280	480	26800	1.8
43	B	HPMS SECTION CHANGE	112.78	WY 59	Campbell	17700	360	20290	460	20400	480	19920	2.4
43	B	JCT ROUTE 300 (WY 50)	114.855	WY 59	Campbell	12300	785	17800	1030	17910	1050	16860	5.9
43	B	GILLETTE NORTH CORP LIMITS	115.412	WY 59	Campbell	7450	485	9810	1150	9810	1170	8640	11.9
43	B	JCT HANNUM ROAD	117.863	WY 59	Campbell	4100	325	4250	490	4250	510	3740	12.0
43	B	JCT ROUTE 302 (US 14/16) & AIRPORT RD	118.65	WY 59	Campbell	620	110	1350	150	1160	280	880	24.1
43	B	JCT LITTLE POWDER RIVER	120.44	WY 59	Campbell	1020	110	1310	240	1350	270	1080	20.0
43	B	GILLETTE NORTH URBAN LIMITS	121.8	WY 59	Campbell	1020	110	1310	240	1350	270	1080	20.0
43	B	RAILROAD SEPARATION	122.62	WY 59	Campbell	610	110	900	140	1000	200	800	20.0
43	B	JCT COUNTY ROAD 26 EAST	135.6	WY 59	Campbell	440	70	550	90	540	100	440	18.5
43	B	WESTON	143.888	WY 59	Campbell	320	65	420	80	470	90	380	19.1
43	B	JCT COUNTY RD 33 WEST TO RECLUSE	155.388	WY 59	Campbell	300	55	380	70	480	90	390	18.8

Section Description	Construction Phase: Projected Volume Trucks	Construction Phase: Percent Increase Trucks	Construction Phase: Projected Volume Auto Traffic	Construction Phase: Percent Increase Auto Traffic	Operational Phase: Projected Volume Trucks	Operational Phase: Percent Increase Trucks	Operational Phase: Projected Volume Auto Traffic	Operational Phase: Percent Increase Auto Traffic	Aquifer Restoration Phase: Projected Volume Trucks	Aquifer Restoration Phase: Percent Increase Trucks	Aquifer Restoration Phase: Projected Volume Auto Traffic	Aquifer Restoration Phase: Percent Increase Auto Traffic	Decommissioning Phase: Projected Volume Trucks	Decommissioning Phase: Percent Increase Trucks	Decommissioning Phase: Projected Volume Auto Traffic	Decommissioning Phase: Percent Increase Auto Traffic
CONVERSE - CAMPBELL COUNTY LINE	360	5.6	1342	2.4	341	0.3	1358	3.5	341	0.3	1358	3.5	340	0.1	1320	0.8
JCT COUNTY ROAD 30 EAST	520	3.8	2002	1.6	501	0.2	2018	2.4	501	0.2	2018	2.4	500	0.1	1980	0.5
JCT ROUTE 2300 (WY 450)	950	2.1	3662	0.9	931	0.1	3678	1.3	931	0.1	3678	1.3	930	0.0	3640	0.3
JCT ROUTE 42 (RENO JCT, WY 387)	840	2.4	3312	1.0	821	0.1	3328	1.4	821	0.1	3328	1.4	820	0.0	3290	0.3
JCT COUNTY ROAD 16 EAST TO LAWVER	850	2.4	4122	0.8	831	0.1	4138	1.2	831	0.1	4138	1.2	830	0.0	4100	0.2
JCT COUNTY ROAD 44 EAST	810	2.5	4252	0.8	791	0.1	4268	1.1	791	0.1	4268	1.1	790	0.0	4230	0.2
JCT COUNTY ROAD 12 EAST	750	2.7	5472	0.6	731	0.2	5488	0.9	731	0.2	5488	0.9	730	0.0	5450	0.2
JCT COUNTY ROAD SOUTHEAST	770	2.6	6542	0.5	751	0.1	6558	0.7	751	0.1	6558	0.7	750	0.0	6520	0.2
GILLETTE SOUTH URBAN LIMITS	770	2.6	7332	0.4	751	0.1	7348	0.7	751	0.1	7348	0.7	750	0.0	7310	0.1
JCT WHITETAIL STREET	770	2.6	7512	0.4	751	0.1	7528	0.6	751	0.1	7528	0.6	750	0.0	7490	0.1
JCT UNION CHAPEL ROAD	770	2.6	15542	0.2	751	0.1	15558	0.3	751	0.1	15558	0.3	750	0.0	15520	0.1
JCT SOUTHERN DRIVE	780	2.6	15242	0.2	761	0.1	15258	0.3	761	0.1	15258	0.3	760	0.0	15220	0.1
GILLETTE SOUTH CORP LIMITS	800	2.5	19692	0.2	781	0.1	19708	0.2	781	0.1	19708	0.2	780	0.0	19670	0.1
JCT LAKEWAY ROAD	1040	1.9	31442	0.1	1021	0.1	31458	0.2	1021	0.1	31458	0.2	1020	0.0	31420	0.0
JCT I 90 (WY 59 INT)	750	2.7	28832	0.1	731	0.2	28848	0.2	731	0.2	28848	0.2	730	0.0	28810	0.0
RAMPS 703 & 704	500	4.0	26832	0.1	481	0.2	26848	0.2	481	0.2	26848	0.2	480	0.1	26810	0.0
HPMS SECTION CHANGE	500	4.0	19952	0.2	481	0.2	19968	0.2	481	0.2	19968	0.2	480	0.1	19930	0.1
JCT ROUTE 300 (WY 50)	1070	1.9	16892	0.2	1051	0.1	16908	0.3	1051	0.1	16908	0.3	1050	0.0	16870	0.1
GILLETTE NORTH CORP LIMITS	1190	1.7	8672	0.4	1171	0.1	8688	0.6	1171	0.1	8688	0.6	1170	0.0	8650	0.1
JCT HANNUM ROAD	530	3.8	3772	0.8	511	0.2	3788	1.3	511	0.2	3788	1.3	510	0.0	3750	0.3
JCT ROUTE 302 (US 14/16) & AIRPORT RD	300	6.7	912	3.5	281	0.4	928	5.2	281	0.4	928	5.2	280	0.1	890	1.1
JCT LITTLE POWDER RIVER	290	6.9	1112	2.9	271	0.4	1128	4.3	271	0.4	1128	4.3	270	0.1	1090	0.9
GILLETTE NORTH URBAN LIMITS	290	6.9	1112	2.9	271	0.4	1128	4.3	271	0.4	1128	4.3	270	0.1	1090	0.9
RAILROAD SEPARATION	220	9.1	832	3.8	201	0.6	848	5.7	201	0.6	848	5.7	200	0.1	810	1.2
JCT COUNTY ROAD 26 EAST	120	16.7	472	6.8	101	1.1	488	9.8	101	1.1	488	9.8	100	0.3	450	2.2
WESTON	110	18.2	412	7.8	91	1.2	428	11.2	91	1.2	428	11.2	90	0.3	390	2.6
JCT COUNTY RD 33 WEST TO RECLUSE	110	18.2	422	7.6	91	1.2	438	11.0	91	1.2	438	11.0	90	0.3	400	2.5

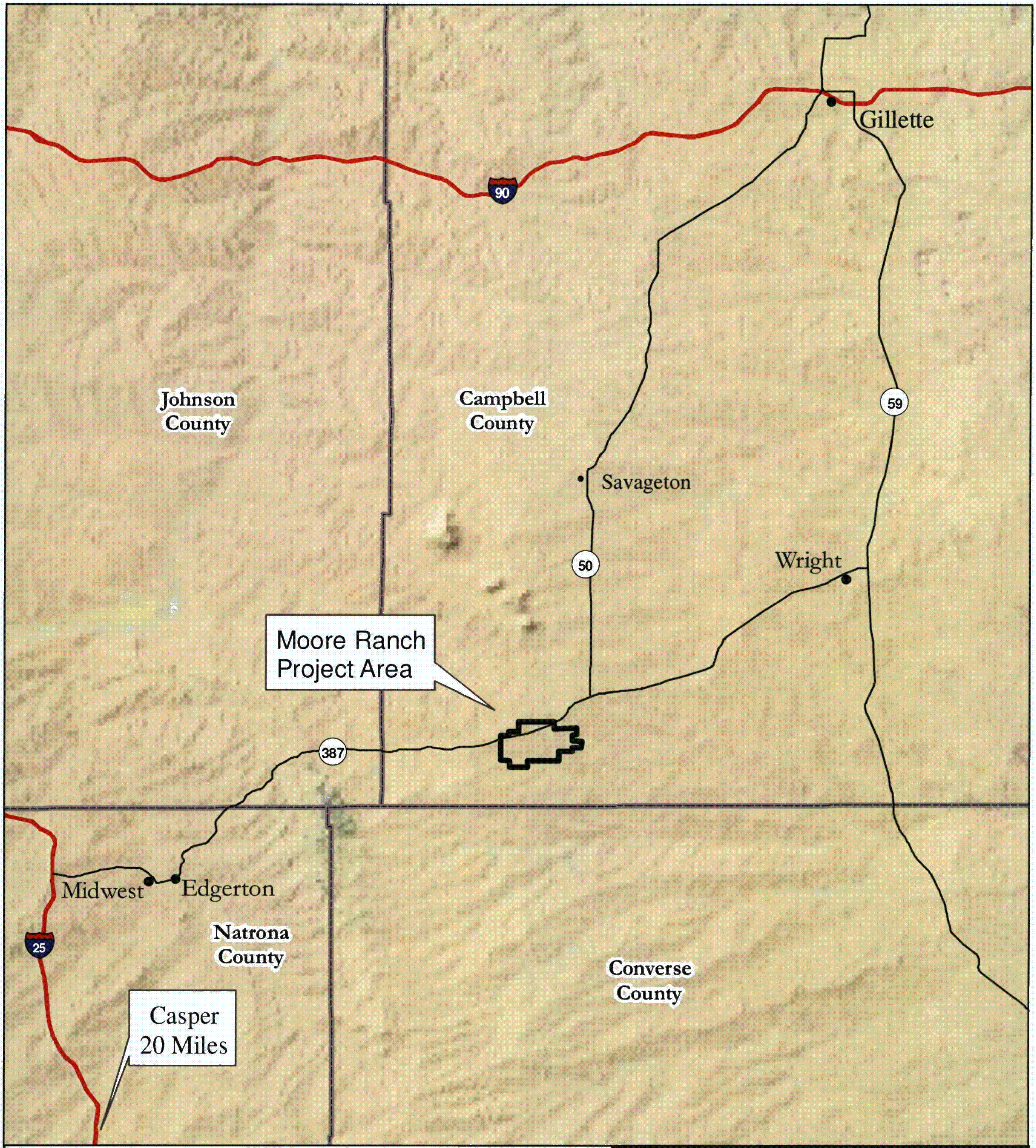
HIGHWAY 387

Route	Dir ^	Section Description	Mile Route Signs: Begin^^ (Mile Marker)	Mile Route Signs: Route	Mile Route Signs: County	1997 All Vehicles	1997 Trucks	2006 All Vehicles	2006 Trucks	2007* All Vehicles	2007* Trucks	2007* All Vehicles Minus Trucks	2007* Truck Percentage
42	B	JOHNSON - CAMPBELL COUNTY LINE	118.726	WY 387	Campbell	1130	260	1600	430	1500	370	1130	24.7
42	B	JCT ROUTE 300 (WY 50 / PINETREE JCT)	131.793	WY 387	Campbell	740	190	970	280	890	220	670	24.7
42	B	JCT COUNTY ROADS NORTH & SOUTH	137.12	WY 387	Campbell	710	250	880	220	900	220	680	24.4
42	B	JCT LOCAL ROADS NORTH & SOUTH	149.24	WY 387	Campbell	1130	320	1900	410	2000	410	1590	20.5
42	B	WRIGHT	150.63	WY 387	Campbell	2140	380	3130	370	3390	480	2910	14.2

Section Description	Construction Phase: Projected Volume Trucks	Construction Phase: Percent Increase Trucks	Construction Phase: Projected Volume Auto Traffic	Construction Phase: Percent Increase Auto Traffic	Operational Phase: Projected Volume Trucks	Operational Phase: Percent Increase Trucks	Operational Phase: Projected Volume Auto Traffic	Operational Phase: Percent Increase Auto Traffic	Aquifer Restoration Phase: Projected Volume Trucks	Aquifer Restoration Phase: Percent Increase Trucks	Aquifer Restoration Phase: Projected Volume Auto Traffic	Aquifer Restoration Phase: Percent Increase Auto Traffic	Decommissioning Phase: Projected Volume Trucks	Decommissioning Phase: Percent Increase Trucks	Decommissioning Phase: Projected Volume Auto Traffic	Decommissioning Phase: Percent Increase Auto Traffic
JOHNSON - CAMPBELL COUNTY LINE	390	5.1	1162	2.8	371	0.3	1178	4.1	371	0.3	1178	4.1	370	0.1	1140	0.9
JCT ROUTE 300 (WY 50 / PINETREE JCT)	240	8.3	702	4.6	221	0.5	718	6.7	221	0.5	718	6.7	220	0.1	680	1.5
JCT COUNTY ROADS NORTH & SOUTH	240	8.3	712	4.5	221	0.5	728	6.6	221	0.5	728	6.6	220	0.1	690	1.4
JCT LOCAL ROADS NORTH & SOUTH	430	4.7	1622	2.0	411	0.3	1638	2.9	411	0.3	1638	2.9	410	0.1	1600	0.6
WRIGHT	500	4.0	2942	1.1	481	0.2	2958	1.6	481	0.2	2958	1.6	480	0.1	2920	0.3
Averages:	593	4.8	6959	1.7	428	0.3	6975	2.5	574	0.3	6975	2.5	574	0.1	7471	0.6

^ Dir = Travel Direction for Traffic Volume (I=Increasing Mile Markers, B=Decreasing Mile Markers)
^^ Begin = Mile Marker Start of Section
All vehicle counts are estimated Average 24 Hour Traffic
* Year 2007 used as base for projected traffic volumes

Construction phase traffic: Assuming a construction workforce of 10 plus 6 wellfield staff traveling one round trip per day to the site (32 auto traffic trips per day), and 10 truck round trips (20 trips) per day for equipment being hauled to the site.
Operational phase traffic: Assuming a site workforce of 24 (48 auto traffic trips per day), and 1.12 average total truck trips per day (yellowcake shipments = 100 round trips per year or 200 truck trips/year = .548 trips/day; non radioactive waste shipments = 100 round trips/year or 200 truck trips/year = 0.548 trips/day; radioactive byproduct waste shipments = 5 round trips/year or 10 trips/year = 0.027trips/day).
Aquifer restoration phase traffic: Assuming a site workforce of 24 (48 auto traffic trips per day) and maximum of 1.12 truck trips per day (using production truck traffic data).
Decommissioning phase traffic: Assuming a site workforce of 5 (10 auto traffic trips per day) and 1 truck round trip per week (2 truck trips per week= 0.285 trips/day) for equipment and waste shipments.



Legend

Moore Ranch License/Permit Boundary

County Boundary

N

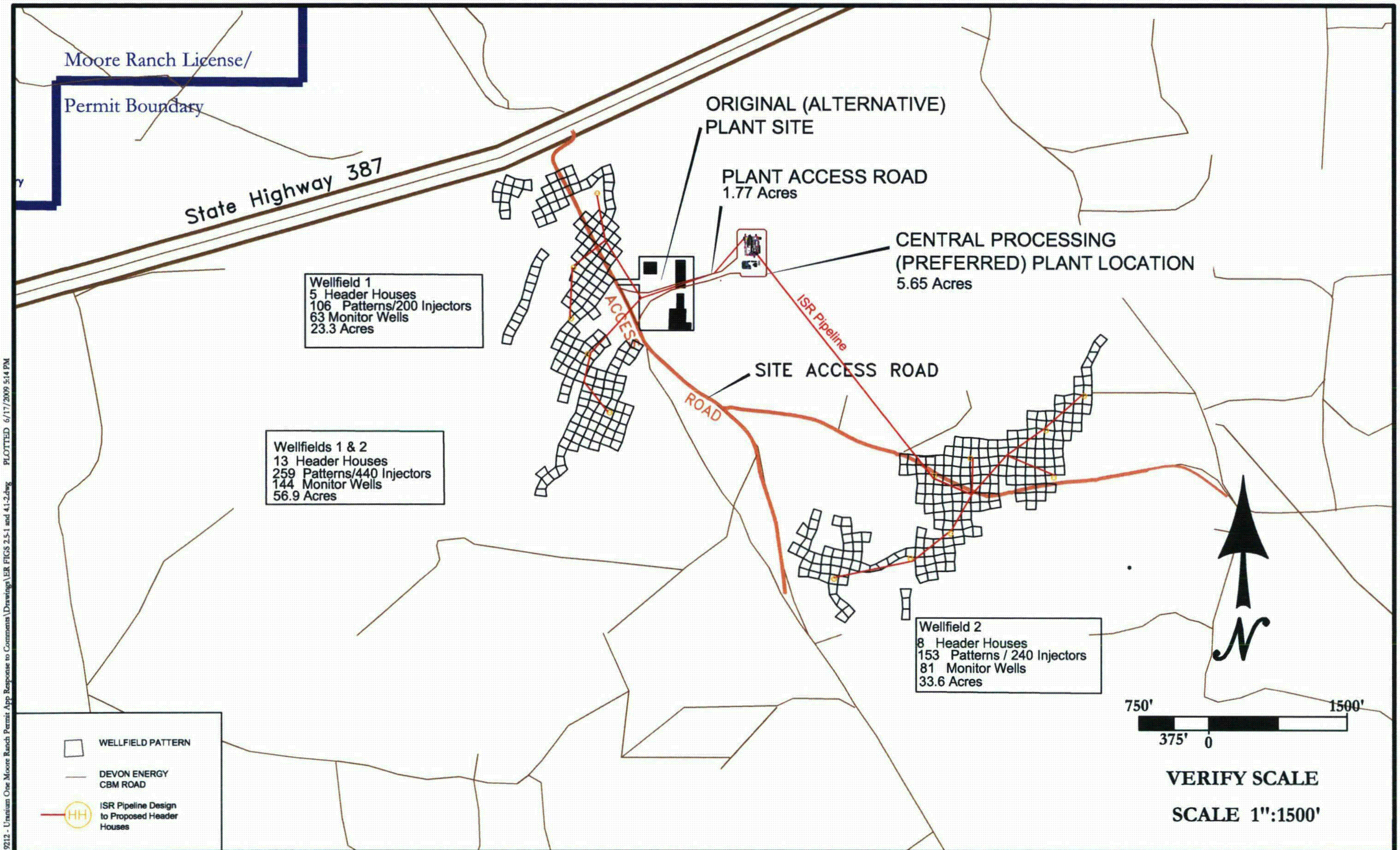
0 2.5 5 10 Miles

Source: Wyoming Geographic Information Science Center

Figure 4.2-1
MOORE RANCH URANIUM PROJECT
Local Highways

uraniumone
investing in our energy

TREC, Inc.
Engineering & Environmental Management
951 Werner Court
Suite 395
Casper, WY 82601
www.treccorp.com
Phone (307) 265-0696
Fax (307) 265-2498



PATH: \\192.168.110.100\trecfiles\Projects\9212 - Uranium One Moore Ranch Permit App Response to Comments\Drawings\ER FIGS 2.5-1 and 4.1-2.dwg PLOTTED 6/17/2009 5:14 PM

TREC, Inc.
Engineering & Environmental Management

951 Werner Court
Suite 395
Casper, WY 82601
Phone (307)265-0696
Fax (307)265-2498
www.treccorp.com

uraniumone™
investing in our energy

907 N Poplar Street
Suite 260
Casper, WY 82601
tel +1 307-234-8235
fax +1 307-237-8235
www.uranium1.com

DRAWN BY: WB
CHECKED BY: JS
APPROVED BY:

MOORE RANCH
CPP
Site Road Plan

REV. #	DESCRIPTION	BY	DATE
0	INITIAL DRAFT	WB	05/19/09
1	UPDATE	KLW	06/17/09

Figure 4.2-2

On-site road maintenance will include periodic grading of the primary access roads, snow plowing, applying water or other agent(s) for dust control, and regular inspections to ensure erosion control measures are adequate.

All wellfield roads will be removed at the time of project decommissioning. The newly constructed gravel road that leads to the Central Plant from the main access road (shown in Figure 4.2-2) will be left in place for future use.

4.2.3 Transportation Accident Impacts

Transportation of hazardous materials to and from the Moore Ranch Project can be classified as follows:

- Shipments of uranium-laden resin from the Moore Ranch plant to a licensed facility for toll "milling" and return shipments of barren, eluted resin. Resin will be transported in tank trucks to a nearby licensed facility for elution, precipitation, and drying.

- Shipments of dried yellowcake. Yellowcake will be transported in 208-L (55-gal.) drums to a distant conversion facility for refining and conversion. Conversion facilities are currently located in Metropolis, Illinois and Port Hope, Ontario, Canada.

- Shipments of process chemicals or fuel from suppliers to the site.

- Shipment of radioactive waste from the site to a licensed disposal facility.

Accident risks involving potential transportation occurrences are discussed in the following sections. Mitigation and control measures to eliminate or minimize transportation accident environmental impacts are discussed in Section 5.2.

4.2.3.1 Accidents Involving Ion Exchange Resin Shipments

A potential transportation risk associated with operation of the Moore Ranch Project as a uranium extraction plant using toll "milling" at another licensed processing facility is the transfer of the ion exchange resin to and from the central plant. Loaded ion exchange resin would be transported from the Moore Ranch Project in a 4,000 gallon capacity tanker trailer. It is currently anticipated that up to four loads of uranium-laden resin may be transported for elution and up to four loads of barren eluted resin may be returned on a daily basis. The transfer of resin will occur on a combination of private, county and state roads. For shipments of ion exchange resin to a central plant, NRC determined that the probability of an accident involving such a truck was 0.009 in any year.

The worst case accident scenario involving resin transfer transportation would be an accident involving the transport truck and tanker trailer when carrying uranium-laden resin where all of the tanker contents were spilled. Because the uranium is ionically-bonded to the resin and the resin is in a wet condition during shipment, the radiological and environmental impacts of such a spill are minimal. The radiological and environmental impact of a similar accident with barren, eluted resin would be less significant. The primary environmental impact associated with either accident would be the salvage of soils impacted by the spill area and the subsequent damage to the topsoil and vegetation structure. Areas impacted by the removal of soil would be revegetated.

4.2.3.2 Accidents Involving Yellowcake Shipments

NUREG-0706 concluded that the probability of a truck accident involving shipments of yellowcake in any year is 11 percent for each uranium extraction facility. This calculation used average accident probabilities (4.0×10^{-7}/km for rural interstate, 1.4×10^{-6}/km for rural two-lane road, and 1.4×10^{-6}/km for urban interstate) that NUREG/CR-6733 determined were conservative.

The worst case accident scenario involving yellowcake transportation would be an accident involving the transport truck where the integrity of one or more drums containing yellowcake was breached, resulting in a release to the environment.

4.2.3.3 Accidents Involving Shipments of Process Chemicals and Fuel

It is estimated that approximately 4 bulk chemical, fuel, and supply deliveries will be made per working day throughout the operational life of the project. Types of deliveries will include carbon dioxide, oxygen, salt, soda ash, hydrogen peroxide, sodium hydroxide, sulfuric and/or hydrochloric acid, and fuel. All shipment will be made in accordance with the applicable DOT hazardous materials shipping provisions.

4.2.3.4 Accidents Involving Radioactive Wastes

Low level radioactive 11e.(2) by-product material or unusable contaminated equipment generated during operations will be transported to a licensed disposal site. Because of the low levels of radioactive concentration involved, these shipments are considered to have minimal potential environmental impact in the event of an accident. Shipments are generally made bulk in sealed roll off containers in accordance with the applicable DOT hazardous materials shipping provisions.

4.3 GEOLOGY AND SOILS IMPACTS

4.3.1 Geologic Impacts

Geological impacts from operations are expected to be minimal, if any. No significant matrix compression or ground subsidence is expected, as the net withdrawal of fluid from the target sandstone will be on the order of 1 percent or less. Further, once mining and restoration operations are completed, groundwater levels will return to near original conditions under a natural gradient.

It is more likely that geologic factors could have an impact on the project. As discussed in Section 3.3, current earthquake probability maps that are used in the newest building codes (2500 year maps) suggest a scenario that would result in moderate damage to buildings and their contents. The probability-based worst-case scenario could result in an Intensity VII earthquake in the area of the Moore Ranch Project. In intensity VII earthquakes, damage is negligible in buildings of good design and construction, slight-to-moderate in well-built ordinary structures, considerable in poorly built or badly designed structures such as unreinforced masonry buildings. Some chimneys will be broken.

Mitigation measures to minimize seismic impacts on the project are discussed in Section 5.3.1.

4.3.2 Soil Impacts

Based on the soil mapping unit descriptions in Section 3.3, the hazard for water erosion within the Moore Ranch Project varies from slight to severe and the hazard from wind erosion varies from moderate to severe. The potential for wind and water erosion is mainly a factor of surface characteristics of the soil, including texture and organic matter content. Given the fine-loamy and sandy texture of the surface horizons throughout the majority of the Moore Ranch Project and the semi-arid climate, the soils are more susceptible to erosion from wind than water. See Table 4.3-1 for a summary of wind and water erosion hazards within the Moore Ranch Project.

The 6 acre fenced controlled area is underlain by soils with a slight potential for water erosion and a severe potential for wind erosion. The soils underlying the proposed wellfields are at a moderate to severe risk of erosion from both wind and water. Though no topsoil will be stripped from the wellfields, construction may result in an increase in the erosion hazard from both wind and water due to the removal of vegetation and the physical disturbance from heavy equipment.

Mitigation measures for soil impacts are described in Section 5.3.2.

Table 4.3-1 Summary of Wind and Water Erosion Hazards[1] Within the Moore Ranch Unit

Map Symbol	Map Unit Description	Water Erosion Hazard	Wind Erosion Hazard
110	Bidman loam, loamy substratum, 0 to 6 percent slopes	Slight	Moderate
144	Forkwood loam, 0 to 6 percent slopes	Slight	Moderate
156	Hiland fine sandy loam, 0 to 6 percent slopes	Slight	Severe
226	Ulm loam, 0 to 6 percent slopes	Slight	Moderate
227	Ulm clay loam, 0 to 6 percent slopes	Slight	Moderate
235	Vonalee fine sandy loam, 0 to 10 percent slopes	Moderate	Severe
111-1	Bidman loam, 0 to 6 percent slopes	Slight	Moderate
111-2	Parmleed loam, 0 to 6 percent slopes	Slight	Moderate
112-1	Bidman loam, 6 to 15 percent slopes	Slight	Moderate
112-2	Parmleed loam, 6 to 15 percent slopes	Slight	Moderate
116-1	Cambria loam, 0 to 6 percent slopes	Slight	Moderate
116-2	Kishona loam, 0 to 6 percent slopes	Slight	Moderate
116-3	Zigweid loam, 0 to 6 percent slopes	Slight	Moderate
117-1	Cambria loam, 6 to 15 percent slopes	Slight	Moderate
117-2	Kishona loam, 6 to 20 percent slopes	Severe	Moderate
122-1	Cushman loam, 6 to 15 percent slopes	Severe	Moderate
124-2	Shingle loam, 3 to 30 percent slopes	Severe	Moderate
127-2	Theedle loam, 0 to 30 percent slopes	Severe	Moderate
140-1	Embry sandy loam, 3 to 20 percent slopes	Moderate	Severe
146-2	Cushman loam, 0 to 6 percent slopes	Severe	Moderate
147-1	Forkwood loam, 6 to 15 percent slopes	Slight	Moderate
153-1	Haverdad clay loam, 0 to 6 percent slopes	Slight	Moderate
153-2	Kishona clay loam, 0 to 6 percent slopes	Slight	Moderate
157-2	Bowbac fine sandy loam, 0 to 6 percent slopes	Slight	Severe
158-1	Hiland fine sandy loam, 6 to 15 percent slopes	Slight	Severe
158-2	Bowbac fine sandy loam, 6 to 15 percent slopes	Slight	Severe
170-2	Tullock loamy sand, 6 to 30 percent slopes	Slight	Severe
171-1	Keeline, dry complex, 3 to 30 percent slopes	Moderate	Severe
194-1	Pugsley sandy loams, 6 to 15 percent slopes	Severe	Severe
194-2	Decolney sandy loams, 6 to 15 percent slopes	Severe	Severe
205-1	Samday clay loam, 3 to 15 percent slopes	Severe	Moderate
213-1	Terro sandy loam, 6 to 30 percent slopes	Severe	Severe
216-2	Kishona loam, 6 to 30 percent slopes	Severe	Severe
221-1	Turnercrest fine sandy loam, 6 to 30 percent slopes	Severe	Severe
221-3	Taluce fine sandy loam, 6 to 30 percent slopes	Severe	Severe
228-2	Renohill clay loam, 0 to 6 percent slopes	Moderate	Moderate
236-2	Terro fine sandy loam, 2 to 10 percent slopes	Moderate	Severe

[1]Based on soil mapping unit descriptions.

4.4 WATER RESOURCES IMPACTS

4.4.1 Surface Water Impacts

4.4.1.1 Impacts on Surface Waters and Wetlands

EMC plans to construct two wellfields and a central plant facility for the Moore Ranch Project. No wetlands will be impacted due to the construction of the central plant and the western wellfield site (Wellfields #1). Wetlands or surface water channels may be impacted in the easternmost wellfield site (Wellfield #2), which is located in Section 35. The second tributary to Simmons Draw runs north to south in the northern half of the eastern wellfield site. The section of the tributary is between waypoint W70 (a CBM outfall location) and W37. There is a small POW stock pond (0.02 acres) at W36. The tributary in the eastern wellfield area is considered PUB on the drainage bottom and is approximately 1.66 acres. As previously noted in Section 3.5, wetlands located within the Moore Ranch boundaries are recommended as non-jurisdictional.

No drainages or bodies of water will be significantly modified or altered within the Moore Ranch Project area during project construction or operations. If significant changes or alterations were to occur, the impact to the second tributary to Simmons Draw wetlands would be minimal as the disturbance is short-term and the draw is intermittent. The potential for erosion is present due to the construction of the wells near the drainage; however, disturbance is short-term and disturbed areas will be reseeded soon after the wellfields are constructed.

The proposed Moore Ranch Project facilities have been located to minimize impacts to surface water features. Figure 4.4-1 shows the site plan of the Project area. Included in the site plan are the locations of State Highway 387, the current local access roads, power lines, CBM wells and associated CBM pipelines and gas distribution plants. In addition, the proposed Project facilities are shown on the site plan including the location of the Central Plant, the anticipated layout of the injection well patterns for Wellfields 1 and 2, and the location of the road to be improved from the main access road to the Plant. Local surface water features including two tributaries to the Simmons Draw and their associated wetlands are also shown in Figure 4.4-1.

The wellfield design, including header house locations, pipelines, utility lines and header house access roads, is currently being finalized. The project layout described herein is based on information that is currently available as of the date of this revision. The Project wellfield patterns will use the five-point well setup where a production well will be located at the center of each pattern and four injection wells at each corner. Six header houses are planned for Wellfield 1 and eight header houses are planned for Wellfield 2, and roads will be constructed to access individual header houses. Individual well lines leading to the injection and production wells will travel to the local header house and trunk lines will lead in and out of the Central Plant through a pipe vault located on the northwest side of the Central Plant. A description of the proposed facilities for the Moore Ranch Project is discussed in Section 2 of this Environmental Report.

A portion of the Project is located in the second tributary to Simmons Draw and wetlands area in the vicinity of Wellfield 2 as shown in Figure 4.4-1. Within this impacted area there will be no new road crossings. However there will be one trunk-line pipe crossing and 14 small (approximately 1" in diameter) pipe line crossings. The small pipe lines lead from individual injection and production wells to a header house. The small lines will be combined into common trenches wherever possible. There will also be one utility crossing providing power to the header houses east of the second tributary to Simmons Draw. In addition, an estimated eight wellfield patterns are partially or fully within the wetland area in the second tributary to Simmons Draw, including approximately seven production wells and six injection wells. Building construction will not occur in surface water features in the Project area.

The wetland delineation study of the Moore Ranch Project area, found in section 3.5.5.2 of this Environmental Report, included a recommendation to the United States Army Corps of Engineers (USACE) that all of the wetlands in the study area be considered non-jurisdictional as the wetlands are isolated and do not support interstate commerce. As of the date of this response, the USACE has not issued a final determination of jurisdiction for the wetlands within the Project area. The ruling on the jurisdiction classification of the wetlands in the Project area will partially determine the method of construction and mitigation activities in the wetland areas.

If the wetland area is deemed jurisdictional by the USACE, the proposed impacts will be mitigated, as required by USACE, and proper permitting will be acquired prior to impacting any wetland areas. Impacts to wetlands and drainages will be minimized regardless of their jurisdictional status. The main activities for minimizing surface-water encroachments or impacts to wetlands in Wellfield 2 will be: limiting soil compaction; conducting operations in accordance with standard operating procedures (SOPs) for spill prevention and spill prevention control and countermeasure (SPCC) plans; ensuring that runoff from disturbed areas meet Wyoming pollutant discharge elimination system (WYPDES) permit guidelines for storm water management and sediment reduction; and completing appropriate reclamation practices in a timely manner.

Soil compaction during pipeline installation and drilling of production and injection wells can be limited by using existing roads to the extent possible, by designating haul routes where existing roads are not available, and by placing multiple pipelines and/or utilities in the same trench, when possible. Pipelines and utilities that will cross the second tributary to Simmons Draw will cross at a right angle to minimize erosion and impacts to wetlands. However, as it may not always be feasible or warranted to construct crossings at right angles or along elevation contours, implementation of erosion measures appropriate for the situation will occur. Measures that may be implemented to minimize erosion include; contouring and revegetation to stabilize soils; placement of hay bales, engineered sedimentation breaks and traps, and water contour bars; and the use of diversion ditches, engineered culverts, and energy dissipaters to prevent excessive erosion and to control runoff.

It is anticipated that one culvert will be installed during the development of site access roads to maintain existing site surface drainage conditions. The culvert is planned for the road leading to the Central Plant from the main access road, along a topographic low point as shown in Figure 4.4-2. Culvert construction will meet all State of Wyoming standards, including inlet and outlet control, head room, and bedding, where appropriate. Locally, surface drainage will be directed away from facilities, roads and topsoil stockpiles using shallow ditches and/or berms.

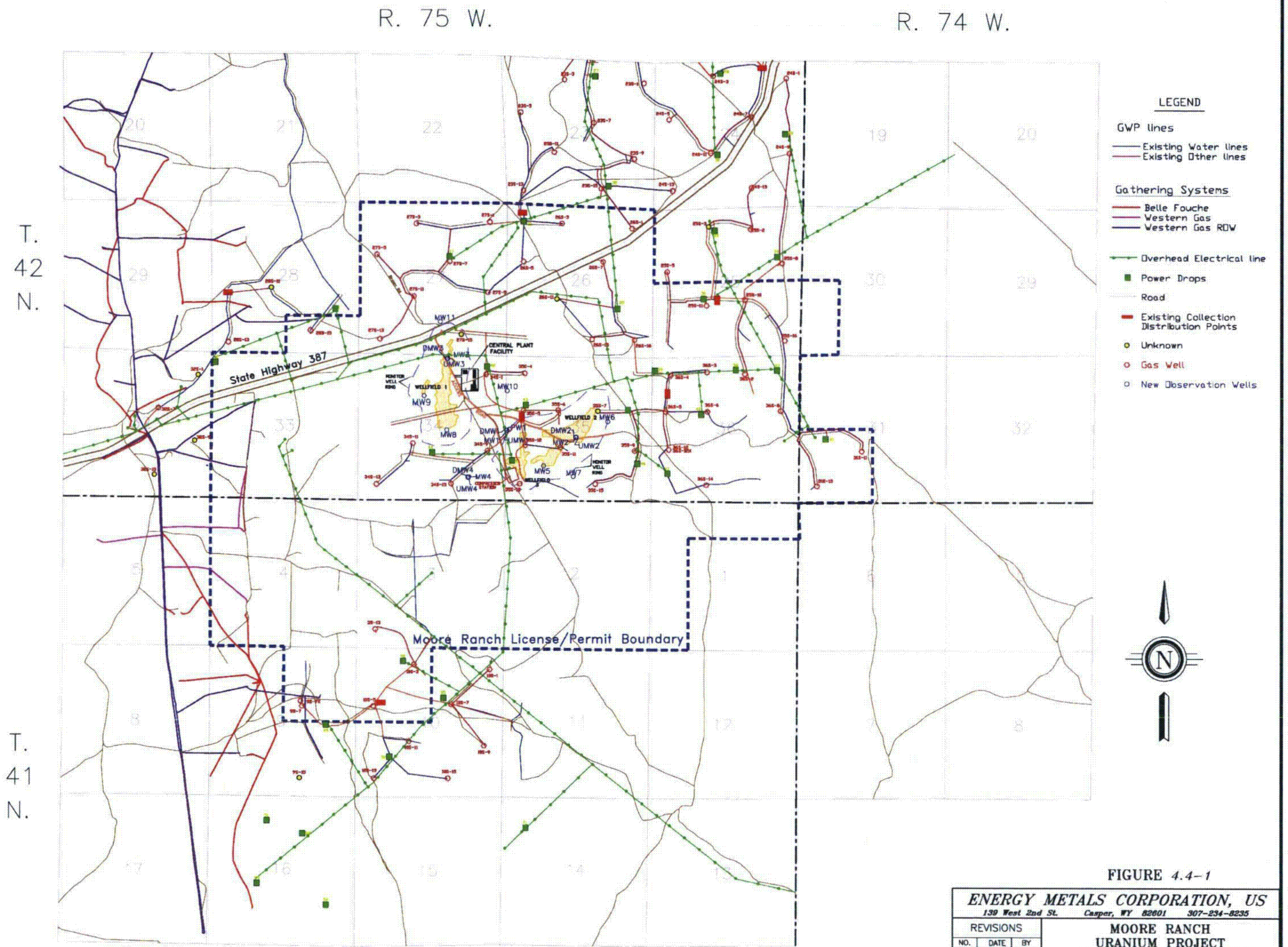


FIGURE 4.4-1

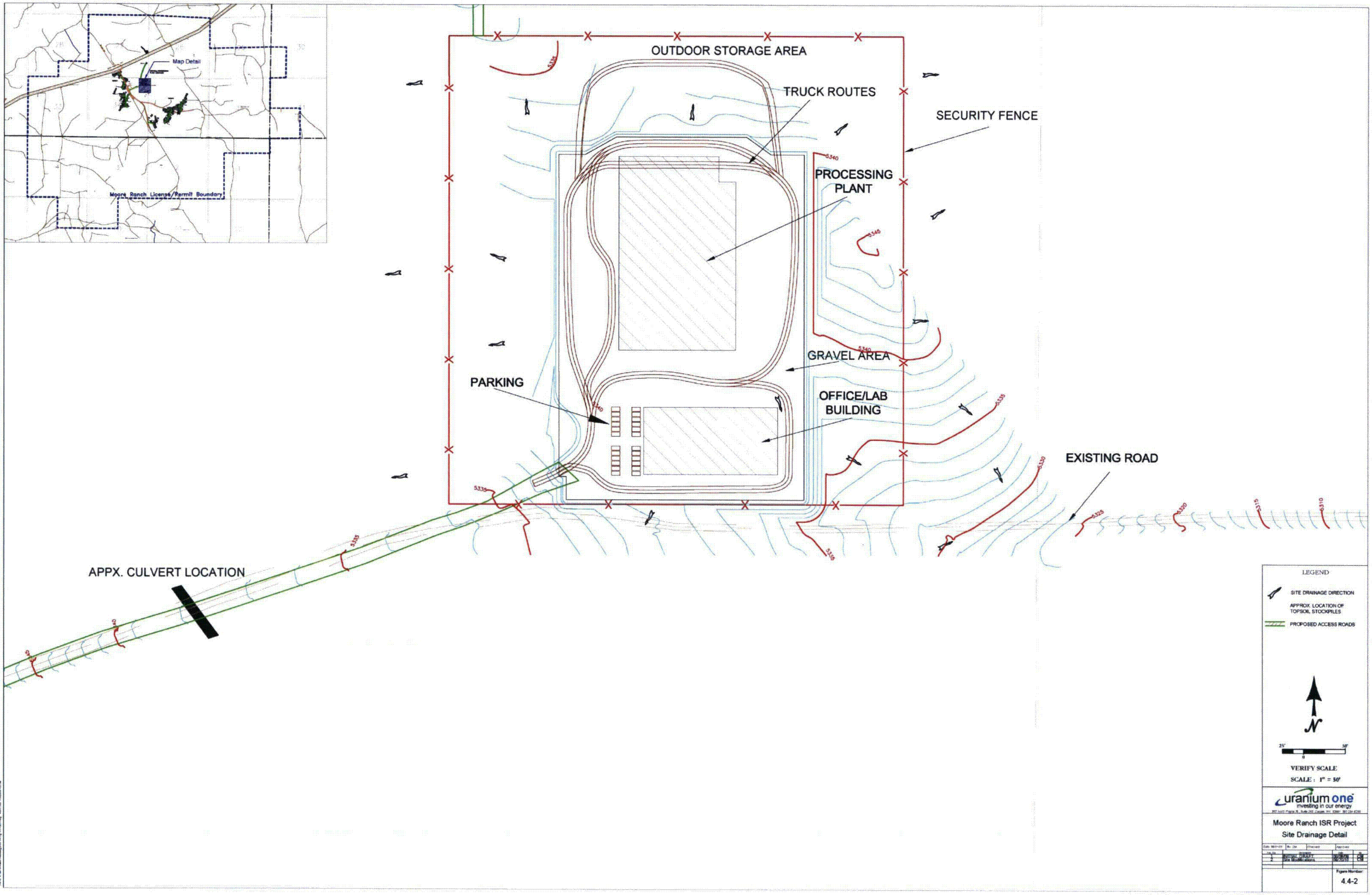
ENERGY METALS CORPORATION, US
139 West 2nd St. Casper, WY 82601 307-234-8235

REVISIONS		
NO.	DATE	BY
1		

MOORE RANCH
URANIUM PROJECT
EXISTING AND PROPOSED
SITE FEATURES

PORTIONS OF T. 41 & 42 N., R. 74 & 75 W.

GEOL. BY:	APPR. BY:	DATE: 9/19/07	SHT. NO.
ENG. BY:	APPR. BY:	DATE:	
DRAFT. BY: Penny Hague	SCALE: See Scalebar	FILE:	



Map Detail
Moore Ranch License/Permit Boundary
OUTDOOR STORAGE AREA
TRUCK ROUTES
SECURITY FENCE
PROCESSING PLANT
GRAVEL AREA
PARKING
OFFICE/LAB BUILDING
EXISTING ROAD
APPX. CULVERT LOCATION
LEGEND
SITE DRAINAGE DIRECTION
APPROX. LOCATION OF TOPSOIL STOCKPILES
PROPOSED ACCESS ROADS
N
25'
0
50'
VERIFY SCALE
SCALE : 1" = 50'
uranium one
investing in our energy
Moore Ranch ISR Project
Site Drainage Detail
INITIAL DRAFT
Site Modifications
Figure Number:
4.4-2

4.4.1.2 Surface Water Impacts from Sedimentation

Normal construction activities within the wellfields, process plant, and along the pipeline courses and roads have the potential to increase the sediment yield of the disturbed areas. However, the relative size of these disturbances is small when compared to the size of the overall areas and to the size of the watersheds, and also have a short term impact. Since well field decommissioning and reclamation activities will be on-going throughout the life of the project, the area to be reclaimed at the conclusion of operations will be reduced, although a slight increase in sediment yields and total runoff can still be expected. Since all natural flow within the project boundaries is ephemeral with no intermittent or perennial streams, potential impacts to surface water from construction and decommissioning activities are also limited to uncommon precipitation or runoff events.

The physical presence of the surface facilities including wellfields and associated structures, access roads, office buildings, pipelines, facilities and other structures associated with ISR mining and processing of uranium are not expected to significantly change peak surface water flows because of the relatively flat topography of the drainages at the site, the low regional precipitation, the absorptive capacity of the soils, and the small area of disturbance relative to the large drainage within and adjacent to the proposed License Area.

Mitigation and control measures to eliminate or reduce surface water impacts from sedimentation are discussed in Section 5.4.2.3.

4.4.1.3 Potential Surface Water Impacts from Accidents

Surface water quality could potentially be impacted by accidents such as excessive rainwater or runoff in impacted soil areas or failure or an uncontrolled release of process liquids due to a wellfield leak. Section 5.4.2 discusses measures to prevent and control wellfield spills. Process buildings and chemical storage areas will be constructed with sumps or secondary containments, and a regular program of inspections and preventive maintenance will be implemented.

4.4.2 Groundwater Impacts

The potential groundwater impacts of ISR mining are related to the consumption of groundwater and short-and long-term changes to groundwater quality. Perhaps the most significant environmental impact that can occur as a result of ISR mining is the degradation of water quality in the ore-bearing aquifer.

4.4.2.1 Impacts on Groundwater Quality during Construction and Wellfield Development

During facility construction, potential impacts to shallow water could occur from consumptive use of groundwater, introduction of drilling fluids and muds during well installation, discharge of pumped water during hydrologic testing and surface spills of fuels and lubricants. Groundwater use during construction is minor relative to the available water supply in the shallow Wasatch aquifers. Most water used for the Moore Ranch project is extracted from a well completed in the 40 and 50 Sand at depths of 470 to 590 ft below ground surface, much deeper than the shallow aquifers beneath the site. Consumptive use of groundwater is generally limited to dust control, drilling support and cement mixing. Impacts from groundwater consumptive use during construction would be minor and temporary to water supplies of the Powder River Basin.

The volume of drilling fluids and muds used during well installation is limited and would have negligible to small impacts on shallow aquifers beneath the License Area. The depth to the water table is generally more than 40 feet across most of the site so infiltration of drilling fluids and muds are unlikely to cause noticeable changes in water quality. Drilling fluids and muds will be placed into mud pits to control the spread of the fluids, to minimize the area of soil contamination and to enhance evaporation.

Pumped waters from hydrologic testing during construction of the wellfields will be discharged in accordance with approved permits. The permits protect near surface aquifers by limiting the discharge volume and prescribing concentration limits to waters that can be discharged.

Groundwater quality of near surface aquifers will be protected by best management practices including implementation of a spill prevention and cleanup program to prevent soil contamination. The volume of fluids and lubricants kept on the License Area is generally small and any spills or leaks will result in immediate cleanup response.

Best management practice will include implementation of a spill prevention and cleanup program, extracting water from deeper, more prolific aquifers to minimize consumptive use impacts, compliance with WDEQ approved discharge permits, and minimization of surface disturbance through the use of mud pits.

4.4.2.2 Groundwater Consumption

Based on a bleed of 0.5% to 1.5% which has been successfully applied at other ISR operations, the potential impact from consumptive use of groundwater is expected to be minimal. In this regard, the vast majority (e.g., on the order of 99%) of groundwater used in the mining process will be treated and re-injected. Potential impacts on groundwater due to consumptive use outside the proposed License Area are expected to be negligible.

A numerical groundwater flow model was used to quantify the potential impact of drawdown due to mining and restoration operations. Details regarding the model development, calibration and simulations are provided in the report "Numerical Modeling of Groundwater Conditions Related to Insitu Recovery at the Moore Ranch Uranium Project, Wyoming" (Petrotek 2008) that is included as Appendix B4 of the Technical Report. The model incorporates aquifer properties determined from site pump tests and also replicates the transition from unconfined conditions in the southern portion of the site to confined groundwater conditions in the northern portion of the site within the 70 Sand.

The model was used to simulate the full cycle of ISR production and restoration at Moore Ranch. The production cycle was divided into three phases with initial production over a portion of Wellfield 2 (2,960 gpm), a second phase with production in both Wellfields, (totaling 2,840 gpm) and the final phase with production only in a portion of Wellfield 1 (1,980 gpm). Each production phase was simulated as 18 months. In order to maintain an inward hydraulic gradient toward Wellfield 2 while Wellfield 1 was finishing production, limited groundwater sweep (20 gpm) was simulated in Wellfield 2 during the phase three production cycle. Restoration was assumed to require removal of 6 pore volumes from each wellfield. Restoration was simulated in two phases with the first phase being concurrent restoration of Wellfields 1 and 2 that runs for 4.3 years. The assumption for restoration is that RO capacity is 500 gpm with a 20 percent reject brine. The RO rate was evenly divided between the two Wellfields (250 gpm each) during the first restoration phase. The second restoration phase includes restoration of Wellfield 2 (at 500 gpm) for an additional period of 1.8 years. The additional time needed for Wellfield 2 is because the Pore Volume estimate for Wellfield 2 (125.9 million gallons) is larger than Wellfield 1 (90.3 million gallons). Total length of the simulation is 10.5 years. The operational parameters for this simulation are summarized in Table 4.4.1 below:

Table 4.4.1 Simulated Production and Injection Rates, Moore Ranch ISR Project

	Wellfield	Production Rate	Injection Rate	Net Bleed	Bleed (%)
Production		(gpm)	(gpm)	(gpm)	
Phase P1	2	2959.8	2935.5	24.3	0.8
Phase P2	2	1619.9	1598.8	21.1	1.3
Phase P2	1	1219.9	1206.4	13.5	1.1
Phase P2 Totals		2839.8	2805.2	34.6	
Phase P3	1	1979.9	1959.5	20.4	1.0

Restoration	Wellfield	Extraction/Treatment	Reinjection	Consumptive Use
		(gpm)	(gpm)	(gpm)
Phase R1	2	250.0	200.0	50.0
Phase R1	1	250.0	200.0	50.0
Phase R1 Totals		500	400	50.0
Phase R2	2	500.0	400.0	100.0

The simulated drawdown throughout the model domain at the end of production operations, the end of restoration of Wellfield 1, and the end of restoration of Wellfield 2 is shown on Figures 4.4-3, 4.4-4 and 4.4-5, respectively. Wells completed in the 70 or 68 sand (excluding monitor wells) potentially impacted by drawdown induced by production or restoration operations are shown on the figures.

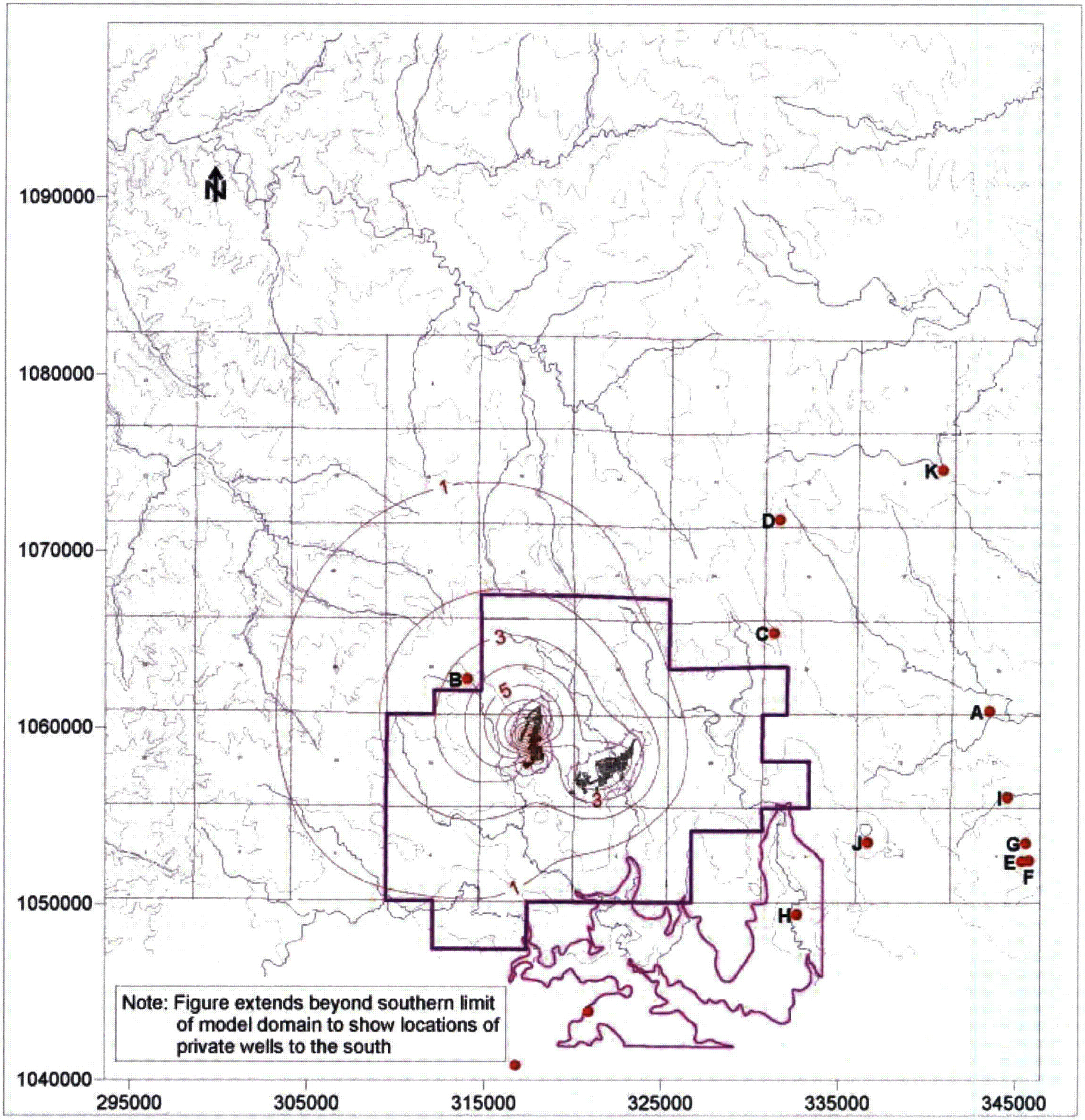
A total of fourteen domestic, industrial, stock or miscellaneous use wells within two miles of the License Area are projected as being completed within the 68 or 70 Sands. None of those wells are within the License Area. Information regarding the wells is summarized in Table 4.4.2. The simulated drawdown for wells completed within the 70 (or the combined 68-70 or 70-72 Sands) are also summarized in Table 4.4.2. The table cross references the wells with Figures 4.4-3, 4.4-4 and 4.4-5. Three of the wells (P120983W, P22296P and P78124W) that are projected as 70 Sand completions are located south of the model domain and therefore, no model predicted drawdowns are provided for those wells. The largest predicted drawdown (almost 8 feet after restoration of Wellfield 1) occurs at well P14660 (located in T42N, 75 W, Section 28, approximately 1 mile northwest of proposed Wellfield 1). This well is identified as a stock well and is located in an area where the 70 Sand is fully saturated and under confined conditions. The less than 8 feet of drawdown at the location of well P14660 is not anticipated to negatively effect the ability of that well to produce water for stock purposes. Most other wells had less than 1 foot of drawdown at any time during the life of the ISR operations. The simulated drawdowns represent a small percentage of the total available drawdown which is typically greater than 70 feet within the License Area.

Table 4.4-2 Simulated Drawdown at Water Wells in the Vicinity of the Moore Ranch License Area

Permit #	Township Range Section QtrQtr	Uses	Well Depth (ft bgs)	Static Depth (ft bgs)	Estimated Completion Zone	Simulated Drawdown (ft)			Cross Reference to Figures*
						End Production	End Restoration Wellfield 1	End Restoration Wellfield 2	
P12244P	42N74W S 28 SESW	STO	200	100	70 sd	0.00	0.00	0.00	A
P14660P	42N75W S 28 NESE	STO	355	150	70 sd	3.53	7.87	5.90	B
P14683P	42N74W S 30 NWNW	STO	275	175	68-70 sd	0.08	0.68	1.08	C
P14684P	42N74W S 18 SWSW	STO	350	235	68-70 sd	0.23	0.91	1.20	D
P17301P	41N74W S 4 NESE	STO	130	55	68 sd	0.00	0.00	0.00	E
P17302P	41N74W S 4 NESE	DOM, STO	165	90	68 Sd?	0.00	0.00	0.00	F
P17304P	41N74W S 4 SENE	DOM, STO	137	80	68 Sd?	0.00	0.00	0.00	G
P17305P	41N74W S 7NENW	STO	50	18	70-72 sd	0.00	0.06	0.12	H
P6972W	42N74W S 33 SWSE	STO	210	95	60-68 sd	0.00	0.01	0.01	I
P6973W	41N74W S 5 SWNW	STO	170	60	68 sd	0.01	0.01	0.04	J
P85802W	42N74W S 17SENE	STO	300	180	70-72 sd	0.06	0.22	0.30	K

Estimates of completion zones with greatest uncertainty are indicate with a ?
Use categories include domestic, stock, industrial or miscellaneous
gpm – gallons per minute
ft bgs – feet below ground surface
Cross reference to Figures 4.4-3, 4.4-4 and 4.4-5

Mitigation measures associated with groundwater consumption are discussed in Section 5.4.2.1.



Permit Area Boundary

Outcrop of 70 Sand

Topographic Surface C.I. = 20 feet

Wellfield Patterns

Monitor Well Ring

Simulated Drawdown C.I. = 1 foot

A Private Well Completed in 70 or 68 Sand Cross Referenced to Table D6.1-4

0 5000 10000

Feet

Petrotek

10288 W Chatfield Ave, Ste 201
Littleton, CO 80127-4239

URANIUM ONE

Figure 4.4-3
Simulated Drawdown At End of ISR Production

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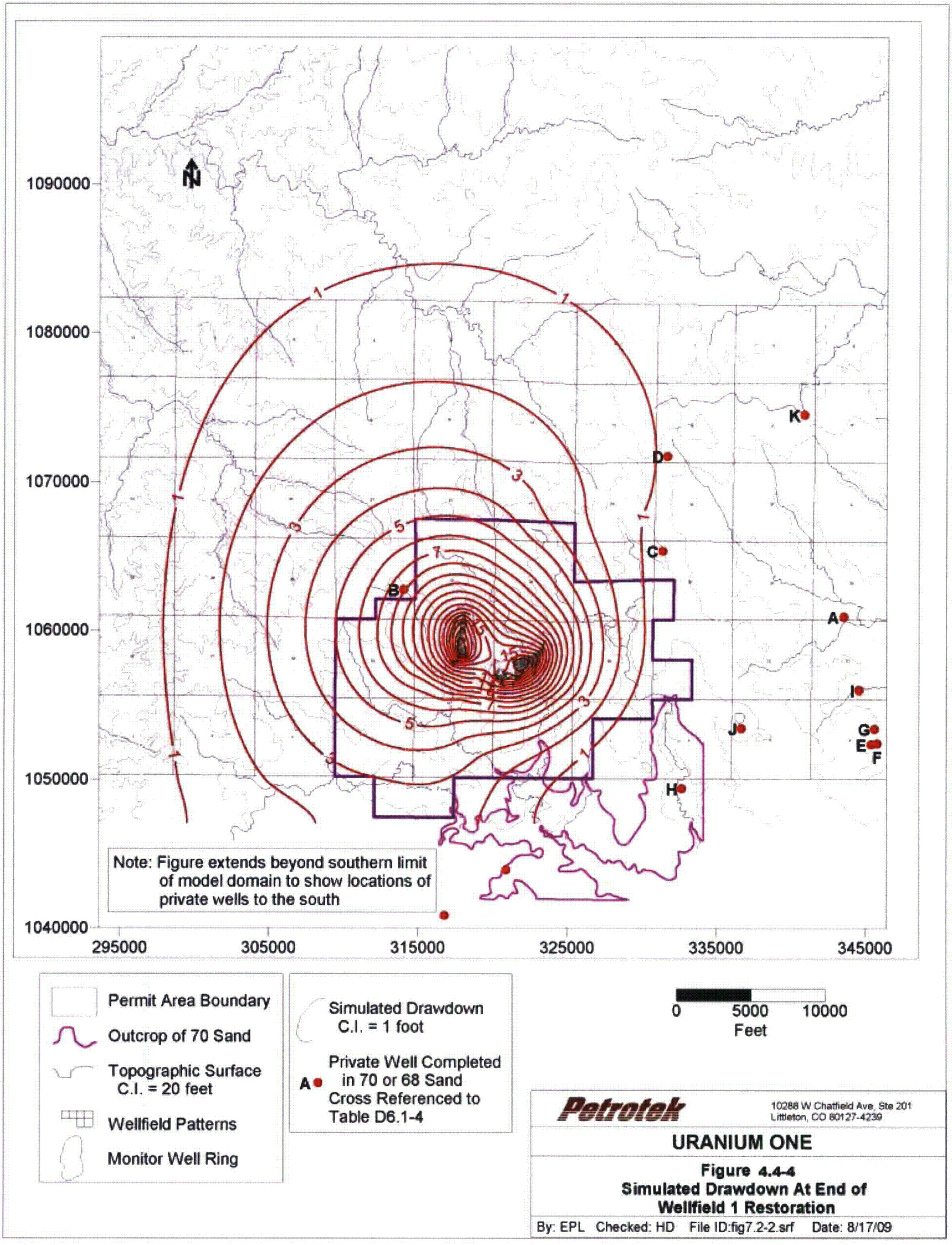

Figure 4.4-4
Simulated Drawdown At End of Wellfield 1 Restoration

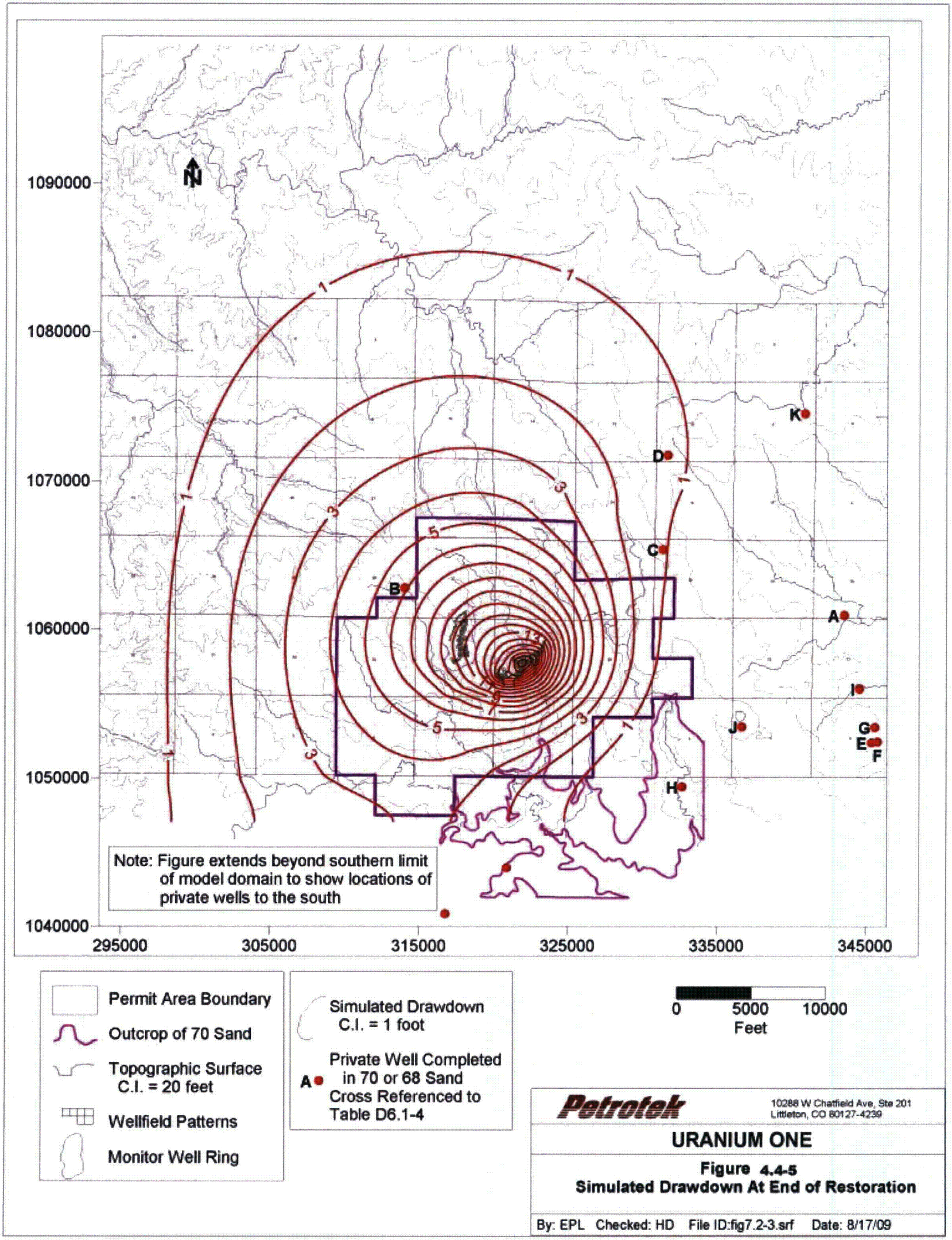

Figure 4.4-5
Simulated Drawdown At End of Restoration

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4.4.2.3 Impacts on Ore Zone Groundwater Quality

During ISR mining operations, water quality impacts are usually of greater concern than water consumption impacts because water consumption during mining is relatively small. Contamination of groundwater from the proposed lixiviant is caused by (1) the addition of sodium bicarbonate and oxygen to the groundwater, (2) the addition of chloride to the groundwater by the processing plant, and (3) the interaction of these chemicals with the mineral and chemical constituents of the aquifer being mined. The result is that during mining, the concentration of most of the naturally occurring dissolved constituents in the mining zone will be appreciably higher than their concentrations in the original groundwater.

EMC has estimated the post-mining water quality based on the experience of COGEMA Mining, Inc. in Production Units 1 through 9 at the Irigaray ISR project located in the Powder River Basin near the proposed Moore Ranch Uranium Project. The Irigaray data was selected because of the proximity and similar geologic conditions to Moore Ranch. Cogema employed ammonium bicarbonate with hydrogen peroxide as the oxidant during early mining operations. In May 1980, the lixiviant system for the entire site was converted to sodium bicarbonate chemistry with gaseous oxygen as the oxidant. The water quality database is extensive because it represents nine production units located in a 30 acre site.

The water quality of the Irigaray ore zone after mining was established by sampling each of the designated restoration wells. The post-mining mean of the analytical results from Production Units 1 through 9 is presented in Table 4.4-3. The chemical alteration of the ore zone aquifer can be observed through comparison of the post-mining mean concentrations with the baseline concentrations.

Table 4.4-3 Irigaray Post-Mining Water Quality

Parameter (units)	Irigaray Baseline Range	Irigaray Post-Mining Mean
Dissolved Aluminum (mg/l)	<0.05 – 4.25	<1.037
Ammonia Nitrogen as N (mg/l)*	<0.05 – 1.88	23
Dissolved Arsenic (mg/l)	<0.001 – 0.105	<0.601
Dissolved Barium (mg/l)	<0.01 – 0.12	<1.067
Boron (mg/l)	<0.01 – 0.225	<0.442
Dissolved Cadmium (mg/l)	<0.002 – 0.013	<0.979
Dissolved Chloride (mg/l)*	5.3 – 15.1	277
Dissolved Chromium (mg/l)	<0.002 – 0.063	<1.018
Dissolved Copper (mg/l)	<0.002 – 0.04	<0.828
Fluoride (mg/l)	0.11 – 0.66	<1
Total and Dissolved Iron (mg/l)	0.02 – 11.8	<1.098
Dissolved Mercury (mg/l)	<0.0002 - <0.001	<0.971
Dissolved Magnesium (mg/l)	0.02 – 9.0	45.7
Total Manganese (mg/l)	<0.005 – 0.190	1.249
Dissolved Molybdenum (mg/l)	<0.02 - <0.1	<1.067
Dissolved Nickel (mg/l)	<0.01 - <0.2	<1.018
Nitrate + Nitrite as N (mg/l)	<0.2 – 1.0	<3
Dissolved Lead (mg/l)	<0.002 - <0.050	<1.018
Radium-226 (pCi/L)	0 – 247.7	200.5
Dissolved Selenium (mg/l)	<0.001 – 0.416	0.247
Dissolved Sodium (mg/l)	95 - 280	827
Sulfate (mg/l)	136 - 824	639
Uranium (mg/l)	<0.0003 – 18.8	7.411
Vanadium (mg/l)	<0.05 – 0.55	<1.067
Dissolved Zinc (mg/l)	<0.01 – 0.200	<0.065
Dissolved Calcium (mg/l)*	1.6 – 33.5	199.2
Bicarbonate (mg/l)*	5 - 144	1343
Carbonate (mg/l)	0 - 96	<2

Table 4.4-3 Irigaray Post-Mining Water Quality

Parameter (units)	Irigaray Baseline Range	Irigaray Post-Mining Mean
Dissolved Potassium (mg/l)	0.4 – 17.5	9
Total Dissolved Solids (TDS) @ 180°F (mg/l)	308 - 1054	2451

* Parameters with RTV other than baseline

In general, these post-mining concentrations are within the range of those projected by NRC for ISR operations at the Crownpoint Uranium Project. EMC expects similar baseline and post-mining water quality at the Moore Ranch site.

Mitigation measures for impacts on groundwater quality are discussed in Section 5.4.2.2.

4.4.2.4 Potential Groundwater Quality Impacts from Accidents

4.4.2.4.1 Lixiviant Excursions

Water quality impacts in adjacent aquifers from ISR mining activities are related to the identification, control, and clean-up of excursions. During production, injection of the lixiviant into the wellfield results in a temporary degradation of water quality compared to pre-mining conditions. Movement of this water out of the wellfield results in an excursion. Excursions of contaminated groundwater in a wellfield can result from an improper balance between injection and recovery rates, undetected high permeability strata or geologic faults, improperly abandoned exploration drill holes, discontinuity and unsuitability of the confining units which allow movement of the lixiviant out of the ore zone, poor well integrity, or hydrofracturing of the ore zone or surrounding units. Past experience from other commercial scale in-situ recovery projects in the Powder River Basin has shown that when proper steps are taken in monitoring and operating a wellfield, excursions, if they do occur, can be controlled and recovered and that serious impacts on the groundwater are prevented.

Excursions of lixiviant at ISR facilities have the potential to contaminate adjacent aquifers with radioactive and trace elements that have been mobilized by the mining process. These excursions are typically classified as horizontal or vertical. A horizontal excursion is a lateral movement of mining solutions outside the mining zone of the ore-body aquifer. A vertical excursion is a movement of solutions into overlying or underlying aquifers.

The historical experience at other ISR uranium operations indicates that the selected excursion indicator parameters and UCLs allow detection of horizontal excursions early enough that corrective action can be taken before water quality outside the exempted aquifer boundary is significantly degraded. As noted in NUREG/CR-6733, significant risk from a horizontal excursion would occur only if it persisted for a long period without being detected.

Vertical excursions can be caused by improperly cemented well casings, well casing failures, improperly abandoned exploration wells, or leaky or discontinuous confining layers.

Mitigation measures to prevent excursions are described in Section 5.4.2.3.

4.4.2.4.2 Wellfield Spills

Potential impacts to groundwater and surface water may occur during operations as a result of an uncontrolled release of process liquids due to a wellfield leak. Should an uncontrolled wellfield release occur, there would be a potential for contamination of the shallow aquifer as well as surrounding soil. With a slow leak that remains undiscovered or a short duration, high volume release, a shallow excursion is one potential impact. The potential impact to shallow groundwater from a slow, low volume leak occurring over a period of 18 months and a short duration, relatively high volume release are assessed in Addendum 4-1.

The rupture of an injection or recovery line in a wellfield, or a trunkline between a wellfield and the plant, would result in a release of injection or production solution which would contaminate the ground in the area of the break. Small leaks in wellfield piping typically occur in the injection system due to the higher system pressures. These leaks seldom result in soil contamination.

Occasionally, small leaks at pipe joints and fittings in the headerhouses or at the wellheads may occur. Until remedied, these leaks may drip process solutions onto the underlying soil. These leaks seldom result in soil contamination.

Mitigation measures to prevent wellfield spills are described in Section 5.4.2.3.

4.5 ECOLOGICAL RESOURCES IMPACTS

4.5.1 Vegetation

Wellfield and production facilities will be constructed within upland grassland vegetation communities. Direct impacts include the short-term loss of vegetation (modification of structure, species composition, and areal extent of cover types). Indirect impacts would include the short-term and long-term increased potential for non-native species invasion, establishment, and expansion; exposure of soils to accelerated erosion; shifts in species composition or changes in vegetative density; reduction of wildlife habitat; reduction in livestock forage; and changes in visual aesthetics. An estimated 150 acres of upland grassland would be affected by construction disturbance under current development plans.

Construction activities, increased soil disturbance, and higher traffic volumes could stimulate the introduction and spread of undesirable and invasive, non-native species within the project area. Non-native species invasion and establishment has become an increasingly important result of previous and current disturbance in Wyoming. These species often out-compete desirable species, including special-status species, rendering an area less productive as a source of forage for livestock and wildlife. Additionally, sites dominated by invasive, non-native species often have a different visual character that may negatively contrast with surrounding undisturbed vegetation. The presence of two State-designated weeds, Canada thistle and field bindweed, was observed in the Moore Ranch Project area during the baseline surveys along with other undesired annual grass species such as cheat grass brome.

No threatened or endangered vegetation species were observed within the Moore Ranch Project area; therefore, no impacts are anticipated.

Mitigation measures to lessen impacts on native vegetation and control State-designated weeds are discussed in Section 5.5.1.

4.5.2 Wildlife and Fisheries

ISR uranium mining differs from conventional surface mining by using less intrusive extraction methods that are more efficient and, thus, have less impact on the surrounding area. In situ operation use a series of injection and production wells that extract the uranium from the ore body without physically removing the ore or overburden from the ground. The mine area consists of a series of wells within a systematic pattern with a single processing facility to remove the uranium from the lixiviant.

ISR uranium mining can have direct and indirect impacts on local wildlife populations. These impacts are both short-term (lasting until successful reclamation is achieved) and long-term (persisting beyond successful completion of reclamation). However, long term impacts are not expected to be substantial due to the relatively limited habitat disturbance associated with this mining method. The direct impacts of ISR mining on wildlife include injuries and mortalities caused by collisions with project-related traffic or habitat removal actions such as topsoil stripping, particularly for smaller species with limited mobility such as some rodents and herptiles, and restrictions on wildlife movement due to construction of fences. The likelihood for the impacts resulting in injury or mortality is greatest during the construction phase due to increased levels of traffic and physical disturbance during that period. Traffic will persist during production, but should occur at a reduced, and possibly more predictable level. Speed limits will be enforced during all construction and maintenance operations to reduce impacts to wildlife throughout the year, but particularly during the breeding season.

During the construction and operation phases of the project, open mud pits used for well drilling and maintenance activities could pose a hazard to wildlife. This potential impact will be mitigated by the use of temporary fencing around all open mud pits to protect wildlife from this hazard.

Because ISR mining has a much smaller impact footprint than conventional surface mining, topsoil stripping and habitat destruction are restricted to relatively small areas needed for the processing facility and access roads. Surface disturbance associated with the Moore Ranch Project is expected to consist of approximately 150 acres of disturbed area including a 6 acre central plant facility, approximately 1.0 mile of new access roads, and a permanent working staff of approximately 60 individuals. Total surface disturbance from this new infrastructure would be approximately 150 non-contiguous acres. As indicated, most of that habitat disturbance will consist of scattered, confined drill sites for wells that will not result in large expanses of habitat being dramatically transformed from its original character as in surface mining operations. Therefore, most indirect impacts would relate to the displacement of wildlife due to increased noise, traffic, or other disturbances associated with the development and operation of the Moore Ranch Project, as well as from small reductions in existing or potential cover and forage due to habitat alteration, fragmentation, or loss. Indirect impacts typically persist longer than direct impacts. However, the nature of ISR mining decreases the occurrence of large-scale habitat alterations and, thus, the need for reclamation efforts that can result in dramatic differences between pre-construction and post-construction vegetative communities.

Repeated surveys over multiple, consecutive years in the project area have documented that three wildlife species of particular concern do not occur in the Moore Ranch Project area: the bald eagle, greater sage-grouse (Centrocercus urophasianus), and mountain plover. Suitable habitat for all three species (trees, sagebrush, and sparse, low-growth vegetation, respectively) is extremely limited, further minimizing the potential for both direct and indirect impacts for those species, and others that require similar habitats. Other wildlife species of concern, such as ferruginous hawks (Buteo regalis), that do occur in the area may experience indirect impacts from increased travel and noise in the area during project construction and operation. However, the combination of documented nesting despite existing CBM facilities, the presence of potential alternate nesting and foraging habitat in the immediate vicinity, and the mobility of this species reduces impacts to ferruginous hawks and other such species.

Some vegetative communities currently present in the project area can be difficult to reestablish through artificial plantings, and natural seeding of those species would likely take many years. Consequently, wildlife species associated with specific habitats such as blue grama (Bouteloua gracilis) grasslands, birdsfoot sagebrush (Artemisia pedatifida), and big sagebrush (Artemisia tridentata) could be reduced in number or replaced by generalist species with broader habitat requirements until natural reseeding of certain vegetation occurs or reclamation matures to its target mix. Again, because the proposed Moore Ranch Project area is dominated by mid-grass species, the species using these three habitat types do not occur in the project area, and because the actual surface disturbance will be relatively limited (approximately 150 non-contiguous acres), negative impacts to these wildlife species are expected to be minimal.

Mitigation measure to control impacts on wildlife are discussed in Section 5.5.2.

4.5.3 Medium-Sized and Small Mammals

Medium-sized mammals (such as lagomorphs, coyotes, and foxes) may be temporarily displaced to other habitats during the initial uranium mining activities. Direct losses of some small mammal species (e.g., voles, ground squirrels, mice) may be higher than for other wildlife due to their more limited mobility and likelihood that they would retreat into burrows when disturbed, and thus be impacted by topsoil scraping or staging activities. However, given the limited area expected to be disturbed (approximately 150 non-contiguous acres) by the Moore Ranch Project, such impacts would not be expected to result in major changes or reductions in mammalian populations for small or medium-sized animals. The species known to be, or potentially, present in the project area have shown an ability to adapt to human disturbance in varying degrees, as evidenced by their presence in CBM developments and residential areas of similar, or greater, disturbance. Additionally, small mammal species in the area have a high reproductive potential and tend to re-occupy and adapt to altered and/or reclaimed areas quickly.

4.5.4 Big Game Mammals

Beginning in 2000, the Wyoming Game and Fish Department (WGFD) and WDEQ/LQD no longer required surface mining operations in Wyoming to conduct surveys for big game.

Under the proposed action, big game could be displaced from portions of the Moore Ranch Project to adjacent areas, particularly during construction of the wellfield and facilities, when disturbance activities would be greatest. Disturbance levels would decrease during actual production and restoration operations and would consist primarily of vehicular traffic on improved and unimproved (two-track) roads throughout the project area. Similar disturbance is already present in the area due to existing CBM operations. Pronghorn would be most affected, as they are more prevalent in the area. However, no areas classified as crucial pronghorn habitat occur on or within several miles of the Moore Ranch Project area and this species is not as common in the general analysis area as elsewhere within the region due to the limited presence of sagebrush in the area. Mule deer would not be substantially impacted given their infrequent use of these lands, the paucity of winter forage and security cover, and the availability of suitable habitat in adjacent areas. The WGFD does not consider the general area to be within the "use range" of any other big game species. Sightings of those species in that vicinity are rare, if they occur at all.

4.5.5 Upland Game Birds

ISR uranium mining in the Moore Ranch Project area would affect approximately 150 non-contiguous acres of potential foraging and nesting habitat for mourning doves, though such disturbance is not expected to have any marked impacts on doves. While woody corridors are not abundant in the general area, they also are not unique to the Moore Ranch Project area. Similar habitat is present immediately south of the area, where mining is not projected to occur in the near future. Additionally, doves are not restricted to treed habitats, nor are they subject to any special mitigation measures for habitat loss.

Annual monitoring studies conducted by private and agency biologists in the Moore Ranch Project area since at least 2003 have repeatedly demonstrated that sage-grouse do not inhabit that locale. As described previously in Section 3.5, those surveys encompassed most of the proposed License Area and its one-mile perimeter through 2006, and the entire area in 2007. The nearest known sage-grouse lek is approximately 3.0 miles northwest of the Moore Ranch Project area (WGFD records obtained from D. Thiele, Regional Biologist, WGFD, Buffalo, WY). Given the lack of sage-grouse observations in the area, and the minimal quantity and marginal quality of potential sage-grouse habitat, implementation of the proposed action is not likely to negatively impact any existing or potential sage-grouse leks, or important sagebrush habitats.

Baseline monitoring studies have repeatedly demonstrated that sage-grouse do not inhabit the license area. As described previously in Section 3, those surveys encompassed most of the proposed license area and its one-mile perimeter for much of that period. No sage-grouse leks were observed in that region during any survey year. WGFD records and USDA-FS records also failed to document any sage-grouse leks within the area that encompasses the general analysis area (i.e., proposed Moore Ranch boundary and a one-mile perimeter). Given the lack of sage-grouse observations in the area, and the minimal quantity and marginal quality of potential sage-grouse habitat, EMC does not plan to conduct operational monitoring for sage-grouse at this time.

4.5.6 Other Birds

The Moore Ranch Project could impact 14 avian species of concern (8 Level I and 6 Level II) known to occur or potentially present as seasonal or year-round residents. Direct impacts could include injury or mortality due to encounters with vehicles or heavy equipment during construction or maintenance operations. Indirect impacts could include habitat loss or fragmentation and increased noise and activity that may deter use of the area by some species. Surface disturbance would be relatively minimal (total of approximately 150 non-contiguous acres) and would be greatest during construction.

4.5.7 Raptors

ISR uranium mining in the Moore Ranch Project area would not impact regional raptor populations, though individual birds or pairs may be affected. Mining activity could cause raptors to abandon nests proximate to disturbance, particularly if mining encroaches on active nests during a given breeding season. The Wyoming Ecological Services Office of the US Fish and Wildlife Service (FWS) recommends a one-mile buffer around all ferruginous hawk nests. Nests of most other raptor species (including all of the others present in the project area) are typically buffered by a one-quarter- or one-half-mile radius. Thirteen intact ferruginous hawk nests were known to be present within the portions of the Moore Ranch Project area monitored during 2007. Eleven were located within the proposed license boundary and two were located within a one-mile radius. Three documented great horned owl nest sites (one-quarter mile buffer or less) are located within the license area. Only one of four intact red-tailed hawk nest sites (one-half mile buffer) occurred within that boundary in 2007. Other potential direct impacts to these species are limited to injury or mortality due to collisions with mine-related vehicular traffic.

Typically, approval from the leading regulatory agency is required before disturbance activities can occur within buffer zones for active raptor nests. All three species represented on the Moore Ranch Project have successfully nested near active surface coal mining and other energy development areas throughout the Powder River Basin for many years as documented in Annual Reports from various coal mines submitted to the

WDEQ/LQD. Efforts to maintain viable raptor territories and protect nest productivity have succeeded due to a combination of the raptors becoming acclimated to the gradual encroachment of mine operations and the successful execution of state-of-the-art mitigation techniques.

Construction activities associated with the Moore Ranch Project that occur within or near active raptor territories would temporarily impact the availability of foraging habitat for nesting birds. However, equipment yards associated with mining provide additional habitat for prey species such as cottontails and raptors have been documented voluntarily nesting quite near those areas. As at surface mines throughout the region and nearby uranium projects, nesting raptors at the Moore Ranch project have likely been influenced primarily by natural factors such as prey abundance and availability of nesting substrates. Due to the paucity of woody vegetation and river cliffs, raptors that nest in trees or on high cliffs are not as abundant as those that either nest on the ground or are adaptable to nesting on mine facilities or other man-made structures (platform nests, etc.). During active mining, new nesting habitat can be created through enhancement efforts (nest platforms, nest boxes, and tree plantings) to mitigate any negative impacts associated with the project.

Mitigation measures for impacts on raptors are discussed in Section 5.5.4.

4.5.8 Fish and Macroinvertebrates

No aquatic habitat exists on the Moore Ranch Project that will support fish or macroinvertebrates. Therefore, no impacts from construction or operations to fish or macroinvertebrates can occur.

4.5.9 Threatened and Endangered Species

4.5.9.1 Bald Eagle

As discussed in Section 3.5.5, the bald eagle was delisted from its Threatened status on June 28, 2007 in the lower 48 states. Its primary legal protection was transferred from the Endangered Species Act to the Bald and Golden Eagle Protection Act (BGEPA).

ISR mining at the Moore Ranch Project may affect, but is not likely to adversely affect, bald eagles. As bald eagle nests and winter roost sites are absent in the study area, potential hazards for this species would be limited to foraging individuals during winter.

Direct impacts to bald eagles would include the potential for injury or mortality to individual birds foraging in the project area due to collisions with mine-related equipment during construction or operation of the Moore Ranch Project. The increased human presence and noise associated with construction activities, if conducted while eagles are wintering within the area, could displace individual eagles from using the area during that period. As bald eagles have not been documented in the project area, impacts of the proposed action would be limited to occasional foraging individuals rather than a large segment of the population. If necessary, the majority of direct impacts could be mitigated if construction activities were conducted outside the winter and early spring months, or outside the daily roosting period, should eagles be present during construction. Any bald eagles that might roost or nest in the area once the mine is operational would be doing so in spite of continuous and on-going human disturbance, indicating a tolerance for such activities.

Indirect impacts such as area avoidance could result from increased noise and human presence associated with mining related operations. Potential winter foraging habitat could be further fragmented by linear disturbances such as fences and new roads associated with the project. Given the size of the proposed project, those disturbances would occur within narrow corridors over relatively short distances.

Due to the lack of potential nesting or roosting sites and the lack of concentrated sources of prey, both the direct and indirect effects of the proposed action to bald eagles are expected to be minimal.

4.5.9.2 Reptiles, Amphibians, and Fish

Potential habitat for reptiles, amphibians, and aquatic species is quite limited within the proposed license area and occurs primarily as ephemeral or intermittent habitat associated with small, scattered stock ponds or drainages in the area. Portions of Pine Tree Draw, Simons Draw, and Ninemile Creek, and their ephemeral tributaries, occur within the proposed License Area, but do not represent reliable water sources.

Activities associated with the Moore Ranch Project are not expected to disturb existing surface water or alter the topography in the area. Furthermore, under natural conditions, such habitat is limited in the project area and few observations of aquatic species have been recorded there over time. Impacts to surface water flow and channels are expected to be minimal, as no significant alterations to these features would result from construction and operations. Additionally, any primary channels and surface water flow affected during mining would be restored during reclamation.

4.5.10 Waterfowl and Shorebirds

Construction and operation of the Moore Ranch Project would have a negligible effect on migrating and breeding waterfowl and shorebirds. Little existing habitat is present in the area, so it does not currently support large groups or populations of these species. Ponding of water from fluid releases during operations will be immediately removed, minimizing any contact of released fluids with waterfowl or shorebirds. Any new treated water sources would enhance current habitat conditions for these species, though such effects may be ephemeral and temporary in nature.

4.6 AIR QUALITY IMPACTS

The only gaseous effluent from the Moore Ranch Project is radon-222 gas. The impacts from this effluent are discussed in detail in Section 4.12.2.

Construction activities at the Moore Ranch Project will cause minimal short term effects on local air quality. Increased suspended particulates from vehicular traffic on unpaved roads, fugitive dust caused by wind erosion of areas cleared of vegetation, and diesel emissions from construction equipment would be the primary air quality impacts. Diesel emissions from construction equipment are expected to be short term only, ceasing once the operational phase begins.

EMC estimated fugitive dust emissions from operation of the Moore Ranch Project based on projected activity levels and emission factors supplied by the WDEQ. Projected activities impacting dust emissions included ongoing wellfield construction activities, routine site traffic related to operations and maintenance, heavy truck traffic delivering chemicals and material and shipping product, and employee traffic to and from the site. Based on these activities, the projected total PM_{10} emissions is 15.5 tons per year. This level of emissions is small relative to surface mines and other industrial operations that generate dust from vehicles and disturbed areas. The larger surface mines in the Powder River Basin show PM_{10} emissions inventories in the thousands of tons per year. Sections of unpaved county roads can also exceed this 15 tons per year emission rate by an order of magnitude or more. Viewed another way, atmospheric dispersion modeling generally shows that fugitive PM_{10} emissions on the order of 15 tons per year result in insignificant impacts to ambient air beyond a distance of a few hundred yards from the sources. Significant impact for PM_{10} is defined as 1.0 μg/m3 or more. For reference purposes, the national ambient standard for annual average PM_{10} is 50 μg/m3.

It is important to note that no control factors were assumed for the emission calculations. Periodic watering or chemical treatment of the unpaved roads will reduce emission factors by half or more.

Mitigation measures for air quality impacts from dust are discussed in Section 5.6.

4.7 NOISE IMPACTS

There are no occupied housing units in the vicinity of the proposed Moore Ranch Project. Open rangeland is the primary land use within and in the surrounding 2.0-mile area. Other land uses include oil and gas and coal bed methane production facilities, as well as pastureland located to the west of the project area. As a result of the remote location of the project and the low population density of the surrounding area, impact to noise or congestion within the project area or in the surrounding 2.0-mile area are not anticipated. Additionally, given the maximum increase in population due to migrant workers is insignificant, noise and congestion impacts are not anticipated in Campbell or other neighboring counties.

Although noise impacts during construction will be minimal at the Project site and surrounding area, a compilation of the noise levels of equipment anticipated to be used during construction is provided below. Equipment required for construction and installation of the proposed facility will include heavy equipment (cranes, bulldozers, graders, track hoes, trenchers and front end loaders), and heavy- and light-duty trucks. For the purposes of this environmental evaluation, additional equipment that may be used during construction is listed below. Table 4.7-1 below is an inventory of potential construction equipment. Noise levels in this inventory are expressed in terms of L_{max} noise levels and are accompanied by a usage factor value. Specification 721.560 was originally developed by the Central Artery/Tunnel (CA/T) program in Massachusetts for use on the "Big Dig" project. This program was developed to be consistent with the intent of the city of Boston's Noise Code. The CA/T program has adopted and refined the most comprehensive and stringent construction noise control specification 721.560 of any public works project in the country. The specification contains both "relative" noise criteria limits at identified noise sensitive receptor locations, as well as "absolute" noise emission limits for any/all equipment used on the construction site (Thalheimer, 1999). Information from the CA/T program is used for reference only as the remote conditions and potential impacts of the Moore Ranch Project, located in a remote area of Wyoming, are far different than the urban impacts of the Big Dig Project in Boston.

Table 4.7-1 Noise Emission Reference Levels and Usage Factors				
Equipment Description	**Impact Device?**	**Acoustical Usage Factor (%)**	**Spec. 721.560 L_{max} @ 50 feet (dBA, slow)**	**Actual Measured L_{max} @ 50 feet (dBA, slow) (Samples Averaged)**
All Other Equipment > 5 HP	No	50	85	N/A
Auger Drill Rig	No	20	85	84
Backhoe	No	40	80	78
Bar Bender	No	20	80	N/A
Blasting	Yes	N/A	94	N/A
Boring Jack Power Unit	No	50	80	83
Chain Saw	No	20	85	84
Clam Shovel (dropping)	Yes	20	93	87
Compactor (ground)	No	20	80	83
Compressor (air)	No	40	80	78
Concrete Batch Plant	No	15	83	N/A
Concrete Mixer Truck	No	40	85	79
Concrete Pump Truck	No	20	82	81
Concrete Saw	No	20	90	90
Crane	No	16	85	81
Dozer	No	40	85	82
Drill Rig Truck	No	20	84	79
Drum Mixer	No	50	80	80
Dump Truck	No	40	84	76
Excavator	No	40	85	81
Flat Bed Truck	No	40	84	74
Front End Loader	No	40	80	79
Generator	No	50	82	81

Table 4.7-1 Noise Emission Reference Levels and Usage Factors

Equipment Description	Impact Device?	Acoustical Usage Factor (%)	Spec. 721.560 L_{max} @ 50 feet (dBA, slow)	Actual Measured L_{max} @ 50 feet (dBA, slow) (Samples Averaged)
Generator (<25KVA, VMS Signs)	No	50	70	73
Gradall	No	40	85	83
Grader	No	40	85	N/A
Grapple (on backhoe)	No	40	85	87
Horizontal Boring Hydraulic Jack	No	25	80	82
Hydra Break Ram	Yes	10	90	N/A
Impact Pile Driver	Yes	20	95	101
Jackhammer	Yes	20	85	89
Man Lift	No	20	85	75
Mounted Impact Hammer (hoe ram)	Yes	20	90	90
Pavement Scarifier	No	20	85	90
Paver	No	50	85	77
Pickup Truck	No	40	55	75
Pneumatic Tools	No	50	85	85
Pumps	No	50	77	81
Refrigerator Unit	No	100	82	73
Rivit Buster/Chipping Gun	Yes	20	85	79
Rock Drill	No	20	85	81
Roller	No	20	85	80
Sand Blasting (single nozzle)	No	20	85	96
Scraper	No	40	85	84
Sheers (on backhoe)	No	40	85	96

Table 4.7-1 Noise Emission Reference Levels and Usage Factors

Equipment Description	Impact Device?	Acoustical Usage Factor (%)	Spec. 721.560 L_{max} @ 50 feet (dBA, slow)	Actual Measured L_{max} @ 50 feet (dBA, slow) (Samples Averaged)
Soil Mix Drill Rig	No	50	80	N/A
Tractor	No	40	84	N/A
Ventilation Fan	No	100	85	79
Vibrating Hopper	No	50	85	87
Vibratory Concrete Mixer	No	20	80	80
Vibratory Pile Driver	No	20	95	101
Warning Horn	No	5	85	83
Welder/Torch	No	40	73	74

For each generic type of equipment listed in Table 4.7-1, the following information is provided:

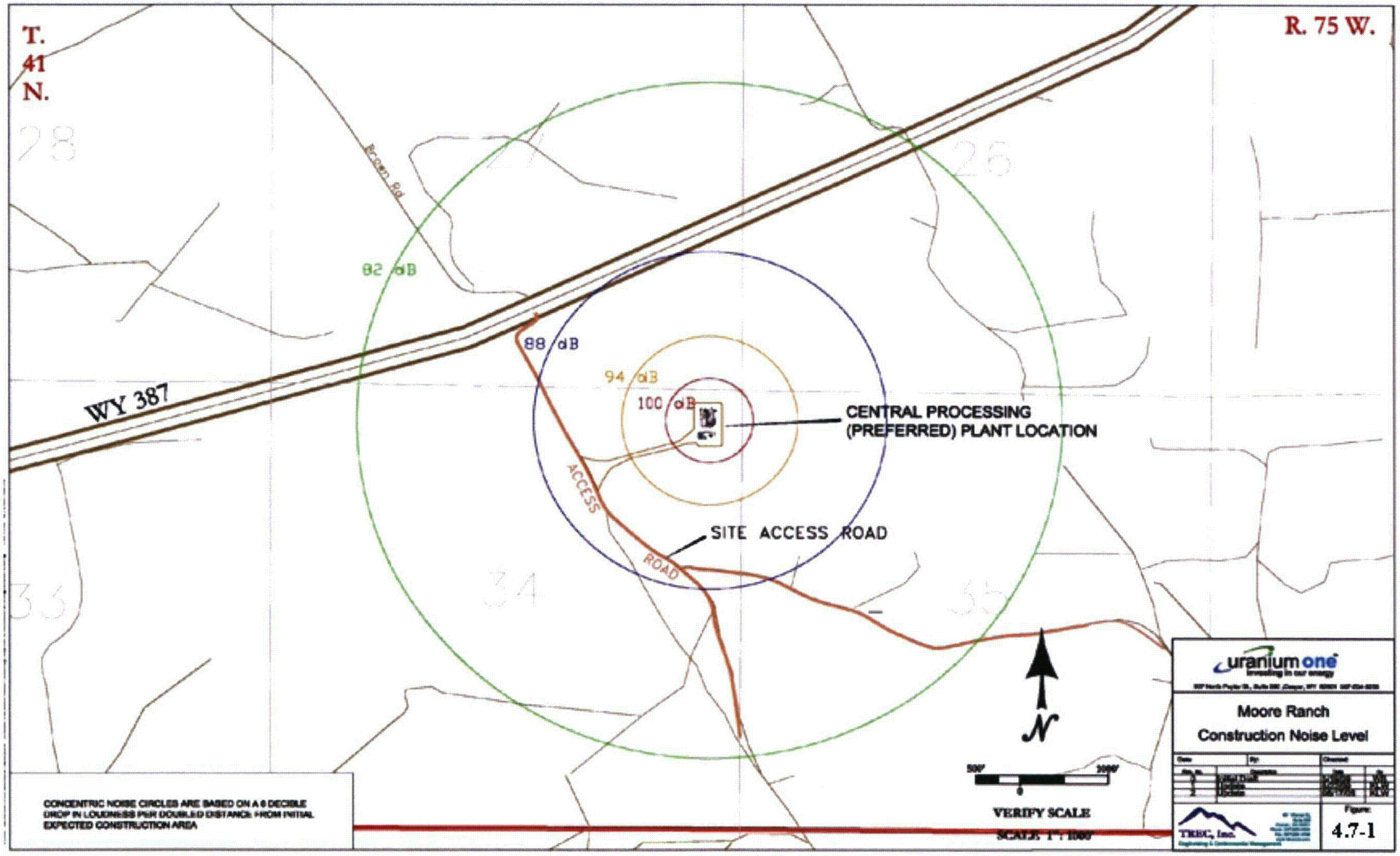
- an indication as to whether or not the equipment is an impact device;
- the acoustical usage factor to assume for modeling purposes;
- the specification "Spec" limit for each piece of equipment expressed as an L_{max} level in dBA "slow" at a reference distance of 50 foot from the loudest side of the equipment;
- the measured "Actual" emission level at 50 feet for each piece of equipment based on hundreds of emission measurements performed on CA/T work sites.

Although there is no site-specific noise data for the Moore Ranch Project, noise information is available from the Lost Creek ISR project in Wyoming, with a license application currently pending with the NRC. The Lost Creek ISR project is located in a fairly remote part of Wyoming, with areal topographic similarities to Moore Ranch and is comparable in project scale, making Lost Creek an appropriate analog. During construction, ISR projects create noise due to heavy equipment use and mine unit drilling. Drill rigs, heavy trucks, and equipment will generate noise that will be audible on-site above the 30 to 40 A-weighted decibels (dBA) of the background noise levels. At

Lost Creek ISR the maximum measure of sound pressure (noise) during exploration activities was from a cement mixer and a generator running concurrently, which was 102 dBA, four feet from the source. During construction, occasional instantaneous levels could be somewhat higher. Field observations for the Lost Creek project indicated that drilling activities are inaudible to humans at distances greater that one mile, due to topographic interference and other factors (Lost Creek ISR, LLC. 2008).

Figure 4.7-1 shows the maximum noise levels anticipated at the Moore Ranch site during the construction phase of the project. Noise levels at the Project site boundary could be as high as 80dB at times during construction. However this construction activity sound level is less than or similar to vehicle traffic noise along HWY 387, and will not be a significant impact in the area.

Figure 4.7-1 Moore Ranch Project Maximum Construction Noise Levels



Truck traffic is common on State Highways 387, 59 and 50 as a result of the construction and operational activities of the oil and gas, coal and CBM industries. Average daily traffic volumes for the local highways in the project area, State Highways 50, 59 and 387, are shown in Table 4.2-1 (WYDOT, 2009). The traffic information includes data from years 1997, 2006 and 2007; additionally, projected daily truck and auto traffic volume data for the three local State Highways are also presented.

During the construction phase of the project, truck traffic will consist of a maximum of ten deliveries per day, resulting in an estimated maximum increase in truck traffic of 4.8%. The projected truck traffic increase is based on the conservative scenario of all three local State Highways being subjected to the increased traffic. Travelling from the construction site, trucks will only pass occupied residences once they reach WYO 387, which is a well-traveled road as shown in Table 4.2-1. Therefore the increase in truck traffic caused by the project is not expected to be noticeable, and the noise impact will be very minor given the location.

Mitigation measures to control impacts from noise are discussed in Section 5.7.

4.8 HISTORIC AND CULTURAL RESOURCES IMPACTS

As discussed in Section 3.8, the Class II Inventory investigations found seven sites, 48CA6691-48CA6697, and 25 Isolate Resources/Artifacts, including artifacts from the Paleo-Indian, Middle Archaic, Late Archaic and Historic periods. Two sites, 48CA6694 and 48CA6696, are considered eligible for nomination to the National Register of Historic Places (NRHP). All sites and artifacts are described in detail in the Class III Inventory Report in Appendix A. Six previously recorded sites were also revisited during this investigation. None of the previously recorded sites have been affected by CBM development or exploratory drilling activities associated with uranium development. Only two sites, 48CA965 and 48CA966, which are listed as not eligible for nomination to the NRHP, are at or near any current development areas (near the monitor well ring). No sites are located within planned wellfield areas (see report in Appendix B).

None of the sites eligible for nomination are located within areas currently planned for in situ development, and in fact, are located well over a mile away from any planned development. As concluded in the Class III Inventory Report in Appendix B, the currently proposed Moore Ranch Project will not affect any known significant cultural resources and additional archaeological work is not considered necessary.

Mitigation measures that will be implemented if future development expands near these eligible sites are discussed in Section 5.8.

4.9 VISUAL/SCENIC RESOURCES IMPACTS

The visible surface structures proposed for the Moore Ranch Project include wellhead covers, headerhouses, electrical distribution lines, and the central plant facility. The project will use existing and new roads to access each headerhouse and the central plant.

Each wellhead cover typically consists of a weatherproof structure placed over the well. These covers are approximately 3 feet high and 2 feet in diameter. Each headerhouse is a small metal building. The central plant building will be approximately 400 feet by 100 feet in size for the initial phase. In addition, warehouse/shop, and office structures are planned. A disturbance area around each headerhouse is necessary to provide an adequate area for operations and maintenance vehicles to turn around. Electric distribution lines would connect headerhouses to existing electric distribution lines. The distribution poles are approximately 20 feet high and are wooden so that their natural color harmonizes with the landscape.

Temporary and short-term visual effects during the construction period in each wellfield would result from headerhouse construction, well drilling, and construction of access roads and electric distribution lines. Following completion of wellfield installation, temporarily disturbed areas will be reclaimed. Only long-term effects associated with operations and maintenance will remain following post-construction reclamation.

Long-term effects will result from the addition of structures to the landscape, such as the central plant and associated structures, headerhouses, wellhead covers, access roads, and electric distribution lines. Effects from long-term activities will occur over the life of the project.

Project development is planned for an area where extensive CBM development has already occurred and where additional development is planned. CBM installations are similar in visual impact to those associated with ISR uranium mining. CBM wells are installed in a network of approximately eight wells per square mile. These wells are connected by underground pipelines to collection and pumping structures that appear similar to ISR wellhouses. Overhead power lines are installed to each well.

As noted in Section 3.9, the total score of the scenic quality inventory for the Moore Ranch License Area is 4. According to NUREG-1569, if the visual resource evaluation rating is 19 or less, no further evaluation is required. Therefore, no further evaluation of changes to scenic resources from the proposed Moore Ranch Project is required.

Despite the existing visual impacts from CBM development and the low scenic quality rating for the proposed project site, EMC intends to implement measures to lessen the visual impact from the project. Mitigative measures for visual and scenic resource impacts are discussed in section 5.9.

4.10 SOCIOECONOMIC IMPACTS

The construction and operating work force for the Moore Ranch project is anticipated to come from the region surrounding the License Area, primarily Campbell and Natrona Counties in northeastern Wyoming. At least 50 percent of the work force would likely be located in Gillette, which provides labor for a number of large-scale energy related projects in the region. The proposed project is located in Campbell County, which would be most likely to experience effects to housing, public and other community services, recreation, county and municipal finances, crime, and the local transportation network. The adjacent Natrona County would also experience effects to housing and community services, as some of the project workforce would likely reside in Natrona County communities.

It is anticipated that the overall effect of the proposed facility operations on the local and regional economy would be beneficial. Purchases of goods and services by the mine and mine employees would contribute directly to the economy. Local, state, and the federal governments would benefit from taxes paid by the mine and its employees. Indirect impacts, resulting from the circulation and recirculation of direct payments through the economy, would also be beneficial. These economic effects would further stimulate the economy, resulting in the creation of additional jobs. Beneficial impacts to the local and regional economy provided by the proposed Moore Ranch operation would continue for the life of the facility, estimated to be 10 years for the well field operation and 15 years for the central plant operations as of June 2007. Economic impacts of the proposed operation are discussed in detail in Section 7.

4.10.1 Construction

The construction phase would cause a moderate impact to the local economy, resulting from the purchases of goods and services directly related to construction activities. Impacts to community services in rural Campbell County or the nearby towns of Midwest and Edgerton in Natrona County, and Wright in Campbell County, such as roads, housing, schools, and energy costs would be minor or non-existent and temporary.

An estimated 50 percent (25 workers) of the construction work force would be based in Campbell County, which contains the project site. The workforce hired outside of the County would likely be based in Casper, located in the neighboring Natrona County, as

Casper is a regional economic hub that provides a variety of construction services and labor for projects located throughout Wyoming.

Most construction work available to the local construction labor pool consists of temporary contract work that varies in duration, depending on the scope of each construction project. Further, the number of unemployed construction workers does not represent the number of workers that would be available to the proposed project from the local construction labor pool. The number is an annual average that does not take into account monthly variations in the available construction labor pool from construction start-ups and completions. Contractors for projects located throughout northeastern Wyoming typically hire the local construction labor pool. The actual number of construction workers available for the proposed project would potentially draw from the entire construction labor pool of 6,268 (2005 estimate; the construction labor pool as of 2007 is likely to be larger), as construction activities from some active projects would conclude so that workers would be available for future projects.

4.10.2 Operations Workforce

An estimated 40 to 60 people would be required for the operation of the proposed Moore Ranch Project. It is not known how many of the required operations workforce would be hired from outside of Campbell and Natrona Counties. In the event that the entire operations workforce and their families relocated to the counties, the population increase would be a maximum of 150, based on the 2005 average household size of 2.52 in Wyoming. This increase would account for 0.1 percent of the population of Campbell and Natrona Counties, and is smaller than the projected annual growth rate. Therefore, there would be little to no effect to the vacancy rates of any type of housing in Gillette area or Campbell County.

4.10.3 Effects to Housing

The License Area lies within commuting distance of Gillette and Wright, in Campbell County, and Casper in Natrona County, so that workers from these counties would likely commute from their homes. There would be no impact to temporary housing located within commuting distance (an estimated 1 to 2 hours) of the License Area.

In the event that workers from other states are hired for construction of the project, temporary housing such as motel/hotel rooms and RV sites located within commuting distance would be required, as no on-site housing (man camp) is planned. The available stock of motel/hotel rooms would accommodate relocating workers.

It is recognized, however, that the coal bed methane gas and mineral industries are presently a dominating factor for temporary housing availability in the area, and the workforce employed in these industries occupy much of the temporary housing that becomes available.

It is anticipated that few of the construction work force during any phase of the proposed project would purchase or rent housing of any type. Therefore, there would be no effects on the costs of any type of housing in the counties. Because rental housing usually require a long-term lease (generally a minimum of 6 months), only operations employees would likely enter into this type of lease agreement. Under a hiring scenario that assumes all of the proposed operations workforce would need to relocate to the area, 40 to 60 housing units would be required over the life of the project. In 2006, there were a total of 60 vacant housing units in Campbell and Natrona Counties, which would not meet the future demand for housing in the counties from anticipated population growth. Therefore, there would be little to no effect to the rental rates of any type of housing in Gillette or Campbell County.

Household projections estimate an increase in households from 2000 to 2030 as 140 percent in Campbell County and 73 percent in Natrona County. The existing housing stock would not accommodate the projected households. Local communities in general are aware of the pressing need for the new residential development.

4.10.4 Effects to Services

It is likely that both the construction and operating work force would be from Campbell and Natrona Counties, or other nearby counties in northeast Wyoming, and would not require permanent or temporary housing. In the event that up to 50 percent of the construction and operating workforce are non-local workers, it is anticipated that there would be a less than one percent increase in the population of Campbell and Natrona Counties from the permanent relocation of the workers and their families. Most non-local workers would utilize temporary housing. Because existing mobile home and RV parks will be used for a majority of the temporary housing, the project will not require new water, sewer, electrical lines, or other infrastructure. There will be no additional demands of increases in service levels for local infrastructure, such as police, fire, water, or utilities. In addition, there would be little measurable increase in non-basic employment, as these jobs are generated from ongoing employment of the existing base of construction workers, and would be maintained through the continued employment of local construction workers. Therefore, construction and operation of the project would not significantly affect the various public and non-public facilities and services described above from the in-migration of workers for non-basic employment opportunities.

Families moving into the Natrona and Campbell County school districts as a result of the proposed Moore Ranch License Area operations would not stress the current school system because it is presently under capacity.

4.10.5 Economic Impact Summary

Economic impacts are discussed in detail in the benefit-cost analysis in Section 7.

4.11 ENVIRONMENTAL JUSTICE

The U.S Census 2000 Decennial Population program provides race and poverty characteristics for Census Tracts and Block Groups, which are subdivisions of Census Tracts. The Moore Ranch License Area and the surrounding 2-mile buffer are contained within five Census Tracts and one additional Block Group that encompass portions of Campbell, Converse, Johnson, and Natrona Counties.

As summarized in Table 4.11-1, the combined population of the surrounding Census Tracts was 4,799. Minority populations accounted for a small percentage of the total population, with percentages of minorities generally similar to or smaller than those of the state as a whole.

The State of Wyoming was selected to be the geographic area to compare the demographic data for the population in the affected Census Tracts. This determination was based on the need for a larger geographic area encompassing affected area Census Tracts in which equivalent quantitative resource information is provided. The population characteristics of the affected Census Tracts are compared with Wyoming population characteristics to determine whether there are concentrations of minority or low-income populations in the Census Tracts relative to the state.

The data in Table 4.11-1 show that minority populations in the affected Tracts account for an overall smaller proportion of the population than the proportion of minority populations at the state level. No concentrations of minority populations were identified as residing near the proposed project facilities, as residents nearest to the License Area are rural populations, while most of the minority population lives in Gillette and communities along the I-25 corridor to the south. There would be no disproportionate impact to minority population from the construction and operation of the Moore Ranch Project.

With the exception of Census Tracts 9551 in Johnson County and 14.01 in Natrona County, the populations within the Tracts exhibit lower rates of people living below the poverty level than the state. Census Tracts 9551 and 14.01 contain rural populations; therefore, there is no concentration of people living below the poverty level in these

Tracts. No disproportionate adverse environmental impacts would occur in populations living below the poverty level within the Census Tracts from proposed project activities.

Table 4.11-1 Race and Poverty Level Characteristics of the Population in the Moore Ranch License Area Census Tracts

	State of Wyoming	Percent of Total State Population	Census Tract 1, Campbell County	Percent of Census Tract 1	Census Tract 9566, Converse County	Percent of Census Tract 9566	Block Group 1, Census Tract 9566, Converse County	Percent of Block Group 1, Census Tract 9566	Census Tract 9551, Johnson County	Percent of Census Tract 9551	Census Tract 14.01, Natrona County	Percen t of Census Tract 14.01	Census Tract 18, Natrona County	Percent of Census Tract 18	Total
Total	493,782	100.0	4,779	100.0	2,944	100.0	1,412	100.0	1,918	100.0	3,478	100.0	3,285	100.0	**17,816**
Urban:	322,073	65.2	418	8.7	0	0.0	0	0.0	0	0.0	0	0.0	9	0.3	**427**
Inside urbanized areas	125,706	25.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	9	0.3	**9**
Inside urban clusters	196,367	39.8	418	8.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	**418**
Rural	171,709	34.8	5,615	117.5	2,944	100.0	1,412	100.0	1,918	100.0	3,478	100.0	3,276	99.7	**18,643**
White alone	454,095	92.0	4,671	97.7	2,805	95.3	1,331	94.3	1,877	97.9	3,284	94.4	3,150	95.9	**17,118**
Black or African American alone	3,126	0.6	1	0.0	6	0.2	3	0.2	1	0.1	11	0.3	8	0.2	**30**
American Indian and Alaska Native alone	11,363	2.3	22	0.5	18	0.6	13	0.9	8	0.4	41	1.2	45	1.4	**147**
Asian alone	2,972	0.6	4	0.1	12	0.4	5	0.4	3	0.2	8	0.2	6	0.2	**38**
Native Hawaiian and Other Pacific Islander alone	232	0.0	2	0.0	1	0.0	1	0.1	0	0.0	8	0.2	2	0.1	**14**
Some other race alone	12,595	2.6	24	0.5	60	2.0	46	3.3	11	0.6	47	1.4	28	0.9	**216**
Two or more races	9,399	1.9	55	1.2	42	1.4	13	0.9	18	0.9	79	2.3	46	1.4	**253**
People who are Hispanic or Latino	31,384	6.4	88	1.8	113	3.8	73	5.2	52	2.7	106	3.0	78	2.4	**510**
Median household income in 1999	37,892	-	55,233	-	47,250	-	44,821	-	40,053	-	38,629	-	45,481	-	na
Per capita income in 1999	19,134	-	21,886	-	22,673	-	19,598	-	20,595	-	15,601	-	21,084	-	na
Population with income in 1999 below poverty level:	54,777	-	398	-	157	-	85	-	241	-	571	-	191	-	**1,643**
Percent below poverty level	11.1%	-	8.3%	-	5.3%	-	6.0%	-	12.6%	-	16.4%	-	5.8%	-	**9.2%**