ATTACHMENT 2

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Power Resources, Inc.

Gas Hills Project

US NRC Amendment Application

Filing Instructions: September 1999 Revision

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1. PROPOSED ACTIVITIES

1.1 Introduction and Background

This application for an amendment to NRC Source Material License SUA-1511 covers approximately 8500 acres located in the Gas Hills Uranium District in Fremont and Natrona Counties, Wyoming. Power Resources, Inc. (PRI) is proposing to develop an *in situ* uranium production facility (ISL), the Gas Hills Project, in this area which will produce up to 2.5 million pounds of uranium per year over the next 20 years.

The Project will be operated as a satellite to PRI's existing Highland Uranium Project (Source Material License SUA-1511), and will consist of wellfield and ion exchange activities only. Uranium bearing ion exchange resin will be transported by truck to the Highland Central Processing Facility (CPF) for processing into dried yellowcake.

This Project will provide employment for approximately 30 full time employees and approximately 12 to 24 contractor drilling personnel. In addition, the Project will contribute substantial mineral, property, and sales and use tax revenues to the State of Wyoming.

PRI controls the majority of the mineral rights within the Amendment Area. The majority of the land surface is public land which is administered by the U.S. Bureau of Land Management (BLM). PRI has also applied for a Permit to Mine with the Wyoming Department of Environmental Quality.

The Gas Hills Project is located within the most extensive uranium mining district of Wyoming. The Gas Hills District has produced over one hundred million pounds of U_3O_8 during the last forty years. The history of the Gas Hills Uranium District has been dominated by conventional open pit and underground mine operations with ores processed at one of three uranium mills in the district or transported outside the district for processing. The history of conventional mining and milling in the area has resulted in the reclamation of several thousands of acres of mined lands and several hundreds of acres of lands impacted by uranium milling and tailings disposal operations. By comparison, the proposed ISL project will disturb less than 15% of the land surface within the Amendment Area (i.e. less than 1275 acres),while maximizing resource recovery. ISL allows for the economic recovery of uranium deposits that are no longer viable by conventional mining methods. In addition, the surface disturbance will impact only the near surface materials, and the majority of the disturbed area will remain vegetated during operations.

1.2 Location

The Gas Hills Project is located in the eastern portion of the Gas Hills Uranium District of south-central Wyoming in Fremont and Natrona Counties, Wyoming (see Figure 1-1). The Project site is located approximately 45 miles east of Riverton and 65 miles west of Casper.

FIG 1-4
GAS HILLS PROJECT
OPERATIONS SCHEDULE

ID	Task Name
1	**MINE UNIT NO. 1 CONSTRUCTION**
2	MU # 1 Delineation
3	MU # 1 Mon Wells Designed
4	MU # 1 Mon Wells Installed
5	MU #1 Well Installation
6	MU #1 Pipelines/Power lines
7	**MINE UNIT NO. 1 OPERATIONS**
8	MU #1 Operations
9	**MINE UNIT NO. 1 RESTORATION**
10	MU # 1 GWS
11	MU # 1 RO Phase
12	Stability/Sign Off
13	**MINE UNIT NO. 1 RECLAMATION**
14	Plug & Abandon
15	Surface Reclamation
16	**MINE UNIT NO. 2 CONSTRUCTION**
17	MU # 2 Delineation
18	MU # 2 Mon Wells Designed
19	MU # 2 Mon Wells Installed
20	MU # 2 Pump Test
21	MU #2 Well Installation
22	Design evap ponds #3, #4, #5, & #6
23	Construct ponds #3 #4, #5, & #6

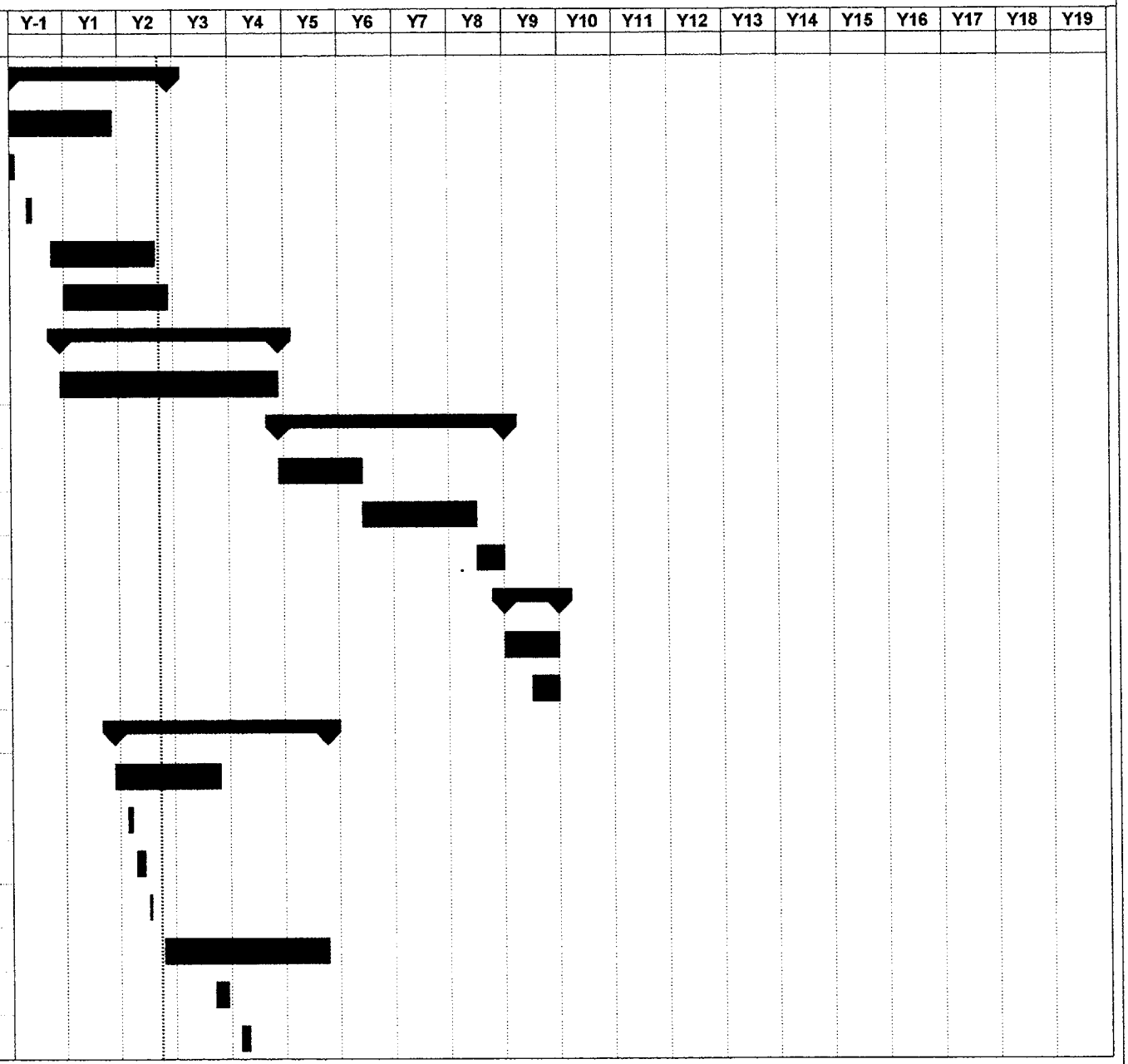


FIG 1-4
GAS HILLS PROJECT
OPERATIONS SCHEDULE

ID	Task Name
24	MU #2 Pipelines/Power Lines
25	**MINE UNIT NO. 2 OPERATIONS**
26	MU #2 Operations
27	**MINE UNIT NO. 2 RESTORATION**
28	MU # 2 GWS
29	MU # 2 RO Phase
30	Stability/Sign Off
31	**MINE UNIT NO. 2 RECLAMATION**
32	Plug & Abandon
33	Surface Reclamation
34	**MINE UNIT NO. 3 CONSTRUCTION**
35	MU # 3 Delineation
36	Satellite No. 2 built
37	MU # 3 Mon Wells Designed
38	MU # 3 Mon Wells Installed
39	MU # 3 Pump Test
40	MU #3 Pipeline/Power Lines
41	MU #3 Well Installation
42	**MINE UNIT NO. 3 OPERATIONS**
43	MU #3 Operations
44	**MINE UNIT NO. 3 RESTORATION**
45	MU # 3 GWS
46	MU # 3 RO Phase

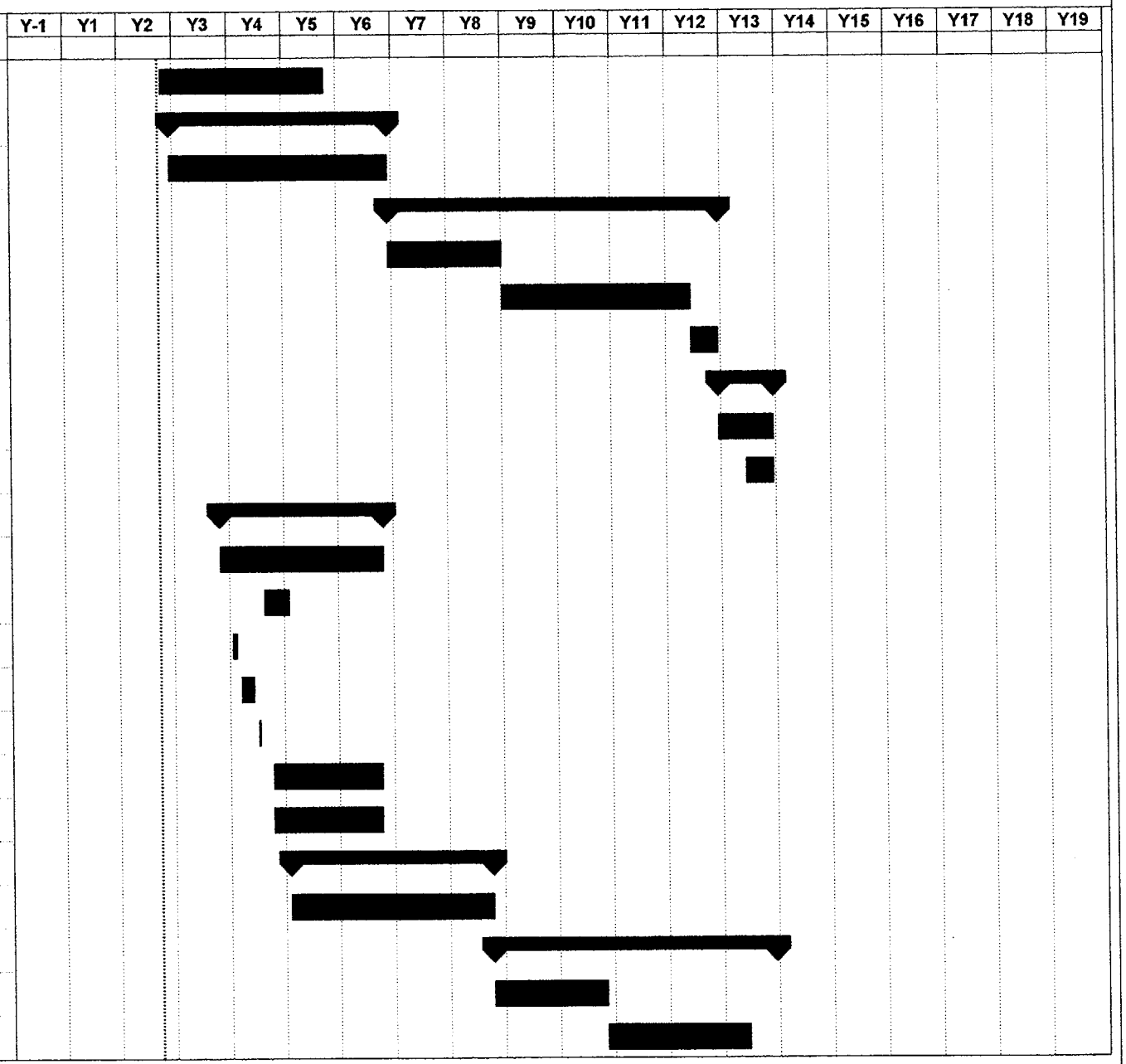


FIG 1-4
GAS HILLS PROJECT
OPERATIONS SCHEDULE

ID	Task Name
47	Stability/Sign Off
48	**MINE UNIT NO. 3 RECLAMATION**
49	Plug & Abandon
50	Surface Reclamation
51	**MINE UNIT NO. 4 CONSTRUCTION**
52	MU #4 Delineation
53	MU # 4 Mon Wells Designed
54	MU # 4 Mon Wells Installed
55	MU # 4 Pump Test
56	MU #4 Pipeline/Power Lines
57	MU #4 Well Installation
58	**MINE UNIT NO. 4 OPERATIONS**
59	MU #4 Operations
60	**MINE UNIT NO. 4 RESTORATION**
61	MU # 4 GWS
62	MU # 4 RO Phase
63	Stability/Sign Off
64	**MINE UNIT NO. 4 RECLAMATION**
65	Plug & Abandon
66	Surface Reclamation
67	**MINE UNIT NO. 5 CONSTRUCTION**
68	MU #5 Delineation
69	MU #5 Mon Wells Designed

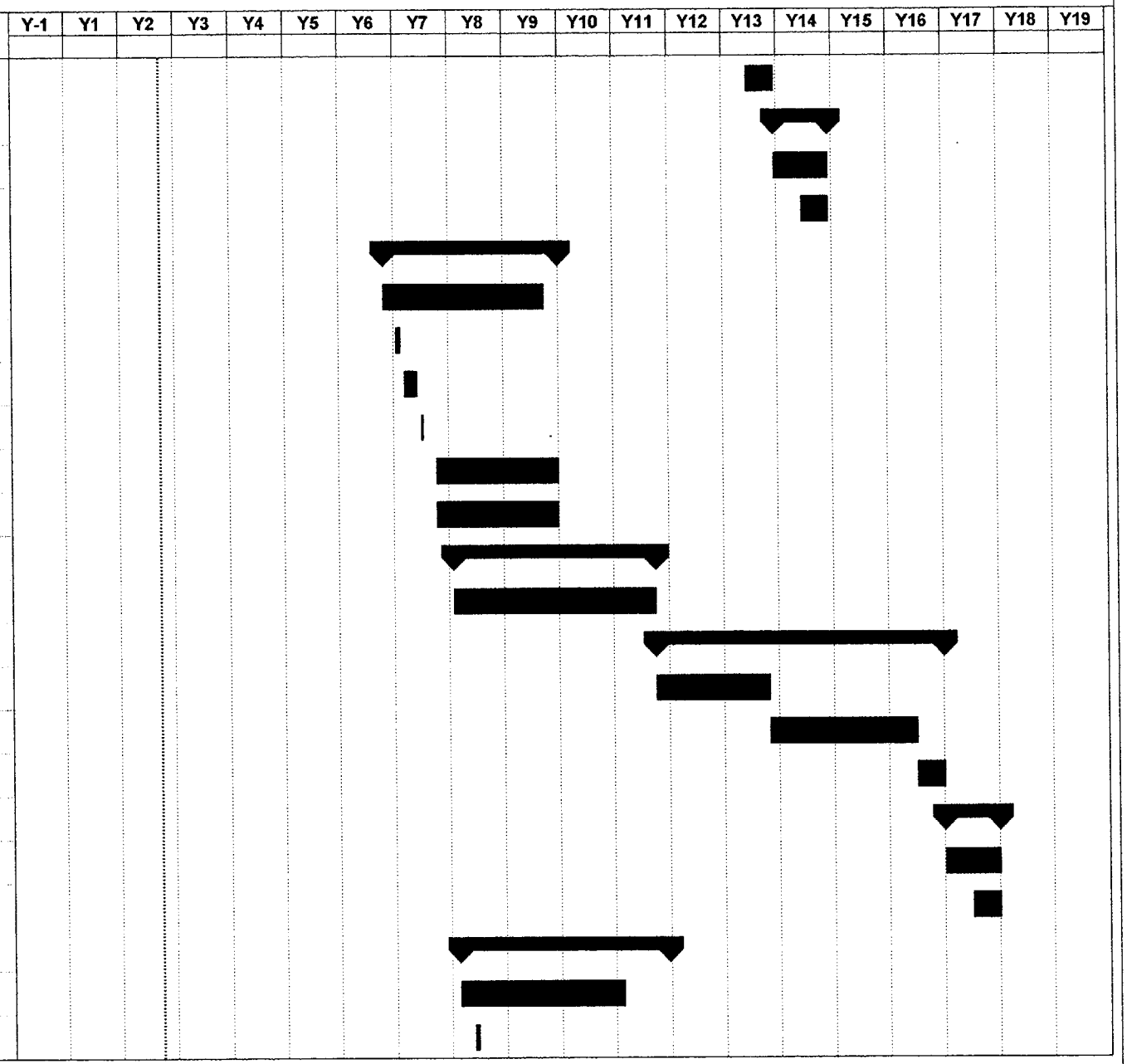
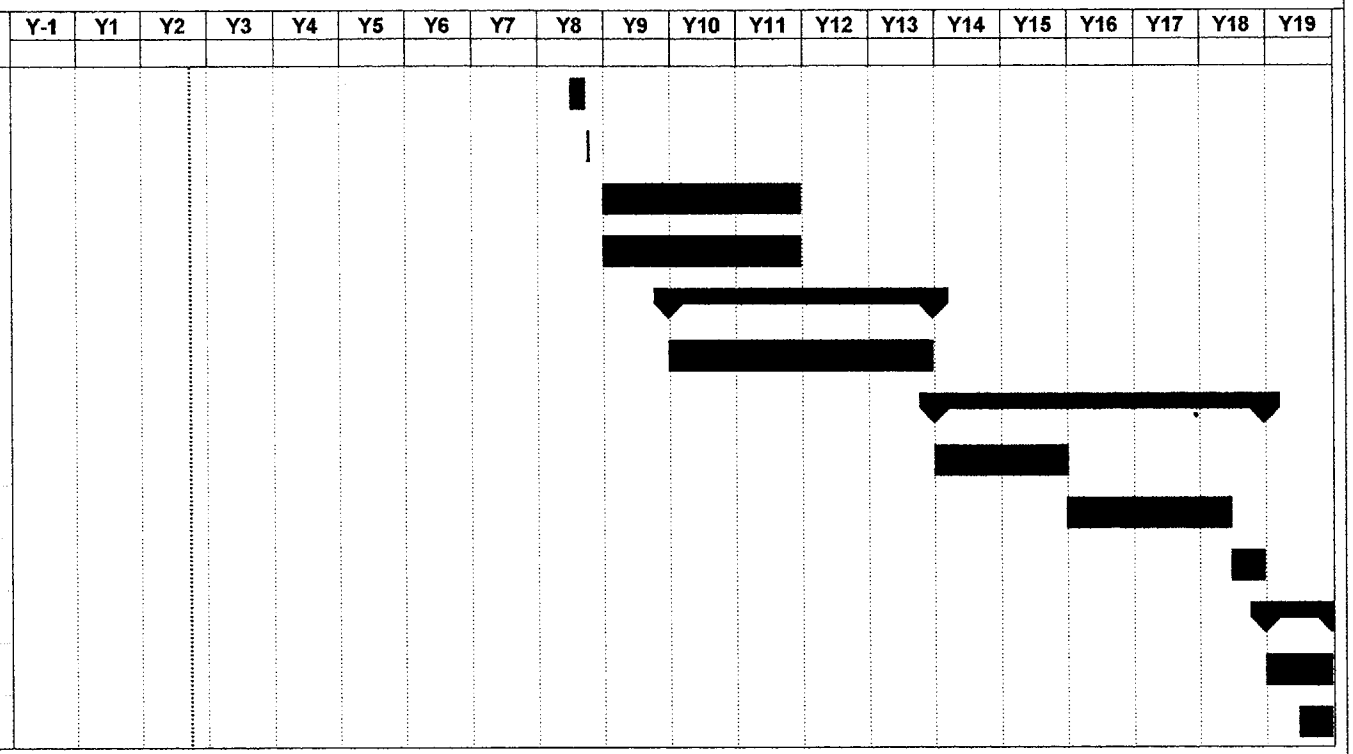


FIG 1-4
GAS HILLS PROJECT
OPERATIONS SCHEDULE

ID	Task Name
70	MU #5 Mon Wells Installed
71	MU #5 Pump Test
72	MU #5 Pipeline/Power Lines
73	MU #5 Well Installation
74	**MINE UNIT NO. 5 OPERATIONS**
75	MU #5 Operations
76	**MINE UNIT NO. 5 RESTORATION**
77	MU #5 GWS
78	MU #5 RO Phase
79	Stability/Sign Off
80	**MINE UNIT NO. 5 RECLAMATION**
81	Plug & Abandon
82	Surface Reclamation



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Addendum 2-1	BLM Correspondence related to grazing leases
Addendum 2-2	BLM Correspondence related to Cultural Resources

2. SITE CHARACTERISTICS

2.1 Site Location And Layout

The Gas Hills Project is located in Fremont and Natrona Counties, Wyoming approximately 45 miles east of Riverton and 65 miles west of Casper. The nearest population center is Jeffrey City located 25 miles south of the project. The area is remote and contains a low population density. The majority of people living in the area reside on widely dispersed ranches. The nearest residence is approximately 12 miles northeast of the Project site.

Access to the Project site from Riverton is via 40 miles of paved highway on Wyoming State Highway No.136 and five miles of graded road. From Casper, access is via 50 miles of paved highway on US 20/26 to Waltman, 25 miles of graded county road to the Fremont County line and five miles of existing graded road. Access from Jeffrey City is via 25 miles of existing mine haul road. State Highway No.136 is maintained year round. The other routes may be closed during inclement weather. (See Figure 1-1).

The Project site is located at the south end of the Wind River topographic basin, north of and adjacent to the Sweetwater Plateau. The boundary between these two geomorphic provinces is the Beaver Rim, which is a 500 to 700 feet high, north facing erosional escarpment. Elevations within the Amendment Area range from 6700 to 7400 feet above mean sea level, with the highest elevations being on top of the Beaver Rim.

Plates 1-1E and 1-1W show the location of the proposed ISL operations, including wellfields, satellite facilities, pump stations, roads, evaporation ponds, and access routes. These proposed facilities are described in detail in Chapter 3.

Plates 2-1 and 2-2 show surface and mineral ownership, respectively, within the Amendment Area, and within one half mile of the Amendment Area boundary.

Plate 1-2 shows the project location and access, rights -of-way and easements, abandoned oil and gas wells, overlapping WDEQ permit areas, political subdivisions (Natrona and Fremont county line) and existing power lines and oil and gas pipelines.

2.2 Uses of Adjacent Lands and Waters

Land surface within the Amendment Area is controlled primarily by the U.S. Bureau of Land Management (BLM) with small parcels of private and state lands scattered across the Amendment Area. There are no schools, hospitals, sports facilities, residential areas or parks within two miles of the Amendment area boundary. Several conventional uranium mines/mills exist both upwind and downwind within two miles of the Amendment area boundary. These facilities are in various stages of reclamation and decommissioning. Current

and historical use of the Amendment Area and the surrounding areas for more than two miles includes:

Uranium mining and milling: The Gas Hills Mining district has produced more than 100 million pounds of uranium over the last forty years. Three uranium processing facilities are located within close proximity of the Amendment Area, the UMETCO Minerals Corporation facility (UMETCO), the Pathfinder Mines Corporation facility (PMC), and the American Nuclear Corporation facility (ANC). These facilities and the conventional mines which delivered ore to them have been, or are in the process of being decommissioned and reclaimed. In addition to private sector mine reclamation, the State of Wyoming Abandoned Mine Lands Program (AML) has completed several mine reclamation projects in the area and continues to complete such projects.

Oil and gas production: There is currently no oil or gas production within the Amendment Area or within two miles of the Amendment Area boundary. Most of the historic oil and gas drilling activity took place on the Dutton basin Anticline, located approximately three miles northeast of the Amendment area. One wild cat well was drilled into the Ten Sleep formation within the Amendment Area in June 1997. This well did not produce economic quantities of oil and was abandoned. PRI purchased the well and converted it into a water well which is used for drilling and will also be used during site construction for compaction and dust suppression.

Limestone and Shale Quarries: Temporary limestone and shale quarries have been developed in the past by conventional uranium mine/mill operators to provide material for their tailings reclamation projects. The two most recent quarry operations are a limestone quarry, located approximately five miles north of the Amendment Area, and a shale quarry, located approximately ten miles north of the Amendment Area. There are no potential or current quarry operations within two miles of the Amendment Area.

Sheep and cattle grazing: The majority of the land surface is controlled by the BLM and is leased for grazing use. The Philp Sheep Company has the current grazing allotment within and surrounding the Amendment Area. Their allotment allows for 308 cattle between May 16 and October 30 and 3,858 sheep between September 1 and December 10 of each year. The Amendment Area represents approximately 22% of the grazing allotment or approximately 57 cattle and 733 sheep. (See Addendum 2-1). As the actual area to be disturbed and/or removed from grazing will be small compared to the total Amendment Area, impacts to livestock grazing will be minimal. These impacts are discussed in Chapter 7 of this application.

Livestock grazing is the only agricultural land use on or within two miles of the Amendment Area. The low annual precipitation rate and lack of irrigation water precludes the production of hay and grain crops. No vegetables or milk are produced on or within two miles of the Amendment Area boundary.

Recreation use: The area is used by the general public for recreational purposes including hunting and other outdoor activities.

Wildlife habitat: Wildlife habitat is also part of the land use in the area with Mule Deer and Pronghorn Antelope being the primary big game species.

From the 1960's to the early 1980's, areas within and adjacent to the Amendment Area were extensively mined for uranium using conventional surface and underground mining methods. The majority of uranium ore was recovered by surface mining methods. Within the Amendment Area boundary, approximately 20% of the total area has been previously disturbed by either underground or surface mining activities. In addition, exploration of the uranium resources in the area has disturbed the majority of those areas which will be disturbed by ISL wellfields. Plates 2-3E and 2-3W show the areas within and surrounding the Amendment Area that have been previously disturbed by mining activities.

There has been no conventional uranium mining in the area since the mid 1980's due to economic conditions. Current market conditions and the high capital costs involved make it doubtful that conventional methods will be used to recover uranium in this area in the near future. Any additional uranium recovery in the area will likely be by ISL methods.

2.2.1 Nearest Site Boundary

Table 2-1 provides the distances from the geographic center of the Amendment area to the Amendment area boundary for each of the 16 compass directions.

2.2.2 Nearest Residence

There are no permanent residences within two miles of the Amendment Area (see Table 2-2). The nearest downwind residence is located approximately 12 miles northeast of the

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and were designated as domestic or municipal wells at the time they were filed with the Wyoming State Engineer's Office (P501G, P557W, P558W, P559W, P439G). These wells were constructed to provide water supply to the man camps which were operational at the time the wells were drilled. None of these wells are currently being used as either domestic or municipal wells. Due to the remoteness of the location and the marginal quality of the water in the Wind River Aquifer, future domestic use of the ground water in the vicinity of the Amendment Area is unlikely.

Due to previous conventional mining operations in the Gas Hills and associated pit dewatering, cones of depression currently exist in and adjacent to the Amendment Area. Based on pre-mining water level elevations developed for Pathfinder's and Umetco's mining operations, and reported in their respective WDEQ permit documents, it is estimated that the Wind River Aquifer water levels within the Amendment Area are presently lowered from five feet to greater than 50 feet depending on proximity to the pits (see Appendix D-6). The proposed ISL operation will have a relatively small bleed rate resulting in minimal additional water level elevation depression. It is anticipated that no additional water level lowering of non-mining ground water rights will occur due to the proposed ISL operations. A slight decrease in the overall rate of recovery of the potentiometric surface from previous mining activities will be the most likely impacted. Sources and use rates are not anticipated to change over the life of the project and beyond. The post-project use will be the same as pre-project use, wildlife and livestock watering.

2.2.5 Abandoned Wells and Drill Holes

A computer database has been compiled listing the coordinates, elevation, depth drilled and completion date of all known exploration and development drill holes completed by previous mineral owners and PRI from the late 1950's to the present. This database has been included as addendum D5-3 of Appendix D5. Approximately 13,500 drill holes have been drilled within the Amendment Area. Plates D5-17E and D5-17Wof Appendix D5 show the locations of all known abandoned drill holes within the Amendment Area. Drill hole abandonment is discussed in detail in Chapter 3. Well abandonment is discussed in Chapter 6.

2.3 POPULATION DISTRIBUTION

The Amendment Area is located in a remote portion of Fremont and Natrona Counties, approximately 45 miles east of Riverton and 65 miles west of Casper. The nearest population center for which census data is available is Shoshoni, located approximately 40 miles northwest of the project. The population of Fremont and Natrona Counties, including the population centers of Casper, Riverton and Lander, have fluctuated since 1940. The population of the area peaked in the 1970's as a result of uranium mining and oil and gas activities. The downturn of both industries resulted in a population decline through the

1980's. This population fluctuation can be seen on Tables 2-2a and 2-2b which show decennial population figures for the state and the host counties and their cities and towns from 1940 to 1990.

Based upon current 1990 census information, Natrona County has a population of 61,226 and Fremont County has a population of 33,662.

Within 50 miles of the Project, Riverton is the largest population center with 9,202 people, based upon 1990 census data. Baroil, located approximately 37 miles south of the Project has a population of 228, based upon the 1990 census data. Jeffrey City reportedly has a population of less than 100.

Figure 2-2 shows the major population centers within 50 miles of the center of the Amendment Area. Concentric circles have been drawn at 1, 2, 3, 4, 5, 10, 20, 30, 40, 50, 60, 70 and 80 kilometers from the Project center. The radiating lines represent 22½ degree segments and coincide with the 16 major compass points.

Table 2-2 shows the population distribution as of the 1990 Census, for each of the segments depicted on Figure D1.1. Table 2-2c provides population estimates for Wyoming and Fremont and Natrona Counties, from 1991 through 1998. Table 2-2d provides population estimates for towns in Fremont and Natrona Counties from 1991 through 1997. Table 2-2e provides populations through 2008 for Wyoming, Fremont and Natrona Counties, and their respective towns and cities.

2.4 HISTORIC, ARCHAEOLOGICAL, ARCHITECTURAL, SCENIC, CULTURAL, AND NATURAL LAND MARKS

2.4.1 Archaeological Resources

2.4.1.1 General

A Class III Cultural Resources Inventory was performed over most of the Amendment Area in 1992. This inventory included the re-examination of sites previously inventoried for the WDEQ Permit to Mine 438 located in the Buss area. The 1992 survey, which identified over 30 potential sites, was reviewed by the BLM Lander Resource Office, and four sites were determined to be potentially eligible for nomination to the National Register of Historic Places (NRHP) (see Attachment 2-2 of this Chapter). One site was determined to be eligible for NRHP status. Locations of inventoried sites are shown on Figure 2-3.

Site 48FR3232 contains several stone circle and hearth features and is located in an area that will contain an ISL wellfield. PRI worked with the WDEQ and US BLM during 1997 and 1998 to mitigate potential disturbance by PRI's mineral development drilling activities. In February 1998, Native America Elders were brought to the site to perform an assessment.

The Native America Elders indicated that the features represented prayer or vision quest circles. They requested that all surface disturbances be kept 50 feet away from the site features. PRI agreed to this and abandoned several planned drill hole locations located within 50 feet of the features. This action is documented in a letter dated March 4, 1998 from the US BLM to the Wyoming SHPO who acknowledged concurrence on March 13, 1998. A copy of this letter is provided in Addendum 2-2.

2.4.1.2 1997 Program

In May 1997, an intensive Class III cultural resource inventory was conducted for the 2840 acres located within the western portion of the Amendment Area which had not been previously inventoried. The purpose of the inventory was to locate, record, and evaluate all visible cultural resources within the Amendment Area and to evaluate the eligibility of all discovered sites for nomination to the NRHP.

At the conclusion of the inventory, a total of 36 sites, including 14 isolated artifacts were identified and recorded. These are shown on Figure 2-4.

All of the sites encountered, except site 48FR3874 , are not considered eligible for inclusion to the NRHP. This was determined by the density of the artifacts discovered, the type of soils within the site boundary, the potential for contributing significant data important to the prehistory of the area, and shovel tests. The shovel tests were conducted to better define the soil stratigraphy and to determine if any buried cultural materials might be present.

Site 48FR3874 is considered eligible for inclusion to the NRHP. This site appears to contain information important to the understanding of stone circles. Site 48FR3874 located on private land, consists of a single stone circle. However, there is a possible hearth feature located in the eastern portion of the circle. The site is near a proposed pipeline right of way between a proposed satellite and Mine Unit No. 3. No surface disturbance will occur at this site until the required mitigation and site clearance has been received from the WDEQ and US BLM.

The location of all eligible and unknown status sites, and their relationship to proposed disturbed areas, are shown on plate D3-1 of the May 1996 application. This plate is incorporated into this document by reference.

2.4.1.3 Mitigation

Prior to development in any areas containing eligible or unknown eligibility, cultural, and paleontological sites, PRI will notify WDEQ and US BLM and request an evaluation of the site. Should mitigation action be necessary, PRI will work with the WDEQ and US BLM to develop an acceptable plan for protecting or removing the resource. Disturbance of the

area will not take place until written authorization to proceed has been issued by the US BLM and WDEQ.

2.4.2 Architectural, Scenic, Cultural and Natural Landmarks

Of the 56 sites located within Fremont and Natrona counties that are listed on the NRHP none are within five miles of the proposed Project site. The closest listed site, the Castle Gardens Petroglyph Site, is approximately 14 miles northwest of the Project Site. The nearest unique natural landmark is Hell's Half-Acre, located approximately 27 miles northeast of the Project site.

Based on the review of the NRHP and available Wyoming State Cultural Resources information, the Project will have no adverse impact on any listed Federal or State historic place, scenic or cultural feature or natural landmark.

2.5 METEOROLOGY

2.5.1 General

The climate of the Gas Hills District is generally classified as semiarid and cool and is influenced by elevation, topography and distance from the oceans. Wyoming is in the latitudes of prevailing westerly winds. Air movement in this direction is most pronounced during the winter, causing greater precipitation on the western slopes of mountains. During the spring and summer, circulation patterns bring moist air and precipitation to Wyoming from the Gulf of Mexico. In the summer, when the air is generally much warmer and thus higher in moisture-carrying capacity, precipitation often evaporates before it reaches the ground. Summers are mild with warm to hot days and cool nights. Winters are harsh with cold temperatures, high winds and infrequent blizzards. Warm days and cold nights are experienced during both spring and fall; wet heavy snowfalls can be expected in both of these seasons. The growing season is between 90 and 120 days long, from late May to early September. July is typically the warmest month and January the coldest.

A National Weather Service (NWS) station, Gas Hills 4E, is located in the Gas Hills. Data has been acquired for the period of September, 1962 through July, 1996 (Wyoming Water Research Institute, University of Wyoming). Data from the Gas Hills NWS Station has been utilized for site characterization by the three existing nuclear fuel facilities (conventional uranium mills) in the Gas Hills area adjacent to the proposed Amendment Area. The Gas Hills NWS Station records temperature and precipitation data only. The nearest complete NWS stations are at Lander, located 55 miles west of the Project site, and Casper, located 58 miles east of the Project site. The data from the Lander station would not be representative of the Gas Hills because of its sheltered position near the Wind River Mountains. Wind

2.5.6 Evaporation

Evaporation data is not recorded at the site. The nearest NWS recording station for evaporation is Pathfinder Reservoir, some 60 air miles from the site. Average lake evaporation is estimated at 42 inches annually.

2.6 GEOLOGY AND SEISMOLOGY

A detailed description of the regional and Amendment Area geology and seismology is provided in Appendix D5. Appendix D5 is an exact reproduction of the Appendix D5 submitted to the Wyoming Department of Environmental Quality - Land Quality Division and follows the current format required for submission to the Wyoming Department of Environmental Quality - Land Quality Division, based on 1993 Noncoal Rules and Regulations and Wyoming Department of Environmental Quality - Land Quality Division Guideline No. 4, "In-situ Mining." This section was not formatted according to USNRC Regulatory Guide 3.46, dated June, 1982, since the Wyoming requirements are more extensive than those of the USNRC. The only item specified in USNRC Regulatory Guide 3.46 which has not been included is an isopach map of the intended zone of injection or production and associated confining units. Plates D5-9 through D5-22 submitted with the May 1996 application are isopachs of the confining units and aquifers at the Gas Hills Project. These plates are incorporated into this document by reference. Also, plate D5-23 of the May 1996 Application, a seismic epicenter location map is incorporated by reference into this application document.

2.7 HYDROLOGY

A detailed description of the regional and Amendment Area hydrology is provided in Appendix D6. Appendix D6 is an exact reproduction of the Appendix D6 submitted to the Wyoming Department of Environmental Quality - Land Quality Division and follows the current format required for submission to the Wyoming Department of Environmental Quality - Land Quality Division, in accordance with 1993 Noncoal Rules and Regulations and Wyoming Department of Environmental Quality - Land Quality Division Guideline No. 4, "In-situ Mining." This section was not formatted according to USNRC Regulatory Guide 3.46, dated June, 1982, since the Wyoming requirements are more extensive than those of the USNRC. Appendix D6 defines surface and ground water hydrologic baseline conditions. Operational controls and potential ground water impacts are described in Chapter 3.

2.8 ECOLOGY

The current Wyoming Department of Environmental Quality, Land Quality Division (WDEQ/LQD), Noncoal Rules and Regulations, 1993, require a variety of baseline ecological studies. WDEQ/LQD regulations require submittal of these ecological studies as appendices

TABLE 2-2
GAS HILLS PROJECT
POPULATION DISTRIBUTION

Kilometers	N (0.0°)	NNE (22.5°)	NE (45.0°)	ENE (67.5°)	E (90.0°)	ESE (112.5°)	SE (135.0°)	SSE (157.7°)	S (180.0°)	SSW (202.5°)	SW (225.0°)	WSW (247.5°)	W (270.0°)	WNW (292.5°)	NW (315.0°)	NNW (337.5°)	TOTAL
0.0-1.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.0-2.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.0-3.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.0-4.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.0-5.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.0-10.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10.0-20.0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
20.0-30.0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4
30.0-40.0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	4	4	20
40.0-50.0	8	29	10	0	0	0	0	10	0	100	4	0	4	4	4	5	178
50.0-60.0	8	12	70	0	0	0	0	0	0	0	20	5	0	0	4	10	129
60.0-70.0	8	12	9	0	0	0	0	50	230	0	12	12	4	0	685	8	1030
70.0-80.0	4	0	8	5	80	0	10	0	0	0	8	8	9000	200	16	16	9355
TOTAL	36	61	101	5	80	0	10	60	230	100	44	25	9008	204	713	43	10720

NOTES:
1. Distance in kilometers from center of Project area
2. Population shown as total persons in each sector based on 1990 Census data

Source: US Bureau of the Census

Table 2-2a
Historical Decennial Census Population
of Wyoming
and Fremont and Natrona Counties: 1940-1990

Area Name	1940 Census	1950 Census	1960 Census	1970 Census	1980 Census	1990 Census
Wyoming	250,742	290,529	330,066	332,416	469,557	453,588
Fremont Co.	16,095	19,580	26,168	28,352	38,992	33,662
Natrona Co.	23,858	31,437	49,623	51,264	71,856	61,226

Source: US Bureau of the Census

Table 2-2b
Historical Decennial Census Populations for Cities and Towns in Fremont and Natrona Counties: 1940-1990

City/Town	County	1990 Census	1980 Census	1970 Census	1960 Census	1950 Census	1940 Census
Bar Nunn	Natrona	835	N/A	N/A	N/A	N/A	N/A
Casper	Natrona	46,742	51,016	39,361	38,930	23,673	17,964
Dubois	Fremont	895	1067	898	574	279	412
Edgerton	Natrona	247	510	350	512	203	232
Evansville	Natrona	1,403	2,335	832	678	393	206
Hudson	Fremont	392	514	381	369	293	330
Lander	Fremont	7,023	7,867	7,125	4,182	3,349	2,594
Midwest	Natrona	495	638	N/A	N/A	N/A	N/A
Mills	Natrona	1,574	2,139	1,724	1,477	866	379
Pavillion	Fremont	126	287	181	190	241	176
Riverton	Fremont	9,202	9,562	7,995	6,845	4,142	2,540
Shoshoni	Fremont	497	879	562	766	891	226

N/A, Not available.

Table 2-2c
Annual Population Estimates of Wyoming and Fremont and Natrona Counties: July 1, 1991 to July 1, 1998

Area Name	7/1/91 Estimate	7/1/92 Estimate	7/1/93 Estimate	7/1/94 Estimate	7/1/95 Estimate	7/1/96 Estimate	7/1/97 Estimate	7/1/98 Estimate
Wyoming	457,768	463,519	469,065	474,894	478,364	480,060	480,043	480,907
Fremont Co.	34,098	34,251	34,711	35,080	35,607	35,851	35,959	36,044
Natrona Co.	61,885	62,317	62,850	63,804	63,807	63,643	63,635	63,341

Source: Wyoming Department of Administration and Information

Table 2-2d
Annual Population Estimates for Cities and Towns in Fremont and Natrona Counties: 1991 - 1997

Area Name	1991 Estimate	1992 Estimate	1993 Estimate	1994 Estimate	1995 Estimate	1996 Estimate	1997 Estimate
Fremont County							
Dubois	907	916	940	962	1,003	1,018	979
Hudson	395	398	402	405	411	411	415
Lander	7,077	7,068	7,131	7,191	7,302	7,372	7,403
Pavillion	126	127	128	129	131	135	133
Riverton	9,405	9,473	9,643	9,797	9,962	10,050	9,963
Shoshoni	500	504	510	513	520	522	526
Natrona County							
Bar Nunn	845	851	860	872	876	879	871
Casper	47,325	47,689	48,125	48,914	48,867	48,800	48,718
Edgerton	248	249	251	255	254	254	255
Evansville	1,497	1,505	1,518	1,537	1,540	1,541	1,538
Midwest	497	497	497	500	495	489	503
Mills	1,592	1,601	1,613	1,635	1,642	1,648	1,638

Table 2-2e
Population Projections for Wyoming and Fremont and Natrona Counties, Cities, and Towns: 1998-2008

Area Name	1998 Forecast	1999 Forecast	2000 Forecast	2001 Forecast	2002 Forecast	2003 Forecast	2004 Forecast	2005 Forecast	2006 Forecast	2007 Forecast	2008 Forecast
Wyoming	480,960	482,800	485,590	488,620	491,370	493,880	496,040	498,090	500,120	502,330	504,350
Fremont County	36,010	36,180	36,420	36,670	36,910	37,130	37,320	37,500	37,680	37,880	38,060
Dubois	983	987	994	1,001	1,007	1,013	1,018	1,023	1,028	1,034	1,039
Hudson	417	419	421	424	427	430	432	434	436	438	440
Lander	7,428	7,463	7,512	7,564	7,613	7,659	7,698	7,735	7,772	7,814	7,851
Pavillion	134	134	135	136	137	138	138	139	140	140	141
Riverton	9,997	10,044	10,111	10,180	10,247	10,308	10,360	10,410	10,460	10,516	10,566
Shoshoni	528	531	534	538	541	544	547	550	552	555	558
Natrona County	63,690	63,820	64,080	64,370	64,620	64,840	65,000	65,160	65,310	65,480	65,620
Bar Nunn	872	874	877	881	885	888	890	892	894	897	898
Casper	48,758	48,858	49,057	49,279	49,470	49,639	49,761	49,883	49,998	50,128	50,236
Edgerton	255	255	256	257	258	259	260	261	261	262	262
Evansville	1,540	1,543	1,549	1,546	1,562	1,567	1,571	1,575	1,579	1,583	1,586
Midwest	503	504	506	508	510	512	513	515	516	517	518
Mills	1,639	1,643	1,650	1,657	1,663	1,669	1,673	1,677	1,681	1,686	1,689

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ADDENDA

ADDENDUM 3-1	Federal Register
ADDENDUM 3-2	Ground Water Modeling
ADDENDUM 3-3	HEC-1 Data
ADDENDUM 3-4	Evaporation Pond Hydrology
ADDENDUM 3-5	COE Wetlands Correspondence

The AML Road intersects the Carol Shop Road in the vicinity of the Carol Shop. Within the limits of WDEQ Permit to Mine 438, held by PRI, reclamation of the Carol Shop Road is bonded in accordance with an approved reclamation plan. The reclamation bond for this road will be transferred to the Gas Hills Project's surety bond and is accounted for in the surety calculation provided in Chapter 6.

3.2.1.3 Existing Buildings and Facilities

The Carol Shop will house project offices, water treatment facilities and other ancillary facilities. Decommissioning of the Carol Shop and reclamation of surface disturbances is currently bonded in accordance with an approved reclamation plan for WDEQ Permit to Mine 438, held by PRI. The reclamation bond for reclaiming this area will be transferred to the Gas Hills Project's Surety Bond and is accounted for in the surety calculation provided in Chapter 6.

3.2.1.4 Wetlands

Potential wetlands are discussed in Section 4.1.8 of Appendix D8 and Appendix D11. The mapping of potential wetlands was based solely on the presence of facultative and obligate vegetation. Approximately 28 acres of potential wetlands were identified within the permit area, based on the vegetative criteria. A jurisdictional wetlands determination would likely delineate less acreage due to the additional soil and hydrological characteristics that must be met in order to meet the definition of a wetland. With the exception of West Canyon Creek, all potential wetlands are located outside of the proposed production areas.

A representative of the U.S. Army Corps of Engineers (COE) visited the site on October 6, 1998, to perform a jurisdictional wetland determination and recommended that all wetlands be avoided wherever possible (see Addendum 3-5). In general, disturbances of wetland areas within the limits of the proposed production areas will be avoided. If it becomes apparent that a potential wetland area(e.g., West Canyon Creek) may become affected during the operation, the COE will be contacted prior to any disturbance. The most likely type of disturbance would be a road and/or pipeline crossing. According to the COE, these types of activities can be completed under the provisions of Nationwide Permits 12 and 14 (see Addendum 3-5). Wetlands mitigation plans will be developed for approval by, and coordination with, the WDEQ and COE.

3.2.1.5 Wildlife Monitoring

The occurrence and relative distribution of wildlife at the project site is discussed in Appendix D9. It is not anticipated that ISL related activities at the Gas Hills Project

will cause significant adverse impacts to wildlife at or near the project site because of the limited surface disturbance and areal extent of the proposed activities.

Based on ISL operating experience, it is not anticipated that ISL activities will adversely impact any raptor nests, or disturb a nesting raptor, since activities are limited to relatively small areas for relatively short periods of time. Of the known active nest sites, only four are located near proposed wellfields and satellite locations.

During operations, a raptor nest survey will be conducted in late April or early May of each year to identify any new nests and assess whether known nests are being utilized. The survey will cover all areas of planned activity for the life of the mine (wellfields, satellite, etc.) and a one mile area around the activity. Status and production at known nests will be determined, if possible. This survey program will be primarily intended to protect against unforeseen conditions, such as the construction of a new nest in an area where operations may take place.

3.2.1.6 Wildlife Mitigation Programs During Operations

Adverse impacts to wildlife as a result of the proposed project activities will be minimal for the following reasons:

1. No unique or critical habitats are present within the Amendment Area;

2. No important wildlife migration routes are contained within the Amendment Area (see Appendix D9);

3. ISL activities disturb relatively minor amounts of land surface (approximately 15% of the total Amendment Area);

4. Areas disturbed by wellfield activities will be revegetated after wellfield construction and will be available for wildlife use throughout the project life;

5. Restrictive fencing will be limited to relatively small areas, which will not significantly impede wildlife movements; and

6. Vehicular traffic will be limited with reduced speed limits utilized for safety purposes and to decrease the likelihood of vehicle and wildlife collisions.

Specific commitments for wildlife protection and wildlife monitoring follow:

Threatened and Endangered Species - In the case that a threatened or endangered species not reported in the baseline study (Appendix D9) begins to use the Amendment Area or adjacent areas, the Wyoming Field Office of the U.S. Fish and Wildlife Service will be notified.

Raptor nests - In the unlikely event that it is necessary to disturb a raptor nest, a permit for a mitigation plan will be acquired from the U.S. Fish and Wildlife Service, and the Wyoming Game and Fish Commission. Annual raptor nest surveys will be completed to identify any new nests or changes in raptor activity.

Power line Construction - New power lines will be constructed to minimize potential electrocution hazards to raptors by following the guidance in "Suggested Practices for Raptor Protection on Power Lines - The State of the Art in 1996," by the Avian Power Line Interaction Committee (APLIC), 1996.

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5. Upon completion of wellfield installation, disturbed areas within the wellfield will be revegetated at the first available seeding window (spring or fall of each year); and

6. During wellfield operation, traffic will be restricted to the defined access corridors. Should there be any disturbance outside the defined access corridors, the disturbed area will be reclaimed as soon as possible.

As additional measures to minimize surface disturbance from wellfield operations, the use of Low Ground Pressure (LGP) vehicles may be used, particularly during inclement weather or periods of excessive soil moisture.

3.2.1.10 Fugitive Dust Control

Unlike conventional mine sites, fugitive dust emissions are minimal at ISL Project sites. Dirt moving equipment, haul roads and large excavations are not used. Disturbed areas within each mine unit will be revegetated during the first available seeding window after construction is complete to minimize soil loss and fugitive dust emissions to the atmosphere. All roads will either be unconstructed light-use two-track roads or narrow (ie., 12-15 feet wide) access roads. Primary equipment used will consist of light duty trucks. Speed limits on wellfield roads will be limited to 10 mph which will minimize the dust raised by vehicular traffic. PRI does not anticipate that additional dust control measures beyond those discussed above will be necessary at the Gas Hills Project site.

3.2.1.11 Weed Control

During operations and following surface reclamation, noxious weeds will be controlled, as needed, using herbicides. This will occur on an annual basis and continue until bond release is obtained. Herbicide application will be conducted throughout the Amendment Area, both within and outside those areas disturbed by mining activities.

Plant species that are considered designated or prohibited noxious weeds by the State of Wyoming and that may be targeted include field bindweed, Canada thistle, leafy spurge, perennial sowthistle, quackgrass, hoary cress (whitetop), perennial pepperweed, ox-eye daisy, skeletonleaf bursage, Russian knapweed, yellow toadflax, dalmatian toadflax, scotch thistle, musk thistle, common burdock, plumeless thistle, dyers woad, houndstongue, spotted knapweed, and diffuse knapweed.

The types of herbicides used will depend on the target species and recommendations from County Weed & Pest Control personnel. Application methods will be site-specific, but typically consist of spraying by hand or broadcast application using truck-mounted spraying equipment.

3.2.1.12 Surface and Ground Water Environmental Monitoring Program

Effects on surface water quality and quantity will be minimal at the Gas Hills Project. With the exception of West Canyon Creek, most drainages throughout the property are ephemeral in nature and flow only intermittently in response to spring run-off or occasional strong thunderstorms.

Initially, three surface water sites and one ground water site will be routinely monitored during the project life. These will include the following:

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access to the wellfields. Approximately 7,250 linear feet of secondary access roads will be constructed outside the wellfield along with approximately 11,000 linear feet of internal wellfield access roads as shown on Plate 3-6. Each header house and associated heavily used area will disturb a surface area of approximately 100 by 100 feet or one quarter of an acre. All suitable topsoil from the newly constructed access roads and from the area of the header houses will be salvaged and stockpiled for final reclamation. Table 3-8 provides the estimated topsoil volumes which will be salvaged from these areas of disturbance and the estimated acreage of disturbance necessary to operate Mine Unit No. 1.

3.5.2.2 Environmental Considerations

Potential environmental considerations for wellfield development include wetlands, wildlife, threatened and endangered plant and animal species, and archaeological sites. Within Mine Unit No. 1:

1. No wetlands have been delineated;

2. No critical wildlife habitat has been delineated;

3. No threatened or endangered plant or animal species have been identified;

4. No raptor nests are known to exist within Mine Unit No. 1. Several ferruginous hawk nests, a great horned owl nest, and a prairie falcon nest are located within 0.5 miles of the Mine Unit No. 1 boundary. All nest sites and other potential habitat for raptors will be monitored annually; and

5. One potentially significant archaeological site has been located near the eastern boundary of Mine Unit No. 1. Site 48FR3232, discussed in Chapter 2, will receive cultural clearance from BLM prior to any surface disturbance, or will be avoided.

3.5.2.3 Hydrologic Control Features

Design level hydrology and hydraulic design have been completed for the primary access road and Mine Unit No.1 secondary access roads. A similar level of design analysis will be completed for other proposed mine units when these areas begin the design phase. As part of this analysis, nineteen culvert crossing locations were identified on two access roads within Mine Unit No. 1. The roads which were considered for this analysis included: the Carol Shop Road and the Mine Unit No. 1 access road. The Carol Shop Road has been used for other mining operations in the Gas Hills and numerous culvert crossings have been installed. However many of the culverts are undersized and have deteriorated and require replacement. The Mine

ADDENDUM 3-5

COE WETLANDS CORRESPONDENCE

XC PLH
MBW
MSC
File RR-9
ORIG FILE GH-9

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
215 NORTH 17TH STREET
OMAHA, NEBRASKA 68102-4978

REPLY TO
ATTENTION OF

October 30, 1998

Wyoming Regulatory Office
2232 Dell Range Blvd., Suite 210
Cheyenne, Wyoming 82009

Mr. Paul Hildebrand
Power Resources, Inc.
800 Werner Court
Casper, Wyoming 82601

Dear Mr. Hildebrand:

This is in reference to our October 5 and 6 site visits to your proposed uranium mining proposals at the Ruby Ranch site (File No. **199840354**) as well as the Gas Hills site (File No. **199840356**). The sites are contained in Section 31 and 32 as well as 5-8 and 18, Townships 43 and 44N, Range 74W, Campbell County and Sections 1-3, 10-12; 21, 22, 27-29, 31-34, Townships 32 and 33N, Ranges 89 and 90W, Fremont and Natrona Counties, Wyoming.

Both proposed projects entail the construction of wellheads, access roads, and pipelines which may impact wetlands and other waters of the U.S. I reviewed the wetland and waters delineation at the Ruby Ranch site. Revisions are needed to the data sheets following Wyoming Regulatory Office protocols as detailed in the enclosed guidance. Additionally, the delineation map needs to identify all waters of the U.S., including ephemeral and intermittent channels and stockponds constructed on those features. The wetland areas identified on the map are an accurate representation. The Gas Hills site contains mostly ephemeral draws as well as wetlands which are confined to West Canyon Creek. Cameron Spring and Canyon Creek Reservoirs occur within the proposed permit boundary.

It is strongly encouraged that all wetland areas at both sites, as well as Cameron Spring and Canyon Creek Reservoirs at the Gas Hills site, be avoided relative to filling activities, especially with well head placement and pad areas. Pipeline crossings and road placement can be accomplished under the provisions of Nationwide Permits 12 and 14. I have enclosed fact sheets relative to these two permits for your information. Once project design is more formal and you intend to place dredge and/or fill material into waters of the U.S., (the ephemeral and intermittent draws, wetlands, and/or reservoirs) please contact this office for further coordination. Although formal contact is not always required, it is strongly encouraged coordination occur to ensure compliance with regulatory requirements.

If you have any questions concerning these actions, please contact me at (307) 772-2300. Please reference File Nos. **199840354** and **199840356** in any future correspondence concerning these projects.

Sincerely,

Chandler J. Peter
Project Manager
Wyoming Regulatory Office

Enclosures

Copies furnished: (w/o enclosures)

Chris Lidstone
Lidstone & Anderson
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6.4.5 Vegetative Success Criteria

The success of revegetation in meeting land use and reclamation success standards will be assessed prior to application for bond release by utilizing the "Extended Reference Area" method as detailed in WDEQ-LQD Guideline No. 2 - Vegetation (March 1986) and Chapter III of the WDEQ-LQD Rules and Regulations. This method compares, on a statistical basis, the reclaimed area (percent vegetation cover, percent total ground cover, and total herbaceous production) with adjacent undisturbed areas of similar vegetation type (Refer to Appendix D8).

Appendix D8 and Plates D8-1E and D8-1W describe and illustrate the proposed extended reference areas. These areas were selected in coordination with WDEQ personnel (Refer to correspondence Addendum D8-1 of Appendix D8). Appendix D8 also provides baseline cover and productivity data for the proposed mine units and the extended reference areas.

Revegetation will be considered successful when such surveys, completed following reclamation, demonstrate equal or greater vegetative cover and productivity in the reclaimed areas when compared to the extended reference areas.

As discussed in Appendix D8, the number of trees is very limited within the Amendment Area and consists of a small group of cottonwoods (Populus angustifolia) along the upper portion of West Canyon Creek and scattered junipers (Juniperus scopulorum) and Limber Pines (Pinus flexilis) on ridges, hilltops and in steep draws. Because of the limited surface disturbance associated with the ISL technique, it is not anticipated that the proposed activities will adversely affect any trees. However, in the unlikely event that any trees are removed, they will be inventoried and replaced in kind, based on approval by the WDEQ-LQD.

6.4.6 Fencing

All fencing installed will be of a temporary nature to protect the wellfield areas during operations and to protect vegetated areas following reclamation. Fence design and specifications shown on Plate 6-2 follow BLM specifications as they are the dominant land owner within the Amendment Area. Upon demonstration of vegetative success and bond release, the temporary fencing will be removed.

6.5 SURETY ARRANGEMENTS

6.5.1 General

PRI will establish and maintain appropriate surety arrangements with the WDEQ covering the costs of ground water restoration, facility decommissioning and surface reclamation for the areas and facilities involved. This surety will be reviewed on an annual basis and adjusted as

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7.2 Construction and Operational Effects

7.2.1 Land Impacts

Of the approximately 8500 acres within the Amendment Area, less than 1275 acres are proposed to be disturbed by buildings, roads, ponds, and wellfield development (i.e., less than 15% of the total Amendment Area). Approximately 140 acres of the Amendment Area have been previously disturbed by conventional mining activities.

The main office will be located in the existing 21 acre Carol Shop complex. Additional surface disturbance is not anticipated to accommodate planned facilities at this location. A second satellite facility will be located at one of the two locations shown on Plate 1-1W, and will disturb approximately two acres. The proposed solar evaporation ponds will disturb approximately 15 acres.

Main site access to the Project site is discussed in Chapter 2, and shown on Plate 2-3. Approximately 3300 linear feet of main access road will be constructed to allow access to the alternate satellite location described above. Plate 3-3 shows design and maintenance requirements for all main and secondary access roads.

To control access and to prevent livestock damage to wells and facilities, all wellfields, evaporation ponds and Satellite facilities will be fenced. With the exception of the evaporation ponds, fence construction will be such that wildlife grazing activities will not be affected. Because of the potential damage to synthetic pond liners by deer and antelope and the radionuclide content of the waste water, deer and antelope proof fencing will be constructed around the evaporation ponds.

No habitat or forage for waterfowl will be established in the evaporation ponds and no sediment is expected at the bottom of these ponds. Therefore, significant use of the ponds by waterfowl for nesting or foraging is not expected. The evaporation ponds will be routinely inspected during operations. If it is determined that waterfowl are using the ponds for nesting or foraging, the need for design measures (e.g., netting) to prevent waterfowl use of the ponds will be evaluated.

Mine unit wellfield installation activities will cause the majority of the land surface impacts at the Gas Hills Project. Even so, this disturbance will be temporary and much less severe than surface disturbance caused by conventional open pit mining. The surface disturbance caused by the installation of mine unit wellfields will be reclaimed and returned to grazing use sequentially once ground water restoration and final surface reclamation has been achieved. Mine units will continue to be installed throughout the life of the project to maintain the Satellite flow and uranium recovery rates. As the first mine unit becomes depleted of uranium (ie, mined out), ground water restoration will commence and continue sequentially through the proposed mine units as areas are mined out. Additionally, all mine

unit wellfields will be revegetated during the first available seeding window after construction has been completed. These areas will be available for wildlife grazing during the life of the operation.

Each mine unit could be removed from livestock grazing use for up to nine years before final surface reclamation is performed. This includes approximately four years for mining, and up to five years for ground water restoration and stability monitoring (see Figure 1-4). After final surface reclamation has been achieved, these areas will be returned to livestock grazing use.

Over the anticipated 20 year life of the Project, it is estimated that up to approximately 1275 acres of range land will be removed from livestock grazing use. Because of the sequential nature of the ISL process, it is estimated that only approximately 50% of the total potential disturbed area will be disturbed (ie, approximately 640 acres) and removed from livestock grazing use at any one time. Considering a worse case basis is that the entire 1275 acres are taken out of livestock grazing use for the 20 year project life, this would mean a total of 122 animal unit months would be removed from livestock grazing use. In the Gas Hills, this would be a loss of grazing capacity for approximately 26 cows per year. All of the surface impacts will be temporary and reversible by returning the land surface to its former grazing use by post-ISL surface reclamation.

Topsoil and wetlands protection erosion control and wildlife monitoring and mitigation measures are discussed in section 3.2.1 of Chapter 3. Waste disposal procedures are discussed in Chapter 4.

The proposed project will not adversely impact the recreational use of the Gas Hills area, which is primarily big game hunting. The acre encompassed by the Amendment Area boundary is very small compared with the hundreds of square miles of available hunting area. Additionally, because there are few big game animals present in the area, hunting is limited by quota to only 40 licenses and two weeks each year for deer and 75 licenses and one month each year for antelope. The area is closed to elk hunting. It is probable that, due to PRI's revegetation practices, large game animals may be attracted into the area over the project life thereby enhancing the overall recreational hunting value of the area.

7.2.2 Vegetation Impacts

The greatest impact to vegetation will be in the wellfield areas during wellfield construction. This impact will be of a temporary nature as each wellfield will be reseeded after construction activities are completed. Experience at other ISL projects shows that these areas provide as good or better wildlife habitat after reclamation as native areas. Proposed revegetation practices are provided in section 3.2.1.9 of Chapter 3, and Section 5 of Chapter 6.

7.2.3 Cultural Resources Impacts

As discussed in Chapter 2, class III cultural resource surveys have been performed over the Amendment Area and submitted to the USBLM and WDEQ for review. Proposed mitigation actions for cultural resource impacts are provided in Section 3 of Chapter 2, and will be in accordance with US BLM and Wyoming State Historic Preservation Office (SHPO) requirements.

7.2.4 Air Impacts

Air quality impacts which may result from construction and operation activities will be primarily fugitive dust and engine exhaust emissions. Based on experience at other ISL facilities, these types of emissions are not expected to be significant.

Exhaust from diesel drilling rigs and gasoline powered service vehicles will produce small amounts of carbon monoxide, sulfur dioxide and other internal combustion engine emissions. These will be dispersed rapidly and will not exceed air quality standards.

Travel on unpaved roads and wellfield construction activities will result in minor emissions of fugitive dust. These will be intermittent and should not represent significant air emission impacts. The proposed wellfield reclamation/revegetation practices will minimize fugitive dust releases from these areas. Fugitive dust control measures are also discussed in Section 3.2.1 of Chapter 3.

During operations, small amounts of gaseous oxygen, carbon dioxide and/or radon may be emitted from the wellfields and the satellites. These emissions will be readily dispersed in the atmosphere and will not create an adverse impact.

7.2.5 Water Impacts

Impacts on surface and ground water by the proposed ISL activities will be temporary and short term in nature, unlike conventional mining when large and permanent alterations to the hydrologic regime are common.

7.2.5.1 Surface Water

Proposed ISL activities will have negligible effect on surface water resources in the area. Additionally, unlike conventional surface mining activities, few, if any, stream diversions will be needed, and stream channels will not be significantly impacted. Additionally, all streams in the vicinity of planned activities are ephemeral in nature and only flow in direct response to infrequent large precipitation events or large snowmelt events.

It will be necessary to cross small ephemeral stream channels with wellfield piping and light use wellfield roads. All piping will be buried under the stream channel, thereby minimizing any impacts. The pre-existing stream channel configuration will be re-established and vegetation seeding will occur as soon as possible after construction. Culverts will be installed in all road crossings where fill material is utilized. Conventional erosion control methods such as mulching, straw bale dikes, and porous rock check dams will be utilized in these areas if necessary. No stock ponds should be affected by the proposed activities. Surface water monitoring is discussed in Section 3.2.1 of Chapter 3. Pollution control measures are discussed in Section 3.4 and 3.5 of Chapter 3.

7.2.5.2 Ground Water

Potential impacts to ground water systems within and near the wellfields will be minimal and short term. Unlike conventional mining activities, which often result in massive dewatering or total elimination of intersected aquifers, ground water levels at the Gas Hills Project will only be minimally affected within and near operating wellfields. Although ISL activities will change the quality of the ground water within the production zone of operating wellfields, operational controls and ground water monitoring will insure that injection fluids stay within the identified production zone (see Chapter 3).

Additionally, existing regulatory requirements for ground water restoration will adequately protect the quality of affected ground water resources. Wellfield ground water restoration is discussed in Chapter 6. In summary, after ISL and ground water restoration activities are completed, the ground water quality will be similar to pre-existing conditions and will be suitable for the same pre-existing uses, or potential uses.

7.2.6 Impacts to Human Populations

As discussed in Chapter 2, the nearest permanent residence is located approximately 12 miles northeast of the Project site on the graded county road. Impacts due to noise from the project and movement of people and equipment will be minimal. Noise caused by drilling and operations activities will have a negligible impact on the nearest resident.

It is anticipated that a large portion of the work force will live in Riverton and commute using Wyoming State Highway No. 136. Therefore, traffic disturbance on the county road should be minimal. Disruption of grazing patterns will be minimal, and only a small portion of the Amendment Area acreage will be fenced to restrict livestock use. At the end of the project, all of the land will be returned to livestock grazing and wildlife habitat use.

7.2.7 Beneficial Impacts

The beneficial effects of constructing and operating the Gas Hills Project are discussed in Section 9.2 of Chapter 9 and include upgrading and additional maintenance of existing roadways, additional employment in Fremont County, additional income to local distributers, contractors and suppliers, and an increase in local and county revenues through taxes paid by the Project.

7.2.8 Aquatic Ecology Impacts

The only two natural surface water habitats on the permit area are Cameron Spring Reservoir and West Canyon Creek. Neither habitat supports a fishery due to either shallow water or the transient occurrence of water.

Cameron Spring Reservoir is surrounded by a halo of wetland habitat with sedges, reeds, and cattails. This habitat extends for approximately 20 feet on the southern edge of the pond and for approximately 5 feet on the northern edge where it is bound by a road and dike. This habitat provides nesting areas for waterfowl and shorebird species as well as songbirds such as red-winged and yellow-headed blackbirds. Likely aquatic species include the tiger salamander, leopard frog, and chorus frog, although no amphibian species were observed on the site during reconnaissance in early June 1999.

West Canyon Creek is an ephemeral stream along much of its length as it crosses the permit area. In the southern portion of the permit area, it provides a ribbon of riparian habitat with willows and a few cottonwood trees. However, except for small pond and puddle areas, it does not support aquatic habitat due to the lack of water, except during spring runoff and following significant precipitation events.

Impacts to man-made aquatic habitats are also not expected from the proposed Project. Reclamation ponds are located at least 1000 feet from any proposed production areas and stock ponds are too short-lived in nature for any aquatic species to be established.

7.2.9 Wetlands Impacts

With the exception of West Canyon Creek, all potential wetlands are located outside of proposed production areas. Impacts to wetlands along West Canyon Creek will be avoided wherever possible. Wellfields will be designed to prevent wellhead placement and all associated drilling and construction activities within wetlands, if possible. Pipeline and/or road crossings will be designed to limit the amount of disturbance to wetlands. If a potential wetland area cannot be avoided during operations, a mitigation plan will be developed prior to any disturbance. Wetlands mitigation measures are provided in Section 3.2.1 of Chapter 3.

7.2.10 Threatened and Endangered Species Impacts

The only threatened and endangered (T&E) species observed in the Project area was a bald eagle. It is likely this bird was flying through the area during migration. Bald eagles typically nest and roost along larger rivers and lakes. This type of habitat is not present on the permit area and the Project is expected to have no impact on the bald eagle.

The black-footed ferret and peregrine falcon are unlikely on the permit area and no impact to these two species is expected.

The permit area is on the eastern-most boundary of expected swift fox habitat. However, the preferred habitat for this species, i.e. rolling grassland, is not abundant on the permit area or in the buffer zone. Also, the topography of the permit area is more pronounced than typical swift fox habitat. Although it is possible this species could inhabit the area, its occurrence is unlikely, therefore no impacts to this species are expected.

The permit area is within potential mountain plover habitat. However, the preferred habitat for this species, i.e., short-grass prairie, is not abundant on the permit area. This habitat type if patchy and is typically surrounded by the more dominant sagebrush habitat. The most expansive grassland areas occur on the reclaimed areas of previous open pit mining activity. This project is expected to have no impact on this species.

No T&E plant species have been observed on the Project site and, based on the types of habitats present in the Project area, only two T&E plant species may be present in the permit area. These include *Spiranthes diluvialis*, listed Threatened, and *Yermo xanthocephalus,* listed Proposed Threatened. *Spiranthes* habitat may be marginal while suitable habitat for *Yermo* is present in the Rough Breaks vegetation type of the western permit area. The Yermo is a late blooming species and should have been found, if present, during sampling in 1997, based on the timing of that vegetation survey. Addendum D8-5 of Appendix D8 contains a list of sensitive plant species and their potential for occurrence on the Project site.

7.3 Radiological Effects

ISL facility exposure pathways to radiological materials are considerably different from pathways associated with conventional uranium mining methods. First, the majority of the uranium radioactive daughter products are not removed from the ore body, but remain underground within the ore zone. Additionally, no precipitation or drying of the uranium product will be performed at the Gas Hills Project. This eliminates the radiological air particulate pathway typically associated with conventional uranium ore milling or those ISL facilities which produce dried product.

Radon will be released from the solutions at the wellfields and vented from the satellite building to the atmosphere during resin transfer or when vessels are opened for maintenance.

Experience from other ISL projects show that these releases will only be a small fraction of the natural background dose contribution and will not result in a significant offsite impact.

Specific radiological impacts expected by ISL activities at the Gas Hills Project have been evaluated utilizing the MILDOS-Area computer code and its associated calculated exposures. This evaluation shows that the expected radon-222 concentrations at the site boundaries and downwind human receptors will be less than the effluent release limit in 10 CFR 20, Appendix B. Based upon the evaluation and experience at other ISL projects, it is anticipated that the effluent limits in 10 CFR 20 and 40 CFR 190, and the dose to the public limit in 10 CFR 20 will not be exceeded. The MILDOS evaluation including all applicable information as requested by NRC in Appendix A of Regulatory Guide 3.46 is included as Appendix 12.

The MILDOS evaluation provided in Appendix 12 does not include Mine Unit No. 5 because there is currently insufficient data available to determine whether it will contain economically recoverable reserves. Because it is a potential resource area, it has been included in the application. Once sufficient data is available, and prior to production development in Mine Unit No. 5, a MILDOS evaluation will be performed to include the Mine Unit No. 5 area as a source location.

7.4 Nonradiological Effects

7.4.1 Nonradioactive Airborne Effluents

Section 4.1.1 of Chapter 4 describes the type of nonradioactive airborne effluents expected at the Project. It is not anticipated that there will be a significant environmental impact from the nonradioactive airborne effluent releases.

7.4.2 Nonradioactive liquid effluents

It is not anticipated that there will be any nonradioactive liquid effluents discharged to the environment during the operation of the Gas Hills Project other than those discussed in Section 4.2 of Chapter 4. The RO treated wellfield bleed stream will be reinjected into the aquifer. During ground water restoration, the RO treated water may be surface discharged. This will take place under a National Pollutant Discharge Elimination (NPDES) permit. The discharged RO treated water will be monitored to ensure the NPDES discharge limits are not exceeded.

7.5 Effects of Accidents and System Failures

7.5.1 Storage Tank Failure

Storage tanks and vessels will be located both inside and outside of the satellite buildings. These storage vessels will include tanks for waste water treatment and storage of hydrochloric acid, and bulk dry chemicals (e.g., sodium bicarbonate). Pressurized vessels will be used to contain the ion exchange resin, carbon dioxide, oxygen, hydrogen peroxide and propane. There will also be small tanks containing diesel fuel and gasoline. The acid, fuel, carbon dioxide, oxygen, hydrogen peroxide and propane will be located outside and away from the building. Tanks containing liquid fuels and acids will be bermed to contain potential leaks or spills. Overflows or leaks from tanks located inside the buildings will drain to a sump and will be returned to either the process or the waste water circuit.

7.5.2 Pipeline Failure

All wellfield pipelines will be buried at a minimum depth of six feet to prevent freeze damage. Materials of construction will be high density polyethelene (HDPE) or similar materials. Well heads will be insulated to prevent freezing. Prior to burial, pipelines with field fusion welds will be pressure tested to ensure integrity.

To minimize the impacts of a potential pipeline leak, all pipeline systems will be equipped with high and low pressure and flow sensors that will shut down the system should the pipeline pressure or flow deviate from a pre-set range. These systems will also be equipped with alarms to alert the operator of a malfunction. Operating procedures will require investigating and reporting of such leaks or failures (see section 3.4.7 of Chapter 3). The use of manual pipeline valve boxes will allow the isolation of a pipeline rupture and prevent complete drainage of a long section of pipeline.

7.5.3 Fires and Explosions

Fire or explosion hazard inside the satellite facilities will be minimal, because flammable liquids are not used in the uranium dissolution, complexing or ion exchange process. The

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9.2.2 Employment and Income

The Gas Hills Project payroll will represent a direct benefit to the employees and the community. The payroll and equipment/supplies expenditures will have a multiplier effect as the money is turned over throughout the local economy. The estimated community benefit resulting from the Gas Hills Project employee payroll is shown on Table 9-1.

During construction, it is anticipated that approximately 50 contract personnel and 15 to 20 employees will be employed at the Gas Hills Project. Once operations begin, the number of contractor personnel will decrease to just what is needed for well installation and the number of employees will slowly increase to approximately 30 as wellfield production activities increase. As Riverton is the closest community, it is anticipated that approximately 60 to 75% of contractors, supplies and employees will come from that area with the remainder coming from the Casper area.

9.2.3 Taxes

Federal, state and local governments will receive various revenues from employee income taxes, royalty owners taxes, severance taxes, ad valorem taxes and sales taxes. The estimated benefit from taxes is shown on Table 9-1.

9.2.4 Ancillary Benefits

Improvement and maintenance of area roads during project construction and operation will provide for better public access to the Gas Hills and Beaver Rim areas. Wellfield reclamation and revegetation will enhance big game habitat thereby enhancing the recreational value (ie, hunting) in the Gas Hills area.

9.3 Costs

9.3.1 Internal Costs

The primary internal costs associated with the Gas Hills Project will include (1) the capital costs of land acquisition, (2) the capital costs of facility construction, (3) operating and maintenance costs, and (4) the costs of ground water restoration, site reclamation and facility decommissioning. These estimated costs are provided in Table 9-1.

9.3.2 External Costs

External costs are those costs that directly impact the economy of the local community, and are more difficult to quantify than internal costs.

9.3.2.1 Public Facilities and Services

The adverse impact on public facilities and services, such as congestion of streets and highways, overloading of water supply and sewage systems, and the overtaxing of schools, hospitals and police and fire protection will be negligible because of the small

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9.3.2.5 Restrictions on Access to Land and Water

Access to some land and surface water will be restricted throughout the life of the project, but will be temporary and have only a minimal impact on livestock grazing and watering. Over the 20+ year expected project life, up to a total of approximately 1300 acres of rangeland will be taken out of livestock grazing use. Of this total acreage, only up to approximately 50% may be restricted at any one time. As wellfield areas are restored, reclaimed and released from bond, the fencing will be removed and the land returned to its previous use. Therefore, it is anticipated that the project will have a minimal adverse impact relative to loss of land and water resources and ranching.

9.3.2.6 Cost of Aesthetic Impacts

PRI does not anticipate that there will be any costs associated with aesthetic impacts. In fact, it is most probable that the project will enhance the current site aesthetics. Buildings will be painted in colors that will blend with the natural background colors. The wellfield reclamation program will enhance vegetation growth and cover which will improve the overall aesthetics of the area.

9.3.2.7 Decreased Real Estate Values

There ultimately will be no decrease in real estate value as a result of the proposed project. The greatest potential temporary impact to real estate value will be associated with wellfield development and installation when vegetation and topsoil are disturbed. This will, however, be reversed within six to 12 months after wellfield installation is complete by the proposed wellfield revegetation procedures which will return the land to its pre-mining use, quality and value.

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Table D8-23 Derived t-Test Values
Table D8-24 1997 Shrub Density Summary
Table D8-25 Comparison of 1997 Major Vegetative Parameters
Table D8-26 comparison of Absolute Cover Data between Areas
Table D8-27 Comparison of Relative Vegetation Cover Data, by Life form, between Areas
Table D8-28 Life of Species Encountered during 1992 and 1997 Sampling

PLATES

Plate D8-1E Vegetation Map (East)
Plate D8-1W Vegetation Map (West)

LIST OF ADDENDA

Addendum D8-1 Correspondence
Addendum D8-2 Photographs
Addendum D8-3 Raw Data
Addendum D8-4 Natural Resource Conservation Service Correspondence
Addendum D8-5 Sensitive Plant Probability

3.7 Plot Size and Shape

Cover was gathered with 50 meter line intercept transects, while shrub density was gathered with 50 meter belt transects associated with the cover transect.

3.8 Collection and Analysis of Cover Data

Cover sampling was conducted with 50 meter line intercept transects. Within line transects, sample hits were read at 1 meter intervals along the entire length of the 50 meter transect. First hit (50) readings constituted the absolute cover values for individual species, total vegetation and total cover. The first hit information was used to compile portions of the overall plant list for the study area. In addition, litter/rock and bare ground percentages were recorded. Random numbers between 1 and 360 were generated to orient the transect. A compass was then used in the field to orient the transect to the nearest 1/8 of 360 degrees. Transects that exceeded designated vegetation boundaries were randomly reoriented to be within the sampled affected and reference area vegetation types.

The number of transects sampled in affected areas vs reference areas was based on WDEQ Guideline 2 (August 1994). A minimum of 20 transects for cover were sampled within each affected area vegetation type. If statistical adequacy was not obtained, as defined in WDEQ Guideline 2, additional transects were sampled, in increments, up to the maximum number of 50, if necessary. A minimum of 15 transects for cover were sampled within each reference area vegetation type. The maximum sampled, if necessary, was 30.

Definitions of vegetation terms utilized in the following cover tables are as follows:

Mean Cover - Sum total of all absolute cover values for a given species or category within that vegetation type divided by the number of sample points.

Range of Cover Values - The minimum and maximum absolute cover values for a given species or category within that vegetation type.

Relative Cover - Percentage of total sum of species cover.

Frequency - Number of samples in which a species occurs divided by the sample size, times 100.

Relative Frequency - Percent of number of plots of occurrences for a species divided by the total number of plots of occurrences by all species, times 100.

Importance Value - Sum of relative cover and relative frequency.

Rank - A serial ranking of species on the basis of Importance Value.

3.9 Collection and Analysis of Tree and Shrub Density Data

Trees occur as scattered junipers within the Rough Breaks vegetation type and small clumps of willows within the West Canyon Creek drainage. PRI does not believe that is appropriate to identify these areas as separate vegetation types on the vegetation map due to their size and nature of the understory which is similar to the surrounding vegetation types. In addition, PRI does not anticipate the need for tree disturbance and commits to avoiding trees completely in their mining operation. If necessary, at some future point in mining, PRI will inventory such trees prior to disturbance and include that information in the appropriate annual report.

A complete census of trees was not taken during the 1997 fieldwork within the affected area. Isolated tree locations within the affected area were plotted on the vegetation map, if possible. However, clumps or larger areas of trees were not delineated. The survey for possible trees took place during cover and shrub sampling. No height or diameter information was collected since no trees will be impacted.

Shrub density was collected, in conjunction with cover transects. All shrubs, full or half, were counted within 50 centimeters either side of the 50 meter cover transect (i.e., 1 meter X 50 meter belt transect). Shrub height measurements were taken only to get a general indication of overall plant vigor.

Individuals/acre were calculated using the following formula:

$$\text{individuals/acre} = \text{individuals}/50\text{m}^2 \times \frac{10{,}000\text{m}^2}{1 \text{ hectare}} \times \frac{1 \text{ hectare}}{2.2 \text{ acres}}$$

Refer to Table 24.

3.10 Cropland and Prime Farmland Productivity

No cropland or prime farmland were noted within the proposed permit area. This determination was confirmed by the Riverton Field Office of the Natural Resource Conservation Service in correspondence dated March 31, 1999, which is included as Addendum D8-4.

3.11 Plant Species of Special Concern

This study included field surveys and file searches for plant species which may fall into several categories of concern as required by the WDEQ-LQD. They include threatened or endangered species, noxious weeds, and selenium indicator species.

File searches were made to determine if any federally listed threatened or endangered plants may occur within the area. This included state and federal agencies, plant taxonomic keys,

vegetation surveys for adjacent mines, U.S. Fish and Wildlife Services Endangered and Threatened Plant lists, and the Endangered Species Update.

During October, 1996, permit area legal coordinates were run through the Wyoming Natural Diversity Database. No federal or state protected plants were found in the existing records. However, considerable work has been conducted on the western end of the Beaver Rim. The resulting report, "Survey of Plant Species and Communities of Interest in the Beaver Rim Area of Critical Environmental Concern" by George Jones, Wyoming Natural Diversity Database, in 1989 was reviewed prior to the 1997 fieldwork. This information, in addition to a phone conversation with Walt Fertig, Wyoming Natural Diversity Database, formed a "potential list" to be included in the 1997 fieldwork. This list is included as Addendum D8-5. Refer to Addendum D8-1 for the October 1996 correspondence.

4. RESULTS

4.1 Description of Vegetation Types

Four native vegetation types occur within the proposed permit area. They are Bottomland Sagebrush (Big Sage in the attached tables), Mixed Sagebrush Grassland (Mixed Shrub Grassland in the attached tables), Rough Breaks, and Upland Grass. Rough Breaks is further divided into "east" and "west" due to distinct variations in that type.

Bottomland sagebrush, mixed sagebrush grassland, and upland grassland were differentiated primarily by overall cover percentages of shrubs and species composition. Based on WDEQ Guideline 2, bottomland sagebrush is primarily a "shrubland", i.e., greater than 20% shrub cover (full and half). Mixed sagebrush grassland and upland grassland are both "grasslands", as defined in the guideline. Apart from the overall shrub cover, species composition is quite different between the three vegetation types.

A total of eight map units were identified on the proposed permit area. These map units are listed in Table D8-1a and the areal extent of these areas is shown on the attached map. These map units are briefly discussed in the following sections. During the 1996 remapping, Badlands acreage was combined with Rough Breaks.

4.1.1 Bottomland Sagebrush (Big Sage)

The Bottomland Sagebrush (Big Sage) vegetation type occupies 991 acres within drainages and upland areas where deeper soil and moisture are present. Major species include *Artemisia tridentata*, big sagebrush, *Poa cusickii*, Cusick bluegrass, and *Agropyron dasystachum,* thickspike wheatgrass. Within this type, some willows and cottonwoods were found along the upper portion of West Canyon Creek.

4.1.2 Mixed Sagebrush Grassland (Mixed Shrub Grassland)

The Mixed Shrub Grassland vegetation type is dominant in the proposed permit area and occupies 4,089 acres of upland sloped areas with moderately deep to deep, loamy soils or shallow rocky soils. Vegetation and topography within this unit are very diverse, ranging from dense patches of sagebrush in slight draws to small patches of transitional grassland on uplands that were too small to map out separately. Major species include big sagebrush, thickspike wheatgrass, and *Carex filifolia,* threadleaf sedge.

4.1.3 Rough Breaks

The Rough Breaks vegetation type is the second largest map unit and occupies 2,081 acres of upland, relatively steep sloped areas with generally shallow, rocky or

gravelly soils. This unit is found on slopes, ridges, hilltops and sideslopes of steep draws. Rock outcrops and steep bare slopes are also found within this type. Major species in Rough Breaks East include big sagebrush, threadleaf sedge and, thickspike wheatgrass. Major species in Rough Breaks West include *Agropyron spicatum,* bluebunch wheatgrass, big sagebrush, and thickspike wheatgrass. A few junipers and limber pines are also found within this type.

4.1.4 Upland Grass

The Upland Grass vegetation type occupies 131 acres of upland flat areas within the Mixed Sagebrush Grassland that contain somewhat saline soil conditions. Major species include threadleaf sedge, *Artemisia pedatifida,* birdfoot sagewort, and thickspike wheatgrass.

4.1.5 Reclaimed Areas

These sites are reclaimed areas distinct from other disturbed lands and mining activities. these varying aged areas comprise 844 acres of the proposed permit area. Dominant plant species are primarily wheatgrasses, but Indian ricegrass was also common. Some of these areas were reclaimed by mining companies responsible for the disturbances and other areas were reclaimed under the Wyoming Abandoned Mine Lands Program.

4.1.6 Disturbed Land

This map unit covers 319 acres of the study area. This unit consists of areas devoid of vegetation or with limited vegetation such as existing mine pits, topsoil stockpiles, spoil piles, associated roads and facilities.

4.1.7 Reservoirs

Several reservoirs were identified that encompassed 17 acres within the proposed permit area. These represent open bodies of water and range from small stockponds to large mine impoundments.

Vegetation of reservoirs is varied. Vegetation immediately adjacent to reclaimed mine pits is essentially seeded grass species and contains essentially no hydrophytic vegetation. Vegetation adjacent to the water body in Cameron Springs is zoned based on nearness to the water and contains numerous hydrophytic species immediately adjacent to the water body or within a near saturated soil zone. These species include, in part, various *Carex*, *Juncus*, and *Eleocharis*.

4.1.8 Wetlands

Several small wetland areas were identified that encompassed 28 acres within the proposed permit area. These areas may not be jurisdictional wetlands under the Corps of Engineers delineation criteria; no formal wetland delineation was conducted. They consist of areas that visually contained plant species more adapted to moist and/or saline conditions. The dominant hydrophytic species found in these areas include various *Carex*, *Juncus*, and *Eleocharis*. A complete description of potential wetlands areas is provided in Appendix D11. Additional information on hydrologic and soil characteristics is included in Appendices D6 and D7, respectively.

4.2 Sample Site Location

Affected area vegetation types and sampling sites are outlined on the vegetation map.

4.3 Weeds, Selenium Indicators, Endangered or Threatened Species

No species cited as primary "noxious" weeds in the Agricultural Experiment Station, University of Wyoming, 1979, Bulletin 498, "Weeds of Wyoming" were encountered. Prohibited noxious weed identified on the study area include musk thistle, Canada thistle, hoary cress (whitetop), and field bindweed. Restricted noxious weeds include tansymustard, little blue mustard, and American licorice. These weed species were most common along drainages, roadsides, and disturbed areas.

Primary selenium indicator species identified during the 1997 survey include *Haplopappus multicaulis,* multistem goldenweed. Past documentation also include two-grooved milkvetch and woody aster. Milkvetch was common on Disturbed and Reclaimed sites. Multistem goldenweed was encountered in the Upland Grassland and Rough Breaks map units. Woody aster was observed in several types but was not common.

None of the plants identified on the proposed permit area appear on the U.S. Department of Interior's "Endangered and Threatened Species Plants", as published in the Federal Register. Federally designated plants for Wyoming include *Arabis pusilla*, Fremont County rockcress, currently listed as a candidate species, *Gaura neomexicana ssp. coloradensis*, Colorado beeblossom, currently listed as proposed threatened, *Spiranthes diluvialis*, Ute ladies'-tress, currently listed as threatened, and *Yermo xanthecephalus*, Yermo, currently listed as proposed threatened.

Legal coordinates for the study area were run through the Wyoming Natural Diversity Database in Laramie, Wyoming. Previously encountered plants of concern found in the region include *Physaria eburniflora*, Devil's Gate twinpod, currently state ranked S2; *Cirsium aridum*, Cedar Rim thistle, currently state ranked S2; and *Astragalus nelsonianus*,

Nelson's milkvetch, currently state ranked S2. None of these plants were identified on the proposed permit area. A summary of the occurrence potential for federally designated plants and state plants of concern is provided as Addendum D8-5.

4.4 Species Composition

Table 28 lists species of plants encountered during the 1997 baseline survey and is arranged by lifeform.

4.5 Cover

4.5.1 Bottomland Sagebrush (Big Sage)

Absolute total vegetation cover for the Big Sage affected area was 63.40%. Absolute bare soil and litter/rock percentages were 13.80 and 22.80, respectively. Absolute total cover percentage was 77.2%. Wyoming big sagebrush provided the highest relative vegetation cover, 24.90%, followed by Cusick bluegrass, at 9.62%. A summary of cover values for the Big Sage affected area is presented in Table 2.

Absolute total vegetation cover for the Big Sage reference area was 55.88%. Absolute bare soil and litter/rock percentages were 16.75 and 27.38, respectively. Absolute total cover percentage was 83.25%. Wyoming big sagebrush provided the highest relative vegetation cover, 48.64%, followed by *Poa sandbergii,* Sandberg

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4.8 t-Test Comparisons

Vegetation data between the affected and reference areas were compared with the use of student t-tests. T-tests were calculated using the vegetation data software Rima, Version 2, for each of the affected/reference area vegetation types using the following formula:

$$t = \frac{(x_1 - x_2)}{Sp(^1/n_1 + {}^1/n_2)^{1/2}}$$

where:

x_1 = Sample mean for the affected area;
x_2 = Sample mean for the reference area;
n_1 = Sample number for the affected area;
n_2 = Sample number for the reference area; and
Sp= Pooled variance between affected and reference area.

Refer to Table 23.

The negative values of t listed in the table indicate that the reference area means are higher than the affected area means, based on the formula described above. PRI understands that the higher values for the established reference areas may mean that reclamation standards may be higher than what was actually disturbed during mining; however, the extent and location of "suitable" reference areas is limited.

The calculated value of t exceeds (either positively or negatively for a two-tailed test) the tabular value of t in the majority of vegetation types for vegetation cover. Wherever the calculated t value far exceeds the tabular t value, the null hypothesis that the affected and reference area are equal is rejected and the two areas are statistically different at a significance level of 0.10. Therefore, Big Sage, Mixed Shrub Grassland, Upland Grass exceed their tabular t values for vegetation cover and would be the least similar at a significance level of 0.10. The two Rough Break vegetation types are most similar for vegetation cover between the affected and reference areas. In terms of total cover, all affected area vegetation types are similar to their established reference areas.

5. DISCUSSION

Transition between the four vegetation types is dynamic and boundaries are often obscure. Every effort was made to refine existing mapping; however, it should be noted the map boundaries are often gross estimations of actual boundaries. Small inclusions within vegetation types were not mapped. Although narrow drainage bottoms (i.e., ranging in width from two to four feet) generally support higher productivity and diversity, these areas were not delineated in mapping.

Locations of the major vegetation types were often linked to existing geologic features and resulting soil formation. Ridgetops often contained rocky soil material and were associated with the Rough Breaks vegetation type. Flatter topography with moderately deep soils were more characteristic of the Mixed Shrub Grassland. The clayey and saline soils resulted in more expanses of the Upland Grass vegetation type. Big Sage is often associated with deeper soils and is present in the draws within the proposed permit area.

Higher cover sampling variability was generally found in the Rough Breaks portion of the proposed permit area. This may be due, in part, to the topographic extremes noted in the Rough Breaks. Some points may have fallen within the "rocky or bare phase" which would result in very small cover levels. Extreme sample numbers were not generally noted within the Mixed Shrub Grassland and Big Sage vegetation types.

Overall shrub density was generally higher in the Upland Grass vegetation type, both reference and affected areas. Halfshrubs (primarily *Artemisia pedatifida*) were much higher in number within the Upland Grass reference vegetation type. Full shrubs were much higher in number in the Big Sage affected area.

Although, the affected and reference areas for three of the native vegetation types are not statistically similar, based on t test calculations, these areas are "most suitable" given the limited extent and location of suitable reference areas. Means and standard deviations do not indicate wide differences between the two areas in any of the three vegetation types. In addition, standard deviations are not high compared to the means which means the data is generally not variable. It is PRI's opinion that these established reference areas are suitable for the ultimate purpose of reclamation success monitoring.

For a discussion of reclamation success monitoring of pre-mine vegetation map units, refer to the Reclamation Plan.

Table 6 PRI Gas Hills Upland Grass Affected Cover

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron dasystachyum	7.90	15.72	0 - 20	95.00	11.11	26.83	3
Agropyron smithii	1.00	1.99	0 - 4	35.00	4.09	6.08	11
Agropyron spicatum	1.20	2.39	0 - 6	35.00	4.09	6.48	10
Carex filifolia	11.70	23.28	0 - 26	90.00	10.53	33.81	1
Koeleria macrantha	0.30	0.60	0 - 2	15.00	1.75	2.35	15
Oryzopsis hymenoides	2.10	4.18	0 - 8	70.00	8.19	12.37	6
Poa cusickii	2.00	3.98	0 - 8	45.00	5.26	9.24	8
Poa sandbergii	5.10	10.15	0 - 14	85.00	9.94	20.09	4
Sitanion hystrix	0.70	1.39	0 - 6	20.00	2.34	3.73	13
Stipa comata	1.50	2.99	0 - 12	35.00	4.09	7.08	9
Stipa viridula	0.10	0.20	0 - 2	5.00	0.58	0.78	18
Sub-total	33.60	66.87					
PERENNIAL FORBS							
Aster species	0.10	0.20	0 - 2	5.00	0.58	0.78	18
Astragalus spatulatus	0.40	0.80	0 - 4	15.00	1.75	2.55	14
Hymenoxys acaulis	0.80	1.59	0 - 4	20.00	2.34	3.93	12
Oxytropis nana	0.25	0.50	0 - 4	10.00	1.17	1.67	16
[illegible]chia sessiliflora	0.30	0.60	0 - 2	15.00	1.75	2.35	15
[illegible]hoodii	1.60	3.18	0 - 8	65.00	7.60	10.79	7
Sub-total	3.45	6.87					
SEMI-SHRUBS OR HALF-SHRUBS							
Artemisia pedatifida	9.10	18.11	2 - 18	100.00	11.70	29.81	2
Ceratoides lanata	0.10	0.20	0 - 2	5.00	0.58	0.78	18
Gutierrezia sarothrae	0.10	0.20	0 - 2	5.00	0.58	0.78	18
Sub-total	9.30	18.51					
SHRUBS							
Artemisia cana	0.10	0.20	0 - 2	5.00	0.58	0.78	18

Table 6 (cont'd). PRI Gas Hills Upland Grass Affected Cover

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
Artemisia tridentata	3.50	6.97	0 - 20	65.00	7.60	14.57	5
Chrysothamnus nauseosus	0.10	0.20	0 - 2	5.00	0.58	0.78	18
Sub-total	3.70	7.36					
CACTI AND SUCCULENTS							
Opuntia polyacantha	0.20	0.40	0 - 2	10.00	1.17	1.57	17
Sub-total	0.20	0.40					
SUM OF SPECIES COVER	50.25						
Lichens	1.00		0 - 4	35.00			
TOTAL VEGETATION	51.40 +/-	10.62					
LITTER/ROCK	20.40 +/-	8.70					
BARE SOIL	28.20 +/-	9.56					
TOTAL COVER	71.80 +/-	9.56					
Number of Species/sample	8.55						

Table 9 PRI Gas Hills Rough Breaks East Reference Cover.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron dasystachyum	1.37	2.97	0 - 14	21.05	2.15	5.13	10
Agropyron smithii	0.32	0.69	0 - 4	10.53	1.08	1.76	18
Agropyron spicatum	8.63	18.76	2 - 18	100.00	10.22	28.98	1
Carex filifolia	2.95	6.41	0 - 16	52.63	5.38	11.78	5
Festuca idahoensis	0.21	0.46	0 - 2	10.53	1.08	1.53	20
Koeleria macrantha	1.79	3.89	0 - 10	47.37	4.84	8.73	6
Muhlenbergia species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Oryzopsis hymenoides	0.21	0.46	0 - 2	10.53	1.08	1.53	20
Poa cusickii	4.00	8.70	0 - 16	78.95	8.06	16.76	4
Poa sandbergii	0.63	1.37	0 - 4	26.32	2.69	4.06	14
Sub-total	20.21	43.94					
PERENNIAL FORBS							
Achillea millefolium	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Amsinckia species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Arenaria hookeri	0.42	0.92	0 - 4	10.53	1.08	1.99	17
Aster species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Astragalus bisulcatus	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Astragalus drummondii	0.21	0.46	0 - 2	10.53	1.08	1.53	20
Astragalus lentiginosus	0.74	1.60	0 - 4	26.32	2.69	4.29	13
Astragalus spatulatus	0.32	0.69	0 - 4	10.53	1.08	1.76	18
Astragalus species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Cirsium species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Comandra umbellata	0.84	1.83	0 - 4	31.58	3.23	5.06	11
Crepis acuminata	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Dalea candida	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Haplopappus multicaulis	0.84	1.83	0 - 4	36.84	3.76	5.59	9
Hymenoxys acaulis	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Linum species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Machaeranthera grindelioides	0.11	0.23	0 - 2	5.26	0.54	0.77	22

Table 9(cont'd). PRI Gas Hills Rough Breaks East Reference Cover.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
Oxytropis nana	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Paronychia sessiliflora	0.32	0.69	0 - 2	15.79	1.61	2.30	16
Phlox hoodii	0.84	1.83	0 - 6	26.32	2.69	4.52	12
Phlox multiflora	1.47	3.20	0 - 10	31.58	3.23	6.43	8
Sedum species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Solidago species	0.32	0.69	0 - 6	5.26	0.54	1.22	21
Vicia americana	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Sub-total	7.79	16.93					
ANNUAL AND BIENNIAL FORBS							
Orthocarpus luteus	0.21	0.46	0 - 2	10.53	1.08	1.53	20
Sub-total	0.21	0.46					
SEMI-SHRUBS OR HALF-SHRUBS							
Artemisia frigida	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Erigonum ovalifolium	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Eriogonum brevicaule	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Gutierrezia sarothrae	0.32	0.69	0 - 2	15.79	1.61	2.30	16
Leptodactylon pungens	0.21	0.46	0 - 2	10.53	1.08	1.53	20
Sub-total	0.84	1.83					
3S							
temisia nova	8.32	18.08	0 - 24	94.74	9.68	27.76	2
Artemisia tridentata	4.84	10.53	2 - 16	89.47	9.14	19.67	3
Chrysothamnus viscidiflorus	1.16	2.52	0 - 6	42.11	4.30	6.82	7
Purshia tridentata	0.53	1.14	0 - 10	5.26	0.54	1.68	19
Ribes cereum	1.05	2.29	0 - 10	15.79	1.61	3.90	15
Rosa species	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Symphoricarpos albus	0.84	1.83	0 - 4	26.32	2.69	4.52	12
Sub-total	16.84	36.61					
CACTI AND SUCCULENTS							
Opuntia polyacantha	0.11	0.23	0 - 2	5.26	0.54	0.77	22
Sub-total	0.11	0.23					

Table 9(cont'd). PRI Gas Hills Rough Breaks East Reference Cover.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
SUM OF SPECIES COVER	46.00						
Lichens	0.11		0 - 2	5.26			
TOTAL VEGETATION	46.21 +/-	10.48					
LITTER/ROCK	30.42 +/-	10.64					
BARE SOIL	23.26 +/-	13.99					
TOTAL COVER	76.74 +/-	13.99					
Number of Species/sample	9.79						

Table 11 PRI Gas Hills Upland Grass Reference Cover.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
COOL SEASON PERENNIAL GRASSES							
Agropyron dasystachyum	2.40	5.81	0 - 12	53.33	6.84	12.64	6
Agropyron smithii	3.87	9.35	0 - 12	86.67	11.11	20.47	4
Agropyron spicatum	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Carex filifolia	6.80	16.45	0 - 14	93.33	11.97	28.42	3
Carex stenophylla	0.40	0.97	0 - 4	13.33	1.71	2.68	12
Koeleria macrantha	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Oryzopsis hymenoides	1.20	2.90	0 - 4	53.33	6.84	9.74	9
Poa cusickii	0.67	1.61	0 - 6	20.00	2.56	4.18	11
Poa sandbergii	7.60	18.39	2 - 16	100.00	12.82	31.21	2
Stipa comata	4.00	9.68	0 - 12	66.67	8.55	18.22	5
Sub-total	27.20	65.81					
PERENNIAL FORBS							
Arenaria hookeri	0.67	1.61	0 - 4	20.00	2.56	4.18	11
Astragalus drummondii	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Astragalus lentiginosus	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Astragalus spatulatus	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Lomatium species	0.13	0.32	0 - 2	6.67	0.85	1.18	13
Phlox hoodii	1.73	4.19	0 - 8	53.33	6.84	11.03	7
Sub-total	2.93	7.10					
SEMI-SHRUBS OR HALF-SHRUBS							
Artemisia pedatifida	7.87	19.03	2 - 20	100.00	12.82	31.85	1
Ceratoides lanata	1.20	2.90	0 - 4	40.00	5.13	8.03	10
Sub-total	9.07	21.94					
SHRUBS							
Artemisia tridentata	2.13	5.16	0 - 8	40.00	5.13	10.29	8
Sub-total	2.13	5.16					

Table 11 (cont'd). PRI Gas Hills Upland Grass Reference Cover.

Species	Mean Cover (%)	Relative Cover (%)	Range of Cover Values (%)	Percent Frequency (%)	Relative Frequency (%)	Importance Value	Rank
SUM OF SPECIES COVER	41.33						
Mosses	0.13		0 - 2	6.67			
Lichens	2.53		0 - 8	46.67			
TOTAL VEGETATION	44.13 +/-	7.15					
LITTER/ROCK	22.93 +/-	7.74					
BARE SOIL	32.93 +/-	12.33					
TOTAL COVER	67.07 +/-	12.33					
Number of Species/sample	7.80						

Table 25. Comparison of 1997 Major Vegetative Parameters.

Area	Sample Parameter	
	Total Veg (% Absolute)	Total Cover (% Absolute)
Affected		
Big Sage	63.40	77.20
Mixed Shrub Grassland	55.30	75.00
Rough Breaks East	49.00	73.50
Rough Breaks West	38.10	60.70
Upland Grass	51.40	71.80
Reference		
Big Sage	55.88	83.25
Mixed Shrub Grassland	50.13	80.27
Rough Breaks East	46.21	76.74
Rough Breaks West	40.78	64.67
Upland Grass	44.13	67.06

NOTE: Previously submitted Table 26 contained Upland Grass AFFA TV at 51.00, Rough Breaks East REFA TV at 46.11, and Upland Grass REFA TC at 67.60.

Revised 6-13-99

Table 26. Comparison of Absolute Cover Data between Areas.

Area	Total Veg Cover	Litter/ Rock	Bare Ground	Total Cover
Affected				
Big Sage	63.40	13.80	22.80	77.20
Mixed Shrub Grassland	55.30	19.80	24.90	75.00
Rough Breaks East	49.00	24.30	26.70	73.50
Rough Breaks West	38.10	22.60	39.30	60.70
Upland Grass	51.40	20.40	28.20	71.80
Reference				
Big Sage	55.88	27.38	16.75	83.25
Mixed Shrub Grassland	50.13	30.13	19.73	80.27
Rough Breaks East	46.21	30.42	23.26	76.74
Rough Breaks West	40.78	23.89	35.33	64.67
Upland Grass	44.13	22.93	32.93	67.06

NOTE: Previously submitted Table 26 contained Upland Grass AFFA TV at 51.00, Rough Breaks East REFA TV at 46.11, and Upland Grass REFA TC at 67.60.

Revised 6-13-99

ADDENDUM D8-4
NATURAL RESOURCE CONSERVATION SERVICE CORRESPONDENCE

UNITED STATES
DEPARTMENT OF
AGRICULTURE

NATURAL
RESOURCES
CONSERVATION
SERVICE

320 EAST LINCOLN
RIVERTON, WY
82501
(307) 856-7524

Subject: Soils - Prime Farmland DATE: March 31, 1999

TO: BRS Engineering
1225 Market Street
Riverton, WY 82501

I have reviewed the soil survey information available for portions of East Fremont County which you requested information dealing with a mine permit for Power Resources. The areas in the Gas Hills, T32N R89W, T32N R90W, and T33N R89W have no prime farmlands. The only prime farmlands in Wyoming are certain soils under irrigated conditions.

If you need any further information, please feel free to contact me.

Sincerely,

Nick Biltoft, District Conservationist
Riverton Field Office

cc: Tom Gustafson, Soil Survey Project Leader, Riverton NRCS

ADDENDUM D8-5
SENSITIVE PLANT PROBABILITY

ADDENDUM D8-5. Sensitive Plant Probability within the Proposed Permit Area**.

Species	Federal or State	Status	Potential (Region)	Occurrence Potential (Local)	Found (Permit Area)
Arabis pusilla	Federal	Candidate	Medium	None	No
Astragalus nelsonianus	State	S2	High	High	No
Cirsium aridum	State	S2	High	High	No
Gaura neomexicana ssp. coloradensis	Federal	Proposed Threatened	Low	None	No
Physaria eburniflora	State	S2	Medium	Low	No
Spiranthes diluvialis	Federal	Threatened	Medium	Low	No
Yermo xanthocephalus	Federal	Proposed Threatened	High	Medium	No

**Based on four federally designated plants for Wyoming and the database search by the Wyoming Natural Diversity Database (October 1996).

S2 = State Rank 2, Imperiled because of rarity (often known from 6-20 occurrences) or because of factors demonstrably making a species vulnerable to extinction (Wyoming Natural Diversity Database).

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PLATES

D9-1 Wildlife Map

Appendix D6 - Hydrology. Surface water discharge, originating from the West Canyon Creek spring, was observed flowing for almost two miles in late September of 1996 as shown on Plate D9-1.

Small rock outcrops were confined to small areas along Beaver Rim as shown on Plate D9-1. These areas were composed primarily of low cliffs or rock ledges.

Ponds within the study area consisted of several stockponds, mine-related sediment control structures, existing mine pits and reclaimed mine pits which have been permitted by WDEQ to remain as postmine reclamation features. Cameron Springs was the only stockpond feature that consistently retained water. Most of the reclaimed mine reservoirs contained water throughout the year.

Details of major habitat/vegetation types and mapping are included in Appendix D8 (Vegetation). Minor habitat type locations not included in Appendix D8, are shown on Plate D9-1. The Wyoming Game and Fish Department (WG&FD) uses the term "crucial" to designate big game ranges that are vital to the survival of the local population. The U.S. Fish and Wildlife Service (USFWS) uses the term "critical" to indicate habitat that is vital to the survival of endangered species. No crucial or critical habitats as defined by WG&FD and USFWS respectively, were identified within the permit area or adjacent areas.

were recently combined into one herd unit with the 1995 post-hunt population estimated at from 14000-16000 animals (WG&FD, 1996). All potential disturbances will be within the Fremont Antelope Herd Unit.

5.2 Other Mammals

Specific surveys for other mammals (i.e. small mammal trapping, lagomorph surveys, predator surveys) were not required for this project as agreed upon with the WG&FD through personal communication (P. Deibert, Oct.1996) and correspondence dated May 13,1999 (see Addendum D9C). However, all mammal species, or their sign, observed during the course of other field work were recorded and are documented with an asterisk on the species list in Addendum D9A. A total of 14 other mammal species were recorded on the study area. The most common species observed were the Wyoming ground squirrel and least chipmunk. The coyote was the most abundant predator while lagomorph populations were still low and had not recovered from the crash in the early 1990's. The entire permit area and one mile perimeter were searched for prairie dog towns but none were found. Searches revealed the nearest prairie dog town was located over one mile north of the permit area and was occupied by white-tailed prairie dogs. The majority of mammal species were observed in the various habitat types dominated by big sagebrush.

5.3 Upland Game Birds

Surveys focused on sage grouse strutting ground (lek) areas were completed at dawn over three mornings on April 29-30 and May 1 of 1993. Additional lek surveys were completed on April 4, 1997 covering the entire permit area. Known strutting grounds were inventoried and the entire permit and one half-mile buffer were also searched for additional strutting grounds. Surveys were completed by traversing the area and stopping periodically to glass potential strutting ground sites and listen for strutting birds. Sage grouse brood surveys were not required by the WG&FD (see Addendum D9C) and, therefore, were not conducted.

Mourning doves and sage grouse were the only upland game birds noted for the area. Mourning doves are migrants which only inhabit the area from spring into early fall. Sage grouse may inhabit the area year long. A strutting ground has been located north of the Permit Area on the border of Section 30 and Section 19, T33N, R89W (Plate D9-1). This lek was noted in file searches and counts are shown in Table D9-3. The lowest number of birds recorded was three males on April 13, 1996. No other leks are known to exist within or adjacent to the study area and the April 29-30, 1993, surveys did not record any new active strutting grounds. Sage grouse were observed during other survey periods but did not appear to be abundant in the area. All sage grouse were recorded in association with mixed sagebrush grasslands and bottomland sagebrush.

5.4 Waterfowl and Shorebirds

Specific surveys were not conducted for waterfowl and shorebirds as agreed upon with the WG&FD through personal communication (P. Diebert, Oct. 1996) and correspondence dated May 13, 1999 (see Addendum D9C). All such species recorded during other surveys were designated on the species list. A total of 10 waterfowl species and five shorebirds were observed during surveys. All species recorded are common to the region.

Habitat for waterfowl and shorebirds is not abundant in the study area. Most of the natural seeps do not discharge an adequate quantity of water to support waterbird habitat. Other man-made bodies of water (i.e., reclaimed mine pits, stock ponds) have some emergent vegetation, but such habitat is sparse. The best habitat for waterfowl and shorebird species is at Cameron Springs Reservoir. Species would be expected on the site during migrations in the spring and fall in addition to use in the summer. Due to the small size of the reservoir, the number of breeding pairs of waterfowl or shorebirds is expected to be limited. Waterfowl and shorebirds would not be expected in the area during late fall or winter.

5.5 Raptors

A raptor nest survey of the entire permit area and buffer zone was conducted in 1993. The surveys conducted in 1994 and 1996 identified additional raptor nests in expanded portions of the permit area and buffer zones. In 1997, additional raptor nests were identified within the permit area and buffer zone at the same territorial locations as previously identified next sites. The raptor survey conducted in 1999 was the first survey since 1993 which covered the entire permit area and provided updates on the status of previously identified nests. The buffer zones for the surveys conducted between 1993-1997 generally extended at least one mile from the permit boundary, while the buffer zone for 1999 was limited to ½ mile. Surveys were conducted by a single biologist on foot or using a 4-wheel drive truck or all terrain vehicle (ATV), as needed, between 5:30 am and 8:00 pm. Raptor observations were made using binoculars and a high-powered spotting scope. Nest site activity and production surveys were completed so as not to cause excessive disturbance to nesting birds. In some cases, production could not be determined due to inaccessibility of nest sites and the prolonged disturbance that would have been required to make those determinations.

Agency files were also reviewed to obtain additional information regarding raptors inhabiting the area. File searches identified only five previously documented raptor nests within the study area. These nest sites are identified in Tables D9-4, D9-5, D9-6 and on Plate D9-1 as FH-4b, FH-7a, FH-12, FH-14 and GHO-1. Nest site FH-4b was listed in agency files as unknown, with no past history. Based on field surveys completed in 1993, this nest site was used by ferruginous hawks. Nest site GHO-1 is located in a reclaimed area and consists of a man-made pole structure. This site was placed for mitigation of a great horned owl nest removed during reclamation of mining facilities. Site FH-7a was located within a mine disturbance (Pathfinder's Lucky Mc Mine). Site FH-12 is located in a limber pine and FH-

14 on a rock outcrop.

In addition to the five nests identified during file searches, 59 new raptor nest sites were identified by Intermountain Resources during the 1992-1997 field surveys. Overall, nest sites identified included eight red-tailed hawk nests representing six pairs of birds, 45 ferruginous hawk nests representing 16 territories, three golden eagle nests of two pairs and three prairie falcon nests. Tables D9-4, D9-5, D9-6, and D9-7 provide the status of these nest sites for different survey periods as known. Plate D9-1 shows the locations of raptor nest sites. Production was recorded for red-tailed hawks and ferruginous hawks, while production of the active prairie falcon aerie was undetermined. The golden eagle and great horned owls failed to produce young.

The golden eagle nest on the highwall of the Buss Pit was caged in 1993 under permits from the USFWS and WG&FD to enable reclamation activities to proceed (nest site GE-2a in the table and on the map). This pair has an alternate nest site (GE-2b) and suitable highwalls were to be left during reclamation. Suitable highwalls are also found on permanently reclaimed areas adjacent to the site.

The status of all previously identified nest sites (total = 64) during the 1999 raptor survey includes the following: red-tailed hawk (1-inactive, 1-active, 5-gone, 1-not surveyed); ferruginous hawk (29-inactive, 1-active, 9-gone, 10-not surveyed); golden eagle (2-inactive, 1-gone); prairie falcon (2-inactive, 1-active); and great horned owl (1-inactive). As indicated above, some of the nest sites were not surveyed in 1999 because they were located outside of the ½-mile buffer zone.

In addition to updating the status of previously identified nests, one new nest (FH-3f) was observed during the 1999 survey. This nest was being used by ferruginous hawks, and was located in SENW, Section 33, T33N, R89W, as shown on Plate D9-1. Other active nests included one ferruginous hawk (FH-6a), one red-tailed hawk (RTH-2b), and one prairie falcon (PF-2). All of the active nests observed during the 1999 survey are located within 0.5 miles of proposed disturbance areas and one nest, FH-3f, is located within the Mine Unit No. 2 boundary, as shown on Plate D9-1.

Several other raptor species were recorded within the study area but nesting was not documented. These species included the Swainson's hawk, rough-legged hawk, bald eagle and turkey vulture. The marsh hawk and American Kestrel were also recorded and undoubtedly nest in the area, however, specific nest sites were not recorded.

5.6 Passerine Birds

Specific surveys for passerine bird species were not required as agreed upon with the WG&FD through personal communication (P. Deibert, Oct. 1996) and correspondence dated May 13, 1999 (see Addendum D9C). However, all such species observed during the course

of field work were recorded and are documented with an asterisk on the species list in Addendum D9A. A total of 33 other bird species were recorded during surveys. The most common species were the horned lark, vesper sparrow and meadowlark. Most passerine species were recorded in the various sagebrush shrublands which dominate the permit area. However, the best diversity of bird species was observed in the scattered pine - rough breaks shrublands due to the high diversity of plant species and topography.

5.7 Migratory Birds of High Federal Interest (MBHFI)

MBHFI and other wildlife species surveys were completed during all site visits. This was accomplished by searching all suitable or potentially suitable habitats and recording any species encountered.

Several MBHFI species are known to occur in the region and include the bald eagle, golden eagle, ferruginous hawk, prairie falcon, burrowing owl, mountain plover, and loggerhead shrike. The golden eagle, bald eagle, ferruginous hawk, prairie falcon, and loggerhead shrike have been documented in the study area while the mountain plover and burrowing owl have been noted in adjacent areas.

Bald eagle use of the site is limited to temporary roosting during the winter as it migrates through the area. No nesting sites are present on the permit area or within the half-mile buffer zone. The golden eagle, ferruginous hawk and prairie falcon nest on the area and have been discussed in Section D9.5.5. Loggerhead shrikes probably nest in the area but active nest sites were not found.

Additional surveys were completed for mountain plovers in April and May of 1997, following USFWS guidelines. Specifically, the surveys were conducted from a stationary vehicle in suitable grassland and sparse shrub habitats typically used by this species for nesting. No plovers were observed.

5.8 Threatened or Endangered Species (T&E) and State-listed Rare Species

Threatened, endangered, and candidate wildlife species surveys were completed during all site visits by searching suitable habitats and recording any species encountered. The specific survey techniques used to identify each species, and their potential for occurrence on the permit area, are included in Table D9-8.

The bald eagle, peregrine falcon, and black-footed ferret are endangered species which may occur in the area. Nesting habitat does not exist within the study area for the bald eagle or peregrine falcon but they may inhabit the area during migration. Although the bald eagle has been recorded in the study area, winter concentrations and roost areas have not been documented. Golden eagles nest in the area and are also protected along with the bald eagle.

Prairie dog towns provide habitat for black-footed ferrets. Active prairie dog towns were not observed within the study area, although active towns are known to exist within several miles. These towns were inhabited by white-tailed prairie dogs and are located over one mile north of the study area as shown on Plate D9-1. The small size and wide spacing of prairie dog towns in the region would make survival of black-footed ferret populations difficult.

A ferret survey was completed in 1994 on 55O acres of white-tailed prairie dog towns located three to five miles northwest of the permit area. This survey was submitted to, and approved by the USFWS. The survey reported no evidence of ferrets.

On Tuesday, February 16, 1999, the USFWS proposed to list the mountain plover as threatened under the Endangered Species Act. According to the USFWS, current research shows that breeding habitat requirements are typically sites where the vegetation is less than 10 cm in height, has at least 30 percent bare ground, and less than 5 percent slope. Nest sites are also usually heavily grazed by domestic livestock or by prairie dogs. Vegetation commonly found at nest sites (from research in Colorado) consists of blue grama, buffalo grass, and prickly pear cactus.

As previously discussed in Section 5.7 above, no mountain plovers were observed within the permit area during the surveys conducted in April and May 1997. Although the occurrence of mountain plovers are possible on the permit area, the preferred habitat for this species is not abundant. The preferred habitat of the plover is patchy throughout the permit area and is typically surrounded by the more dominant sagebrush habitat.

The swift fox is currently under consideration for listing as a threatened or endangered species by the USFWS. Surveys for this species were conducted during other wildlife surveys on the site in 1993 and no evidence of its use of the area was found.

The permit area is on the eastern-most boundary of expected swift fox habitat. However, the preferred habitat for this species, i.e., rolling grassland, is not abundant on the permit area or in the buffer zone. Also, the topography of the permit area is more pronounced than typical swift fox habitat. Although it is possible this species could inhabit the area, its occurrence is unlikely.

State-listed wildlife species (that are not included under other wildlife categories already identified) that could occur on the permit area are listed in Table D9-9. Suitable roosting habitat for the fringed myotis, spotted bat, and pallid bat was not specifically identified but it is likely that rock cracks and crevices along Beaver Divide could serve this purpose. None of these species was observed on the site.

The area was searched for the black-tailed prairie dog. This species was not found on the permit area or within a half-mile buffer. Potential habitat for the species is present on the permit area.

Other state-listed species already identified in previous discussions include the bald eagle, peregrine falcon, black-footed ferret, and the swift fox.

5.9 Reptiles and Amphibians

Specific surveys for reptiles and amphibians were not required for this project as agreed upon with the WG&FD through personal communication (P. Deibert, Oct. 1996) and correspondence dated May 13, 1999. (see Addendum D9C) Several species were observed as noted in Addendum D9A and included the sagebrush lizard, short-horned lizard, garter snake and leopard frog.

5.10 Fish

Natural habitats for fish species do not exist within the study area.

6. IMPACTS

Crucial or critical wildlife habitats have not been documented on the permit area or adjacent areas. Whereas big game animals, including pronghorn antelope and mule deer would be directly affected by mining activities from increased road kills resulting from increased vehicular traffic, the indirect impacts of temporary habitat loss, displacement, and harassment would be more significant. However, since no crucial big game winter habitat occurs on the proposed mine permit or half-mile buffer, impacts are expected to be minor

Actual disturbance levels, i.e. relating to the number of animals displaced, would be difficult to predict because of a myriad of factors such as density of wildlife in adjacent areas, timing of the disturbance, sight distance to the disturbance, and type of disturbance (long term or short term).

Approximately 1,082 acres of the 8,500-acre permit area would be disturbed during mining activities. The reduction of food and cover would displace resident animals to adjacent ranges. When big game are displaced from otherwise suitable habitats they may 1) find equally suitable habitat that is not occupied by other animals, 2) occupy suitable habitat that is already being used by other animals, or 3) occupy poorer quality habitat than that from which they are displaced. In the second and third possibilities, displaced animals suffer as consequences of increased competition with other animals. Predicting the outcome of displacement is difficult, if not impossible. Most likely, the two limiting habitat requirements for big game in the Gas Hills area are availability of water and availability of open winter range. It is unlikely the proposed project will have an impact on either of these two factors. It is expected sufficient suitable habitat is available in adjacent areas and in undisturbed areas of the permit area; no impacts from displacement of big game populations are expected with this project.

Noise, dust, and increased human presence may also cause some localized avoidance of otherwise acceptable big game foraging areas. Big game animals are, however, highly mobile and should have little difficulty moving to adjacent undisturbed areas if movements are not restricted (i.e., appropriate fencing materials are used). Big game species continue to occupy areas immediately adjacent to other mining activities in the area, suggesting that they can become conditioned to mining disturbances.

A sage grouse strutting ground is located about one mile north of the permit area and should not be impacted. Individual birds may be disturbed as a limited amount of nesting and foraging habitat will be affected.

Potential sage grouse nesting and foraging habitat is present in the mixed sagebrush-grassland habitat and bottomland sagebrush. Of these, the bottomland sagebrush is expected to be the preferred habitat for this species. Approximately 93 acres of this habitat will be affected by the proposed mining. This represents 9.4 percent of this habitat type in the

permit area. In addition, 552 acres of mixed sagebrush-grassland habitat would be affected by the project. This is 13.5 percent of that habitat type in the permit area.

Displacement of sage grouse into adjacent habitat has the same three potential consequences as listed for big game (above). Over 90 percent of the sagebrush bottomland habitat will be undisturbed and additional habitat is present immediately adjacent to the permit area. For this reason, displacement is not expected to impact the sage grouse population.

Habitat for waterfowl and shorebirds is limited within the study area. These habitats are not expected to be impacted by mining but increased human activity may affect migrating and feeding birds.

No nest sites will be lost through mining activities. Active nests within 0.5-mile of disturbance could be impacted if adult birds abandon a nest containing eggs or nestlings, however, species such as golden eagles are known to be tolerant of mining operations, as shown by their nesting on highwalls within active pits. The USFWS would be consulted prior to conducting mining activities within 0.5-mile of active nests.

A maximum of approximately 1,082 acres of habitat would be affected by mine activities and would be unavailable as raptor hunting and foraging habitat. Since considerable suitable raptor hunting and foraging habitat remains adjacent to the proposed mine area, the loss of of disturbed areas for raptor foraging is not expected to affect raptor numbers, composition, or productivity.

Other bird, mammal, reptile and amphibian species will be displaced from areas where vegetation and soils are removed. However, these disturbances will be minor with respect to the entire study area.

Approximately 13% of habitat within the Permit Area will be affected by mining activities. Acreage of each habitat type and the acreage as a percentage of that habitat type in the permit area are presented in Table D9-10.

Disturbance of wetland habitat will be avoided or mitigated as required under federal regulations, therefore less than 11 acres of wetland habitat is expected to be impacted by proposed mining activities.

The greatest acreage for the affected area is in mixed sagebrush-grass habitat. However, this habitat is common on the permit area and adjacent areas and the loss of this habitat is not expected to impact wildlife diversity in the area.

Not including wetlands, the upland grassland habitat will be affected in the highest proportion to its abundance on the permit area. Impacts to wildlife due to this reduction are expected to be minimal because additional upland habitat is being created through current

and future reclamation efforts. Much of the 844 acres of reclaimed habitat is now upland grassland and additional upland grassland will be created with reclamation following habitat disturbance associated with this project. The net result will be an increase in upland habitat as a result of the mining project.

The only MBHFI species which will probably be impacted by this operation are raptor species and include the ferruginous hawk, prairie falcon and golden eagle. These species are all known to nest in the study area. Although nest sites will not be physically disturbed, surface activities related to in situ mining may impact some of the sites as previously discussed. The ferruginous hawk is the most common nesting MBHFI species while only one pair of golden eagles and one pair of prairie falcons have been recorded nesting on the study area in previous years. The loggerhead shrike generally nests in tall shrubs which are located along ephemeral drainages in the study area. Most of the anticipated disturbances should occur in uplands and not within drainages, so therefore, this species should be minimally impacted. The mountain plover should not be impacted since this species was not observed on site and very little upland grassland or sparse subshrub habitats exist on the area for this species.

T&E or other species of concern should not be impacted by this operation. The only T&E species observed was the bald eagle. This species is only a migrant to the area and should not be affected by the project. Prairie dog towns do not exist within one mile of the permit area, therefore, habitat for black-footed ferrets is not present. Tall cliffs preferred for nesting peregrine falcons also do not exist on site so this species should not be impacted.

In general, the majority of the anticipated disturbances will occur within the sagebrush-grass habitat areas. Habitat types required by T&E or other species of concern either do not exist within the study area or are limited in extent and will not be disturbed. The two T&E or candidate species that have potential habitat on the permit area are the swift fox and mountain plover. However, with both species, their occurrence in the area is unlikely due to the lack of significant grassland or short-grassland habitats. The long-term impacts of the proposed mining action would increase the acreage of upland grassland on the Project area and could increase the potential for these species occurring in the area.

7. MITIGATION AND MONITORING

Impacted wildlife habitats will be mitigated following mining by establishing vegetation in accordance with the approved reclamation plan. Rock outcrops, trees, seeps and ponds should not be impacted, therefore, mitigation is not planned for those features. Raptor nest sites will not be removed, however, temporary mitigation will be needed for nest sites where operations are near enough to preclude successful reproduction. Where possible, mining activities will be avoided within 0.5 mile of an active raptor nest during the nesting season and prior to fledging of young. Mitigation will be carried out as approved by the USFWS and WG&FD under the appropriate permits obtained from those agencies. Proposed mitigation will include construction of alternate nest sites on natural features (trees, rock outcrops, cliffs), on mine highwalls, or the erection of appropriately sized nesting platforms. Fences, if needed, will be constructed to the required WG&FD standards with approval from the WDEQ and BLM. Minimal fencing, if any, is projected. Controlled speed limits will be implemented to reduce wildlife/vehicle collisions. Employees will be educated about wildlife protection, sensitive species and game laws through use of applicable publications and during safety meetings. The implementation of all of the above commitments will help alleviate impacts to wildlife.

Table D9-8.
Threatened, Endangered, and Candidate Wildlife Species Potentially Occurring in the Gas Hills Project Area.

Species	Survey Techniques	Potential Occurrence
Mammals		
Black-Footed ferret	Entire permit area and half-mile buffer were surveyed for prairie dogs. The nearest prairie do colony is a mile outside the permit boundary.	Unlikely
Swift Fox	Potential habitat was surveyed during spring and summer surveys.	Possible, but unlikely due to the lack of gentle rolling grassland habitat.
Birds		
Bald Eagle	Winter surveys were conducted in 11/92 and 4/94 in conjunction with big game and sage grouse surveys.	Unlikely except as migrant through area. Preferred habitat characteristics are lacking in permit area.
Peregrine Falcon	Cliff habitat surveyed with other raptor surveys.	Unlikely except temporary flights over area.
Mountain Plover	Driving surveys of short-grass prairie habitat during 1994 surveys.	Possible in grassland patches but its occurrence would be unexpected due to limited acreage of suitable habitat.

Table D9-9.
Wildlife Species of Special Concern in the State of Wyoming and their Potential for Occurrence in the Gas Hills Project Area.

Species	Preferred Habitat	Potential Occurrence
Mammals Long-eared myotis *(Myotis evokes)*	Forested habitat.	Unlikely
Fringed myotis *(Myotis thysanodes)*	Grassland, deserts, and woodlands. Roosts in caves and abandoned buildings.	Possible
Spotted Bat *(Euderma Maculatum)*	Cliff habitat near perennial water.	Possible
Townsend's big-eared bat *(Corynorhinus townsendii)*	Roosts in caves.	Unlikely
Pallid bat *(Antrozous pallid)*	Roosts in rock crevices.	Possible
Black-tailed prairie dog *(Cynomys ludovicianus)*	Short-grass prairie habitat	Possible but not found. This is the western-most boundary of the black-tailed prairie dog. The prairie dog species observed in the vicinity is the white-tailed prairie dog.
Water Vole *(Microtus richardsoni)*	Alpine and subalpine streams	Unlikely
Birds Snowy egret (Egretta thula)	Shallow water of lakes, ponds.	Unlikely
Black-crowned night heron *(Nycticorax nycticorax)*	Marshes and wooded streams.	Unlikely
Common loon *(Gavia immer)*	Medium to large lakes.	Unlikely
Clark's grebe *(Aechmophorus clarkii)*	Ponds, lakes and reservoirs.	Unlikely

Table D9-9 (continued)

American bittern *(Botaurus lentiginousus)*	Marshes and vegetated shorelines.	Unlikely except migrating through area.
Harlequin duck *(Histrionicus histrionicus)*	Rapid mountain streams and rivers.	Unlikely
Caspian tern *(Sterna caspia)*	Lakes, reservoirs, and rivers.	Unlikely
Forster's tern *(Sterna forsteri)*	Lakes, reservoirs, and marshes.	Unlikely
Northern pygmy owl *(Glaucidium gnoma)*	Coniferous forest	Unlikely
Great gray owl *(Strix nebulosa)*	Coniferous forest	Unlikely
Boreal owl *(Aegolius funereus)*	Coniferous forest	Unlikely

Table D9-10.
Habitat Types within the Permit Area and Affected Areas of the Gas Hills Project.

Habitat Type	Permit Area	Affected Area	Percent of Habitat Type Affected by Project
	Acres	Acres	Percent (%)
Mixed Sagebrush-grass	4089	552	13.5
Rough breaks west	569	29	5.1
Rough breaks east	1512	216	14.3
Bottomland sagebrush	991	93	9.4
Upland grasslands	131	42	32.1
Reclaimed mining areas	844	98	11.6
Disturbed land	319	41	12.9
Reservoirs	17	0	0.0
Wetlands	17	11	64.7
Total	**8500**	**1082**	**12.7**

ADDENDUM D9C

WG&FD Correspondence

WYOMING
GAME AND FISH DEPARTMENT

Jim Geringer, *Governor* John Baughman, *Director*

"Conserving Wildlife —Serving People"

May 13, 1999

WER 8435
Power Resources Gas Hills In-situ Uranium Project
Fremont County

Amber Travsky
Real West Natural Resource Consulting
1116 Albin Street
Laramie, WY 82072

Dear Amber:

This is in response to your inquiry as to wildlife baseline data requirements for the Power Resources Gas Hills in-situ uranium project.

Basic state data requirements for a project of this type will include identification of crucial and important habitats. These include crucial seasonal ranges for big game species, known sage grouse leks, and nesting sites for raptors. These areas can often be identified by requesting this information from the Wyoming Game and Fish Department when your permit area is identified. Depending on the area, some additional field surveys may be required. Information concerning threatened and endangered species, species of high federal interest, and other raptors can be obtained from the state office of the U.S. Fish and Wildlife Service in Cheyenne.

For a project of this type, other more extensive baseline data requirements, including small mammal and passerine bird surveys, are not required.

If you need any other information, please contact Vern Stelter at 307-777-4587.

Sincerely,

Tom Collins

Thomas C. Collins
Coordinator
Office of Director
Habitat Protection Program

TC:as
cc: USFWS

Headquarters: 5400 Bishop Boulevard, Cheyenne, WY 82006-0001
FAX (307) 777-4610

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WITHIN THIS PACKAGE... OR BY SEARCHING USING THE DOCUMENT/REPORT NO. PLATE D9-1, REV. 2

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