

SECTION 1

NORTH HILIGHT FIELD LBA TRACT

S1-1 TOPOGRAPHY AND PHYSIOGRAPHY

The general analysis area for the North Hilight Field tract is located in the northern portion of the general Wright analysis area. The LBA tract is bound by the Burlington Northern Santa Fe & Union Pacific (BNSF & UP) railroad on the west, the existing Jacobs Ranch Mine on the south and southeast, and the existing Black Thunder Mine on the south. The topography of the tract's general analysis area, like the area within the adjacent mines' existing permit areas, is relatively subdued. The landscape consists primarily of gently rolling terrain broken by minor drainages and internally-drained playa areas. Drainage densities are fairly low, and the playas are common topographic and hydrologic features. The tract is located near the headwaters of, and the drainage divide between, Black Thunder Creek and North Prong Little Thunder Creek. Low-order, ephemeral tributaries of North Prong Little Thunder Creek and Black Thunder Creek drain some of the LBA tract as applied for and lands added by the BLM study area; however, much of the study area does not contribute runoff to any stream. Internally-drained ephemeral streams, such as Springen Draw, and playas have formed in the lowest portion of these non-contributing drainage areas.

Elevations range from 4,748 feet to 4,950 feet within the LBA tract as applied for, from 4,748 feet to 5,130 feet within the BLM study area, and from 4,693 feet to 5,170 feet within the tract's general analysis area. Slopes within the tract's general analysis area range from essentially flat in the lower portion of the Springen Draw drainage and the eastern portion of the BLM study area where playa areas dominate the landscape, to a maximum of 49 percent in the north-central portion of the BLM study area, near the highest elevations and the drainage divide. The slopes of the gently rolling uplands, which comprise most (about 80 percent) of the tract's general analysis area, seldom exceed 5 percent.

S1-2 GEOLOGY

Stratigraphic units in the general analysis area include, in descending order, recent (Holocene age) alluvial and eolian deposits, the Eocene age Wasatch Formation (the overburden), and the Paleocene age Fort Union Formation (which contains the target coal beds).

The majority of the recent surficial deposits in the general analysis area are reworked Wasatch Formation residuum or deposits that are of mixed alluvial and eolian nature. The lithologies of these unconsolidated deposits represent materials eroded locally from the Wasatch Formation and reflect relatively near-source deposition. There are thin alluvial deposits along ephemeral streams and closed basin drainage channels. These alluvial deposits typically consist primarily of poorly to well-sorted, irregularly bedded to laminated, unconsolidated sand, silt, and clay with minor intervals of fine gravel. Eolian processes have reworked some of the surficial sands and silts, resulting in isolated deflation basins having no natural drainage. These internally-drained

surface features (playas) commonly contain fine-grained sediments recently deposited from seasonal rainfall or snowmelt runoff events.

The Eocene Wasatch Formation forms most of the overburden in the general analysis area. Wasatch rocks are exposed on the surface in some locations, particularly along steeper slopes formed by the more erosionally resistant strata and along the breaks or the broken land dissected by small ravines and gullies. The Wasatch overburden consists of interbedded, lenticular sands/sandstones, silts/siltstones, clays and shales with thin discontinuous coal seams. Typically, units are gradational mixtures of these sediments. There is no distinct boundary between the Wasatch Formation and the underlying Paleocene Fort Union Formation. From a practical standpoint, however, the top of the mineable coal zone is considered as the contact between the two formations. Scoria (also called clinker or burn) occurs at the eastern-most edge of the BLM study area where the overlying Wasatch sedimentary rocks were baked, fused or melted in place when the underlying Wyodak coal seam burned in-situ.

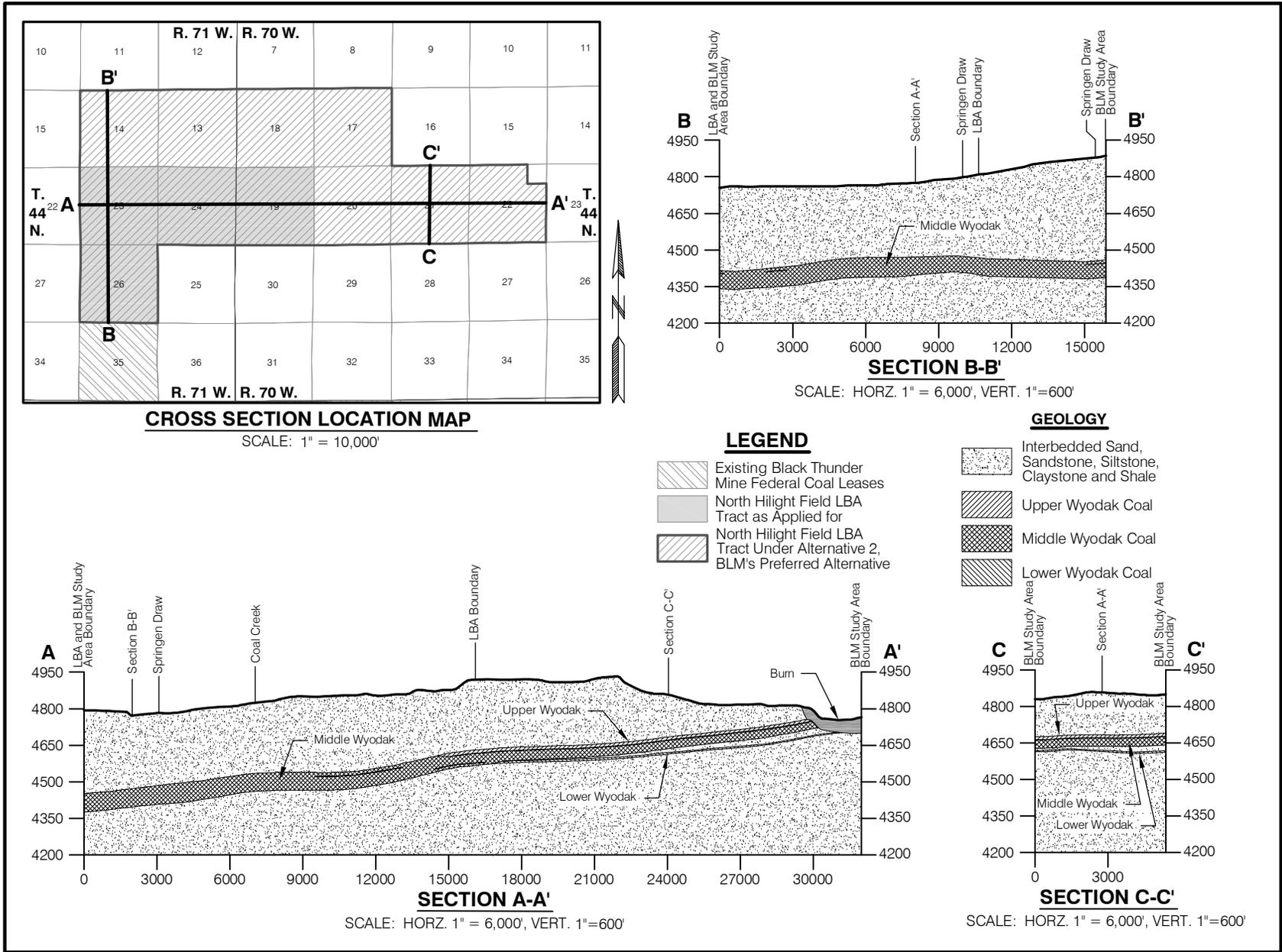
Within the North Hilight Field LBA Tract as applied for, there are two coal seams (referred to as Upper and Middle Wyodak) and three coal seams (referred to as Upper, Middle, and Lower Wyodak) in the BLM study area for the North Hilight Field LBA Tract (Alternative 2 configuration). Locally, the mineable seams are referred to as the upper/rider seam, the main seam, and basal seam. The seams are separated by a shale parting of variable thickness, but averages approximately 1 foot. The Lower Wyodak (basal seam) is not present over the entire BLM study area; the total coal thickness decreases in areas where it is not present. Due to quality issues, the Upper Wyodak may not be recovered. The upper coal seam within the study area averages approximately 13 feet, and the main coal seam within the study area averages approximately 48 feet, representing a cumulative coal depth of 61 feet. Table S1-1 presents the average thickness of the overburden, interburden, and the coal seams for the North Hilight Field LBA Tract. Figure S1-1 depicts two geologic cross sections (one north-south and one east-west) drawn through the LBA tract's BLM study area.

Table S1-1. Average Overburden and Coal Thicknesses in the North Hilight Field LBA Tract.

Mining Unit	Proposed Action (ft)	Alternative 2 (ft)
Overburden	246.0	246.0
Coal	61.0	61.0
Interburden	1.0	1.0

The Fort Union coal seams are subbituminous and are generally low-sulfur, low-ash coals. Typically, the coal being mined in the PRB has a lower heating value and higher sulfur content north of Gillette than south of Gillette. According to the analyses (which were done on an as-received basis) of exploration drilling samples collected in the North Hilight Field LBA Tract as

Figure S1-1. Geologic Cross Sections for the North Hilight Field LBA Tract.



applied for and the area added under Alternative 2, the average heating value of the coal is approximately 8,800 British thermal units per pound (Btu/lb), with an average of less than 0.6 percent sulfur, 5.4 percent ash, and 27.2 percent moisture.

S1-3 PALEONTOLOGY

Although the Wasatch Formation is known to produce fossil vertebrates of scientific significance in Wyoming, outcrops of the Wasatch Formation in the PRB are not generally well exposed and the conditions of deposition of the formation have contributed to a low preservation potential for fossils.

Geologic mapping by the U.S. Geological Survey and Wyoming State Geological Survey have documented that the general Wright analysis area is underlain by sedimentary deposits of the Wasatch Formation. Geologic maps depict bedrock units that would occur at the surface in the absence of recent, unconsolidated colluvial and eolian deposits that occur widespread over the general analysis area. These surficial materials in the general Wright analysis area are derived primarily from the underlying bedrock, which consists mainly of soft shale, sandstone and coal beds, and most of these rocks weather to fine-grained material. The physical properties of the weathered materials depend largely on the mode of transportation and deposition, whether by water, gravity, or wind that account for the position of the weathered materials. Actual outcrops of the Wasatch and underlying Fort Union formations that could be prospected for fossils occur infrequently and are found most commonly in areas having the steepest slopes (i.e., rough breaks between upland areas and drainage channels). The landscape of the LBA tract's general analysis area is not particularly suited to paleontological exposure. The general analysis area is generally rolling sagebrush shrubland and grassland. No substantial areas of bedrock exposures are found in this vicinity.

Vertebrate fossils that have been described from the Wasatch Formation include mammals such as early horses, tapiroids, condylarths, primates, insectivores, marsupials, creodonts, carnivores, and multituberculates; reptiles such as crocodylians, alligators, lizards, and turtles; birds; eggs; amphibians; and fish. Non-marine invertebrates such as mollusks and ostracods have also been described from the Wasatch.

Fossil plant material is common in the Wasatch Formation. The fossil plants inventoried are primarily leaves and fossilized wood. The leaves usually occur as lignitic impressions in sandstone and siltstone and as compact masses in shale. Leaves are the most abundant fossils found during paleontological surveys and are frequently encountered during mining operations. Fossilized wood often occurs near the top of a coal seam, in carbonaceous shale or within channel sandstone. Exposures of fossil logs are common, but usually very fragmentary. Like fossil leaves, fossil logs can be readily collected in the PRB.

Professional archeologists, in effort to locate unique pockets of fossilized bone such as those reported elsewhere in the Wasatch Formation in the PRB, closely examined outcrop localities in conjunction with the intensive pedestrian surveys for cultural resources. Due the ubiquitous nature of fossilized tree remains and bivalve fragments in the Wasatch Formation, the recording of fossil locations was confined to unique finds. The only observed fossils were of petrified wood fragments. Fossilized wood and leaves are common and can be observed at many unrecorded locations, particularly in associated with coal outcrops. No Wasatch Formation outcrop localities produced exceptional examples and no unique finds were located within the LBA tract's general analysis area.

S1-4 AIR QUALITY

S1-4.1 Existing Emission Sources

In the vicinity of the North Hilight Field LBA Tract, the main sources of air pollution are surface coal mining activities, vehicular traffic, railroad traffic, and various sources associated with oil and gas production and farming and ranching activities. The closest existing coal-fired power plants to the LBA tract are the Dave Johnston plant (approximately 61 miles south-southwest) and the Wyodak Complex (approximately 48 miles north), which consists of the 90-Mw WyGen No. 1, the 335-Mw Wyodak No. 1, the 21.8-Mw Neil Simpson No. 1, the 80-Mw Neil Simpson No. 2, and two 40-Mw natural gas-fired power plants.

S1-4.2 Proposed Emission Sources

All of the currently proposed emission sources in the eastern PRB are discussed in Chapter 4 of the WAC DEIS document. There are currently 12 pending LBA applications, including the North Hilight Field tract. Table S1-2 provides the approximate distances from the North Hilight Field tract to each of the other 11 pending LBA tracts.

S1-4.3 Historical Ambient Air Quality: Particulate Emissions

Emission Producing Activities

Fugitive particulate (dust) emissions are produced within the mine areas by activities such as coal and overburden blasting, excavating, loading and hauling, and large areas of disturbed land. Stationary or point sources of particulate emissions produced within the mine areas include coal crushing, handling/conveying, and storage facilities.

Monitoring Results

Wyoming Department of Environmental Quality/Air Quality Division (WDEQ/AQD) requires the collection of information documenting the quality of

Table S1-2. Distances to Pending LBA Tracts.

LBA Tract	Adjacent Mine	Distance from North Hilight Field
Hay Creek II	Buckskin	47 miles northwest
Caballo West	Caballo	23 miles north
Belle Ayr North	Belle Ayr	22 miles north
West Coal Creek	Coal Creek	10 miles north
Maysdorf II	Cordero Rojo	12 miles north
West Jacobs Ranch	Jacobs Ranch	Proximate
West Hilight Field	Black Thunder	2 miles southwest
South Hilight Field	Black Thunder	4 miles south
North Porcupine	North Antelope Rochelle	10 miles south
South Porcupine	North Antelope Rochelle	13 miles south
West Antelope II	Antelope	14 miles south

the air resource at each of the PRB surface coal mines. Each mine was required to monitor air quality for a 24-hour period every six days at multiple monitoring sites through the end of 2001. Beginning in 2002, all PM₁₀ monitors located at the active mines are required by WDEQ/AQD to sample air quality for a 24-hour period every three days.

In accordance with the Ambient Air Quality Assurance Project Plan, Black Thunder Mine operates a particulate and meteorological monitoring network. Figure 3-3 in the WAC DEIS shows the locations of the mine's particulate (PM₁₀ and TSP) air quality sampling sites (BTM-9, BTM-25, BTM-26, BTM-31, and BTM-36) and meteorological monitoring station. TSP was originally monitored at the Black Thunder Mine at all sites, but they began reporting particulate emissions using low-volume PM₁₀ in 1995. The State of Wyoming added PM₁₀-based standards in 1989 and retained the TSP standards until March 2000; therefore, the TSP standard is no longer being enforced. Black Thunder Mine continued to monitor TSP at site BTM-26 through 2007. The progression of mining operations requires that the location and number of particulate monitors be adjusted in order to provide the best documentation of the ambient air quality. Black Thunder Mine discontinued monitoring at site BTM-31 in October 2006; relocated site BTM-26 to BTM-25 in February 2008; and began monitoring at site BTM-9 in February 2008, as approved by WDEQ/AQD.

There were no exceedances of the 24-hour TSP standard at the Black Thunder Mine when TSP was the federally regulated pollutant, and there have been no exceedances of the annual average PM₁₀-based standards at the Black Thunder Mine since PM₁₀ became the federally regulated pollutant. There were no exceedances of the 24-hour PM₁₀-based standards at the Black Thunder Mine through 2001. From 2002 through 2007 the Black Thunder Mine had

Supplementary Information on the Affected Environment

experienced seven exceedances of the 24-hour PM₁₀ standard; all at Site BTM-36. Each of the seven events occurred in conjunction with winds exceeding 20 mph, which could have qualified as a high-wind event under the Natural Events Action Plan. Prior to 2007, there was no mechanism in place to account for exceedances demonstrated to be the result of natural events. The WDEQ/AQD collaborated with the Wyoming Mining Association (WMA) to develop a Natural Events Action Plan (NEAP) for the coal mines of the PRB, based on EPA Natural Event Policy guidance. Under certain conditions, excessive PM₁₀ concentrations resulting from dust raised by exceptionally high winds or other natural events will be treated as uncontrollable natural events. The one exceedance that was reported in 2007 at the Black Thunder Mine is currently under review by EPA as an exceptional event under the NEAP and may be treated as an uncontrollable natural event (not considered when determining the region's air quality designation).

Table S1-3 presents the average annual particulate emissions measured at the mine's three air quality monitoring sites active from 1997 through 2008. In an effort to relate measured particulate emissions to mine activity, Black Thunder Mine's annual coal and overburden production are included in Table S1-3.

Table S1-3. Summary of Black Thunder Mine Annual Coal and Overburden Production and Particulate Emissions Monitoring Data, 1997 - 2008.

Year	Coal Produced (mmtpy)	Overburden Moved (mmbcy)	Average Annual Particulate Emissions ¹				
			BTM-26	BTM-31	BTM-36	BTM-25	BTM-9
1997	37.6	141.0	18	N/A	12	--	--
1998	42.7	133.5	23	N/A	14	--	--
1999	48.7	122.0	33	N/A	17	--	--
2000	60.1	191.9	31	18	25	--	--
2001	67.6	152.8	27	26	37	--	--
2002	65.1	155.6	25	21	38	--	--
2003	62.6	155.3	16	16	36	--	--
2004	66.8	183.3	21	25	33	--	--
2005	62.7	181.5	15	26	33	--	--
2006	67.3	182.7	29	38 ²	35	--	--
2007	65.3	203.5	25	N/A	34	--	--
2008	68.5	301.9	19	N/A	34	16	22

¹ PM₁₀ (in µg/m³)

² Site was discontinued October 2006

Source: EPA (2009b), Shamley (2008a)

Control Measures

The WDEQ/AQD requires the use of Best Available Control Technology (BACT) on all sources of emissions in the State of Wyoming. Black Thunder Mine practices control measures that are applicable to surface mining operations, which are outlined in Section 14 of the Wyoming Air Quality Standards and Regulations (WAQSR).

Fugitive emissions are controlled with a variety of methods that the agency considers BACT. Section 3.4.2.3 in the WAC DEIS addresses a variety of dust control measures that WDEQ/AQD requires for all surface coal mines in the PRB. Additional site-specific requirements related to mine-specific layout and mining practices are typically included in the individual mine's air quality permit, examples of which are also given in the WAC DEIS. The WDEQ/AQD has issued several new air quality permits modifying Black Thunder Mine's air quality controls/operating procedures, and in 2008, WDEQ/AQD issued air quality permit MD-3851 to combine the Black Thunder and North Rochelle air quality permits and to allow a maximum annual production of 135 mmtpy (BTM 2008b).

S1-4.4 Historical Ambient Air Quality: NO₂ Emissions

Emission Producing Activities

Vehicular traffic, both inside and outside the areas of mining, is responsible for tailpipe emissions. Exhaust emissions from large-scale mining equipment, emissions from compressor engines used in the production of natural gas, emissions from railroad locomotives, and coal-fired power plant emissions all contain oxides of nitrogen (NO_x). Tailpipe emissions consist primarily of nitrogen dioxide (NO₂), carbon monoxide (CO), and volatile organic compounds (VOCs), but may also include sulfur dioxide (SO₂) and other trace constituents. Overburden blasting also sometimes produces gaseous orange-colored clouds that contain NO₂. NO₂ is one of several products resulting from the incomplete combustion of the explosives used in the blast.

Monitoring Results

NO₂ monitoring results are available from several currently-active air quality monitoring stations in the eastern PRB, including the Thunder Basin National Grasslands Site, located approximately 65 miles north of the Black Thunder Mine; the Campbell County Site, located approximately 30 miles north-northwest of the Black Thunder Mine; and the Tracy Ranch Site, located about 1 mile east the Black Thunder Mine. WDEQ/AQD and the Black Thunder Mine (Tracy Ranch site only) maintain these air quality monitoring stations. The monitoring data that have been gathered from these sites, as well as other sites that are no longer monitored, are included in Section 3.4.3 of the WAC DEIS.

Control Measures

Black Thunder Mine received several reports of public exposure to NO₂ from blasting prior to 2001. Measures to control or limit future such incidences when large overburden blasts are planned have been instituted at the mine. Measures to avoid impacts to the public are requirements for the Black Thunder Mine as part of a settlement agreement reached in 2000. The measures that have been implemented include notification of neighbors and workers in the general area of the mine prior to a large blast, monitoring of weather and atmospheric conditions prior to a large blast, blast detonation in daylight hours (preferably between 12:00 p.m. and 3:00 p.m.), posting signs on major public roads that enter the general mine area and on all mine access gates, and closing public roads and railroads when appropriate (Section 3.4.3.3 in the WAC DEIS includes additional information). There have been no incidents of public exposure in the southern PRB reported to the WDEQ for the past 4 years.

S1-5 WATER RESOURCES

The North Hilight Field LBA Tract is adjacent to both the Black Thunder and Jacobs Ranch mine's existing permit areas; therefore, both the regional and site-specific baseline water resources around and within the North Hilight Field LBA Tract are extensively characterized in those mines' Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) mine permits (TBCC 2005, JRCC 2004). The following analysis is based largely on those findings.

S1-5.1 Groundwater

The North Hilight Field LBA Tract overlies three geologic water-bearing strata that have been or would be directly affected by mining. In descending order, these units are the recent alluvial deposits, the Wasatch Formation overburden, and the Fort Union Formation Wyodak coal seam that will be mined. The underlying, subcoal Fort Union Formation is utilized for industrial water supply at the nearby mines, but this unit is not physically disturbed by mining activities. Baseline hydrogeologic conditions within and around the Black Thunder Mine are characterized in the WDEQ/LQD mine permit (TBCC 2005), and ongoing groundwater monitoring data (depth to water and water quality) are included in the mine permit and annual reports. Black Thunder Mine's current groundwater monitoring program is addressed in their 2007 WDEQ Annual Report (TBCC 2007), and Figure 3-20 in the Wright Area Coal Leases Draft EIS (WAC DEIS) depicts the locations of the currently active monitoring wells.

Recent Alluvium

The North Hilight Field LBA Tract is within the North Prong Little Thunder Creek and Black Thunder Creek watersheds. Recent alluvial deposits

associated with surface drainages within the tract's general analysis area are generally very thin and not laterally extensive enough to be considered aquifers. In addition, these unconsolidated deposits are typically very fine-grained and have very limited permeabilities, precluding any significant storage and movement of groundwater (TBCC 2005). Mapping of the area's surficial geology (Reheis and Coates 1987, Moore and Coates 1978, and Coates 1977) shows that alluvial deposits within the LBA tract's general analysis area occur only along Springen Draw, which is a closed basin, and the alluvial materials are comprised of fan, apron and sheet wash deposits (Figure S1-2).

The portion of the North Hilight Field tract's general analysis area that lies within the North Prong watershed is drained to the south by Mills Draw, an ephemeral tributary of North Prong. The portion of the North Hilight Field tract's general analysis area that lies within the Black Thunder Creek watershed is drained to the northeast by Keeline Draw, an ephemeral tributary of Black Thunder Creek. Alluvial deposits have not been mapped along either of those streams. The largest portion of the LBA tract's general analysis area does not contribute runoff to any stream and drains to natural topographic depressions. Springen Draw, for example, is formed by a relatively large closed basin (over 8,000 acres in size) into which several ephemeral draws drain (Figure S1-2).

No aquifer tests on valley fill deposits have been documented in the Black Thunder Mine permit area due to the minimal saturated thickness and low transmissivity of the deposits. Hydrologic properties of the stream laid deposits are variable throughout the permit area due to variable depositional environments. Based on a comparison of soil texture and type with permeability values presented in the literature (Cedergren 1977), the average hydraulic conductivity for the valley fill streamlaid deposits and colluvium is estimated to range from 0.2 to 20 feet per day (ft/day). The specific yield of the streamlaid deposits and colluvium, as determined through laboratory analysis, was an overall transmissivity of 7×10^{-2} to 7×10^{-5} gallons per day per square foot (gpd/ft²) (TBCC 2005).

Alluvial groundwater in this area is of poor quality and highly variable spatially. Available water quality data indicates alluvial groundwater from the valleys of Little Thunder Creek and North Prong Little Thunder Creek generally does not meet all of the WDEQ/WQD Standards (WDEQ/WQD 2009) for domestic and agricultural uses due to high total dissolved solids (TDS), sulfate and/or manganese concentrations. Ten monitoring wells installed to characterize alluvium at Black Thunder Mine exhibit an average TDS concentration of about 1,600 milligrams per liter (mg/L), which indicates the water is suitable for agricultural and livestock use. However, alluvial groundwater from monitoring wells BTA-24e and BTA-25 (refer to Figure 3-20 in the WAC DEIS for well locations) is not considered suitable for livestock use, as well as domestic and agricultural use (TBCC 2007).

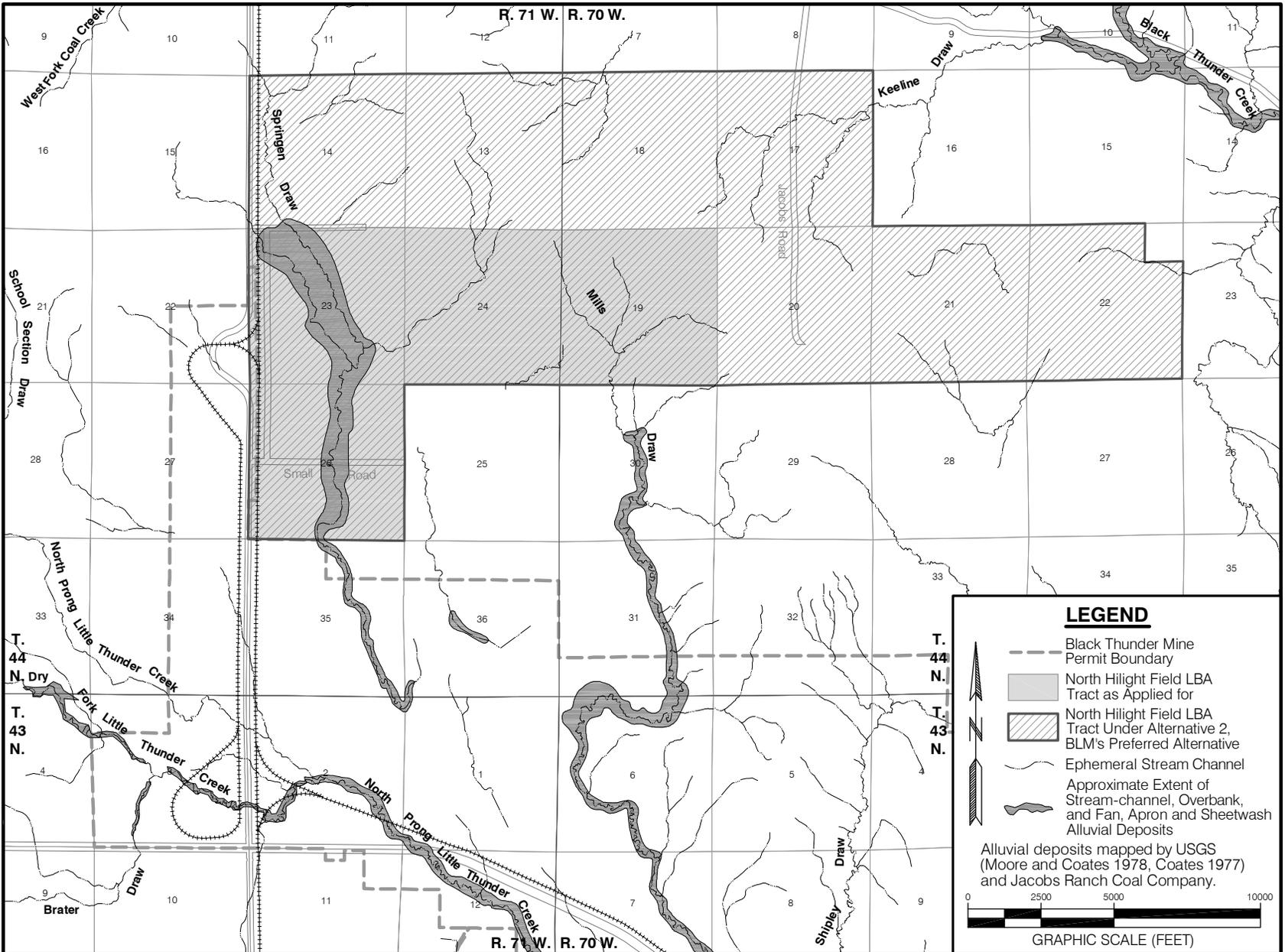


Figure S1-2. Stream Laid Deposits Within and Adjacent to the North Hillight Field LBA Tract.

Wasatch Formation

Within the PRB, the Wasatch Formation (the strata lying above the mineable coal, also called the overburden) consists of non-marine, fluvial and eolian deposits of interbedded sands, silts, and clays with occasional discontinuous deposits of coal, carbonaceous material and clinker. This description basically holds true for the area within and around the North Hilight Field LBA Tract. The Wasatch Formation overburden reportedly consists of approximately 80 percent claystone and siltstone beds and approximately 20 percent sandstone lenses (TBCC 2005). Saturated strata within the Wasatch are limited in areal extent and are typically thin, lenticular sandstones. The hydraulic connection between sandstone lenses is tenuous due to the intervening shale; thus, groundwater movement through the Wasatch Formation overburden is limited. The sandstone and thin coal stringers, where saturated, will yield water to wells. This water is primarily used for livestock watering. Since the saturated sandstone and coal units within the formation are not continuous, the Wasatch is not considered to be a regional aquifer.

Another geologic unit that may be considered a part of the Wasatch Formation is scoria, also called clinker or burn. It consists of sediments that were baked, fused, and melted in place when the underlying coal burned spontaneously. These contact metamorphic sediments collapsed into the void left by the burned coal. Scoria deposits can be a very permeable aquifer and can extend laterally for miles in the eastern PRB. The occurrence of scoria is site specific, typically occurring in areas where coal seams crop out at the surface. The hydrologic function of scoria is to provide infiltration of precipitation and recharge to laterally contiguous overburden and coal beds. Clinker outcrop areas occur along Black Thunder Mine's eastern permit boundary. Scoria does not occur on the general analysis area for the LBA tract.

Water production from the overburden within and around the Black Thunder Mine area is typically low. Most of the overburden is composed of massive silty and clayey shales of very low permeability. Distinct zones of relatively unconsolidated, discontinuous sand bodies are also present in the overburden in the Black Thunder Mine permit area, some of which are saturated. These lenticular-shaped sand bodies are variable in nature and tend to be both vertically and horizontally isolated and discontinuous. Thicknesses range from 0 to over 300 feet. Given the low permeability of the silts and clays that isolate these sand bodies, groundwater yields from them are generally low and not extensive enough to supply a continuous, reliable yield of more than a few gallons per minute (gpm). The overburden sand bodies therefore constitute minor aquifers of interest in the Black Thunder Mine permit area (TBCC 2005).

Recharge to the Wasatch Formation is predominantly from the infiltration of precipitation and lateral movement of water from adjacent scoria bodies. Regionally, groundwater is discharged from the Wasatch Formation by evaporation and transpiration, by pumping wells, by vertical leakage into the underlying coal seams, by drainage into mine excavations, and by seepage into

the alluvium along stream courses. Overburden in the vicinity of the North Hilight Field LBA Tract is recharged naturally by infiltration of precipitation. Additionally, artificial recharge occurs where in-channel reservoirs have been constructed for ranching operations and where coal bed natural gas (CBNG) groundwater is discharged to the surface. Overburden groundwater is not generally connected to the underlying Wyodak coal seam due to a low-permeability stratum at the base of the overburden, which is fairly widespread in the general analysis area. However, part of the water in the overburden recharges the coal and some continues moving laterally and downward until it discharges to the surface in a drainage channel (TBCC 2005).

Due to the discontinuous nature of the permeable overburden sediments, premine overburden groundwater movement generally followed the topography. Before mining, overburden groundwater flow in the vicinity of the Black Thunder Mine was generally toward, and discharged to the Little Thunder Creek and Black Thunder Creek valleys. Groundwater flow has since been affected in the mine area by the removal of overburden, and north and west of the mine by dewatering operations. Monitor well data indicate that overburden groundwater in the North Hilight Field LBA Tract general analysis area now flows toward the Black Thunder's and neighboring mine's open pits. Overburden groundwater levels show steady decline in areas within about ½ mile of the mine pits as a result of mine drainage. Discharge from the overburden occurs in localized areas along North Prong Little Thunder Creek, Little Thunder Creek, and Black Thunder Creek, where the static water level and the valley fill deposits are nearly the same. Insufficient information is available to quantify any discharge from the overburden that may be occurring into these surface drainages (TBCC 2005).

For the Wasatch Formation as a whole in the PRB, the discontinuous nature of the water bearing units results in low overall hydraulic conductivity and low groundwater flow rates. Because of the varied nature of the aquifer units within the Wasatch, hydraulic properties are variable as well. Martin et al. (1988) reported that hydraulic conductivities within the Wasatch ranged from 10^{-4} ft/day to 10^2 ft/day, and the geometric mean hydraulic conductivity based on 203 tests was 0.2 ft/day. The geometric mean hydraulic conductivity from 70 aquifer tests using wells completed in sandstone in the Wasatch overburden was 0.35 ft/day, while that from 63 aquifer tests using wells completed in siltstone and claystone in the Wasatch overburden was 0.007 ft/day (Rehm et al. 1980). Field aquifer tests conducted for the Black Thunder Mine located south of the LBA tract indicate that the water-bearing Wasatch strata have a low hydraulic conductivity, with a range of roughly one order of magnitude (0.077 to 0.927 ft/day); with locally higher values being associated with higher sand fractions relative to the low-permeability silts and clays that make up the majority of the overburden (TBCC 2005).

The quality of groundwater in the Wasatch Formation near the North Hilight Field LBA Tract is variable and generally poor. TDS concentrations measured from overburden monitoring wells at Black Thunder Mine range from about 80

to 5,800 mg/L, averaging about 2,500 mg/L (TBCC 2005). The median TDS for the Wasatch Formation for the group of mines located between Gillette and Wright, as calculated by WDEQ/LQD based on 1,109 samples, is 2,996 mg/L (Ogle et al. 2005). Based on the analyses of over 1,000 water quality samples collected by the southern PRB mines, including Black Thunder, the median TDS concentration was 2,000 mg/L and the predominant constituents were sodium and sulfate (Ogle and Calle 2006). Overburden groundwater is generally considered to be unsuitable for domestic consumption and irrigation use, but is suitable for livestock and wildlife use.

Wyodak Coal

The Tongue River Member of the Fort Union Formation contains the mineable coal zone, which is often divided by partings that separate it into two or more units. The mineable coal zones are variously referred to as the Anderson and Canyon, Roland and Smith, Wyodak-Anderson, Upper and Lower Wyodak, or Wyodak seams. At the Black Thunder Mine, it is referred to as the Wyodak seam. In the North Hilight Field LBA Tract area, the Wyodak seam ranges from 60 to 110 feet thick, with an average thickness of approximately 61 feet.

Due to its continuity, the Wyodak coal seam is considered a regional aquifer because it is water bearing and is laterally continuous throughout the area. Historically, the Fort Union coal seams have been a source of groundwater for domestic and livestock uses in the eastern PRB. However, due to the 1 to 3 degree west-northwest dip of the coal beds, the coal generally becomes too deep to be an economical source of stock water within a couple of miles west of the PRB surface coal mines, including Black Thunder Mine.

Hydraulic conductivity within the coal seams is highly variable and reflective of the amount of fracturing the coal has undergone, as unfractured coal is virtually impermeable. Field tests indicate that the coal has a low to moderate transmissivity with a range of roughly two orders of magnitude. Localized zones of moderately high transmissivity occur due to increased fracturing. The yield of groundwater to wells and mine pits is smallest where the permeability of the coal is derived primarily from localized unloading fractures. The highest permeability is imparted to the coal by tectonic fractures. These are through-going fractures of areal importance created during deformation of the Powder River structural basin. The presence of these fractures can be recognized by their linear expression at the ground surface, controlling the orientation of stream drainages and topographic depressions. Due to their pronounced surface expression, these tectonic fractures are often referred to as "lineaments." Coal permeability along lineaments can be increased by orders of magnitude over that in the coal fractured by unloading only. Such increased permeability in the coal aquifer is seen in the southeast area of the Black Thunder Mine, and is attributed to structural development that has produced additional fracturing. Coal permeability values are highly variable in the general analysis area, indicating extreme variations in the fracture densities.

Hydraulic conductivity values range from 0.16 to 84.6 ft/day in the Black Thunder Mine area (TBCC 2005).

Recharge to the coal occurs principally by infiltration of precipitation in the clinker outcrop areas along the flank of the eastern Powder River structural basin. Secondary vertical recharge from the overburden also occurs, but is highly variable. Prior to mining, the direction of groundwater flow within the areally continuous coal aquifer was generally from recharge areas westward into the basin, following the dip of the coal. Groundwater conditions varied from unconfined to confined, depending on the coal elevation and proximity to the outcrop area. Water levels were generally above the top of the coal away from the outcrop.

Site-specific water-level data collected from monitoring wells by Black Thunder Mine and other Gillette area coal mining companies and presented in the Gillette Area Groundwater Monitoring Organization (GAGMO) 25-year report (Hydro-Engineering 2007) indicate that the groundwater flow directions in the Wyodak coal have been greatly influenced by surface mine dewatering and groundwater discharge associated with CBNG development. Groundwater levels observed near active mining areas prior to 1997 were likely due to mine dewatering alone and the groundwater flow direction within the coal aquifer was typically toward the mine excavations. By year 2000, groundwater level decline rates had dramatically increased because drawdown caused by widespread CBNG development west of the mines was overlapping with drawdown caused by mining operations. A continuous cone of depression existed around the Jacobs Ranch, Black Thunder, North Antelope Rochelle and Antelope mines due to their closeness to each other and the cumulative drawdown effects from pit dewatering and nearby CBNG discharges. The extent of drawdown west of the mines that is specifically attributable to mine dewatering can no longer be defined due to much greater and areally extensive drawdown caused by CBNG development.

Recent coal seam water level data presented in the GAGMO 25-year report (Hydro-Engineering 2007) illustrate that approximately 40 feet of drawdown has occurred near the western edge of the North Hilight Field LBA Tract, and approximately 5 feet of drawdown has occurred near the tract's eastern edge. The 2005 coal seam water level contours in the area of the Jacobs Ranch, Black Thunder and North Antelope Rochelle mines depict the groundwater flow direction to be entirely to the west, away from the open pits. Roughly 30 years of surface mining and 10 years of CBNG development has resulted in complete dewatering of the coal seams in localized areas, particularly near the mines' pits and where the coal seams are structurally highest.

Coal groundwater quality is typically only suitable for livestock and wildlife watering purposes because certain constituent concentrations commonly exceed many suitability criteria for domestic uses, and the water may have a high salinity and sodium hazard, which makes it unsuitable for agricultural uses. Concentrations of individual parameters may exceed the livestock

standards at some locations (Ogle and Calle 2006). Within the Black Thunder Mine area, Wyodak coal groundwater quality is generally poor, but exhibits lower TDS concentrations than alluvial or overburden groundwater. The composition of groundwater in the coal is fairly uniform and there are no seasonal or long-term trends in composition. The predominant cation is sodium, while the predominant anion is bicarbonate. Those coal monitoring wells located closer to the coal-scoria contact have greater magnesium, sodium and sulfate concentrations (TBCC 2007). A median TDS concentration of 952 mg/L was calculated by the WDEQ/LQD for the coal aquifer, based on 832 samples collected from the southern group of PRB mines, including Black Thunder (Ogle and Calle 2006).

Subcoal Fort Union Formation

The Fort Union Formation is divided into three members, which are, in descending order: the Tongue River Member, the Lebo Member, and the Tullock Member. The mineable coal seams occur within the Tongue River Member. The subcoal Fort Union Formation consists primarily of lithified sands and shales, and is divided into three hydrogeologic units: the upper Tongue River aquifer, the Lebo confining layer, and the Tullock aquifer (Law 1976). Of the three units, the Tullock is the most prolific in terms of groundwater yield. The most productive wells in the vicinity of the Black Thunder Mine are completed in the Tullock aquifer at a depth of 1,070 feet below ground level.

Mining does not directly disturb the hydrogeologic units below the mineable coal, but many PRB mines use them for industrial water supply wells. In a few cases there have been drawdowns in the subcoal aquifer due to leakage into mine pits, dewatering, and CBNG development. The upper Tongue River aquifer consists of lenticular, fine-grained sandstone interbedded with mudstone. The Lebo confining layer is typically more fine-grained than the other two members and generally retards the movement of water (Lewis and Hotchkiss 1981). The Lebo confining layer typically separates the Tongue River and Tullock aquifers hydraulically. The Tullock aquifer consists of discontinuous lenses of sandstone separated by interbedded shale and siltstone.

Transmissivity is equal to an aquifer's hydraulic conductivity, or permeability, times the aquifer's saturated thickness, and is commonly used when discussing the hydraulic properties of the subcoal Fort Union Formation where wells are completed by exposing many discrete sand lenses to the well bore. Transmissivities are generally higher in the deeper Tullock aquifer than in the shallower Tongue River aquifer, and many mines in the PRB have water-supply wells completed in this interval (Martin et al. 1988). The average transmissivity for the Tullock, as reported by OSM (1984), is 290 ft²/day. Three industrial water supply wells within Black Thunder Mine's existing permit area are completed in the Fort Union Formation. Well BTFU-27-1 is completed in the upper Tongue River aquifer. Well BTFU-29-1 is completed in the Tullock aquifer; it is 2,200 feet deep, and Well BTFU-17-2 is completed in the Tullock

aquifer; it is 2,428 feet deep. Aquifer tests conducted on Black Thunder Mine's production wells found the transmissivity to be between 82 ft²/day and 132 ft²/day. The locations of these mine supply wells are shown on Figure 3-20 in the WAC DEIS.

The water quality of the subcoal Fort Union Formation is generally good, meeting the standards for domestic use, as well as irrigation and livestock use (Ogle and Calle 2006). TDS concentrations measured in various subcoal Fort Union Formation water supply wells in the eastern PRB range from 250 mg/L to 520 mg/L. Water from the subcoal Fort Union Formation is typically of the sodium-bicarbonate type.

S1-5.2 Surface Water

The Black Thunder Mine site is situated near the southern margin of the PRB, which is a broad structural trough that lies between the Big Horn Mountains and the Black Hills. The PRB is drained by three separate drainage systems: the Powder/Little Powder, the Cheyenne, and the Belle Fourche rivers. The Black Thunder Mine and North Hilight Field LBA Tract lie within the Little Thunder Creek watershed, which is a tributary of Black Thunder Creek, which is a tributary of the Cheyenne River. The topography of the Cheyenne River drainage basin is typified by broad, flat, inter-stream uplands and a wide, level expanse of eastward-sloping plains broken by a few isolated buttes.

Little Thunder Creek flows from west to east through the mine's permit area and empties into the Black Thunder Creek approximately 25 miles east-southeast of the North Hilight Field LBA Tract. The total drainage for Little Thunder Creek is approximately 127 square miles, and the mainstream channel is about 26 miles long. The Little Thunder Creek watershed has a dendritic drainage pattern with an approximate width (north-south) of 11.7 miles and an approximate length (east-west) of 15.3 miles. The relief of Little Thunder Creek's basin is 490 feet from its headwaters to its confluence with the Black Thunder Creek.

The Black Thunder Mine disturbs several drainages within the Little Thunder Creek watershed and Little Thunder Creek is currently diverted around the mining operation. The Black Thunder Mine is currently permitted to disturb approximately 4 percent of the Little Thunder Creek drainage basin. The entire Little Thunder Creek drainage basin was extensively studied by TBCC and the results of that study are included in the Black Thunder Mine permit (TBCC 2005). The North Hilight Field LBA Tract is adjacent to the mine's existing permit area. The topography of the North Hilight Field LBA Tract, like the area within the mine's existing permit area, is essentially subdued and drainage densities are fairly low and internally-drained playas are common topographic and hydrologic features. For example, an area on the LBA tract does not contribute runoff to any stream and a playa has formed in the lowest portion of this non-contributing drainage basin. This playa, being within the Little Thunder Creek watershed and within the mine's permit area, was studied in

the evaluation of the Little Thunder Creek drainage basin. The playa is roughly 183 acres in size with a contributing drainage area of 8,164 acres. The hydrologic characteristics of these non-contributing drainages were quantified and are included in Black Thunder Mine's current mine and reclamation permit (TBCC 2005). Figure 3-27 in the WAC DEIS depicts the surface water features within and adjacent to the North Hilight Field LBA Tract.

Mills Draw, a southeast-flowing, second order ephemeral tributary of North Prong Little Thunder Creek, drains the eastern portion of the North Hilight Field LBA Tract. Near the headwaters of Mills Draw, the stream channel elevation is about 4,900 feet. Total topographic relief in the stream's basin is 240 feet, the channel thalweg length is about 10.72 miles, and the average channel gradient is 0.0040 ft/ft. The channel elevation is about 4,900 feet where it enters the LBA tract and approximately 4,820 feet where it leaves the LBA tract. Mills Draw has a total drainage area of approximately 13.3 square miles and it drains about 29 percent of the North Hilight Field LBA Tract as applied for. Springen Draw, the non-contributing drainage to the large playa area discussed above, covers the balance (71 percent) of the LBA tract as applied for.

Nearly the entire western half of the LBA tract's BLM study area (Sections 13, 14, 23, 24, and 26, T.44N., R.71W.) is drained by the southern-flowing Springen Draw. Springen Draw is an ephemeral stream formed within a closed drainage basin that contributes no streamflow to North Prong Little Thunder Creek. The balance of the BLM study area outside of the LBA tract as applied for is drained by Keeline Draw, a northeast flowing ephemeral tributary to Black Thunder Creek, and two non-contributing drainages flowing to playas located in Sections 20, 21, and 22, T.44N., R70W. (see Figure 3-27 in the WAC DEIS).

All streams within and adjacent to the LBA tract are typical for the region, in that flow events are ephemeral. Stream runoff is typically of short duration and exhibits temporal patterns similar to precipitation events. All ephemeral streams in the region show the characteristic extreme low-flow period from October through January. Flow events frequently result from snowmelt during the late winter and early spring. Although peak discharges from such events are generally small, the duration and therefore the percentage of annual runoff volume can be considerable. During the spring, general storms (both rain and snow) are more frequent; hence increasing soil moisture and decreasing infiltration capacity, and subsequent rainstorms can result in higher runoff volumes and peak discharges.

Black Thunder Mine has not monitored the streamflow on Springen Draw; however, hydrographs generated using data collected from the gaging stations located on Mills Draw exhibit similar data to those found on North Prong Little Thunder Creek, which is infrequent stream flow events of very low magnitude (less than 5 cubic feet per second). Each stream flow event is separated by periods of no flow ranging in duration from 3 days to 20 months with an average length of 8 months.

Presently, 10 in-channel reservoirs are located in the North Hilight Field LBA Tract as applied for, and an additional 13 in-channel reservoirs are located on lands added by the BLM study area. These impoundments have served to capture most of the streamflow, causing pronounced stream channel aggradation to the point at which it is difficult in places to distinguish the active channel from abandoned channel scars. The channel floor and banks are vegetated, no active erosion is evident, and the channel profile is irregular indicating the reduced streamflow cannot maintain its former gradient prior to the construction of the stock ponds. Due to the relatively small drainage areas and the storage capacities of the impoundments, streamflow events are limited and heavily regulated (TBCC 2005).

North Prong Little Thunder Creek is listed in the WDEQ/WQD Surface Water Classification List as a Class 3B stream that is not known to support fish populations or drinking water supplies. Class 3B waters are intermittent or ephemeral streams with sufficient water present to normally support aquatic life including invertebrates, amphibians, or other flora and fauna at some stage of their life cycles. Class 3B waters are also characterized by frequent linear wetlands or impoundments over its entire length (WDEQ/WQD 2009).

Due to the lack of natural streamflow in Mills Draw, flowing water quality samples have not been collected from the stream. Surface water samples have however been collected from Little Thunder Creek and North Prong Little Thunder Creek at Black Thunder Mine's monitoring sites, shown on Figure 3-27 in the WAC DEIS. Insufficient data and the ephemeral flows prevent the identification of seasonal trends; however, TDS values generally range from about 300 mg/L to 5,000 mg/L, and the water type is a sodium sulfate.

The streamflow and water quality in North Prong Little Thunder Creek and Little Thunder Creek are currently being monitored by the Black Thunder Mine at sites located upstream and downstream of the mine operation and the data are being reported to the WDEQ/LQD in the mine's annual reports.

S1-5.3 Water Rights

The Wyoming State Engineer's Office (SEO) administers water rights in Wyoming. Water rights are granted for both groundwater and surface water appropriations. Prior to development of water resources associated with energy development, water appropriations (either groundwater or surface water) in the PRB were typically for livestock use.

Records of the SEO have been searched for groundwater rights within a 3-mile radius of the BLM study area for the North Hilight Field LBA Tract. This information is required for WDEQ permitting. The summary of the most recent search is provided below. Currently, mining companies and coal bed natural gas (CBNG) development companies hold the majority of the water rights in the search area. A more detailed listing of the non-coal mine related groundwater rights within a 3-mile radius of the LBA tract is presented in Table S1-4.

Supplementary Information on the Affected Environment

For the North Hilight Field Tract, SEO data indicate that, as of October 9, 2007, there were 609 permitted water wells within 3 miles of the tract, of which, 191 wells are owned by coal mining companies. The other 418 non-coal mine related, permitted water wells, which include 314 wells permitted for uses related to CBNG development, are permitted for the following uses:

- 314 CBNG
- 61 livestock
- 16 domestic
- 14 monitoring
- 5 industrial
- 8 miscellaneous

SEO records have been searched for surface water rights within a 3-mile radius of the BLM study area for the North Hilight Field LBA Tract. Like the groundwater rights, this information is also required for WDEQ permitting. A summary of the most recent search is provided below. A more detailed listing of the non-coal mine related surface water rights is presented in Table S1-5.

For the North Hilight Field LBA Tract, SEO records indicate that as of October 10, 2007, there were 104 permitted surface water rights within 3 miles of the tract, of which 46 are owned by coal mining companies. The other 58 non-coal mine related, permitted surface water rights are permitted for the following uses:

- 3 livestock
- 1 irrigation and domestic
- 54 not designated

Table S1-4. Groundwater Rights for North Hilght Field LBA Tract.

Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P52336W	5/6/1980	43	70	1	NWNE	W.R.R.I.	OBS #1	GST	MON	0	103
P102852W	7/10/1996	43	70	1	NWNE	KERR-MCGEE COAL CORP	JRM1-7ST	GST	MON	0	84
P95947W	6/14/1994	43	70	1	SWNE	KERR-MCGEE COAL CORP	JRM 1-3ST	GST	MON	0	77
P95948W	6/14/1994	43	70	1	SWNE	KERR-MCGEE COAL CORP	JRM 1-4ST	GST	MON	0	80
P166939W	4/20/2005	43	70	1	NWSW	THUNDER BASIN COAL CO.	BT-2005 & BT-2131	GSI	MIS, DEW		
P166940W	4/20/2005	43	70	1	NESW	THUNDER BASIN COAL CO.	BT-2007, BT-2127 & BT-2130	GST	MIS, DEW	70	380
P166941W	4/20/2005	43	70	1	NWSW	THUNDER BASIN COAL CO.	BT-2006	GST	MIS, E W	100	395
P167210W	4/20/2005	43	70	1	NESW	THUNDER BASIN COAL CO.	BT-2128	GST	MIS	5	370
P170555W	8/31/2005	43	70	1	SWNW	THUNDER BASIN COAL CO.	BT-2196	GSI	MIS		
P170556W	8/31/2005	43	70	1	SWNE	THUNDER BASIN COAL CO.	BT-2195	GSI	MIS		
P28607P	12/3/1974	43	70	2	NENE	JACOBS LAND & LIVESTOCK CO.	JACOBS 2 1	GST	STO	8	255
40/2/308W	8/17/2007	43	70	2	NESE	JACOBS RANCH COAL COMPANY	JRM2-1R	UNA	MON		
P28606P	12/3/1974	43	70	3	NWSW	JACOBS LAND & LIVESTOCK CO.	JACOBS 3 1	GST	STO	5	220
P28912W	1/3/1975	43	70	3	NWNW	JACOBS LAND & LIVESTOCK COMPANY	KMG 9C-3	GST	MON	0	240
P88749W	6/2/1992	43	70	3	NWSW	THUNDER BASIN COAL CO., LLC	BT-PIT 4	GST	STO, MIS	200	-5
30/8/153W	8/7/2000	43	70	4	NWSW	RIM OPERATING, INC	GATHERING POINT WELL H#13-04	REJ	MIS		
P74932W	6/19/1987	43	70	4	SWSE	JACOBS LAND & LIVESTOCK COMPANY	JRM 4 1W	GST	MON	0	225
P74933W	6/19/1987	43	70	4	SEW	JACOBS LAND & LIVESTOCK COMPANY	JRM 4 1C	GST	MON	0	290.8
P120260W	11/1/1999	43	70	4	NWNW	RIM OPERATING, INC	CBM H #11-04	GST	STO, CBM	25	292
P120261W	11/1/1999	43	70	4	NWSW	RIM OPERATING, INC	CBM H #13-04	GST	STO, CBM	25	287
P132547W	2/8/2001	43	70	5	NENW	RIM OPERATING, INC	CBM H # 21-05	GST	MON	0	380
P8961P	7/31/1964	43	70	5	NWSW	USDA FOREST SERVICE	JACOBS #T B 85	GST	STO	4	268
P120262W	11/1/1999	43	70	5	NWNW	RIM OPERATING, INC	CBM H #11-05	GST	STO, CBM	25	314
P120263W	11/1/1999	43	70	5	NWSW	RIM OPERATING, INC	CBM H #13-05	GST	STO, CBM	25	291
P120264W	11/1/1999	43	70	5	SESW	RIM OPERATING, INC	CBM H #24-05	GST	STO, CBM	25	300
P120265W	11/1/1999	43	70	5	NWNE	RIM OPERATING, INC	CBM H #31-05	GST	STO, CBM	25	311
P120266W	11/1/1999	43	70	5	NWSE	RIM OPERATING, INC	CBM H #33-05	GST	STO, CBM	25	315
P120267W	11/1/1999	43	70	5	SENE	RIM OPERATING, INC	CBM H #42-05	GST	STO, CBM	25	295
P120268W	11/1/1999	43	70	5	SESE	RIM OPERATING, INC	CBM H #44-05	GST	STO, CBM	20	238
P121849W	12/27/1999	43	70	5	NENW	RIM OPERATING, INC	CBM H #22-05	GST	STO, CBM	10	326
P132546W	2/8/2001	43	70	5	SWSW	RIM OPERATING, INC	CBM H # 14-05	GST	STO, CBM	0	305
P166502W	3/31/2005	43	70	5	NENW	JACOBS RANCH COAL COMPANY	01PIEZO2005	GSI	MON		
P166506W	3/31/2005	43	70	5	NWNE	JACOBS RANCH COAL COMPANY	01INCLIN2005	GSI	MON		
P99924W	8/1/1995	43	70	5	SENE	THUNDER BASIN COAL COMPANY, LLC	JRM T5-11W	GST	MON	0	200
P99921W	8/1/1995	43	70	5	NWSW	THUNDER BASIN COAL COMPANY	JRM T5-10C	GST	MON	0	286
P2976P	6/11/1961	43	70	6	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #25	GST	STO	5	260
P120269W	11/1/1999	43	70	6	NWNW	RIM OPERATING, INC	CBM H #11-06	GST	STO, CBM	25	301

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P120270W	11/1/1999	43	70	6	NWSW	RIM OPERATING, INC	CBM H #13-06	GST	STO, CBM	0	259
P120271W	11/1/1999	43	70	6	SEW	RIM OPERATING, INC	CBM H #22-06	GST	STO, CBM	25	289
P120272W	11/1/1999	43	70	6	SESW	RIM OPERATING, INC	CBM H #24-06	GST	STO, CBM	1	265
P120273W	11/1/1999	43	70	6	NWNE	RIM OPERATING, INC	CBM H #31-06	GST	STO, CBM	25	300
P120274W	11/1/1999	43	70	6	NWSE	RIM OPERATING, INC	CBM H #33-06	GST	STO, CBM	1	273
P120275W	11/1/1999	43	70	6	SENE	RIM OPERATING, INC	CBM H #42-06	GST	STO, CBM	25	317
P120276W	11/1/1999	43	70	6	SESE	RIM OPERATING, INC	CBM H #44-06	GST	STO, CBM	25	291
P135816W	6/15/2001	43	70	6	SESE	RIM OPERATING, INC	ENL CBM H # 44-06	GST	STO, CBM	10	291
P135817W	6/15/2001	43	70	6	SENE	RIM OPERATING, INC	ENL CBM H # 42-06	GST	STO, CBM	10	317
P135818W	6/15/2001	43	70	6	SEW	RIM OPERATING, INC	ENL CBM H # 22-06	GST	STO, CBM	10	29
P99926W	8/1/1995	43	70	6	NWSE	THUNDER BASIN COAL COMPANY, LLC	JRM T6-8W	GST	MON	0	160
40/1/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0742	UNA	MIS		
40/10/202W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0741	UNA	MIS		
40/2/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0743	UNA	MIS		
40/3/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0744	UNA	MIS		
40/4/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0745	UNA	MIS		
40/5/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0746	UNA	MIS		
40/6/203W	6/6/2007	43	70	6	NWSW	THUNDER BASIN COAL COMPANY	DW0747	UNA	MIS		
P167211W	4/20/2005	43	70	6	NWSW	THUNDER BASIN COAL CO.	BT-2114, BT-2019-2020 & BT2115	GST	MIS	10	260
P167214W	4/20/2005	43	70	6	NESW	THUNDER BASIN COAL CO.	BT-2024	GST	MIS	7	270
P170557W	8/31/2005	43	70	6	SENE	THUNDER BASIN COAL CO.	BT-2288	GSI	MIS		
P176133W	6/20/2006	43	70	6	NWSE	THUNDER BASIN COAL CO.	BT2073	GSI	MIS		
P176134W	6/20/2006	43	70	6	NESW	THUNDER BASIN COAL CO.	BT2110	GSI	MIS		
P19254P	9/30/1954	43	70	7	NWSE	KENNETH & SYLVIA REVLAND	REVLAND #2	GST	STO	7	36
P31780W	1/7/1976	43	70	7	SWNW	RENO LIVESTOCK CORPORATION	RENO #1	GST	STO	25	110
P81595W	1/8/1990	43	70	7	SWSW	JACOBS LAND AND LIVESTOCK	#1 SOUTH CONSOL	GST	STO	10	100
P120277W	11/1/1999	43	70	7	NWNW	RIM OPERATING, INC	CBM H #11-07	GST	STO, CBM	25	289
P120278W	11/1/1999	43	70	7	SEW	RIM OPERATING, INC	CBM H #22-07	GST	STO, CBM	21	276
P120279W	11/1/1999	43	70	7	SENE	RIM OPERATING, INC	CBM H #42-07	GST	STO, CBM	25	267
P126215W	6/9/2000	43	70	7	NWNE	RIM OPERATING, INC	CBM H #31-07	GST	STO, CBM	21	270
P135815W	6/15/2001	43	70	7	SENE	RIM OPERATING, INC	ENL CBM H # 42-07	GSI	STO, CBM	10	267
40/9/185W	6/1/2007	43	70	7	NWNW	THUNDER BASIN COAL CO., LLC	DW0756	UNA	MIS		
P38081W	6/2/1977	43	70	7	NWNW	THUNDER BASIN COAL CO., LLC	BTW 16	GST	MON	0	100
P38085W	6/2/1977	43	70	7	NWNW	THUNDER BASIN COAL CO., LLC	BTR 27	GST	MON	0	296
P100818W	10/30/1995	43	70	7	SWNE	THUNDER BASIN COAL COMPANY, LLC	JRM T7-5UC	GST	MON	0	185
P99927W	8/1/1995	43	70	7	SWNE	THUNDER BASIN COAL COMPANY, LLC	JRM T7-5C	GST	MON	0	261
P99928W	8/1/1995	43	70	7	NESE	THUNDER BASIN COAL COMPANY, LLC	JRM T7-6W	GST	MON	0	145
P167212W	4/20/2005	43	70	7	NWSW	THUNDER BASIN COAL CO.	BT-2246	GSI	MIS		

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P170550W	8/31/2005	43	70	7	NWSW	THUNDER BASIN COAL CO.	BT-2300	GSI	MIS		
P170551W	8/31/2005	43	70	7	SWNW	THUNDER BASIN COAL CO.	BT-2299,BT2246	GSI	MIS		
P176127W	6/20/2006	43	70	7	NWSW	THUNDER BASIN COAL CO.	DW0619	GSI	MIS		
P176127W	6/20/2006	43	70	7	NWSW	THUNDER BASIN COAL CO.	DW0619	GSI	MIS		
P176129W	6/20/2006	43	70	7	NWSW	THUNDER BASIN COAL CO.	DW0617	GSI	MIS		
P176130W	6/20/2006	43	70	7	NWSW	THUNDER BASIN COAL CO.	DW0616	GSI	MIS		
P176131W	6/20/2006	43	70	7	SWNW	THUNDER BASIN COAL CO.	DW0615	GSI	MIS		
P176132W	6/20/2006	43	70	7	SWNW	THUNDER BASIN COAL CO.	DW0614	GSI	MIS		
P176136W	6/20/2006	43	70	7	SWNW	THUNDER BASIN COAL CO.	DW0613	GSI	MIS		
P176140W	6/20/2006	43	70	7	SWSW	THUNDER BASIN COAL CO.	BT2344	GSI	MIS		
P176141W	6/20/2006	43	70	7	NWSW	THUNDER BASIN COAL CO.	BT2348	GSI	MIS		
P176145W	6/20/2006	43	70	7	SWSW	THUNDER BASIN COAL CO.	BT2346	GSI	MIS		
P132544W	2/8/2001	43	71	1	SWNE	RIM OPERATING, INC	CBM D # 32-01	GST	MON	0	365
P9681W	7/13/1971	43	71	1	NENE	BELLE FOURCHE PIPELINE CO.**GLADYS KINGTON NORWOOD	SOUTH HILIGHT #1	GST	DOM, STO	30	346
P120245W	11/1/1999	43	71	1	NWSW	RIM OPERATING, INC	CBM D #13-01	GST	STO, CBM	25	376
P120246W	11/1/1999	43	71	1	SESW	RIM OPERATING, INC	CBM D #24-01	GST	STO, CBM	25	359
P120248W	11/1/1999	43	71	1	SESE	RIM OPERATING, INC	CBM D #44-01	GST	STO, CBM	25	310
P121847W	12/27/1999	43	71	1	SENE	RIM OPERATING, INC	CBM D #42-01	GST	STO, CBM	25	310
P121848W	12/27/1999	43	71	1	SENE	RIM OPERATING, INC	CBM D #22-01	GST	STO, CBM	25	345
P123659W	2/28/2000	43	71	1	NWNE	RIM OPERATING, INC	CBM C #31-01	GST	STO, CBM	25	377
P125923W	5/25/2000	43	71	1	NWNW	RIM OPERATING, INC	CBM D #11-01	GST	STO, CBM	25	395
P128064W	8/4/2000	43	71	1	NWSE	USDA, NATIONAL FOREST SERVICE** RIM OPERATING, INC	CBM D 33-01R	GST	STO, CBM	25	326
P135820W	6/15/2001	43	71	1	SESW	RIM OPERATING, INC	ENL CBM D # 24-01	GST	STO, CBM	10	359
P99923W	8/1/1995	43	71	1	NWSE	THUNDER BASIN COAL COMPANY, LLC	JRM T1-8W	GST	MON	0	141
40/4/202W	6/6/2007	43	71	1	NWSW	THUNDER BASIN COAL COMPANY	DW0735	UNA	MIS		
40/5/202W	6/6/2007	43	71	1	NWSW	THUNDER BASIN COAL COMPANY	DW0736	UNA	MIS		
40/7/202W	6/6/2007	43	71	1	NWSW	THUNDER BASIN COAL COMPANY	DW0738	UNA	MIS		
40/8/202W	6/6/2007	43	71	1	NWSW	THUNDER BASIN COAL COMPANY	DW0739	UNA	MIS		
P176135W	6/20/2006	43	71	1	NWSW	THUNDER BASIN COAL CO.	BT2296	GSI	MIS		
P19251P	9/30/1954	43	71	2	NWSE	ARK LAND COMPANY	REVLAND #1	GST	STO	10	147
P162567W	9/20/2004	43	71	2	NENE	RIM OPERATING, INC.	REVLAND TRUST FEDERAL #41-2-4371	GST	CBM	4	400
P162568W	9/20/2004	43	71	2	SWNE	RIM OPERATING, INC.	REVLAND TRUST FEDERAL #32-2-4371	GSI	CBM		
P162569W	9/20/2004	43	71	2	NESE	RIM OPERATING, INC.	REVLAND TRUST FEDERAL #43-2-4371	GST	CBM	15	383
40/6/202W	6/6/2007	43	71	2	NESE	THUNDER BASIN COAL COMPANY	DW0737	UNA	MIS		
40/9/202W	6/6/2007	43	71	2	NESE	THUNDER BASIN COAL COMPANY	DW0740	UNA	MIS		
P152950W	8/4/2003	43	71	2	NESE	THUNDER BASIN COAL COMPANY	NPLTC-03-2	GST	MON	0	10.5
P3050W	9/15/1969	43	71	3	SWSE	INC. STUART BROTHERS	STUART #10	GST	STO	5	145
P128467W	8/17/2000	43	71	3	SWNW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 12-3-4371	GST	CBM	5	496
40/10/267W	7/18/2007	43	71	3	SESE	THUNDER BASIN COAL CO., LLC	WW07	UNA	MIS		
40/6/267W	7/18/2007	43	71	3	NENE	THUNDER BASIN COAL CO., LLC	WW03	UNA	MIS		
40/7/267W	7/18/2007	43	71	3	SENE	THUNDER BASIN COAL CO., LLC	WW04	UNA	MIS		
40/8/267W	7/18/2007	43	71	3	SENE	THUNDER BASIN COAL CO., LLC	WW05	UNA	MIS		

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
40/9/267W	7/18/2007	43	71	3	NESE	THUNDER BASIN COAL CO., LLC	WW06	UNA	MIS		
P3343W	10/6/1969	43	71	4	SWNE	STUART BROTHERS INC.	STUART #8	GST	STO	5	273
P118160W	8/6/1999	43	71	4	NWSW	LANCE OIL & GAS COMPANY, INC	STUART 13-4	GST	CBM	50	617
P118161W	8/6/1999	43	71	4	SESW	LANCE OIL & GAS COMPANY, INC	STUART 24-4	GST	CBM	45	571
P118162W	8/6/1999	43	71	4	NWSE	LANCE OIL & GAS COMPANY, INC	STUART 33-4	GST	CBM	45	590
P118163W	8/6/1999	43	71	4	SESE	LANCE OIL & GAS COMPANY, INC	STUART 44-4	GST	CBM	45	559
P118164W	8/6/1999	43	71	5	SESW	LANCE OIL & GAS COMPANY, INC	STUART 22-5	GST	CBM	40	702
P118166W	8/6/1999	43	71	5	NWSE	LANCE OIL & GAS COMPANY, INC	STUART 33-5	GST	CBM	45	670
P118167W	8/6/1999	43	71	5	SENE	LANCE OIL & GAS COMPANY, INC	STUART 42-5	GST	CBM	45	628
P118168W	8/6/1999	43	71	5	SESE	LANCE OIL & GAS COMPANY, INC	STUART 44-5	GST	CBM	45	648
P121878W	12/29/1999	43	71	5	NWNW	LANCE OIL & GAS COMPANY, INC	STUART 11-5	GST	CBM	45	717
P121880W	12/29/1999	43	71	5	NWNE	LANCE OIL & GAS COMPANY, INC	STUART 31-5-4371	GST	CBM	45	670
P128481W	8/15/2000	43	71	8	NENE	LANCE OIL & GAS COMPANY, INC	FEDERAL 41-8-4371	GST	CBM	10	701
P107568W	7/28/1997	43	71	9	NENE	LANCE OIL & GAS COMPANY, INC	STUART 1-41-9	GST	CBM, MIS	35	540
P110773W	6/22/1998	43	71	9	NESE	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 42-9	GST	CBM	41	542
P115199W	4/16/1999	43	71	9	NENE	BARRETT RESOURCES CORP	ENL STUART FED. 1-41-9	GST	CBM	50	540
P45855W	10/11/1978	43	71	10	SWNE	USDA FOREST SERVICE	MARG #13	GST	STO	3	383
P166310W	3/18/2005	43	71	10	SWSE	LANCE OIL & GAS COMPANY, INC	STUART FED 34-10-4371	GSI	CBM		
P166746W	4/1/2005	43	71	10	SWNE	LANCE OIL & GAS COMPANY, INC	STUART FED 32-10-4371	GSI	CBM		
P166747W	4/1/2005	43	71	10	NESE	LANCE OIL & GAS COMPANY, INC	STUART FED 43-10-4371	GSI	CBM		
P12762P	12/30/1950	43	71	11	SESW	USDA FOREST SERVICE	STUART #TB 37	GST	STO	4	146
P121916W	12/30/1999	43	71	11	SWSE	LANCE OIL & GAS COMPANY, INC	ZIMMER 34-11	GST	CBM	10	442
P121917W	12/30/1999	43	71	11	NESE	LANCE OIL & GAS COMPANY, INC	ZIMMER 43-11	GST	CBM	10	410
P5866W	6/22/1970	43	71	12	SWNE	DALE MILLS**RENO LIVESTOCK CORPORATION	HEARTSPEAR 12	ADJ	STO	25	212
P120249W	11/1/1999	43	71	12	NWNW	RIM OPERATING, INC	CBM D #11-12	GSE	STO, CBM		
P120250W	11/1/1999	43	71	12	NWSW	RIM OPERATING, INC	CBM D #13-12	GSE	STO, CBM		
P120251W	11/1/1999	43	71	12	SESW	RIM OPERATING, INC	CBM D #22-12	GST	STO, CBM	20	375
P120252W	11/1/1999	43	71	12	SESW	RIM OPERATING, INC	CBM D #24-12	GSE	STO, CBM		
P120253W	11/1/1999	43	71	12	NWNE	RIM OPERATING, INC	CBM D #31-12	GST	STO, CBM	25	365
P120254W	11/1/1999	43	71	12	NWSE	RIM OPERATING, INC	CBM D #33-12	GST	STO, CBM	25	392
P120255W	11/1/1999	43	71	12	SENE	RIM OPERATING, INC	CBM D #42-12	GST	STO, CBM	25	365
P120256W	11/1/1999	43	71	12	SESE	RIM OPERATING, INC	CBM D #44-12	GST	STO, CBM	3	375
P135819W	6/15/2001	43	71	12	NWNE	RIM OPERATING, INC	ENL CBM D # 31-12	GST	STO, CBM	10	365
P143826W	4/2/2002	43	71	12	SENE	RIM OPERATING, INC	ENL. CBM D #42-12	GST	STO, CBM	10	365
P144375W	5/2/2002	43	71	12	NWSE	RIM OPERATING, INC.	ENL. CBM D #33-12	GST	STO, CBM	15	392
40/1/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0748	UNA	MIS		
40/1/267W	7/18/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	CS08	UNA	MIS		
40/2/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0749	UNA	MIS		
40/2/267W	7/18/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	CS09	UNA	MIS		
40/3/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0750	UNA	MIS		
40/3/267W	7/18/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	CS10	UNA	MIS		
40/4/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0751	UNA	MIS		

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).

Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
40/5/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0752	UNA	MIS		
40/6/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0753	UNA	MIS		
40/7/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0754	UNA	MIS		
40/8/185W	6/1/2007	43	71	12	NENE	THUNDER BASIN COAL CO., LLC	DW0755	UNA	MIS		
39/1/547W	2/20/2007	43	71	12	NESE	THUNDER BASIN COAL COMPANY	DW0713	UNA	MIS		
39/10/546W	2/20/2007	43	71	12	NESE	THUNDER BASIN COAL COMPANY	DW0712	UNA	MIS		
39/2/547W	2/20/2007	43	71	12	NESE	THUNDER BASIN COAL COMPANY	DW0714	UNA	MIS		
39/3/547W	2/20/2007	43	71	12	SENE	THUNDER BASIN COAL COMPANY	DW0715	UNA	MIS		
39/4/547W	2/20/2007	43	71	12	SENE	THUNDER BASIN COAL COMPANY	DW0716	UNA	MIS		
39/5/546W	2/20/2007	43	71	12	SESE	THUNDER BASIN COAL COMPANY	DW0707	UNA	MIS		
39/5/547W	2/20/2007	43	71	12	SENE	THUNDER BASIN COAL COMPANY	DW0717	UNA	MIS		
39/5/578W	3/5/2007	43	71	12	SENE	THUNDER BASIN COAL COMPANY	DW0718	UNA	MIS		
39/6/546W	2/20/2007	43	71	12	SESE	THUNDER BASIN COAL COMPANY	DW0708	UNA	MIS		
39/7/546W	2/20/2007	43	71	12	SESE	THUNDER BASIN COAL COMPANY	DW0709	UNA	MIS		
39/8/546W	2/20/2007	43	71	12	NESE	THUNDER BASIN COAL COMPANY	DW0710	UNA	MIS		
39/9/546W	2/20/2007	43	71	12	NESE	THUNDER BASIN COAL COMPANY	DW0711	UNA	MIS		
P176120W	6/20/2006	43	71	12	SESE	THUNDER BASIN COAL CO.	DW0626	GSI	MIS		
P176121W	6/20/2006	43	71	12	SESE	THUNDER BASIN COAL CO.	DW0627	GSI	MIS		
P176122W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0624	GSI	MIS		
P176123W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0623	GSI	MIS		
P176124W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0622	GSI	MIS		
P176125W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0621	GSI	MIS		
P176126W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0620	GSI	MIS		
P176128W	6/20/2006	43	71	12	NESE	THUNDER BASIN COAL CO.	DW0618	GSI	MIS		
P137083W	7/24/2001	44	69	30	NENE	KEELINE RANCH CO., INC.	BLACK THUNDER HOLE	GST	STO	3	393
P11885P	12/31/1922	44	70	3	NWSW	GUY W. EDWARDS**BLANCHE KELLY	EDWARDS #11	GST	STO	5	10
P11012W	10/27/1971	44	70	7	NWNW	INEXCO OIL CO.	CENTRAL WSW #5 2	ADJ	IND	350	4940
P28316W	9/24/1974	44	70	7	SWNE	FRANKLIN REALTY	X-2		MIS	0	160
P28317W	9/24/1974	44	70	7	SWNE	FRANKLIN REALTY	X-2 (02)		MIS	0	170
P28318W	9/24/1974	44	70	7	NWNW	FRANKLIN REALTY	X-4		MIS	0	275
P28319W	9/24/1974	44	70	7	NWNW	FRANKLIN REALTY	X-4 (02)		MIS	0	270
P5224W	4/6/1970	44	70	17	SENE	OSTLUND INVESTMENTS	CONRAD #1-17	GST	DOM, STO	25	620
P10403W	9/1/1971	44	70	19	SWNW	DALE MILLS	MILLS JOHNSTON #1	GST	STO	7	190
P121836W	12/27/1999	44	70	19	NWSW	WILLIAMS PRODUCTION RMT, COMPANY	CBM G #13-19	GST	STO, CBM	4	388
P140147W	10/16/2001	44	70	19	NWNW	RIM OPERATING, INC.	CBM G #11-19	GST	STO, CBM	10	465
P142251W	1/18/2002	44	70	19	SENE	RIM OPERATING, INC.	CBM G #22-19	GST	STO, CBM	4	405
P142252W	1/18/2002	44	70	19	SESW	RIM OPERATING, INC.	CBM G #24-19	GST	STO, CBM	0	345
P130723W	11/8/2000	44	70	19	SWSW	JACOBS RANCH COAL COMPANY	JRM 19 - 2W40	GST	MON	0	142
P130724W	11/8/2000	44	70	19	SWSW	JACOBS RANCH COAL COMPANY	JRM 19 - 1C40	GST	MON	0	382
P130725W	11/8/2000	44	70	19	SWSW	JACOBS RANCH COAL COMPANY	JRM 19 - 2W40 OBS	GST	MON	0	142
P120161W	11/1/1999	44	70	21	SESE	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 21 - 2W40	GST	MON	0	106
P120162W	11/1/1999	44	70	21	SESE	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 21 - 1C40	GST	MON	0	190
P152319W	7/15/2003	44	70	24	NESW	RAG LAND COMPANY	RAG #2	GSI	STO		
P28614P	12/3/1974	44	70	26	NWNW	JACOBS LAND & LIVESTOCK CO.	JACOBS 26 1	GST	STO	8	68
P119572W	10/14/1999	44	70	26	SWNW	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 26-1K40	GST	MON	0	18
P119574W	10/14/1999	44	70	27	SENE	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 27-1C40	GST	MON	0	128

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
39/10/540W	2/13/2007	44	70	27	SWNW	JACOBS RANCH COAL COMPANY	TWC-13,14,15	UNA	MIS		
39/9/540W	2/13/2007	44	70	27	NENW	JACOBS RANCH COAL COMPANY	TWC-9	UNA	MIS		
P166507W	3/31/2005	44	70	27	NESW	JACOBS RANCH COAL COMPANY	02INCLIN2005	GSI	MON		
P166508W	3/31/2005	44	70	27	NWSE	JACOBS RANCH COAL COMPANY	03INCLIN2005	GSI	MON		
P166509W	3/31/2005	44	70	27	SENW	JACOBS RANCH COAL COMPANY	04INCLIN2005	GSI	MON		
P166510W	3/31/2005	44	70	27	SENE	JACOBS RANCH COAL COMPANY	05INCLIN2005	GSI	MON		
P174474W	12/9/2005	44	70	27	SWSE	JACOBS RANCH COAL COMPANY	JACOBS RANCH MINE NO. 4	GSI	MIS	500	200
P103356W	8/15/1996	44	70	28	NWNE	JACOBS LAND AND LIVESTOCK	REYNOLDS #1	GST	STO	5	360
P28612P	12/3/1974	44	70	28	NWNE	JACOBS LAND & LIVESTOCK CO.	JACOBS 28 1	GST	STO	10	267
P28613P	12/3/1974	44	70	28	SWSW	JACOBS LAND & LIVESTOCK CO.	JACOBS 28 2	GST	STO	10	261
P128087W	8/7/2000	44	70	28	NWSW	RIM OPERATING, INC	CBM G 13-28	GST	STO, CBM	0	325
P156250W	2/4/2004	44	70	28	SESW	JACOBS RANCH COAL COMPANY	JRM 28-140	GST	MON	0	250
P156251W	2/4/2004	44	70	28	SESW	JACOBS RANCH COAL COMPANY	JRM 28-1W40	GST	MON	0	170
P156252W	2/4/2004	44	70	28	SENW	JACOBS RANCH COAL COMPANY	JRM 28-2C40	GST	MON	0	260
P156253W	2/4/2004	44	70	28	SENW	JACOBS RANCH COAL COMPANY	JRM 28-2W40	GST	MON	0	170
P28611P	12/3/1974	44	70	29	SENE	JACOBS LAND & LIVESTOCK CO.	JACOBS 29 1	GST	DOM, STO	5	292
P59111W	12/29/1981	44	70	29	SENE	JACOBS LAND & LIVESTOCK	JACOBS #1	GST	DOM, STO	7	620
P128088W	8/7/2000	44	70	29	NWNW	RIM OPERATING, INC	CBM G 11-29	GST	STO, CBM	16	395
P128090W	8/7/2000	44	70	29	NWNE	RIM OPERATING, INC	CBM G 31-29	GST	STO, CBM	8	388
P119575W	10/14/1999	44	70	29	SESW	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 29-2W40	GST	MON	0	60
P120165W	11/1/1999	44	70	29	NENW	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 29-4W40	GST	MON	0	207
P120166W	11/1/1999	44	70	29	NENW	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JRM 29-3C40	GST	MON	0	382
P2974P	6/21/1935	44	70	30	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #23	GST	STO	5	60
P121837W	12/27/1999	44	70	30	NWNW	RIM OPERATING, INC	CBM G #11-30	GST	STO, CBM	19	383
P128092W	8/7/2000	44	70	30	NWSW	RIM OPERATING, INC	CBM G 13-30	GST	STO, CBM	19	340
P128093W	8/7/2000	44	70	30	SENW	RIM OPERATING, INC	CBM G 22-30	GST	STO, CBM	5	325
P128094W	8/7/2000	44	70	30	SESW	RIM OPERATING, INC	CBM G 24-30	GST	STO, CBM	10	325
P128095W	8/7/2000	44	70	30	NWNE	RIM OPERATING, INC	CBM G 31-30	GST	STO, CBM	5	315
P128096W	8/7/2000	44	70	30	NWSE	RIM OPERATING, INC	CBM G 33-30	GST	STO, CBM	0	300
P128097W	8/7/2000	44	70	30	SENE	RIM OPERATING, INC	CBM G 42-30	GST	STO, CBM	7	375
P128098W	8/7/2000	44	70	30	SESE	RIM OPERATING, INC	CBM G 44-30	GST	STO, CBM	0	295
P175241W	6/2/2006	44	70	30	SWSW	JACOBS RANCH COAL CO.	TW-30SWSW	GSI	TST		
P175243W	6/2/2006	44	70	30	NESW	JACOBS RANCH COAL CO.	TW-30NESW	GSI	TST		
P147292W	9/27/2002	44	70	30	NENW	JACOBS RANCH COAL COMPANY	JRM 30-1W40	GST	MON	0	85
P178331W	10/4/2006	44	70	30	SESW	JACOBS RANCH COAL COMPANY	DW 2006-7	GSI	MIS		
P178333W	10/4/2006	44	70	30	SWSW	JACOBS RANCH COAL COMPANY	DW 2006-1,2,5,6	GSI	MIS		
P2975P	12/21/1934	44	70	31	SWNW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #24	GST	STO	5	60
P120257W	11/1/1999	44	70	31	SESW	RIM OPERATING, INC	CBM G #24-31	GST	STO, CBM	0	262

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P121843W	12/27/1999	44	70	31	SESE	RIM OPERATING, INC	CBM G #44-31	GST	STO, CBM	25	283
P128099W	8/7/2000	44	70	31	NWNW	RIM OPERATING, INC	CBM G 11-31	GST	STO, CBM	7	305
P128100W	8/7/2000	44	70	31	NWSW	RIM OPERATING, INC	CBM G 13-31	GST	STO, CBM	0	245
P128101W	8/7/2000	44	70	31	SESW	RIM OPERATING, INC	CBM G 22-31	GST	STO, CBM	4	308
P128102W	8/7/2000	44	70	31	NWNE	RIM OPERATING, INC	CBM G 31-31	GST	STO, CBM	4	290
P128103W	8/7/2000	44	70	31	NWSE	RIM OPERATING, INC	CBM G 33-31	GST	STO, CBM	6	285
P128104W	8/7/2000	44	70	31	SENE	RIM OPERATING, INC	CBM G 42-31	GST	STO, CBM	0	285
P175242W	6/2/2006	44	70	31	NWNW	JACOBS RANCH COAL CO.	TW-31NW	GSI	TST		
P147293W	9/27/2002	44	70	31	NWNW	JACOBS RANCH COAL COMPANY	JRM 31-2W40	GST	MON	0	30
P147294W	9/27/2002	44	70	31	NESE	JACOBS RANCH COAL COMPANY	JRM 31-1W40	GST	MON	0	75
P166503W	3/31/2005	44	70	31	NESW	JACOBS RANCH COAL COMPANY	02PIEZO2005	GSI	MON		
P178326W	10/4/2006	44	70	31	SWNW	JACOBS RANCH COAL COMPANY	DW 2006-17,18,19,21,22,24,25	GSI	MIS		
P178327W	10/4/2006	44	70	31	SESW	JACOBS RANCH COAL COMPANY	DW 2006-16,23	GSI	MIS		
P178329W	10/4/2006	44	70	31	NWNW	JACOBS RANCH COAL COMPANY	DW 2006-9,10,13,14	GSI	MIS		
P178330W	10/4/2006	44	70	31	NENW	JACOBS RANCH COAL COMPANY	DW 2006-8,15	GSI	MIS		
P28617P	12/3/1974	44	70	32	SESE	JACOBS LAND & LIVESTOCK CO.	JACOBS 32 1	GST	STO	10	273
P89324W	9/1/1992	44	70	32	SESE	JACOBS LAND AND LIVESTOCK	REYNOLD'S #1	GST	STO	7	300
P120258W	11/1/1999	44	70	32	SESE	RIM OPERATING, INC	CBM G #44-32	GST	STO, CBM	8	285
P128105W	8/7/2000	44	70	32	NWNW	RIM OPERATING, INC	CBM G 11-32	GST	STO, CBM	9	345
P128106W	8/7/2000	44	70	32	SESW	RIM OPERATING, INC	CBM G 22-32	GST	STO, CBM	4	330
P156245W	2/4/2004	44	70	32	NENE	JACOBS RANCH COAL COMPANY	4470-NENESEC32-PDW	GST	MON	0	285
P28616P	12/3/1974	44	70	33	NESW	JACOBS LAND & LIVESTOCK CO.	JACOBS 33 1	GST	STO	15	110
P78390W	10/26/1988	44	70	33	NWSE	JACOBS LAND & LIVESTOCK COMPANY	JRM 33 2W	GST	MON	0	215
P78391W	10/26/1988	44	70	33	NENE	JACOBS LAND & LIVESTOCK COMPANY	JRM 33 1C	GST	MON	0	220
P120259W	11/1/1999	44	70	33	SESW	RIM OPERATING, INC	CBM G #24-33	GST	STO, CBM	0	251
P156180W	2/4/2004	44	70	33	NENW	JACOBS RANCH COAL COMPANY	4470-NENWSEC33-DW	GST	MIS	12	160
P156181W	2/4/2004	44	70	33	NWNE	JACOBS RANCH COAL COMPANY	4470-NWNESEC33-DW	GST	MIS	18	165
P156182W	2/4/2004	44	70	33	NWNW	JACOBS RANCH COAL COMPANY	4470-NWNWSEC33-DW	GST	MIS	6	305
P156246W	2/4/2004	44	70	33	NWNW	JACOBS RANCH COAL COMPANY	4470-NWNWSEC33-PDW	GST	MON	0	255
P156247W	2/4/2004	44	70	33	NWNE	JACOBS RANCH COAL COMPANY	4470-NWNESEC33-PDW	GST	MON	0	175
P156249W	2/4/2004	44	70	33	NENE	JACOBS RANCH COAL COMPANY	4470-NENESEC33-PDW	GST	MON	0	175
P156254W	2/4/2004	44	70	33	SWNW	JACOBS RANCH COAL COMPANY	JRM 33-3C40	GST	MON	0	260
P156255W	2/4/2004	44	70	33	SWNW	JACOBS RANCH COAL COMPANY	JRM 33-3W40	GST	MON	0	160
P156256W	2/4/2004	44	70	33	NENW	JACOBS RANCH COAL COMPANY	JRM 33-4C40	GST	MON	0	250
P156257W	2/4/2004	44	70	33	NENW	JACOBS RANCH COAL COMPANY	JRM 33-4W40	GST	MON	0	160
P156258W	2/4/2004	44	70	33	NWNE	JACOBS RANCH COAL COMPANY	JRM 33-5C40	GST	MON	0	206
P156259W	2/4/2004	44	70	33	NWNE	JACOBS RANCH COAL COMPANY	JRM 33-5W40	GST	MON	0	130
P174470W	12/9/2005	44	70	33	SESW	JACOBS RANCH COAL COMPANY	JACOBS RANCH MINE NO. 1	GST	MIS	500	210
P28615P	12/3/1974	44	70	34	NWNW	JACOBS LAND & LIVESTOCK CO.	JACOBS 34 1	GST	STO	5	260
P78388W	10/26/1988	44	70	34	SWNE	JACOBS LAND & LIVESTOCK COMPANY	JRM 34 2W	GST	MON	0	110
P78389W	10/26/1988	44	70	34	SWNE	JACOBS LAND & LIVESTOCK COMPANY	JRM 34 1C	GST	MON	0	186
P28618P	12/3/1974	44	70	35	NWNE	JACOBS LAND & LIVESTOCK CO.	JACOBS 35 2	GST	STO	25	300
P28619P	12/3/1974	44	70	35	NWNE	JACOBS LAND & LIVESTOCK CO.	JACOBS 35 1	GST	STO	20	280
P78386W	10/26/1988	44	70	35	SENE	JACOBS LAND & LIVESTOCK COMPANY	JRM 35 1C	GST	MON	0	40

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
40/10/307W	8/17/2007	44	70	35	SWNE	JACOBS RANCH COAL COMPANY	JRM35-1R	UNA	MON		
P78387W	10/26/1988	44	70	35	NESE	KERR-MCGEE COAL CORP	JRM 35 2C	GST	MON	0	91
P128334W	8/14/2000	44	70	36	NWSW	WY STATE BOARD OF LAND COMMISSIONERS** JACOBS RANCH COAL COMPANY	JRM 36-2PW GRAZ	GST	STO	25	117
P107263W	8/27/1997	44	70	36	SESW	WYO BOARD OF LAND COMMISSIONERS** KENNECOTT ENERGY & COAL CO.	JRM36-1ST	GST	MON	0	108
P107264W	8/27/1997	44	70	36	SESW	WYO BOARD OF LAND COMMISSIONERS** KENNECOTT ENERGY & COAL CO.	JRM36-2ST	GST	MON	0	100
P107265W	8/27/1997	44	70	36	NWSW	WYO BOARD OF LAND COMMISSIONERS** KENNECOTT ENERGY & COAL CO.	JRM36-3ST	GST	MON	0	98
P107266W	8/27/1997	44	70	36	SWNW	WYO BOARD OF LAND COMMISSIONERS** KENNECOTT ENERGY & COAL CO.	JRM36-4ST	GST	MON	0	83
P141685W	12/20/2001	44	71	1	NWSW	RIM OPERATING, INC.	CBM C # 13-01	GST	STO, CBM	6	445
P2964P	12/21/1952	44	71	2	NENE	MILLS LAND & LIVESTOCK CO., INC.	MILL #13	GST	STO	5	170
P2965P	12/21/1927	44	71	2	SESW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #14	GST	STO	2	60
P141686W	12/20/2001	44	71	2	SESE	RIM OPERATING, INC.	CBM C # 44-02	GST	STO, CBM	3	585
P125047W	4/26/2000	44	71	3	NESW	ALLEN & KAREN TRIGG	TRIGG #1	GST	DOM	20	160
P143430W	3/25/2002	44	71	3	SWSE	BOLLER/MILLS RANCH	ISENBERGER #1	GST	STO	3	120
P143201W	3/7/2002	44	71	3	SWSW	RIM OPERATING, INC.	CBM C #14-3	GST	STO, CBM	12	565
P143202W	3/7/2002	44	71	3	NENW	RIM OPERATING, INC.	CBM C #21-3	GST	STO, CBM	9	545
P143203W	3/7/2002	44	71	3	NESW	RIM OPERATING, INC.	CBM C #23-3	GST	STO, CBM	12	565
P143204W	3/7/2002	44	71	3	SWNE	RIM OPERATING, INC.	CBM C #32-3	GST	STO, CBM	10	545
P143205W	3/7/2002	44	71	3	SWSE	RIM OPERATING, INC.	CBM C #34-3	GST	STO, CBM	3	585
P143206W	3/7/2002	44	71	3	NENE	RIM OPERATING, INC.	CBM C #41-3	GST	STO, CBM	0	465
P143207W	3/7/2002	44	71	3	NESE	RIM OPERATING, INC.	CBM C #43-3	GST	STO, CBM	19	565
P143431W	3/25/2002	44	71	4	SESW	BOLLER/MILLS RANCH	PAPA WELL #1	GST	STO	3	120
P85619W	6/28/1991	44	71	4	NESW	MARIE SWINGHOLM	SWINGHOLM #1	GST	DOM, STO	20	220
P122939W	1/19/2000	44	71	4	SWNW	RIM OPERATING, INC	CBM C #12-4	GST	CBM	6	720
P122940W	1/19/2000	44	71	4	SWSW	RIM OPERATING, INC	CBMC #14-4	GST	CBM	9	720
P122941W	1/19/2000	44	71	4	NENW	RIM OPERATING, INC	CBMC #21-4	GST	CBM	13	665
P122942W	1/19/2000	44	71	4	NESW	RIM OPERATING, INC	CBMC #23-4	GST	CBM	3	725
P122943W	1/19/2000	44	71	4	SWNE	RIM OPERATING, INC	CBMC #32-4	GST	CBM	12	665
P122945W	1/19/2000	44	71	4	NENE	RIM OPERATING, INC	CBMC #41-4	GST	CBM	6	565
P122946W	1/19/2000	44	71	4	NESE	RIM OPERATING, INC	CBMC #43-4	GST	CBM	20	647
P161614W	8/19/2004	44	71	4	SWSE	RIM OPERATING, INC.	CBM C #34-4	GST	STO, CBM	5	625
P122947W	1/19/2000	44	71	5	SWNE	RIM OPERATING, INC	CBMC #32-5	GST	CBM	7	765
P122948W	1/19/2000	44	71	5	NENE	RIM OPERATING, INC	CBMC #41-5	GST	CBM	0	705
P122949W	1/19/2000	44	71	5	NESE	RIM OPERATING, INC	CBMC #43-5	GST	CBM	4	720
P137914W	7/23/2001	44	71	5	SWSE	LANCE OIL & GAS COMPANY, INC	SWINGHOLM FEDERAL 34-5-4471	GST	CBM	10	705
P137916W	7/23/2001	44	71	5	NESW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 23-5-4471	GST	CBM	10	920
P137921W	7/23/2001	44	71	5	SWSW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 14-5-4471	GST	CBM	10	802
P41842W	2/16/1978	44	71	8	SESE	EARL A. BOLLER	PRAIRIE DOG #1	GST	STO	5	232

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P122958W	1/19/2000	44	71	8	SWNW	LANCE OIL & GAS COMPANY, INC	STUART 12-8-4471	GST	CBM	20	792
P122959W	1/19/2000	44	71	8	NENW	LANCE OIL & GAS COMPANY, INC	STUART 21-8-4471	GST	CBM	30	802
P128533W	8/17/2000	44	71	8	SWSW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 14-8-4471	GST	CBM	16	835
P128583W	8/22/2000	44	71	8	SWSE	LANCE OIL & GAS COMPANY, INC	STUART 34-8-4471R	GSI	CBM		
P137889W	7/23/2001	44	71	8	SWNE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 32-8-4471	GST	CBM	16	610
P137895W	7/23/2001	44	71	8	NESE	LANCE OIL & GAS COMPANY, INC	SWINGHOLM FEDERAL 43-8-4471	GST	CBM	16	766
P137936W	7/23/2001	44	71	8	NENE	LANCE OIL & GAS COMPANY, INC	SWINGHOLM FEDERAL 41-8-4471	GST	CBM	16	681
P143429W	3/25/2002	44	71	9	NESE	BOLLER/MILLS RANCH	CIRCLE #1	GST	STO	3	145
P165581W	2/28/2005	44	71	9	NENW	LANCE OIL & GAS COMPANY, INC**BOB & JAMIE SWINGHOLM	SWINGHOLM FED 21-9-4471	GSI	STO		
P165582W	2/28/2005	44	71	9	NENE	LANCE OIL & GAS COMPANY, INC**TOM & BONNIE MILLS	BOLLER MILLS RANCH F 41-9-4471	GSI	STO		
P137906W	7/23/2001	44	71	9	SWSW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 14-9-4471	GST	CBM	16	800
P137923W	7/23/2001	44	71	9	NENW	LANCE OIL & GAS COMPANY, INC	SWINGHOLM FEDERAL 21-9-4471	GST	CBM	16	630
P137926W	7/23/2001	44	71	9	NESE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 43-9-4471	GST	CBM	16	741
P137928W	7/23/2001	44	71	9	NENE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 41-9-4471	GST	CBM	10	587
P137929W	7/23/2001	44	71	9	SWSE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 34-9-4471	GST	CBM	16	656
P137931W	7/23/2001	44	71	9	NESW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 23-9-4471	GST	CBM	16	761
P137935W	7/23/2001	44	71	9	SWNW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 12-9-4471	GST	CBM	16	760
P137945W	7/23/2001	44	71	9	SWNE	LANCE OIL & GAS COMPANY, INC	SWINGHOLM FEDERAL 32-9-4471	GST	CBM	16	566
P143427W	3/25/2002	44	71	10	SESE	BOLLER/MILLS RANCH	HARMS #1	GST	DOM	10	140
P122962W	1/19/2000	44	71	10	NENW	RIM OPERATING, INC	CBMC #21-10	GST	CBM	1	585
P137924W	7/23/2001	44	71	10	SWSW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 41-10-4471	GST	CBM	16	680
P137925W	7/23/2001	44	71	10	SWNW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 12-10-4471	GST	CBM	16	656
P142248W	1/18/2002	44	71	10	SWNE	RIM OPERATING, INC.	CBM C #32-10	GST	STO, CBM	2	565
P143208W	3/7/2002	44	71	10	NENE	RIM OPERATING, INC.	CBM C #41-10	GST	STO, CBM	0	605
P155325W	10/20/2003	44	71	10	NESE	RIM OPERATING, INC.	CBM C #43-10	GST	CBM, MIS	3	570
P115398W	4/22/1999	44	71	11	SWSW	WILLIAM/ELAINE PRIDGEON	PRIDGEON #1	GST	STO	10	174
P2966P	6/21/1955	44	71	11	NENW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #15	GST	STO	4	60
P2967P	12/21/1941	44	71	11	NWNE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #16	GST	STO	5	90
P2969P	4/12/1962	44	71	11	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #18	GST	STO	6	233
P140142W	10/16/2001	44	71	11	SENE	RIM OPERATING, INC.	CBM C #42-11	GST	STO, CBM	0	565
P140822W	11/8/2001	44	71	11	SESE	RIM OPERATING, INC.	CBM C # 44-11	GST	STO, CBM	0	565
P142249W	1/18/2002	44	71	11	NWNW	RIM OPERATING, INC.	CBM C #11-11	GST	STO, CBM	0	545
P142250W	1/18/2002	44	71	11	NWSW	RIM OPERATING, INC.	CBM C #13-11	GSE	STO, CBM		
P146100W	7/19/2002	44	71	11	SENE	RIM OPERATING, INC.	CBM C #22-11	GST	STO, CBM	15	535
P146101W	7/19/2002	44	71	11	NWNE	RIM OPERATING, INC.	CBM C #31-11	GST	STO, CBM	5	526
P11011W	10/27/1971	44	71	12	NWNW	INEXCO OIL CO.	CENTRAL WSW #5 1	ADJ	IND	300	5110

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P2968P	12/21/1942	44	71	12	SENW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #17	GST	STO	5	180
P148382W	11/8/2002	44	71	12	NWSE	RIM OPERATING, INC.	CBM C #33-12	GST	STO, MIS, CBM	5	445
P140823W	11/8/2001	44	71	12	NWSW	RIM OPERATING, INC.	CBM C #13-12	GST	STO, CBM	2	620
P141687W	12/20/2001	44	71	12	NWNW	RIM OPERATING, INC.	CBM C #11-12	GST	STO, CBM	7	545
P146102W	7/19/2002	44	71	12	NWNE	RIM OPERATING, INC.	CBM C # 31-12	GST	STO, CBM	1	365
P2970P	12/21/1939	44	71	13	NESW	MILLS LAND & LIVESTOCK CO., INC.	MILLS #19	GST	STO	5	190
P148383W	11/8/2002	44	71	13	NWNE	RIM OPERATING, INC.	CBM C #31-13	GST	STO, MIS, CBM	12	465
P148384W	11/8/2002	44	71	13	NWSE	RIM OPERATING, INC.	CBM C #33-13	GST	STO, MIS, CBM	2	465
P140143W	10/16/2001	44	71	13	NWNW	RIM OPERATING, INC.	CBM C #11-13	GST	STO, CBM	1	585
P140144W	10/16/2001	44	71	13	SESW	RIM OPERATING, INC.	CBM C #24-13	GST	STO, CBM	7	446
P140824W	11/8/2001	44	71	13	NWSW	RIM OPERATING, INC.	CBM C #13-13	GST	STO, CBM	1	525
P140825W	11/8/2001	44	71	13	SENW	RIM OPERATING, INC.	CBM C #22-13	GST	STO, CBM	0	505
P141688W	12/20/2001	44	71	13	SENE	RIM OPERATING, INC.	CBM C # 42-13	GST	STO, CBM	2	445
P106972W	8/1/1997	44	71	14	NESE	BARRETT RESOURCES CORP.	DURHAM RANCH FED. 43-14A	GST	MON	0	820
P6348W	8/17/1970	44	71	14	SWNW	CARL J. SPRINGEN	SPRINGEN #1	GST	STO	14	104
P148385W	11/8/2002	44	71	14	SWNW	RIM OPERATING, INC.	CBM C #12-14	GST	STO, MIS, CBM	5	505
P148386W	11/8/2002	44	71	14	NWSE	RIM OPERATING, INC.	CBM C #33-14	GST	STO, MIS, CBM	5	485
P148387W	11/8/2002	44	71	14	SESE	RIM OPERATING, INC.	CBM C #44-14	GST	STO, MIS, CBM	1	465
P137892W	7/23/2001	44	71	14	NENW	WILLIAMS PRODUCTION RMT, COMPANY	BOLLER MILLS RANCH FEDERAL 21-14-4471	GST	CBM	1	497
P140826W	11/8/2001	44	71	14	NWNE	RIM OPERATING, INC.	CBM C #31-14	GST	STO, CBM	4	525
P122967W	1/19/2000	44	71	15	SWNE	LANCE OIL & GAS COMPANY, INC	MILLS 32-15-4471	GST	CBM	7	605
P122968W	1/19/2000	44	71	15	NENE	LANCE OIL & GAS COMPANY, INC	MILLS 41-15-4471	GST	CBM	7	560
P128534W	8/17/2000	44	71	15	SWSW	LANCE OIL & GAS COMPANY, INC	MILLS FEDERAL 14-15-4471	GST	CBM	7	682
P128535W	8/17/2000	44	71	15	NESW	LANCE OIL & GAS COMPANY, INC	MILLS FEDERAL 23-15-4471	GST	CBM	7	597
P142372W	1/31/2002	44	71	15	SWNW	LANCE OIL & GAS COMPANY, INC	MILLS 12-15-4471	GST	CBM	16	692
P142374W	1/31/2002	44	71	15	NENW	LANCE OIL & GAS COMPANY, INC	MILLS 21-15-4471	GST	CBM	16	727
P143422W	3/25/2002	44	71	16	NESE	WY STATE BOARD OF LAND COMMISSIONERS** BOLLER/MILLS RANCH	SCHOOL SECTION #1	GST	STO	10	300
P49662W	8/17/1979	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS	RH1-P-2-B	GST	MON	0	750
P54646W	11/20/1980	44	71	16	NESE	WY BOARD OF LAND COMMISSIONERS**EARL BOLLER	JUMPOFF #1		MON, STO, MIS	5	325

Table S1-5. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P121862W	12/29/1999	44	71	16	SWSW	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 14-16-4471	GST	CBM	30	692
P121863W	12/29/1999	44	71	16	NESW	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 23-16-4471	GST	CBM	30	690
P121864W	12/29/1999	44	71	16	SWSE	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 34-16-4471	GST	CBM	30	702
P122969W	1/19/2000	44	71	16	SWNW	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 12-16-4471	GST	CBM	25	710
P122970W	1/19/2000	44	71	16	NENW	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 21-16-4471	GST	CBM	30	823
P122971W	1/19/2000	44	71	16	SWNE	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 32-16-4471	GST	CBM	30	810
P122972W	1/19/2000	44	71	16	NENE	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 41-16-4471	GST	CBM	30	750
P122973W	1/19/2000	44	71	16	NESE	WY STATE BOARD OF LAND COMMISSIONERS** LANCE OIL & GAS COMPANY, INC	STATE 43-16-4471	GST	CBM	30	735
P55913W	3/9/1981	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL C-6	GST	MON	0	733
P55918W	3/9/1981	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL OBCA-2	GST	MON	0	755
P55920W	3/9/1981	44	71	16	NENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL OBUA-3	GST	MON	0	260
P66656W	3/16/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL R-1	GST	MON	0	740
P66657W	3/16/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL R-2	GST	MON	0	730
P66658W	3/16/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL R-3	GST	MON	0	739
P66659W	3/16/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL R-4	GST	MON	0	739
P66660W	3/16/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	ROCKY HILL R-5	GST	MON	0	746
P69281W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH-1-P-3	GST	MON	0	752
P69282W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH 1 - MCA-1	GST	MON	0	755
P69283W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH-1-DW-1	GST	MON	0	744
P69284W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH-1-DW-2	GST	MON	0	743
P69285W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH-1-DW-3	GST	MON	0	743
P69286W	7/20/1984	44	71	16	SENW	WY BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL COMPANY	RH-1-DW-4	GST	MON	0	746
P72569W	5/6/1986	44	71	16	SENW	THUNDER BASIN COAL COMPANY	RH 1 P1	GST	MON	0	752
P72571W	5/6/1986	44	71	16	SENW	THUNDER BASIN COAL COMPANY	RH 1 MCA 3	GST	MON	0	767
P112760W	11/9/1998	44	71	17	SWSW	LANCE OIL & GAS COMPANY, INC	E FORK FLOCCHINI 14-17	GST	CBM	50	754
P122974W	1/19/2000	44	71	17	SWSE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS 34-17-4471	GST	CBM	30	747

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P123996W	3/13/2000	44	71	17	SWNW	LANCE OIL & GAS COMPANY, INC	DURHAM RANCH 12-17-4471	GST	CBM	30	810
P128536W	8/17/2000	44	71	17	NESW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS FEDERAL 23-17-4471	GST	CBM	7	761
P128537W	8/17/2000	44	71	17	NESE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS FEDERAL 43-17-4471	GST	CBM	7	762
P137890W	7/23/2001	44	71	17	NENE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 41-17-4471	GST	CBM	7	759
P137891W	7/23/2001	44	71	17	SWNE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 32-17-4471	GST	CBM	7	802
P137893W	7/23/2001	44	71	17	NENW	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS RANCH FEDERAL 21-17-4471	GST	CBM	7	630
P13289P	12/31/1943	44	71	20	NWSW	DURHAM MEAT CO.	DURHAM MEAT #36	GST	STO	4	108
P112051W	10/6/1998	44	71	20	SWNW	LANCE OIL & GAS COMPANY, INC	EAST FORK FLOCCHINI 12-20	GST	CBM	50	792
P113318W	12/14/1998	44	71	20	NWNW	LANCE OIL & GAS COMPANY, INC	E FORK FLOCCHINI 11-20	GST	CBM	50	781
P121865W	12/29/1999	44	71	20	NENW	LANCE OIL & GAS COMPANY, INC	BOLLER-MILLS 21-20-4471	GST	CBM	40	802
P121866W	12/29/1999	44	71	20	NESW	LANCE OIL & GAS COMPANY, INC	BOLLER-MILLS 23-20-4471	GST	CBM	40	747
P121867W	12/29/1999	44	71	20	SWNE	LANCE OIL & GAS COMPANY, INC	BOLLER-MILLS 32-20-4471	GST	CBM	40	722
P121868W	12/29/1999	44	71	20	SWSW	LANCE OIL & GAS COMPANY, INC	BOLLER-MILLS 34-20-4471	GST	CBM	40	686
P121869W	12/29/1999	44	71	20	NESE	LANCE OIL & GAS COMPANY, INC	BOLLER-MILLS 43-20-4471	GST	CBM	40	642
P123995W	3/13/2000	44	71	20	SWSW	LANCE OIL & GAS COMPANY, INC	DURHAM RANCH 14-20-4471	GST	CBM	25	801
P137920W	7/23/2001	44	71	20	NENE	LANCE OIL & GAS COMPANY, INC	BOLLER MILLS FEDERAL 41-20-4471	GST	CBM	7	710
P143425W	3/25/2002	44	71	21	SENE	BOLLER/MILLS RANCH	RANCH HOUSE WELL #1	GST	DOM, STO	15	140
P121870W	12/29/1999	44	71	21	SWNW	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 12-21-4471	GST	CBM	45	630
P121871W	12/29/1999	44	71	21	SWSW	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 14-21-4471	GST	CBM	45	623
P121872W	12/29/1999	44	71	21	NENW	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 21-21-4471	GST	CBM	45	661
P121873W	12/29/1999	44	71	21	NESW	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 23-21-4471	GST	CBM	45	590
P121874W	12/29/1999	44	71	21	SWNE	WILLIAMS PRODUCTION RMT COMPANY** LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 32-21-4471	GST	CBM	45	630
P121875W	12/29/1999	44	71	21	SWSE	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 34-21-4471	GST	CBM	45	580
P121876W	12/29/1999	44	71	21	NENE	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 41-21-4471	GST	CBM	45	763
P121877W	12/29/1999	44	71	21	NESE	LANCE OIL & GAS COMPANY, INC	DOROUGH TRUST 43-21-4471	GST	CBM	45	650
P3214P	8/24/1928	44	71	22	SESE	FERIBA F. FERGUSON	FERGUSON #1	GST	DOM, STO	10	50
P128463W	8/17/2000	44	71	22	NENW	LANCE OIL & GAS COMPANY, INC	MILLS FEDERAL 21-22-4471	GST	CBM	7	602
P128464W	8/17/2000	44	71	22	SWNW	LANCE OIL & GAS COMPANY, INC	MILLS FEDERAL 12-22-4471	GST	CBM	7	706
P142373W	1/31/2002	44	71	22	NESE	LANCE OIL & GAS COMPANY, INC	FERGUSON 43-2-4471	GSI	CBM		
P145781W	6/26/2002	44	71	22	SWSW	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #14-22	GST	CBM	0	603
P145782W	6/26/2002	44	71	22	NESW	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #23-22	GST	CBM	0	573
P145785W	6/26/2002	44	71	22	SWSE	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #34-22	GST	CBM	0	502
P2971P	12/21/1938	44	71	23	NWNE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #20	GST	STO	6	90
P2972P	9/3/1963	44	71	23	NWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #21	GST	STO	5	42
P121841W	12/27/1999	44	71	23	NWSE	RIM OPERATING, INC	CBM C #33-23	GST	STO, CBM	0	369
P121842W	12/27/1999	44	71	23	NWNE	RIM OPERATING, INC	CBM C #31-23	GST	STO, CBM	12	415
P123654W	2/28/2000	44	71	23	SESE	RIM OPERATING, INC	CBM C #44-23	GST	STO, CBM	2	365
P123655W	2/28/2000	44	71	23	SENE	RIM OPERATING, INC	CBM C #42-23	GST	STO, CBM	15	395
P132543W	2/8/2001	44	71	24	NESW	RIM OPERATING, INC	CBM C # 23-24	GST	MON	0	365

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P19252P	12/31/1920	44	71	24	NESW	ARK LAND COMPANY	REVLAND #4	GST	STO	10	75
P123653W	2/28/2000	44	71	24	NWNW	RIM OPERATING, INC	CBM C #11-24	GST	STO, CBM	15	407
P123656W	2/28/2000	44	71	24	NWSW	WILLIAMS PRODUCTION RMT, COMPANY	CBM C #13-24	GST	STO, CBM	10	371
P123892W	3/6/2000	44	71	24	SESW	RIM OPERATING, INC	CBM C #24-24	GST	STO, CBM	2	338
P128289W	8/14/2000	44	71	24	NWSE	RIM OPERATING, INC	CBM C #33-24	GST	STO, CBM	13	380
P128290W	8/14/2000	44	71	24	SESE	RIM OPERATING, INC	CBM C #44-24	GST	STO, CBM	18	375
P128297W	8/14/2000	44	71	24	SESW	RIM OPERATING, INC	CBM C #22-24	GST	STO, CBM	10	385
P140145W	10/16/2001	44	71	24	NWNE	RIM OPERATING, INC.	CBM C #31-24	GST	STO, CBM	0	425
P140146W	10/16/2001	44	71	24	SENE	RIM OPERATING, INC.	CBM C #42-24	GST	STO, CBM	7	405
P2973P	12/31/1946	44	71	25	SENE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #22	GST	STO	4	90
P121839W	12/27/1999	44	71	25	NWSE	RIM OPERATING, INC	CBM C #33-25	GST	STO, CBM	0	326
P121840W	12/27/1999	44	71	25	NWNE	RIM OPERATING, INC	CBM C #31-25	GST	STO, CBM	0	328
P123657W	2/28/2000	44	71	25	NWNW	RIM OPERATING, INC	CBM C #11-25	GST	STO, CBM	25	327
P123658W	2/28/2000	44	71	25	NWSW	RIM OPERATING, INC	CBM C #13-25	GST	STO, CBM	Unkn own	357
P123891W	3/6/2000	44	71	25	SESW	RIM OPERATING, INC	CBM C #24-25	GST	STO, CBM	18	355
P123893W	3/6/2000	44	71	25	SESW	RIM OPERATING, INC	CBM C #22-25	GST	STO, CBM	0	324
P128291W	8/14/2000	44	71	25	SENE	RIM OPERATING, INC	CBM C #42-25	GST	STO, CBM	11	350
P128292W	8/14/2000	44	71	25	SESE	RIM OPERATING, INC	CBM C #44-25	GST	STO, CBM	20	345
P170774W	10/28/2005	44	71	25	SESE	JACOBS RANCH COAL CO.	TW-25SE1	GSI	TST		
P170775W	10/28/2005	44	71	25	SESE	JACOBS RANCH COAL CO.	TW-25SE2	GSI	TST		
P170776W	10/28/2005	44	71	25	NENE	JACOBS RANCH COAL CO.	TW-25NE1	GSI	TST		
P170777W	10/28/2005	44	71	25	NENE	JACOBS RANCH COAL CO.	TW-25NE2	GSI	TST		
P170778W	10/28/2005	44	71	25	SWNW	JACOBS RANCH COAL CO.	TW-25NW1	GSI	TST		
P170779W	10/28/2005	44	71	25	SWNW	JACOBS RANCH COAL CO.	TW-25NW2	GSI	TST		
P151454W	5/2/2003	44	71	25	NWNW	JACOBS RANCH COAL COMPANY	JRM-DW-25-1	GSE	MIS		
P151455W	5/2/2003	44	71	25	NWNE	JACOBS RANCH COAL COMPANY	JRM-DW-25-2	GSE	MIS		
P151457W	5/2/2003	44	71	25	SESW	JACOBS RANCH COAL COMPANY	JRM-DW-25-4	GSE	MIS		
P151458W	5/2/2003	44	71	25	NWSW	JACOBS RANCH COAL COMPANY	JRM-DW-25-5	GSE	MIS		
P166504W	3/31/2005	44	71	25	SESW	JACOBS RANCH COAL COMPANY	03PIEZO2005	GSI	MON		
P178332W	10/4/2006	44	71	25	SESE	JACOBS RANCH COAL COMPANY	DW 2006-3,4	GSI	MIS		
P121838W	12/27/1999	44	71	26	NWNE	RIM OPERATING, INC	CBM C #31-26	GST	STO, CBM	0	348
P128068W	8/4/2000	44	71	26	SESE	RIM OPERATING, INC	CBM C 44-26	GST	STO, CBM	0	385
P128069W	8/4/2000	44	71	26	SENE	RIM OPERATING, INC	CBM C 42-26	GST	STO, CBM	0	300
P128070W	8/4/2000	44	71	26	NWSE	RIM OPERATING, INC	CBM C 33-26	GST	STO, CBM	25	405
P128293W	8/14/2000	44	71	26	NWNW	RIM OPERATING, INC	CBM C #11-26	GST	STO, CBM	33	422

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P128294W	8/14/2000	44	71	26	NWSW	RIM OPERATING, INC	CBM C #13-26	GST	STO, CBM	25	437
P128295W	8/14/2000	44	71	26	SEW	RIM OPERATING, INC	CBM C #22-26	GST	STO, CBM	25	407
P128296W	8/14/2000	44	71	26	SEW	RIM OPERATING, INC	CBM C #24-26	GST	STO, CBM	25	427
P135821W	6/15/2001	44	71	26	SEW	RIM OPERATING, INC	ENL CBM C # 24-26	GST	STO, CBM	10	427
P135822W	6/15/2001	44	71	26	NWSW	RIM OPERATING, INC	ENL CBM C # 13-26	GST	STO, CBM	10	437
P135823W	6/15/2001	44	71	26	NWNW	RIM OPERATING, INC	ENL CBM C # 11-26	GST	STO, CBM	10	422
P170780W	10/28/2005	44	71	26	NESE	JACOBS RANCH COAL CO.	TW-26SE1	GSI	TST		
P170781W	10/28/2005	44	71	26	NESE	JACOBS RANCH COAL CO.	TW-26SE2	GSI	TST		
P175240W	6/2/2006	44	71	26	NWNE	JACOBS RANCH COAL CO.	TW-26NE	GSI	TST		
P120167W	11/1/1999	44	71	26	NENE	JACOBS RANCH MINE JACOBS RANCH COAL COMPANY	JACOBS RANCH MINE JRM 26- 2W41	GST	MON	0	105
P3215P	7/16/1930	44	71	27	SENE	W. L. FERGUSON	FERGUSON #1	GST	DOM	10	24
P3216P	10/17/1944	44	71	27	SENE	W. L. FERGUSON	FERGUSON #2	GST	DOM, STO	10	100
P118863W	9/1/1999	44	71	27	SWSW	LANCE OIL & GAS COMPANY, INC	CHITTENDEN 14-27	GST	CBM	45	503
P118864W	9/1/1999	44	71	27	NESW	LANCE OIL & GAS COMPANY, INC	CHITTENDEN 23-27	GST	CBM	45	523
P128584W	8/22/2000	44	71	27	SWSE	LANCE OIL & GAS COMPANY, INC	FERGUSON 34-27-4471	GST	CBM	30	501
P128585W	8/22/2000	44	71	27	NESE	LANCE OIL & GAS COMPANY, INC	FERGUSON 43-27-4471	GST	CBM	30	501
P131375W	12/4/2000	44	71	27	SWNW	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #12-27	GST	STO, CBM	0	571
P131376W	12/4/2000	44	71	27	NENW	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #21-27	GST	STO, CBM	0	527
P145783W	6/26/2002	44	71	27	SWNE	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #32-27	GST	STO, CBM	19	512
P145786W	6/26/2002	44	71	27	NENE	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #41-27	GST	STO, CBM	13	458
P118170W	8/6/1999	44	71	28	SWSW	LANCE OIL & GAS COMPANY, INC	STUART 14-28	GST	CBM	45	607
P118171W	8/6/1999	44	71	28	NESW	LANCE OIL & GAS COMPANY, INC	STUART 21-28	GST	CBM	45	582
P118865W	9/1/1999	44	71	28	SWSE	LANCE OIL & GAS COMPANY, INC	CHITTENDEN 34-28	GST	CBM	45	557
P118866W	9/1/1999	44	71	28	NESE	LANCE OIL & GAS COMPANY, INC	CHITTENDEN 43-28	GST	CBM	45	542
P121902W	12/29/1999	44	71	28	SWNW	LANCE OIL & GAS COMPANY, INC	SNODGRASS 12-28-4471	GST	CBM	45	622
P121903W	12/29/1999	44	71	28	NENW	LANCE OIL & GAS COMPANY, INC	SNODGRASS 21-28-4471	GST	CBM	45	609
P121904W	12/29/1999	44	71	28	SWNE	LANCE OIL & GAS COMPANY, INC	SNODGRASS 32-28-4471	GST	CBM	45	565
P121905W	12/29/1999	44	71	28	NENE	LANCE OIL & GAS COMPANY, INC	SNODGRASS 41-28-4471	GST	CBM	40	583
P92738W	9/3/1993	44	71	29	SESE	JAMES R. AND IRENE STUART	ALICE #2	GST	STO	6	100
P118172W	8/6/1999	44	71	29	SWSE	LANCE OIL & GAS COMPANY, INC	STUART 34-29	GST	CBM	40	683
P118173W	8/6/1999	44	71	29	NESE	LANCE OIL & GAS COMPANY, INC	STUART 43-29	GST	CBM	45	642
P121906W	12/29/1999	44	71	29	SWNW	LANCE OIL & GAS COMPANY, INC	STUART 12-29-4471	GST	CBM	45	742
P121907W	12/29/1999	44	71	29	SWSW	LANCE OIL & GAS COMPANY, INC	STUART 14-29-4471	GST	CBM	45	722
P121908W	12/29/1999	44	71	29	NENW	LANCE OIL & GAS COMPANY, INC	STUART 21-29-4471	GST	CBM	40	682
P121909W	12/29/1999	44	71	29	NESW	LANCE OIL & GAS COMPANY, INC	STUART 23-29-4471	GST	CBM	45	690
P121910W	12/29/1999	44	71	29	SWNE	LANCE OIL & GAS COMPANY, INC	STUART 32-29-4471	GST	CBM	45	642
P121911W	12/29/1999	44	71	29	NENE	LANCE OIL & GAS COMPANY, INC	STUART 41-29-4471	GST	CBM	45	662
P118174W	8/6/1999	44	71	32	SWNE	LANCE OIL & GAS COMPANY, INC	STUART 32-32	GST	CBM	65	640
P118175W	8/6/1999	44	71	32	NENE	LANCE OIL & GAS COMPANY, INC	STUART 41-32	GST	CBM	40	622
P118184W	8/6/1999	44	71	32	SWSW	LANCE OIL & GAS COMPANY, INC	FLOCCHINI 14-32	GST	CBM	65	730
P118185W	8/6/1999	44	71	32	NESW	LANCE OIL & GAS COMPANY, INC	FLOCCHINI 23-32	GST	CBM	65	695
P118186W	8/6/1999	44	71	32	SWSE	LANCE OIL & GAS COMPANY, INC	FLOCCHINI 34-32	GST	CBM	65	652
P118187W	8/6/1999	44	71	32	NESE	LANCE OIL & GAS COMPANY, INC	FLOCCHINI 43-32	GST	CBM	65	620

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).

Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P118868W	9/1/1999	44	71	32	SWNW	LANCE OIL & GAS COMPANY, INC	STUART 12-32	GST	CBM	65	710
P118869W	9/1/1999	44	71	32	NENW	LANCE OIL & GAS COMPANY, INC	STUART 21-32	GST	CBM	65	692
P118176W	8/6/1999	44	71	33	SWNW	LANCE OIL & GAS COMPANY, INC	STUART 12-33	GST	CBM	60	620
P118177W	8/6/1999	44	71	33	SWSW	LANCE OIL & GAS COMPANY, INC	STUART 14-33	GST	CBM	60	577
P118178W	8/6/1999	44	71	33	NENW	LANCE OIL & GAS COMPANY, INC	STUART 21-33	GST	CBM	65	610
P118179W	8/6/1999	44	71	33	NESW	LANCE OIL & GAS COMPANY, INC	STUART 23-33	GST	CBM	65	579
P118180W	8/6/1999	44	71	33	SWNE	LANCE OIL & GAS COMPANY, INC	STUART 32-33	GST	CBM	60	560
P118181W	8/6/1999	44	71	33	SWSE	LANCE OIL & GAS COMPANY, INC	STUART 34-33	GST	CBM	65	505
P118182W	8/6/1999	44	71	33	NENE	LANCE OIL & GAS COMPANY, INC	STUART 41-33	GST	CBM	45	580
P152948W	8/4/2003	44	71	33	SWSE	THUNDER BASIN COAL COMPANY	NPLTC-03-01	GST	MON	0	9.6
P5971W	5/29/1970	44	71	34	NESE	INC. STUART BROTHERS	SWP #1	GST	STO	25	245
P5972W	5/29/1970	44	71	34	NESE	INC. STUART BROTHERS	SWP #2	GST	STO	25	250
P92345W	7/20/1993	44	71	34	SWSE	JAMES R. AND IRENE STUART	ALICE #1	GST	DOM	8	630
P128453W	8/17/2000	44	71	34	NESW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 23-34-4471	GST	CBM	10	522
P128454W	8/17/2000	44	71	34	NENW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 21-34-4471	GST	CBM	10	495
P128455W	8/17/2000	44	71	34	SWSW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 14-34-4471	GST	CBM	10	501
P128456W	8/17/2000	44	71	34	SWNW	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 12-34-4471	GST	CBM	10	518
P136616W	7/2/2001	44	71	34	NESE	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 43-34-4471	GST	CBM	10	443
P136617W	7/2/2001	44	71	34	SWSE	LANCE OIL & GAS COMPANY, INC	STUART FEDERAL 34-34-4471	GST	CBM	10	480
P145784W	6/26/2002	44	71	34	SWNE	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #32-34	GST	CBM	0	495
P145787W	6/26/2002	44	71	34	NENE	DAVID D. FERGUSON, ET AL.** COLEMAN OIL & GAS, INC.	FERGUSON #41-34	GST	CBM	0	446
40/4/267W	7/18/2007	44	71	34	NESE	THUNDER BASIN COAL CO., LLC	WW01	UNA	MIS		
40/5/267W	7/18/2007	44	71	34	SESE	THUNDER BASIN COAL CO., LLC	WW02	UNA	MIS		
40/6/277W	7/25/2007	44	71	34	NESE	THUNDER BASIN COAL CO.	WW08	UNA	MIS		
P19250P	12/31/1961	44	71	35	SENE	ARK LAND COMPANY	REVLAND #5	GST	DOM, STO	15	125
P30419W	7/16/1975	44	71	35	NENE	ARK LAND COMPANY	REVLAND #1	GST	DOM, STO	25	303
P128066W	8/4/2000	44	71	35	SENE	RIM OPERATING, INC	CBM C 42-35	GST	STO, CBM	18	425
P128067W	8/4/2000	44	71	35	NWNE	RIM OPERATING, INC	CBM C 31-35	GST	STO, CBM	25	405
P143825W	4/2/2002	44	71	35	NWNE	RIM OPERATING, INC	ENL. CBM C #31-35	GST	STO, CBM	10	405
P146103W	7/19/2002	44	71	35	NWNW	RIM OPERATING, INC.	CBM C # 11-35	GSE	STO, CBM		
P146104W	7/19/2002	44	71	35	SENE	RIM OPERATING, INC.	CBM C # 22-35	GSE	STO, CBM		
P121835W	12/27/1999	44	71	36	NWNE	RIM OPERATING, INC	CBM C #31-36	GST	STO, CBM	25	296
P121844W	12/27/1999	44	71	36	NWSE	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #33-36	GST	STO, CBM	17	282
P121845W	12/27/1999	44	71	36	NWSW	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #13-36	GST	STO, CBM	21	386
P121846W	12/27/1999	44	71	36	NWNW	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #11-36	GST	STO, CBM	18	337
P125924W	5/25/2000	44	71	36	SENE	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #42-36	GST	STO, CBM	0	262
P125925W	5/25/2000	44	71	36	SENE	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #22-36	GST	STO, CBM	25	355
P125926W	5/25/2000	44	71	36	SESE	RIM OPERATING, INC** WY STATE BOARD OF LAND COMMISSIONERS	CBM C #24-36	GST	STO, CBM	18	390

Supplementary Information on the Affected Environment

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P128065W	8/4/2000	44	71	36	SESE	WY STATE BOARD OF LAND COMMISSIONERS** RIM OPERATING, INC	CBM C 44-36	GST	STO, CBM	22	313
P170784W	10/28/2005	44	71	36	NESE	JACOBS RANCH COAL CO.** WY STATE BOARD OF LAND COMMISSIONERS	TW-36SE1	GSI	TST		
P170785W	10/28/2005	44	71	36	NESE	JACOBS RANCH COAL CO.** WY STATE BOARD OF LAND COMMISSIONERS	TW-36SE2	GSI	TST		
P170786W	10/28/2005	44	71	36	NENW	JACOBS RANCH COAL CO.** WY STATE BOARD OF LAND COMMISSIONERS	TW-36NW1	GSI	TST		
P170787W	10/28/2005	44	71	36	NENW	JACOBS RANCH COAL CO.** WY STATE BOARD OF LAND COMMISSIONERS	TW-36NW2	GSI	TST		
P178325W	10/4/2006	44	71	36	SENE	JACOBS RANCH COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	DW 2006-20	GSI	MIS		
P178328W	10/4/2006	44	71	36	NENE	JACOBS RANCH COAL COMPANY** WY STATE BOARD OF LAND COMMISSIONERS	DW 2006-11,12	GSI	MIS		
P33644W	6/2/1976	44	71	36	NENE	WYO BOARD OF LAND COMMISSIONERS** THUNDER BASIN COAL CO., LLC	ECH 6	GST	MON	0	395
P28315W	9/24/1974	45	70	31	SESE	FRANKLIN REALTY	X-1		MIS	0	120
P10722W	8/25/1971	45	70	32	NWNE	GUY W. EDWARDS	EDWARDS #8	GST	STO	5	189
P11883P	7/15/1959	45	70	33	SWNE	GUY W. EDWARDS**BLANCHE KELLY	EDWARDS #9	GST	STO	3	60
P11884P	12/31/1922	45	70	33	SESE	GUY W. EDWARDS**BLANCHE KELLY	EDWARDS #10	GST	STO	5	12
P11886P	8/31/1968	45	70	33	SWSE	GUY W. EDWARDS**BLANCHE KELLY	EDWARDS #12	GST	DOM, STO	7	120
P148380W	11/8/2002	45	71	33	NESW	RIM OPERATING, INC.	CBM B #23-33	GST	STO, MIS, CBM	13	705
P148381W	11/8/2002	45	71	33	SWSE	RIM OPERATING, INC.	CBM B #34-33	GST	STO, MIS, CBM	9	585
P146874W	8/21/2002	45	71	33	SWNE	RIM OPERATING, INC.	CBM B # 32-33	GST	STO, CBM	0	625
P155326W	10/20/2003	45	71	33	SWSW	RIM OPERATING, INC.	CBM B #14-33	GST	CBM, MIS	2	750
P155327W	10/20/2003	45	71	33	NESE	RIM OPERATING, INC.	CBM B #43-33	GST	CBM, MIS	2	570
P160196W	6/18/2004	45	71	33	NENE	RIM OPERATING, INC.	CBM B #41-33	GST	STO, CBM	4	588
P143423W	3/25/2002	45	71	34	NWNW	BOLLER/MILLS RANCH	GILBERT #1	GST	STO	3	50
P143428W	3/25/2002	45	71	34	SESE	BOLLER/MILLS RANCH	BIG SHED WELL	GST	STO	10	80
P146875W	8/21/2002	45	71	34	NWSE	RIM OPERATING, INC.	CBM B # 33-34	GST	STO, CBM	16	465
P146876W	8/21/2002	45	71	34	SESE	RIM OPERATING, INC.	CBM B # 44-34	GST	STO, CBM	12	445
P155681W	11/6/2003	45	71	34	SWNW	RIM OPERATING, INC.	CBM B #12-34	GST	STO, CBM	0	590
P160990W	1/7/2004	45	71	34	SESW	RIM OPERATING, INC.	CBM B #24-34	GST	STO, CBM	10	628
P161000W	7/12/2004	45	71	34	NWNE	RIM OPERATING, INC.	CBM B #31-34	GSI	STO, CBM		
P2601W	6/12/1969	45	71	35	SWSW	JOHN E. JACOBS	ISENBERGER #3	GST	STO	7	155
P2871W	9/19/1969	45	71	35	NWNW	JOHN E. JACOBS	ISENBERGER #4	UNA	IND	100	350
P2962P	12/21/1952	45	71	35	SWSE	MILLS LAND & LIVESTOCK CO., INC.	MILLS #11	GST	STO	5	150
P3443W	11/12/1969	45	71	35	NWNW	JOHN E. JACOBS	ISENBERGER #5	ADJ	IND	150	500
P47620W	3/6/1979	45	71	35	NWNE	INEXCO OIL CO.** CLARKE K. MILLS TRUST	HILIGHT WATER WELL #1	ADJ	MIS	15	1333
P62293W	2/5/1982	45	71	35	NWNE	LESSEE INEXCO OIL COMPANY**LESSOR CLARKE K. MILLS TRUST	ENL HILIGHT WATER WELL #1	ADJ	MIS	15	1333

Table S1-4. Groundwater Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Facility Name	Status	Uses	YLD	TD
P62470W	11/3/1982	45	71	35	SESW	BUTCH REYNOLDS	REYNOLDS #1	GST	DOM, STO	22	203
P140140W	10/16/2001	45	71	35	NWSW	RIM OPERATING, INC.	CBM B #13-35	GST	STO, CBM	9	425
P140141W	10/16/2001	45	71	35	NWSE	RIM OPERATING, INC.	CBM B #33-35	GST	STO, CBM	0	345
P153526W	8/1/2003	45	71	35	NWNE	RIM OPERATING, INC.	CBM B #31-35	GST	STO, CBM	0	350
P153539W	8/1/2003	45	71	35	NWNW	RIM OPERATING, INC.	CBM B #11-35	GST	STO, CBM	0	370
P11009W	10/27/1971	45	71	36	NWNW	INEXCO OIL CO.	CENTRAL WSW #4 1	ADJ	IND	200	5000
P2963P	10/6/1963	45	71	36	SESE	MILLS LAND & LIVESTOCK CO., INC.**WYO BOARD OF LAND COMMISSIONERS	MILLS #12	GST	STO	5	110
P33643W	6/2/1976	45	71	36	SESE	THUNDER BASIN COAL COMPANY**WYO BOARD OF LAND COMMISSIONERS	ECH 5	GST	MON	0	232

Notes for Non Mining-related Groundwater Rights within 3 Miles of the North Hilight Field LBA Tract

Search Conducted October 9, 2007

Groundwater Right Search Area:

Township	Range	Sections
43N	69W	6
43N	70W	1-8
43N	71W	1-5, 9-12
44N	69W	7, 18-19, 30-31
44N	70W	1-36
44N	71W	1-5, 8-17, 20-29, 32-36
45N	70W	31-35
45N	71W	33-36

Water rights were searched to the nearest quarter-quarter of each section listed above. Any part of a quarter-quarter that lies within three miles of the LBA tract is included.

Permit number suffixes are denoted as follows:

"A" Adjudicated (finalized) rights; unless the right is a territorial appropriation, there will be a match in the reference column from one of the following permit types for the unadjudicated portion:

"P" Stock and domestic use wells completed prior to May 24, 1969 and registered with the State Engineer's Office prior to December 31, 1972

"W" Permits are for wells with a priority date for the date of filing with the State Engineer

Status Codes

ADJ	Adjudicated
GSE	Good standing, permitted time limits have been extended
GSI	Good standing incomplete; required notices not received; not yet expired
GSM	Good standing but map is still required
GST	Good standing
UNA	Unadjudicated

Approximately 264 separate water rights with a status code of ABA (Abandoned), A&C (Abandoned and Cancelled), CAN (Cancelled), or EXP (Expired) have been eliminated from the listing provided above, as none of these well codes represent a valid current right.

Use Codes

CBM	Coal Bed Methane	IRR	Irrigation
DEW	Dewatering	MIS	Miscellaneous
DOM	Domestic	MON	Monitoring
DRI	Drilling	RES	Reservoir Supply
IND	Industrial	TEM	Temporary Use
STO	Stock		

Lands described in these copies are the water rights of record in the SEO database and may or may not reflect the actual situation on the ground. Failure to exercise a water right for five years, when water is available, may constitute grounds for forfeiture.

Table S1-5. Surface Water Rights for North Hilght Field LBA Tract.

Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Appropriation	Facility Name	Status	Source	Uses
P6174S	5/13/1968	43	70	3	15	JACOBS LAND & LIVESTOCK CO. INC.			UNA	BURNING COAL BANK DRAW	
P462S	10/28/1953	43	70	4	6	J.A. JACOBS			UNA		
POU		43	70	7	11				GSI		
CR1/387A		43	71	3	9		E. E. STUART	STUART RESERVOIR	PUO		STO
P1163S	3/3/1955	43	71	3	6	E. E. STUART ESTATE				PETTERS BASIN	
P5501R	3/1/1943	43	71	3	9	E.E. STUART			ADJ	DRY FORK LITTLE THUNDER	
P1165S	3/3/1955	43	71	4	6	E. E. STUART ESTATE			PUO	SPRINGEN DRAW	
P5723S	10/10/1966	43	71	4	6	STUART BROTHERS INC.			PUO	HAUMAN DRAW	
33/4/110S	9/26/2005	43	71	5	0	JAMES R. & IRENE STUART TRUSTS			UNA	DRY FORK LITTLE THUNDER CREEK	
P1164S	3/3/1955	43	71	9	16	E. E. STUART ESTATE			PUO	MANOR DRAW	
CR4/254A		43	71	10	4		USDA, FOREST SERVICE	STUART #F.S.9-256-3 STOCK RESERVOIR	PUO		STO
P2343S	8/4/1958	43	71	10	11	PAUL AND RUBY H. STUART			PUO	SCHROYER DRAW	
P5938S	2/27/1967	43	71	10	4	USDA FOREST SERVICE			ADJ	ERICKSON DRAW	
P5724S	10/10/1966	43	71	11	16	HAROLD E. ZIMMER			UNA	ZIMMER DRAW	
C31/424A		44	70	13	11		W. M. BAIRD	BLACK THUNDER RESERVOIR	PUO		IRR, DOM
P1369R	4/7/1908	44	70	13	11	W. M. BAIRD			ADJ	BLACK THUNDER CREEK	
P8577D	4/7/1908	44	70	13	11	W. M. BAIRD			PUD	BLACK THUNDER CREEK	
P27254D	7/31/1981	44	70	17	8	LADD LUKOWICZ			PUD	LINE KEE DRAW	
P4869R	4/28/1938	44	70	17	13	H. W. KEELINE**GEORGE R. KEELINE**JOE J. KEELINE			PUO	KEELINE DRAW	
P5423R	4/8/1941	44	70	17	4	H. W. KEELINE & SONS			PUO	KEELINE DRAW	
P845S	7/26/1954	44	70	25	8	J. A. JACOBS				ANDREWS DRAW	
P12398D	5/6/1914	44	70	26	9	ELLWOOD ANDERSON			PUD	NAMING ERRORS	
P13319D	6/30/1915	44	70	26	9	O. E. ANDERSON			PUD	SAGE CREEK	
P13320D	6/30/1915	44	70	26	9	O. E. ANDERSON			PUD	SAGE CREEK	
P13321D	8/19/1915	44	70	26	8	O. E. ANDERSON			PUD	DIAMOND L. CREEK	
P4086S	1/31/1962	44	70	29	11	J.A. JACOBS			UNA	MILLS #2 DRAW	
P414S	10/7/1953	44	70	30	3	RALPH E. MILLS			UNA	MILLS #1 DRAW (17-43-70)	
P415S	10/7/1953	44	70	30	16	RALPH E MILLS			UNA	MILLS #2 DRAW	
P416S	10/7/1953	44	70	31	3	RALPH E. MILLS			UNA	MILLS #1 DRAW (17-43-70)	
P417S	10/7/1953	44	70	31	13	RALPH E.MILLS			UNA	MILLS #1 DRAW (17-43-70)	
P418S	10/7/1953	44	70	31	15	RALPH E MILLS			UNA	MILLS #1 DRAW (17-43-70)	
P4894S	12/22/1964	44	71	3	6	H.T. ISENBERGER			UNA	BULL FROG DRAW	
P17505S	10/28/2005	44	71	4	9	ROBERT & JAMIE SWINGHOLM			UNA	TREMBEL DRAW	
P17506S	10/28/2005	44	71	4	15	ROBERT & JAMIE SWINGHOLM			UNA	BULL FROG DRAW	
P17291S	8/23/2005	44	71	5	16	ROBERT & JAMIE SWINGHOLM			UNA	FROG LEGS DRAW	
P16798S	12/30/1899	44	71	8	0	TOM MILLS			UNA	BOLLER DRAW (DRNG CLOSED BASIN)	
P17668S	9/1/2005	44	71	11	16	DALE MILLS TRUST			UNA	SPRINGEN DRAW NO. ONE	
P17670S	9/1/2005	44	71	11	13	DALE MILLS TRUST			UNA	MILLS NO. 1 DRAW	
32/3/389S	4/11/2005	44	71	13	9	CLARK K. MILLS TRUST			UNA	TRIB WEST FORK COAL CREEK	
P17671S	9/1/2005	44	71	14	13	DALE MILLS TRUST			UNA	ALE DRAW	
P17673S	9/1/2005	44	71	14	2	DALE MILLS TRUST			UNA	SPRINGEN DRAW NO. ONE	

Supplementary Information on the Affected Environment

Table S1-5. Surface Water Rights for North Hilight Field LBA Tract (Continued).											
Permit No.	Priority	TNS	RNG	SEC	QQ	Applicant	Appropriation	Facility Name	Status	Source	Uses
P4857S	1/26/1963	44	71	14	1	CARL J. SPRINGEN			UNA	SPRINGEN DRAW NO. ONE	
P17278S	8/23/2005	44	71	15	3	DALE & EDITH MILLS			UNA	GRAVEL DRAW	
P17401S	10/20/2005	44	71	15	14	DALE & EDITH MILLS			UNA	GRAVEL DRAW	
P18371S	12/18/2006	44	71	17	13	BOLLER MILLS RANCH			UNA	DRY DRAW	
P17175S	8/23/2005	44	71	20	11	DURHAM RANCHES, INC.			UNA	SAGER DRAW	
P17176S	8/23/2005	44	71	20	10	DURHAM RANCHES, INC.			UNA	SAGER DRAW	
P18314S	11/1/2006	44	71	20	3	BOLLER MILLS RANCH			UNA	DRY DRAW	
P18372S	12/18/2006	44	71	20	3	BOLLER MILLS RANCH			UNA	DRY DRAW	
P17667S	9/1/2005	44	71	22	3	DALE MILLS TRUST			UNA	CHEESE DRAW	
P17669S	9/1/2005	44	71	23	5	DALE MILLS TRUST			UNA	MILLS NO. 1 DRAW	
C27/359A		44	71	28	12		JOHN MORTON SHEEP COMPANY	THUNDER BASIN NO. 1 RESERVOIR	PUO		STO
P17790S	3/3/2006	44	71	28	9	JAMES & IRENE STUART TRUST			UNA	DRY DRAW	
P946R	11/30/1906	44	71	28	12	JOHN MORTON SHEEP COMPANY			PUO	DRY DRAW	
P18350S	8/23/2005	44	71	32	6	PAUL R. STUART REVOCABLE TRUST			UNA	DRY FORK LITTLE THUNDER CREEK	
P2344S	8/4/1958	44	71	34	8	PAUL AND RUBY H. STUART			PUO	DWIGHT DRAW	
P17672S	9/1/2005	44	71	36	9	DALE MILLS TRUST			UNA	QUIGLEY DRAW	
P33346D	11/2/2005	44	71	36	14	E.H. OFTEDAL & SONS, INC.			UNA	NORTH SECTION 36 PLAYA (A CLOSED BASIN)	

Supplementary Information on the Affected Environment

Notes for Non Mining-related Surface Water Rights within 3 Miles of the North Hilight Field LBA Tract

Search Conducted October 10, 2007

Surface Water Right Search Area:

Township	Range	Sections
43N	69W	6
43N	70W	1-8
43N	71W	1-5, 8-12
44N	69W	7, 18-19, 30-31
44N	70W	1-36
44N	71W	1-5, 8-17, 20-29, 32-36
45N	70W	31-35
45N	71W	33-36

Water rights were searched to the nearest quarter-quarter of each section listed above. Any part of a quarter-quarter that lies within three miles of the LBA tract is included.

Record suffixes are denoted as follows:

"A" Adjudicated (finalized) rights; unless the right is a territorial appropriation, there will be a match in the reference column from one of the following permit types for the unadjudicated portion

- "D" Ditch or pipeline permit
- "E" Enlargement of a ditch or pipeline permit
- "R" Reservoir permit
- "S" Stock reservoir permit

Status Codes

ABA	Abandoned	A&C	Abandoned and Cancelled
AME	Amended (moved)	ADJ	Adjudicated
CAN	Cancelled	DSC	Description
ELI	Eliminated	EXP	Expired
GST	Good standing	REJ	Rejected
PU	Point of use non irrigation (not actual status)		
PUD	Point of diversion (not actual status)		
PUO	Point of reservoir outlet (not actual status)		
TEM	Temporary	TRA	Transferred
UNA	Unadjudicated		

Use Codes

DOM	Domestic	IRR	Irrigation
RES	Reservoir supply	STO	Stock

Approximately 47 separate water rights with a status code of ABA, A&C, AME, CAN, ELI, EXP, REJ, or TRA have been eliminated from the search area listing provided above (including those belonging to the mining companies), as none of these use codes represent a valid current right.

The following quarter-quarters are designated by the "QQ" field:

1	NE $\frac{1}{4}$ NE $\frac{1}{4}$	9	NE $\frac{1}{4}$ SW $\frac{1}{4}$
2	NW $\frac{1}{4}$ NE $\frac{1}{4}$	10	NW $\frac{1}{4}$ SW $\frac{1}{4}$
3	SW $\frac{1}{4}$ NE $\frac{1}{4}$	11	SW $\frac{1}{4}$ SW $\frac{1}{4}$
4	SE $\frac{1}{4}$ NE $\frac{1}{4}$	12	SE $\frac{1}{4}$ SW $\frac{1}{4}$
5	NE $\frac{1}{4}$ NW $\frac{1}{4}$	13	NE $\frac{1}{4}$ SE $\frac{1}{4}$
6	NW $\frac{1}{4}$ NW $\frac{1}{4}$	14	NW $\frac{1}{4}$ SE $\frac{1}{4}$
7	SW $\frac{1}{4}$ NW $\frac{1}{4}$	15	SW $\frac{1}{4}$ SE $\frac{1}{4}$
8	SE $\frac{1}{4}$ NW $\frac{1}{4}$	16	SE $\frac{1}{4}$ SE $\frac{1}{4}$

S1-6 ALLUVIAL VALLEY FLOORS

Under the Surface Mining Control and Reclamation Act of 1977 (SMCRA), surface coal mining operations that would interrupt, discontinue, or preclude farming on alluvial valley floors (AVFs) is prohibited unless the affected AVF is undeveloped rangeland that is not significant to farming or if the affected AVF is of such small acreage that it would have a negligible impact on a farm's agricultural production. These restrictions also apply if AVFs that are downstream of the area proposed for mining would be affected by disruptions in streamflow. Provided Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) determines that an AVF is not significant to agriculture, it can be disturbed by mining but must be restored as part of the reclamation process. For any designated AVF, regardless of its significance to agriculture, it must be demonstrated that the essential hydrologic functions of the AVF, both within and outside the mine area, will be protected.

WDEQ regulations define AVFs as unconsolidated stream laid deposits where water availability is sufficient for subirrigation or flood irrigation agricultural activities. Guidelines established by the Office of Surface Mining Reclamation and Enforcement (OSM) and WDEQ/LQD for the identification of AVFs require detailed studies of geomorphology, soils, hydrology, vegetation, and land use. These studies are used to identify: 1) the presence of unconsolidated stream laid deposits, 2) the possibility for artificial flood irrigation, 3) past and/or present flood irrigation, and 4) apparent subirrigated areas and the possibility for natural flood irrigation. Areas that are identified as AVFs following these studies are evaluated for their significance to farming by WDEQ/LQD.

In a decision by the U.S. District Court for the District of Columbia, Civil Action Number 69-1144 (1980) (known as the Flannery Decision), the court noted that an AVF must satisfy both geologic criteria (unconsolidated stream laid deposits) and hydrologic criteria (water sufficient to sustain agriculture). Therefore, the court emphasized that the key to the existence of an AVF is the presence of both geologic and water availability characteristics, which together sustain agricultural activities.

Within the general analysis area for the North Hilight Field LBA Tract, there are numerous ephemeral drainages. The associated alluvial, colluvial and playa deposits are generally very thin and not laterally extensive enough to be considered aquifers. In addition, these unconsolidated deposits are typically very fine-grained and have very limited permeabilities, precluding any significant storage and movement of groundwater (TBCC 2005). Mapping of the area's surficial geology (Reheis and Coates 1987, Moore and Coates 1978, and Coates 1977) shows that alluvial deposits within the LBA tract's general analysis area occur only along Springen Draw, which is a closed basin, and the alluvial materials are comprised of fan, apron and sheet wash deposits (Figure S1-2). Due to its limited areal extent, limited saturated thickness, and low hydraulic conductivity, these unconsolidated alluvial deposits associated with these streams do not consistently produce enough water to be put to beneficial

use. In addition, the alluvial groundwater is generally of such poor quality that it does not meet WDEQ/WQD standards for agricultural use. Surface water quantity is insufficient to support natural or artificial flood irrigation practices, and historic flood irrigation attempts have not been identified along Mills Draw, Keeline Draw, or Springen Draw. Furthermore, the soils (Aeric Fluvaquent, Shingle-Shake Complex, and Arvada Thick Surface (Absted) loam) that dominate the bottoms of drainages within the tract's general analysis area are classified by the National Resource Conservation Service (NRCS) as unsuitable for irrigation.

There are some areas within the LBA tract's general analysis area that have been used as hayland. In years with sufficient precipitation, grass hay (crested wheatgrass) is harvested. Production from these fields is solely driven by early season precipitation; none is due to flood irrigation (artificial or natural) or subirrigation.

Formal declarations of the presence or absence of an AVF, its significance to agriculture, and the appropriate perimeter (areal extent) would be made by the WDEQ/LQD as part of the mine permitting process. Based on previous non-AVF declarations made on Mills Draw and Springen Draw within and adjacent to the existing Jacobs Ranch Mine permit area, which includes a portion of the BLM study area for the North Hilight Field LBA Tract, it is unlikely that WDEQ/LQD would declare that any AVFs exist in the general analysis area for the North Hilight Field tract.

S1-7 WETLANDS

The U.S. Army Corps of Engineers (COE) administers a regulatory program under Section 404 of the Clean Water Act (CWA) for the discharge of fill or dredge materials into Waters of the United States (WoUS). This regulatory program requires that an inventory of WoUS, including wetlands, be performed, permits be acquired prior to dredging and filling jurisdictional wetlands, and that impacts to jurisdictional wetlands and Other Waters of the United States (OWUS) be adequately mitigated. Wyoming Department of Environmental Quality/Land Quality Division (WDEQ/LQD) regulations require that wetlands and other high valued wildlife habitat that is to be disturbed by proposed mining activities be reclaimed following mining operations.

WoUS include all areas subject to regulation by the COE pursuant to the CWA, to include special aquatic sites, of which wetlands is a subset. The definition of WoUS has been very broadly interpreted to include most major water bodies, streams, intermittent drainages, mud flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds. However, recent court decisions have been limiting the COE jurisdiction of some areas. Precise definitions of WoUS or navigability are ultimately dependent on judicial interpretation and cannot be made conclusively by administrative agencies (33 CFR 329). In addition, rules, regulations, policies, and procedures used in determining the extent of jurisdiction have also changed and evolved with time.

Many ephemeral channels and playas in the Powder River Basin (PRB) have, in the past, been classified as WoUS. However, several changes have occurred to the COE regulatory program over the past several years that will have a bearing on the current status of numerous areas historically classified as jurisdictional. For example, the *Solid Waste Agency of Northern Crook County verses the U.S. Army Corps of Engineers (SWANCC vs COE)* decision ruled that isolated waters and playas are not WoUS, and Regulatory Guidance Letter (RGL) 05-05, issued in 2005, details procedures to be used to determine identification of the Ordinary High Water Mark (OHWM). The *Rapanos verses U.S. Supreme Court* decision of June 19, 2006 put into question the COE's jurisdiction over ephemeral streams and their adjacent wetlands. As a result of that ruling, the COE has placed a moratorium on the issuance of approved jurisdictional determinations which will be in place until the COE headquarters, the Environmental Protection Agency (EPA), and the Department of Justice determines how to proceed and issues appropriate legal guidance.

Federal regulations limit jurisdiction to the OHWM (33 CFR 328.4). Previous delineations used the very general criteria that stated "drainages must have an active channel that exhibits relatively stable fluviogeomorphic character (i.e., the channel has a well-defined bed and grade) to be classified as Waters of the United States". RGL 05-05 now provides a specific list of the physical characteristics that are to be evaluated to identify the presence or location of an OHWM. Evaluation of these specific physical characteristics may now lead to a determination that many of the ephemeral drainages in the PRB are not jurisdictional.

Special aquatic sites are a subset of WoUS defined as "geographic areas, large or small, possessing special ecological characteristics and productivity, habitat, wildlife protection, or other important and easily disrupted ecological values" (40 CFR 230.3[q-1]). Special aquatic sites include "sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs and riffle and pool complexes" (40 CFR 230, Subpart E).

The wetland component of special aquatic sites is defined by the COE as "those areas inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation specifically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas" (33 CFR 328.3 [a][7][b]). To be subject to COE jurisdiction as a wetland, an area must be located in an area determined to be a WoUS. If that criterion is met, the area must also meet all three of the following criteria:

- Dominance of hydrophytic plant species;
- Presence of hydric soils; and
- Occurrence of continuous inundation and/or saturation to the soil surface at some time during the growing season (approximated as frost free days) for a period of time equivalent to at least 5% of the growing season.

Thus, in describing wetlands three very different types, from a permitting perspective, may be identified. **Jurisdictional wetlands** are “those wetlands which are within the extent of COE’s regulatory overview” (33 CFR 328.1 and 2). To qualify, an area must be determined to be within a WoUS and meet all three wetland criteria as described in the above paragraph. **Non-jurisdictional wetlands** include areas that meet all three wetland criteria, although they do not have a significant nexus (connection) with traditional navigable waters. **Functional wetlands** are areas that may contain only one or two of the three wetland criteria identified above. The United States Fish and Wildlife Service (USFWS) uses this third categorization in producing National Wetland Inventory (NWI) maps, which are based on aerial photo interpretation with limited field verification.

Black Thunder Mine (BTM) acquired COE authorization under Nationwide Permit (NWP) 21 in 1994, and then under Programmatic General Permit 99-03 (GP 99-03) on March 22, 2001. The correspondence identified that GP 99-03 authorization was valid as long as the WDEQ/LQD permit 233-T6 was valid, and also removed jurisdiction over playas (isolated wetlands). GP 99-03 was then cancelled, and COE authorization under NWP 21 was again granted for the permit 233-T7 term. NWP 21 expired in March 2007, and the mine is currently operating under the permit clause that allows work under contract to continue for up to one year. The mine applied for the new NWP 21 in the winter of 2007. An approved wetland replacement mitigation plan is contained in BTM’s WDEQ/LQD Mine Permit, Subsection RP-7.E.

Various COE wetland delineations have been completed for adjacent mines. BTM history includes several approved delineations. In 2000, a consolidated wetland delineation (for pre-2000 delineations) was received and approved by the COE. The COE submitted a letter to BTM dated March 22, 2001 identifying the removal of playa wetlands and playa waters from jurisdictional status, based on the January 9, 2001 SWANCC court ruling. Additional amendments to total WoUS within the BTM permit area occurred between 2001 and 2007, and a letter to the COE, dated January 30, 2007, includes an updated summary table of WoUS. The updated summary identifies a total of 49.14 acres of jurisdictional wetlands, 65.44 acres of OWUS, and 154.88 acres of isolated waters on the BTM permit area.

A preliminary wetlands inventory of the general analysis area for the North Hilight Field LBA Tract was conducted by Knight Technologies Inc. (KTI), of Gillette, Wyoming, in 2007. This inventory was based on USFWS NWI mapping (1980), review of color-infrared orthophotography maps (2001), and visual field reconnaissance of vegetation and hydrology indicators. Figure S1-3 depicts the USFWS NWI mapping within the general analysis area (wetlands analysis area) for the North Hilight Field LBA Tract.

KTI’s initial field reconnaissance indicated that wetland areas mapped by the USFWS NWI in 1980 have been altered due to coal bed natural gas (CBNG)-related water production within and upstream of the tract’s general analysis

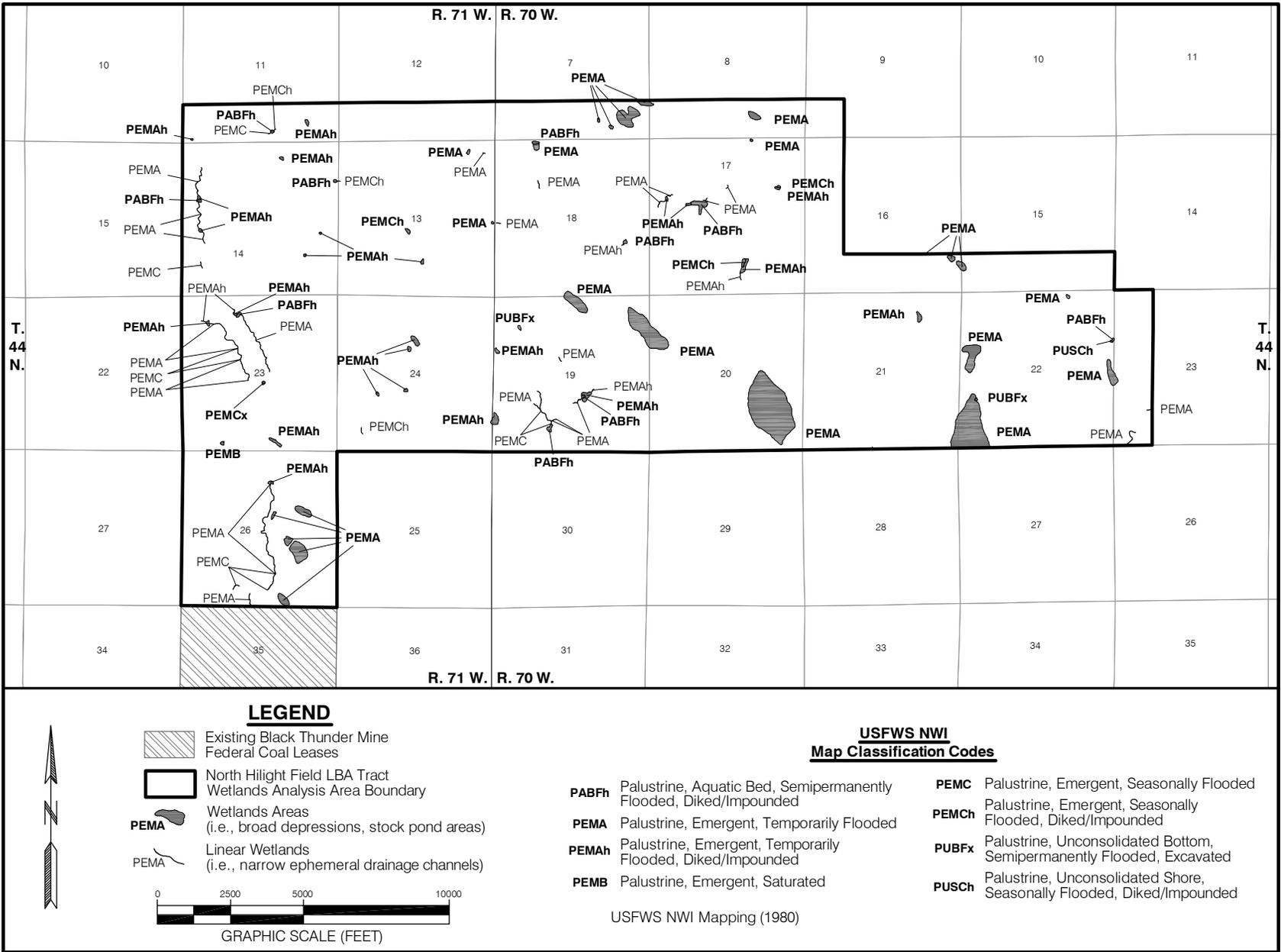


Figure S1-3. Wetlands Within the General Analysis Area for the North Hilight Field LBA Tract.

area. This preliminary assessment identified the presence of several categories of wetlands and OWUS. The categories consisted of dry ephemeral drainages and the following USFWS wetland habitat classifications:

- Palustrine emergent (PEM),
- Palustrine aquatic bed (PAB), and
- Palustrine unconsolidated (PU).

Within the entire general analysis area for the North Hilight Field LBA Tract (8,476.4 acres), the preliminary wetland inventory identified a total of 177.5 acres of wetlands and OWUS. These wetlands and OWUS were found within five general land categories: ephemeral streams, playas, ponds/reservoirs, isolated depressions, and excavated upland areas. These 177.5 acres are vegetated wetlands that consist of approximately 172.0 acres of palustrine emergent herbaceous wet meadow or marsh and approximately 5.5 acres of palustrine aquatic beds located along ephemeral stream channels and around ponds, playas and depressions. No areas of open water (pond or channel OWUS) were observed during this preliminary wetland inventory. Open water or PAB areas typically support a fringe of area classified as PEM wetlands.

At this time, a distinction has not been made between jurisdictional and non-jurisdictional acreages of wetlands and OWUS since only the COE has the authorization to make such determination following the submittal and review of a formal wetland delineation as part of the permitting process. A wetland delineation would be conducted and submitted to the COE with a formal Section 404 Jurisdictional Determination request as part of the WDEQ/LQD mine permitting process.

S1-8 SOILS

The general analysis area for the North Hilight Field LBA Tract has been subjected to Order 1-2 and/or Order 3 soil surveys in the recent past. Those surveys being:

- The S $\frac{1}{4}$ of Sections 19, 20, 21, and 22, T.44N., R.70W., the S $\frac{1}{4}$ of Section 24, the SE $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 23, T.44N., R.71W., and the E $\frac{1}{4}$ of Section 26, T.44N., R.71W., were mapped during the baseline Order 1-2 soil survey of the Jacobs Ranch Mine and are part of its existing approved WDEQ/LQD mine permit.
- The S $\frac{1}{2}$ SW $\frac{1}{4}$ and the SW $\frac{1}{4}$ SE $\frac{1}{4}$ of Section 26, T.44N., R.71W., were mapped during the baseline Order 1-2 soil survey of the Little Thunder Amendment Area of the Black Thunder Mine, which is part of its existing approved WDEQ/LQD mine permit.
- The remainder of the general analysis area has been covered by the National Resource Conservation Service (NRCS) Order 3 soil survey of southern Campbell County (Prink et al. 2004).

Supplementary Information on the Affected Environment

All Order 1-2 soil surveys were completed in accordance with WDEQ/LQD Guideline No.1, which outlines required soils information necessary for a coal mining operation. The WDEQ inventories included field sampling and observations at the requisite number of individual sites, and laboratory analysis of representative collected samples. Soils within the analysis area were identified by series, which consist of soils that have similar horizons in their profile. Horizons are soil layers having similar color, texture, structure, reaction, consistency, mineral and chemical composition, and arrangement in the profile.

NRCS Order 3 mapping is completed according to national guidelines and standards. This scale of mapping, i.e., 40 acre minimum size delineation of soil map unit polygons, is much larger than the WDEQ surveys.

Soils vary depending upon where and how they were formed. Major factors involved in the formation of soils include whether or not the material was transported and how the material was weathered during transportation. Four primary soil formation processes causing different soil types were noted: 1) those soils developing predominantly in thin residuum from sandstone or shale on upland ridges, 2) those soils developing predominantly in slopewash, colluvium, or alluvial fan deposits from mixed sources on gently sloping uplands, 3) those soils developing predominantly in coarse-textured alluvium or sandy eolian deposits on rolling uplands, and 4) drainage soils developing in mixed stream laid alluvium on terraces and channels, and in fine-textured playa deposits in depressions and closed basins.

The soil depths and types in the general analysis area for the North Hilgert Field tract are similar to soils currently being salvaged and utilized for reclamation at the neighboring Black Thunder and Jacobs Ranch mines, as well as other mines in the eastern PRB. The following is a list of the soil types delineated in the tract's BLM study area (note that some series determinations have changed since the original surveys were completed). The major soils series encountered within the soil survey area were grouped according to the primary soil formation processes and are listed as follows:

Soils developing predominantly in thin residuum from sandstone or shale on upland ridges and hills

- Samsil-Shingle-Worf Complex 3 to 10 percent slopes
- Renohill-Worfka clay loams, 3 to 15 percent slopes
- Shingle-Samday-Badlands Complex, 10 to 45 percent slopes
- Theedle-Shingle loams, 3 to 30 percent slopes
- Wibaux-Wibaux, thin solum Complex, 6 to 40 percent slopes

Soils developing predominantly in colluvium or alluvial fan deposits from mixed sources on gently sloping uplands

- Arvada thick surface-Arvada-Slickspots Complex, 0 to 6 percent slopes

- Arvada (Absted) thick surface, 0 to 3 percent slopes
- Arvada loam, 0 to 6 percent slopes
- Bidman-Parmleed loams, 0 to 6 percent slopes
- Bidman-Parmleed loams, 6 to 15 percent slope
- Bidman loam, loamy substratum, 0 to 6 percent slopes
- Ulm clay loam, 0 to 6 percent slopes
- Pugsley fine sandy loam, 0 to 10 percent slopes
- Bowbac and Cushman soils
- Bidman-Ulm loams, 0 to 6 percent slope
- Ulm-Bidman soils, moderately saline, 0 to 3 percent slopes
- Forkwood-Cushman loams, 0 to 6 percent slopes
- Forkwood-Cushman loams, 6 to 15 percent slopes
- Forkwood loam, 3 to 10 percent slopes
- Forkwood loam, 0 to 6 percent slopes
- Savageton-Silhouette clay loams, 6 to 15 percent slopes
- Ulm-Renohill clay loams, 0 to 6 percent slopes
- Bidman loam, 0 to 6 percent slopes
- Ulm loam, 0 to 6 percent slopes
- Heldt clay loam, 0 to 6 percent slopes
- Heldt, saline-slickspots
- Forkwood-Cambria loams, 0 to 6 percent slopes
- Theedle-Kishona loams, 0 to 6 percent slopes
- Theedle-Kishona loams, 6 to 20 percent slopes
- Ulm-Renohill clay loams, 6 to 15 percent slopes
- Renohill loam, 0 to 6 percent slopes
- Pugsley and Bowbac soils
- Renohill and Parmleed soils
- Unnamed Variant B

Soils developing predominantly in coarse-textured residuum, alluvium and sandy eolian deposits on rolling uplands

- Hiland-Bowbac fine sandy loams, 0 to 15 percent slopes
- Hiland-Bowbac fine sandy loams, 6 to 15 percent slopes
- Maysdorf fine sandy loam, 0 to 6 percent slopes
- Bowbac fine sandy loam, 0 to 6 percent slopes
- Hiland (Olney) fine sandy loam, 0 to 6 percent slopes
- Maysdorf-Pugsley sandy loams, 6 to 15 percent slopes
- Vonalee sandy loam, 3 to 10 percent slopes
- Decolney-Hiland fine sandy loams, 0 to 6 percent slopes
- Decolney-Hiland fine sandy loams, 6 to 15 percent slopes
- Decolney and Hiland, 0 to 10 percent slopes
- Hiland-Vonalee fine sandy loams, 0 to 6 percent slopes
- Hiland-Vonalee fine sandy loams, 6 to 15 percent slopes
- Keeline-Tulloch loamy sands, 6 to 30 percent slopes
- Pugsley-Decolney sandy loams, 6 to 15 percent slopes
- Turnercrest-Keeline-Taluce fine sandy loams, 6 to 30 percent slopes
- Vonalee-Terro fine sandy loams, 2 to 10 percent slopes

- Terro sandy loam, 3 to 10 percent slopes

Drainage soils developing in mixed stream laid alluvium on terraces and channels and in fine-textured playa deposits in depressions and closed basins

- Felix clay, ponded, 0 to 2 percent slopes

Table S1-6 provides the extent of five depth classes of suitable topsoil within the BLM study area.

Table S1-6. Acres of Topsoil Available for Reclamation Within the BLM Study Area for the North Hilight Field LBA Tract.

Thickness of Suitable Topsoil (inches)	Acres	Percent
0	133.70	1.9
0 - 12	333.78	4.7
12 - 30	28.76	28.8
30 - 48	4,415.25	61.8
48 - 60	200.94	2.8
Water	2.86	0.0
Total	7,140.43	100.0

The North Hilight Field LBA Tract baseline soils analysis, in conjunction with the county-wide NRCS soil survey, indicate that the amount of suitable topsoil that would be available for redistribution on all disturbed acres within the analysis area during reclamation would have an average depth of 2.7 feet. Areas of unsuitable soils include sites with high alkalinity, salinity or sand content. The tract is expected to have adequate quantity and quality of soil for reclamation. One of the Order 1-2 soil surveys has located hydric soils, which are one component used in identifying wetlands.

S1-9 VEGETATION

The vegetation communities in the general analysis area for the North Hilight Field LBA Tract (8,476 total acres) were appraised and mapped by Habitat Management, Inc. of Gillette, Wyoming in 2007 to provide a preliminary assessment.

Vegetation within the LBA tract's general analysis area consists of species common to eastern Wyoming. A total of eight vegetation types have been preliminarily identified and mapped within the LBA tract's general analysis area. Table S1-7 presents the acreage and percent of the analysis area encompassed by each vegetation type. The vegetation types include Mixed Prairie Grassland, Big Sagebrush Shrubland, Playas, Streamside Grassland, Agricultural Pasture, Saline Bottomland, and variations of these communities. Disturbed lands, reclaimed lands, and reservoir areas were also identified.

Supplementary Information on the Affected Environment

Table S1-7. Vegetation Types Identified and Mapped Within the North Hilight Field LBA Tract.

Vegetation Type	Area Applied For		BLM Study Area		General Analysis Area	
	(Acres)	(Percent)	(Acres)	(Percent)	(Acres)	(Percent)
Mixed Prairie Grassland	269.19	10.31	757.18	10.62	1,137.58	13.42
Big Sagebrush Shrubland	897.23	34.37	3,307.60	46.38	4,184.90	49.37
Playa - Densely Vegetated	31.40	1.20	239.47	3.36	256.37	3.02
Playa - Barren	19.56	0.75	19.56	0.27	19.95	0.2
Streamside Grassland	12.37	0.47	12.69	0.18	12.81	0.15
Alkali Bottom Grassland	0.00	0.00	0.00	0.00	0.00	0.00
Agricultural Pasture 1 (< 20% Shrubs)	174.15	6.67	699.48	9.81	803.61	9.48
Agricultural Pasture 2 (>=20% Shrubs)	990.79	37.96	1,154.96	16.20	1,201.20	14.17
Wildfire Modified Agricultural Pasture 2	0.00	0.00	200.60	2.81	202.92	2.39
Pasture / Hayland	0.44	0.02	309.62	4.34	310.61	3.66
Saline Bottomland	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed Lands (Roads, Trails, etc)	146.26	5.60	308.16	4.32	258.39	3.05
Reclaimed Lands	60.69	2.33	95.61	1.34	61.93	0.73
Reservoir	8.28	0.32	25.98	0.36	26.17	0.31
Total	2,610.00	100.00	7,131.00	100.00	8,476.00	100.00

In terms of total acres of occurrence in the general analysis area, the predominant vegetation types are Big Sagebrush Shrubland (roughly 49 percent), Mixed Prairie Grassland (roughly 13 percent), and Agricultural Pasture 1 and 2 (roughly 30 percent).

These vegetation types are described as follows:

The **Big Sagebrush Shrubland** community is characterized by the presence of Wyoming big sagebrush (*Artemisia tridentata* ssp. *Wyomingensis*) at a density of 20 percent or greater, and the grasses western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), green needlegrass (*Nassella viridula*), needle and thread (*Hesperostipa comata*), and crested wheatgrass (*Agropyron cristatum*). The density of shrubs and grasses varies throughout the area, with some portions consisting of very dense shrubs with minimal grass component and other areas with a lower density of shrubs and a very heavy grass component. Plains prickly pear (*Opuntia polyacantha*) is also common throughout this community type, and lichen can make a substantial contribution to ground cover particularly in dry years. This community is associated with a wide variety of soil types.

The **Mixed Prairie Grassland** community is characterized by the presence of western wheatgrass, blue grama, green needlegrass, needle and thread, and crested wheatgrass and a low density of shrub species (less than 20 percent).

This community frequently occurs on Hiland-Bowbac fine sandy loam soils with 0-6 percent slopes, but can be found on a wide variety of soil types.

Agricultural Pasture 1 and 2 are areas that have been historically seeded with crested wheatgrass for agricultural or grazing purposes, and the species has persisted over time. Vegetation communities delineated as Agricultural Pasture 1 have a low shrub component of 0-20 percent and are generally dominated by a crested wheatgrass monoculture. Agricultural Pasture 1 communities may be currently under use for hay production. Vegetation communities delineated as Agricultural Pasture 2 have a greater shrub component with a density of 20 percent or more, and, although still dominant, the density of crested wheatgrass is reduced and other graminoid species are present. A portion of the Agricultural Pasture 2 community was recently burned in a wildfire, and was mapped as a separate community.

Playas are distinct, low-lying patches that likely accumulate moisture during times of high precipitation or significant snowmelt. They are essentially absent of any shrub component and are usually either dominated by grasses including inland salt grass (*Distichlis spicata*) and foxtail barley (*Hordeum jubatum*) or are barren. Many playas have been modified in the center; with a large pond/reservoir excavated for use as either water sources for livestock or containment for CBMG production-associated discharge water. These playas most frequently occur on Felix clay ponded soils with 0-2 percent slopes, although they also occur on other soil types.

Streamside Grassland is dominated by inland salt grass, alkali sacaton (*Sporobolus airoides*) and some sedge and rush species (*Carex spp.* and *Juncus spp.*). Grasses present in the Mixed Prairie Grassland are also found here. Some areas categorized as streamside grassland may include true wetland; however wetlands were not delineated for the purpose of determining vegetation communities. Streamside grassland is most frequently found on the Arvada, thick surface-Arvada-slickspots soil Complex, and the Theedle-Kishona-Shingle loam soils with 3-30 percent slopes, but can be found on several other soil types as well.

Saline Bottomland is characterized by the presence of highly compacted, exposed soils, Wyoming big sagebrush and plains prickly pear, and a low density of grasses, although inland saltgrass and alkali sacaton are found here. This community has been overgrazed and the surface is highly erodible. It occurs almost exclusively on the Arvada, thick surface-Arvada-Slickspots soil complex.

Disturbed lands include roads, areas surrounding active construction sites and mining facilities, oil and gas facilities, and occupied and abandoned homesteads. Several deciduous and/or coniferous trees have been planted around most homestead sites. Reclaimed lands include areas that were recently reclaimed after disturbance for the installation of oil and gas facilities or pipelines, road construction and other activities. Several reservoirs constructed for containment of CBNG discharge water, irrigation and/or livestock use are also present.

S1-10 WILDLIFE

S1-10.1 Wildlife Resources

Background information on wildlife in the vicinity of the North Hilight Field LBA Tract was drawn from several sources, including Wyoming Game and Fish Department (WGFD) and U.S. Fish and Wildlife Service (USFWS) records, the Wyoming Natural Diversity Database (WYNDD), recent PRB federal coal lease application EIS documents (available for public review on Wyoming BLM's website at <http://www.blm.gov/wy/st/en.html>), and personal contacts with WGFD and USFWS biologists. Site-specific data for the LBA tract's general analysis area were obtained from several sources, including WDEQ/LQD mine permit applications and annual wildlife monitoring reports for the nearby coal mines. Due to the proximity of the proposed lease area to the adjacent mines' (Black Thunder and Jacobs Ranch) permit areas, the general analysis area for the North Hilight Field tract has received some level of coverage annually since the early 1980s. Increasing percentages of the tract's general analysis area were included in annual monitoring efforts as survey areas for the adjacent mines have been expanding due to previous coal lease acquisitions and subsequent permit area amendments. Baseline and annual wildlife surveys cover a large perimeter around mine permit areas; consequently, a majority of the proposed lease area and adjacent lands have been surveyed for wildlife species as part of the required monitoring surveys for these adjacent mines. In addition, Thunder Basin Coal Company (TBCC) initiated baseline investigations during 2006 and early 2007 expressly for the West Hilight Field LBA Tract with additional surveys targeting the North and South Hilight Field LBA Tracts in 2007 and 2008. The results of site-specific surveys for the entire leased area and appropriate perimeter will be part of the mine permitting process if the lease sale is held and the tract is proposed for mining. Thunderbird-Jones & Stokes (J&S), formerly Thunderbird Wildlife Consulting, Inc. (TWC), of Gillette, Wyoming, has conducted the historical and recent wildlife studies for the Black Thunder Mine, while Intermountain Resources (IR), of Laramie, Wyoming, has conducted the historical and recent wildlife studies specifically for the Jacobs Ranch Mine.

In an undisturbed condition, the major vegetation types in the tract's general analysis area provide habitats for many species. Vegetation types tend to occur in a mosaic across the landscape; therefore, many wildlife species can be expected to utilize more than one habitat type. Predominant habitat types classified on the LBA tract and adjacent area correspond with the major plant communities defined by the vegetation survey and consist primarily of sagebrush shrublands (roughly 49 percent of the area), agricultural pasturelands (roughly 30 percent of the area), and mixed prairie grasslands (roughly 13 percent of the area). Disturbed lands include a network of oil and gas field access roads and areas surrounding oil and gas development activities (i.e., well pads, pipelines, tank batteries), mining-related facilities and activities, and both active and abandoned ranching-related facilities. Reclaimed lands include areas that were recently reclaimed after disturbance

for the installation of oil and gas facilities or pipelines, road construction and other activities with varying degrees of recovering vegetation cover.

The predominant natural wildlife habitat is shrubland with upland/mixed prairie grassland as the next largest habitat type. Wyoming big sagebrush characterizes the shrubland and native upland grasses of the region (i.e., western wheatgrass, needleandthread, prairie junegrass, blue grama, Sandberg bluegrass, and cheatgrass brome) characterize the mixed prairie grassland. The seeded grassland/agricultural pastureland is dominated by crested wheatgrass. The few trees that exist on the six WAC LBA tracts are largely limited to those planted around homesteads and ranch buildings. No designated critical, crucial, or unique wildlife habitats are present in the area. No perennial streams or other permanent water bodies exist within the general analysis area for the North Hilight Field LBA Tract.

S1-10.2 Big Game

The two big game species that are common in suitable habitat throughout the general analysis area for the North Hilight Field tract are pronghorn (*Antilocapra americana*) and mule deer (*Odocoileus hemionus*). Elk (*Cervus elaphus*) are frequent winter residents in the area, but spend most of the year in the Rochelle Hills east of the general analysis area. White-tailed deer (*Odocoileus virginianus*) are transients in the area due to their preference for riparian woodlands and irrigated agricultural lands. No crucial big game habitat or migration corridors are recognized by the WGFD in this area. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level.

Pronghorn are by far the most common big game species in this area. This species is most abundant in the sagebrush shrubland or mixed prairie grassland habitats. Reclaimed grassland constitutes only a small portion of the available habitat around the PRB mines, although pronghorn are observed during all seasonal surveys in these areas. Home range for pronghorn can vary between 400 acres to 5,600 acres, according to several factors including season, habitat quality, population characteristics, and local livestock occurrence. Typically, daily movement does not exceed 6 miles. Pronghorn may make seasonal migrations between summer and winter habitats, but migrations are often triggered by availability of succulent plants and not local weather conditions (Fitzgerald et al. 1994). The WGFD has classified the LBA tract's general analysis area as primarily yearlong pronghorn range (a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion) and winter/yearlong pronghorn range (a population or a portion of a population of animals makes general use of this habitat on a year-round basis, with a significant influx of additional animals onto this habitat from other seasonal ranges in the winter). The North Hilight Field tract is within the Hilight Herd Unit (pronghorn Hunt Area 24). In post-season

2007, the WGFD estimated the Hilight Herd Unit population to be approximately 12,397 animals, which is above the WGFD objective of 11,000 (WGFD 2007a).

Mule deer use nearly all habitats, but prefer sagebrush grassland, rough breaks, and riparian bottomland. Browse is an important component of the mule deer's diet throughout the year, comprising as much as 60 percent of total intake during autumn, while forbs and grasses typically make up the rest of their diet (Fitzgerald et al. 1994). Mule deer are frequently observed on mine reclaimed lands. In certain areas of the state this species tends to be more migratory than white-tailed deer, traveling from higher elevations in the summer to winter ranges that provide more food and cover. However, monitoring has indicated that mule deer are not very migratory in the vicinity of the tract's general analysis area. The WGFD has classified a majority of the tract's general analysis area as being out of normal mule deer use range and a portion as being yearlong mule deer use range. The LBA tract's general analysis area is located within the WGFD Thunder Basin Mule Deer Herd Unit (deer Hunt Area 21). No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the tract's general analysis area. The WGFD estimated the 2007 post-season mule deer population in this herd unit at 20,980, which is slightly above the current objective of 20,000 (WGFD 2007a).

The North Hilight Field LBA Tract's general analysis area is located within the WGFD Central White-tailed Deer Herd Unit (deer Hunt Area 21). White-tailed deer are managed and hunted in conjunction with mule deer. White-tailed deer prefer riparian habitats and are therefore seldom observed in the general analysis area due to the lack of that particular habitat. The WGFD classifies the entire general analysis area as out of the normal white-tailed deer use range. A narrow corridor along the Antelope Creek south of the tract's general analysis area is classified as yearlong range. The WGFD does not have population estimates for this herd unit due to the challenges of obtaining adequate classifications in many hunt areas within the herd unit.

A resident elk herd resides in the Rochelle Hills east of the North Hilight Field LBA Tract's general analysis area. None of the tract's general analysis area is classified by the WGFD as within normal elk use range, although elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands in the vicinity of the LBA tract. As more lands are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately 5 square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994). RTEA (owner of the Jacobs Ranch Mine) and the Rocky Mountain Elk Foundation (RMEF) finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on the Jacobs Ranch Mine. The easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to

be used as grazing land and wildlife habitat for the extended future (RMEF 2007). Elk have been observed within the general Wright analysis area in recent years, but they are typically restricted to the pine breaks just east of the Coal Creek, Jacobs Ranch, Black Thunder, and North Antelope Rochelle mines. The WGFD estimated the 2007 post-season elk population for the Rochelle Hills Herd Unit at 600, which is 50 percent above the current objective of 400 animals (WGFD 2007a).

S1-10.3 Other Mammals

A variety of small- and medium-sized mammal species occur in the vicinity of the North Hilight Field LBA Tract, although not all have been observed on the general analysis area for the tract itself. These include predators and furbearers, such as the coyote (*Canis latrans*), red fox (*Vulpes vulpes*), bobcat (*Lynx rufus*), striped skunk (*Mephitis mephitis*), long-tailed weasel (*Mustela frenata*), badger (*Taxidea taxus*), muskrat (*Ondatra zibethicus*), raccoon (*Procyon lotor*), and beaver (*Castor canadensis*). Prey species include various rodents (such as mice, rats, voles, gophers, ground squirrels, chipmunks, muskrats, and black-tailed prairie dogs) and lagomorphs (jackrabbits and cottontails). These prey species are cyclically common and widespread throughout the region. Porcupines (*Erethizon dorsatum*) and bats (such as hoary [*Lasiurus cinereus*] and big brown [*Eptesicus fuscus*]) also have habitat in the vicinity, which is primarily in the pine forest habitat of the nearby Rochelle Hills. The prey species are important for raptors and other predators.

The black-tailed prairie dog was added to the list of candidate species for federal listing on February 4, 2000 (USFWS 2000). The USFWS then removed the black-tailed prairie dog from the list of candidate species on August 12, 2004. On December 2, 2008, the USFWS announced a 90-day finding on a petition seeking federal protection of the black-tailed prairie dog under the ESA. The USFWS subsequently announced that it will conduct a 12-month finding, which will end February 2, 2009, to determine if listing of the species is warranted (USFWS 2009). The USFWS continues to encourage the protection of prairie dog colonies for their value to the prairie ecosystem and the myriad of species that rely on them (USFWS 2004a).

Black-tailed prairie dogs are considered a common resident in eastern Wyoming, utilizing short-grass and mid-grass habitats (Cerovski et al. 2004). The black-tailed prairie dog is a highly social, diurnally active, burrowing mammal. Aggregations of individual burrows, known as colonies, form the basic unit of prairie dog populations. Found throughout the Great Plains in short-grass and mixed-grass prairie areas (Fitzgerald et al. 1994), the black-tailed prairie dog has declined in population numbers and extent of colonies in recent years. The three major impacts that have influenced black-tailed prairie dog populations are the initial conversion of prairie grasslands to cropland in the eastern portion of its range from approximately the 1880s through the 1920s; large-scale control efforts conducted from approximately 1918 through 1972, when an Executive Order was issued banning the use of compound

1080; and the introduction of sylvatic plague into North American ecosystems in 1908 (USFWS 2000 and 2009). In Wyoming, this species is primarily currently found in isolated populations in the eastern half of the state (Clark and Stromberg 1987). The USFWS's most recent (in 2004) estimate of occupied black-tailed prairie dog habitat in Wyoming is about 125,000 acres (USFWS 2004b). Many other wildlife species, such as the black-footed ferret (*Mustela nigripes*), swift fox (*Vulpes velox*), mountain plover (*Charadrius montanus*), ferruginous hawk (*Buteo regalis*), and burrowing owl (*Athene cunicularia*) may be dependent on the black-tailed prairie dog for some portion of their life cycle (USFWS 2000 and 2009).

According to USFS observations on the Thunder Basin National Grassland (TBNG), the largest concentrations of prairie dog colonies in the vicinity of the eastern PRB surface coal mines are found east of the coal burnline, which is outside and east of the area of surface coal mining (Byer 2003). The large prairie dog complexes in this area east of the coal burnline have been drastically impacted by outbreaks of plague at irregular intervals over the years. The colonies west of the burnline, including those within the general Wright analysis area, are generally smaller and less densely concentrated. These colonies have not been affected by plague to the same degree as those located east of the burnline, likely due to their reduced size and density.

Qualified wildlife biologists with IR and J&S have mapped the current acreage of prairie dog colonies in the vicinity of the Jacobs Ranch and Black Thunder mines, respectively, by walking the perimeters of colonies and delineating them using hand-held global positioning system (GPS) receivers and/or by visually mapping them on topographic maps.

Surveys conducted within 2 miles of the general analysis area for the North Hilight Field LBA Tract located four prairie dog colonies that cover a total of approximately 53.8 acres (the colonies are depicted on Figure 3-32 in the WAC DEIS). Two colonies were within the tract's general analysis area itself (the area likely to be affected by development of the North Hilight Field LBA Tract) and were approximately 3.4 and 19.5 acres in size. The other two colonies were approximately 3.7 and 27.2 acres in size.

S1-10.4 Raptors

The raptor species known or expected to occur in suitable habitats in the general Wright analysis area include the golden eagle (*Aquila chrysaetos*), ferruginous hawk, red-tailed hawk (*Buteo jamaicensis*), Swainson's hawk (*Buteo swainsoni*), rough-legged hawks (*Buteo lagopus*), great horned owl (*Bubo virginianus*), burrowing owl, and short-eared owl (*Asio flammeus*). The bald eagle (*Haliaeetus leucocephalus*) is a migrant and common winter resident of the Wyoming Powder River Basin region. On July 9, 2007, the U.S. Fish and Wildlife Service (USFWS) published a Federal Register notice (72 FR 37346) announcing that the bald eagle would be removed from the list of threatened and endangered (T&E) species under the Endangered Species Act of 1973

(ESA), as amended (16 U.S.C 1531 *et seq.*); that de-listing was effective as of August 8, 2007. However, the protections provided to the bald eagle under the Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. 668, and the Migratory Bird Treaty Act (MBTA), 16 U.S.C. 703, will remain in place. The bald eagle is now recognized as a USFS and BLM Sensitive Species.

Raptor species that are known to commonly nest in the general Wright analysis area are the golden eagle, ferruginous hawk, red-tailed hawk, Swainson's hawk, great horned owl, and burrowing owl. No nest sites have been documented in the general Wright analysis area for American kestrels (*Falco sparverius*), northern harriers (*Circus cyaneus*), or short-eared owls, though occasional sightings of recently fledged young indicate that such activities do occur there for one or more of these species. Habitat is limited for those species that nest exclusively in trees or on cliffs, but several species are adapted to nesting on the ground, creek banks, buttes, or rock outcrops. Rough-legged hawks are winter residents in northeast Wyoming, and breed in the arctic regions.

The raptor monitoring areas for the Black Thunder and Jacobs Ranch mines include their respective permit areas and a surrounding 1- or 2-mile perimeter. Due to the proximity of the North Hilight Field LBA Tract to those adjacent mine survey areas, the tract's entire general analysis area and most of the wildlife survey area for the North Hilight Field LBA Tract have been included in annual monitoring surveys since the early 1980s. Previous information regarding nests, including their historical use by nesting raptors is available in the mines' permit applications and annual wildlife monitoring reports.

Figure 3-32 in the WAC DEIS document depicts the locations of raptor nests identified within the North Hilight Field LBA Tract's wildlife survey area, which includes the tract's general analysis area and a 2-mile perimeter encompassing the general analysis area. Over time, raptors have built new nests and natural forces have destroyed many nests, while others have been relocated for mitigation or removed by mining activities. In some cases, nests have been created to mitigate other nest sites impacted by mining operations at this mine.

A total of six raptor species have nested within the combined North, South, and West Hilight Field wildlife survey areas. Five of those six species have regularly nested within this area since annual monitoring began. Swainson's hawks began nesting in the area more recently, and have been a consistent breeder ever since. Based on sightings of young, it is likely that at least one pair of American kestrels nested in one of the many small cavities present in the snags along Little Thunder Creek. There is overlap between these three tracts' study area boundaries, and as such, there is overlap in the reporting of raptor nests on the wildlife figures and in the North, South, and West Hilight Field tract discussions. In addition, due to the West Jacobs Ranch LBA Tract's proximity to the three Hilight Field LBA Tracts, there is also an overlap in the reporting of raptor nests. The number of nests recorded within each of the wildlife survey

areas are addressed separately in this supplemental information document, as well as in Section 3.10 of the WAC DEIS document.

Surveys completed in 2007 by J&S identified a total of 34 intact nests (one golden eagle nest, 23 ferruginous hawk nests, four Swainson's hawk nests, two burrowing owl nest sites, one platform nest erected for ferruginous hawks, and three nests that have been used by multiple raptor species) were present within 2 miles of the general analysis area for the North Hilight Field LBA Tract (see Figure 3-32 in the WAC DEIS for locations). Eight intact nests were present within the general analysis area: four intact nests (two burrowing owl and two ferruginous hawk nests) were present within the LBA tract as applied for; one intact nest used by multiple species (Swainson's hawk, red-tailed hawk, and ferruginous hawk) was present within the area added by Alternative 2; and three intact nests (all ferruginous hawk) were within the ¼-mile disturbance buffer surrounding the tract configured under Alternative 2. Only one of the eight intact nests encompassed by the North Hilight Field tract's general analysis area was active (eggs laid) during 2007. The remaining 26 intact nests were within 2 miles of the tract's general analysis area.

S1-10.5 Upland Game Birds

Four upland game bird species have historically been documented within the general Wright analysis area. These species are the mourning dove (*Zenaida macroura*), gray (or Hungarian) partridge (*Perdix perdix*), wild turkey (*Meleagris gallopavo*), and Greater sage-grouse (*Centrocercus urophasianus*). The mourning dove, however, is the most prevalent upland game bird in the area and the only species known to occur with any regularity. Based on annual lek searches since the late 1970's, sharp-tailed grouse do not appear to inhabit the surface coal mine region of the southern PRB. The nearest sharp-tailed grouse lek is located over 40 miles northwest of the general Wright analysis area.

The three applicant coal mines included in the WAC DEIS (Black Thunder, Jacobs Ranch and North Antelope Rochelle) conduct annual surveys of known sage-grouse leks and searches for new leks each spring as part of their annual wildlife monitoring requirements for WDEQ/LQD. Each active lek is generally surveyed three times within a given breeding season. Baseline inventories included the respective mine permit areas and a 2-mile perimeter, and occurred prior to permitting by WDEQ/LQD. Annual surveys include the mines' permit areas and a 1-mile perimeter, and began when each mine was initially permitted in the early 1980s. As a result, most of the areas included in the North, South and West Hilight Field LBA Tracts have been included in previous regular survey efforts. Those surveys became mandatory with the implementation of Appendix B of the WDEQ/LQD Coal Rules and Regulations in 1993. In May 2002, the USFWS office in Cheyenne, Wyoming, released a list entitled *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, which replaced the previous *Migratory Birds of High Federal Interest*

List. The greater sage-grouse is included on the updated list, giving further impetus to ongoing annual survey efforts.

Baseline inventories encompassing a 2-mile perimeter around Black Thunder Mine's proposed permit expansions were conducted in the late 1970s, 1998, and 2003. Annual surveys conducted since the late 1970s have included the entire general analysis area for the North Hilight Field LBA Tract and most of the North Hilight Field tract's wildlife survey area (a 2-mile radius encompassing the tract's general analysis area). Baseline surveys specific to this EIS, which were conducted in 2007 and 2008, and other previous permit expansions included the entire wildlife survey area for the tract.

Sage-grouse rely on a variety of habitats within sagebrush dominated landscapes to reproduce and survive throughout the year. The sage-grouse is a year-round resident throughout much of the PRB, but has declined in the North, South, and West Hilight Field tracts' wildlife survey areas over the last 30 years. Sage-grouse use, or lack of use, in that region has been well documented from the late 1970s through 2008. As described in the vegetation section, lands on and adjacent to the general analysis areas for the North, South, and West Hilight Field LBA Tracts are dominated by a sagebrush-grassland community, primarily big sagebrush, with shrub cover ranging from roughly 50 to 60 percent. Despite the prevalence of sagebrush in the combined wildlife survey areas for the North, South and West Hilight Field LBA Tracts, sage-grouse numbers were never especially high in the area.

Annual surveys for sage-grouse broods were conducted in native and reclaimed stream channels at Black Thunder from 1994 through 1999; such surveys were no longer required by WGFD and WDEQ/LQD after that year due to the consistent lack of grouse broods at coal mines throughout the PRB. No sage-grouse broods were recorded within the BLM study area for each LBA tract (the tract as applied for and the additional area evaluated by BLM under Alternative 2) during specific surveys or incidental to other wildlife surveys conducted in those areas annually since at least 1993. No broods were seen during recent baseline inventories conducted for the three Hilight Field LBA Tracts. All grouse broods that have been recorded over the years occurred as incidental sightings during other wildlife surveys.

Nesting and winter surveys for sage-grouse are not required as part of the annual wildlife programs for the three applicant mines included in this EIS, though winter surveys have been conducted as part of baseline inventories for previous mine expansions. Additionally, winter surveys for other species (e.g., big game, bald eagle roosts, and other wintering raptors) have occurred at all three WAC lease applicant mines in recent years. Due to their proximity to existing mine permit areas, the combined general analysis areas for the three Hilight Field tracts have been included in a minimum of seven consecutive years (big game surveys 1993-1999) of some level of winter surveys. No sage-grouse were documented in or near the LBA tracts during those surveys.

Sage-grouse were last confirmed in the three Hilight Field tracts' wildlife survey areas in 2003 (Hansen Lakes lek located in the BLM study area for the North Hilight Field tract), though some leks in these areas were not checked annually by the WGFD prior to the 2007 and 2008 baseline surveys associated with this EIS.

Two leks are present in the general analysis area for the North Hilight Field LBA Tract: Butch and Hansen Lakes (Figure 3-32 in the WAC DEIS depicts locations). The Hansen Lakes lek is classified as "occupied" by the WGFD (active in at least 1 of the last 10 years). The Butch lek was first recorded in 1990. The peak male count (15) occurred in 1991, after which numbers declined dramatically. No grouse were recorded at the Butch lek during annual checks conducted over the last 14 years (1994 through 2007). The Butch lek is classified as "unoccupied/abandoned" by the WGFD (no activity for 10 consecutive years).

The Butch lek was discovered in 1990, and was active every year through 1993. The Hansen Lakes lek was discovered in 1993, coincidentally at the same time peak male counts were dramatically declining at the Butch lek; the leks are approximately 1.5 miles apart and could potentially represent a shift in the lekking activity. Peak male counts at the Hansen Lakes lek ranged from 14 to 24 birds from 1993 through 2000, but dropped markedly to only 3 birds in 2001. Grouse were present at the lek for the next 2 years, but no birds were observed there after 2003. No other grouse leks are present within 3 miles of the North Hilight Field tract's general analysis area. The next nearest lek is the Stuart II lek, approximately 4.1 miles southwest of the North Hilight Field tract's general analysis area.

S1-10.6 Migratory Bird Species of Management Concern in Wyoming

USFWS uses a list entitled *Migratory Bird Species of Management Concern in Wyoming*, specifically the *Coal Mine List of 40 Migratory Bird Species of Management Concern in Wyoming*, for reviews related to existing and proposed coal mine leased land (USFWS 2002b). This list was taken directly from the Wyoming Bird Conservation Plan (Cerovski et al. 2001), and was current through 2007. The *Migratory Bird Species of Management Concern in Wyoming* list replaced the *Migratory Birds of High Federal Interest* list. The Black Thunder Mine has conducted specific surveys for migratory birds of concern annually since at least 1993, incorporating new lists and survey protocols as they were issued. The surveys, which are conducted in the spring and summer, include the existing mine permit area and a surrounding ½-mile perimeter for most species. Species of added concern such as the sage-grouse and bald eagle may require expanded survey perimeters.

Due to the proximity of the general analysis area for the North Hilight Field LBA Tract to existing adjacent mine permit areas, significant portions of general analysis area have been included in annual surveys for avian species of concern since at least 1993.

Supplementary Information on the Affected Environment

Thirty of the 40 listed Level I and II species have historically been observed within northeastern Wyoming (Latilong 13) and 18 species have been recorded in the vicinity of the North Hilight Field LBA Tract (Table S1-8). The USFWS considers Level I species as in need of conservation action, which includes having a monitoring and mitigation plan for those birds. The 16 Level I and II species that historically have been recorded, or are suspected of nesting in the North Hilight Field general analysis area include the Greater sage-grouse, McCown’s longspur, ferruginous hawk, Brewer’s sparrow, Swainson’s hawk, short-eared owl, burrowing owl, upland sandpiper, lark bunting, chestnut-collared longspur, sage thrasher, grasshopper sparrow, loggerhead shrike, vesper sparrow, lark sparrow, and merlin. The other non-nesting species documented less often and that have only been observed as migrants in the area include the long-billed curlew and bald eagle.

Table S1-8. Migratory Bird Species of Management Concern in Wyoming: Their Regional Status, and Expected and Actual Occurrence on or Near the North Hilight Field LBA Tract.

Species¹ (Scientific Name)	Seasonal Status/Breeding Records in Northeastern WY¹	Historical Occurrence in the Vicinity of the LBA²	Occurrence and Status in the LBA in 2007³
LEVEL I (species need conservation action)			
Mountain plover (<i>Charadrius montanus</i>)	Summer/Breeder	Not Expected	None
Greater sage-grouse (<i>Centrocercus urophasianus</i>)	Resident/Breeder	Uncommon	None
McCown’s longspur (<i>Calcarius mccownii</i>)	Summer/Breeder	Uncommon	None
Baird’s sparrow (<i>Ammodramus bairdii</i>)	Summer/Observed	Not Expected	None
Ferruginous hawk (<i>Buteo regalis</i>)	Resident/Breeder	Common	Breeder
Brewer’s sparrow (<i>Spizella breweri</i>)	Summer/Breeder	Common	Breeder
Sage sparrow (<i>Amphispiza belli</i>)	Summer/Breeder	Not expected	None
Swainson’s hawk (<i>Buteo swainsoni</i>)	Summer/Breeder	Uncommon	None
Long-billed curlew (<i>Numenius americanus</i>)	Summer/Observed	Uncommon	None
Short-eared owl (<i>Asio flammeus</i>)	Resident/Breeder	Uncommon	None
Peregrine falcon (<i>Falco peregrinus</i>)	Resident/Observed	Not expected	None
Burrowing owl (<i>Athene cunicularia</i>)	Summer/Breeder	Common	None
Bald eagle (<i>Haliaeetus leucocephalus</i>)	Resident/Breeder	Common	None
Upland sandpiper (<i>Bartramia longicauda</i>)	Summer/Breeder	Uncommon	None

Supplementary Information on the Affected Environment

Table S1-8. Migratory Bird Species of Management Concern in Wyoming: Their Regional Status, and Expected and Actual Occurrence on or Near the North Hilight Field LBA Tract (Continued).

Species¹ (Scientific Name)	Seasonal Status/Breeding Records in Northeastern WY¹	Historical Occurrence in the Vicinity of the LBA²	Occurrence and Status in the LBA in 2007³
LEVEL II (species need monitoring)			
Cassin's kingbird <i>(Tyrannus vociferans)</i>	Never Recorded	Not Expected	None
Lark bunting <i>(Calamospiza melanocorvus)</i>	Summer/Breeder	Common	Breeder
Dickcissel <i>(Spiza americana)</i>	Summer/Observed	Not Expected	None
Chestnut-collared longspur <i>(Calcarius ornatus)</i>	Summer/Breeder	Uncommon	None
Black-chinned hummingbird <i>(Archilochus alexandri)</i>	Never Recorded	Not Expected	None
Pygmy nuthatch <i>(Sitta pygmaea)</i>	Never Recorded	Not Expected	None
Marsh wren <i>(Cistothorus palustris)</i>	Never Recorded	Not Expected	None
Western bluebird <i>(Sialia mexicana)</i>	Summer/Breeder	Not Expected	None
Sage thrasher <i>(Oreoscoptes montanus)</i>	Summer/Breeder	Uncommon	None
Grasshopper sparrow <i>(Ammodramus savannarum)</i>	Summer/Breeder	Uncommon	None
Bobolink <i>(Dolichonyx oryzivorus)</i>	Summer/Observed	Not Expected	None
Common loon <i>(Gavia immer)</i>	Summer/Observed	Not Expected	None
Black-billed cuckoo <i>(Coccyzus erythrophthalmus)</i>	Never Recorded	Not Expected	None
Red-headed woodpecker <i>(Melanerpes erythrocephalus)</i>	Summer/Breeder	Not Expected	None
Yellow-billed cuckoo <i>(Coccyzus americanus)</i>	Summer/Observed	Not Expected	None
Eastern screech-owl <i>(Megascops asio)</i>	Never Recorded	Not Expected	None
Western screech-owl <i>(Megascops kennicottii)</i>	Never Recorded	Not Expected	None
Western scrub-jay <i>(Aphelocoma californica)</i>	Never Recorded	Not Expected	None
Loggerhead shrike <i>(Lanius ludovicianus)</i>	Summer/Breeder	Common	Uncommon forager
Vesper sparrow <i>(Poocetes gramineus)</i>	Summer/Breeder	Common	Breeder
Lark sparrow <i>(Chondestes grammacus)</i>	Summer/Breeder	Uncommon	None
Ash-throated flycatcher <i>(Myiarchus cinerascens)</i>	Summer/Observed	Not Expected	None
Bushtit <i>(Psaltriparus minimus)</i>	Never Recorded	Not Expected	None
Merlin <i>(Falco columbarius)</i>	Resident/Breeder	Uncommon	None
Sprague's pipit <i>(Anthus spragueii)</i>	Never Recorded	Not Expected	None
Barn owl <i>(Tyto alba)</i>	Summer/Observed	Not Expected	None

¹ Latilong 13 - Atlas of Birds, Mammals, Amphibians, and Reptiles in Wyoming (Cerovski et al. 2004).

² Historical Occurrence/Status in the North Hilight Field LBA survey area is based on records from annual monitoring conducted at the Black Thunder and Jacobs Ranch mines from 1993 through 2007.

³ Sighting records were derived from actual occurrence on or within ½ mile of the LBA tract and the Alternative 2 tract configuration area or from observations related to Black Thunder and Jacobs Ranch mines' baseline and annual monitoring.

S1-10.7 Other Species

Wildlife surveys completed specifically for the applicant mine and other neighboring mines, as well as biological research projects in the eastern Powder River Basin, have documented numerous other wildlife species that inhabit the region, including various waterfowl, shorebirds and other non-game birds, amphibians, reptiles, and aquatic species. All of these species can be locally common inhabitants of the area, depending on the quantity and quality of aquatic habitats present.

Under natural conditions, the general Wright analysis area provides limited and marginal aquatic habitat for waterfowl and shorebirds. The natural aquatic habitat, prior to CBNG development within the Little Thunder Creek drainage basin, was mainly available during spring migration as ponds (primarily stock reservoirs and playa areas), and intermittent and ephemeral streams. Many of these water features generally were reduced to small, isolated pools or were completely dry during summer. However, the relatively recent development of CBNG resources within and upstream of the general analysis area has enhanced the water resources available in the area, resulting in somewhat improved habitat for waterfowl and shorebirds. Waterfowl and shorebird observations have primarily consisted of relatively low numbers of common species, often restricted to spring migration. Few broods have been recorded in the area during baseline or annual monitoring studies due to limited and unreliable water resources in the area. Avian species typically associated with aquatic habitats in the general Wright analysis area include, but are not limited to, the mallard duck (*Anas platyrhynchos*), killdeer (*Charadrius vociferus*), and red-winged blackbird (*Agelaius phoeniceus*).

The lack of deepwater habitat and extensive and persistent water sources limits the presence and diversity of fish and other aquatic or semi-aquatic species. As discussed above, water discharged from CBNG wells has enhanced the water supply within some drainages in the general Wright analysis area, including Black Thunder Creek and its tributaries, which has increased potential habitat for some aquatic species. However, those temporarily-enhanced areas are still relatively limited and/or isolated in nature, and no perennial drainages are present in the general analysis area. CBNG production and the associated surface discharge of groundwater from coal seams has and will continue to decrease over time and eventually end, returning streamflows to natural conditions.

Few reptiles and amphibians have been recorded during wildlife surveys conducted in the general analysis area for the North Hilight Field LBA Tract over the years. The relatively low quantity and quality of aquatic habitat in the area reduces its potential to attract these species, particularly amphibians and turtles. The boreal chorus frog (*Pseudacris triseriata*) has been the most common herptile observed in the area during baseline and annual monitoring surveys over the last two decades. These frogs have been heard in creeks and ponds throughout the area during spring. Other less common species recorded

on or near the general analysis area over time included the northern leopard frog (*Rana pipiens*) and tiger salamander (*Ambystoma tigrinum*). Prairie rattlesnakes (*Crotalus viridis*) have been observed infrequently in sagebrush stands throughout the area. Other dry land species, such as the bullsnake (*Pituophis melanoleucas*), are likely to occur in the general Wright analysis area.

S1-11 LAND USE AND RECREATION

A majority (approximately 99 percent) of the surface estate on the North Hilight Field LBA Tract as applied for and the area added under Alternative 2 (the BLM study area) is privately owned. Roughly 81 acres, or 1 percent, of the tract's BLM study area is owned by the U.S. Department of Agriculture. The surface ownership of the North Hilight Field tract is shown in detail on Figure 3-40 and the distribution of surface ownership is given in Table 3-14 in the WAC DEIS document. Livestock grazing is the primary land use within the BLM study area for the LBA tract, while oil and gas production, wildlife habitat, and recreation are secondary land uses.

Areas of disturbance within and near the North Hilight Field tract include roads, oil and gas wells and associated production facilities, surface mine-related facilities and activities, and activities associated with ranching operations. State Highway 59, which runs north-south, is located about 6 miles west of the LBA tract, and State Highway 450, which runs east-west, is about 2 miles south of the tract. County roads that border or traverse the North Hilight Field LBA Tract and provide public and private access include Shroyer Road (County Road 116) and Hilight Road (County Road 52). Small Road and Jacobs Road also traverse the tract, but they have recently been vacated by the Campbell County Board of Commissioners. Several unnamed two-track roads traverse and provide private access within and near the proposed lease area. The Burlington Northern Santa Fe & Union Pacific (BNSF & UP) railroad right-of-way (ROW) borders the west side of the LBA tract's general analysis area (Figure 3-1 in the WAC DEIS document).

The oil and gas estate within the North Hilight Field LBA Tract as applied for and the area added under Alternative 2 is federally and privately owned, with the majority (approximately 69 percent) being privately owned. The ownership of the North Hilight Field oil and gas estate is shown in the WAC DEIS document on Figure 3-46. A listing of the current federal oil and gas lessees of record is included as Table 3-15 in the WAC DEIS document.

According to the Wyoming Oil and Gas Conservation Commission (WOGCC) records as of May 14, 2008, there were 27 conventional oil wells on lands included in the North Hilight Field LBA Tract as proposed and the lands added under Alternative 2 that were producing or capable of producing and ten oil wells have been plugged and abandoned (refer to Figure 3-46 in the WAC DEIS document for locations). The most recent oil well in the tract's general analysis area was drilled in 1979 (WOGCC 2008a). Conventional oil and gas wells

capable of production within the BLM study area for the North Hilight Field tract are listed in Appendix E of the WAC DEIS document.

According to the WOGCC records as of May 14, 2008, 34 coal bed natural gas (CBNG) wells were producing and six CBNG wells were shut-in within the lands encompassed by the North Hilight Field LBA Tract as applied for and the lands added under Alternative 2 (refer to Figure 3-46 in the WAC DEIS document for locations). Extensive CBNG development has occurred on lands north, south, and west of the tract. CBNG wells capable of production within the BLM study area for the North Hilight Field LBA Tract are listed in Appendix E of the WAC DEIS document.

Coal mining is a dominant land use to the north and south of the LBA tract. The Black Thunder, Jacobs Ranch, and North Antelope Rochelle mines form a group of contiguous or nearly contiguous surface coal mines located in Campbell and Converse counties (Figure S-1). The North Hilight Field, South Hilight Field, West Hilight Field, West Jacobs Ranch, North Porcupine, and South Porcupine LBA Tracts being evaluated in the WAC DEIS are in this group of mines (Tables 1-1 and 1-2 in the WAC DEIS document). Coal production from the three applicant mines involved in the WAC lease applications (Jacobs Ranch, Black Thunder, and North Antelope Rochelle) increased by roughly 59 percent between 1998 and 2007 (from approximately 120.1 million tons in 1998 to 191.3 million tons in 2007). Since decertification, nine coal leases (the Jacobs Ranch, West Black Thunder, North Antelope/Rochelle, Powder River, Thundercloud, North Jacobs Ranch, NARO South, Little Thunder, and NARO North LBA Tracts) have been issued within this group of mines.

Big game hunting is the principal recreational land use within the LBA tract's general analysis area. Pronghorn and mule deer are the most common big game species within the area. On private lands, hunting is allowed only with landowner permission. Land ownership within the PRB is largely private (approximately 80 percent), with some private landowners permitting sportsmen to cross and/or hunt on their land. There has been a trend over the past two to three decades towards a substantial reduction in private lands that are open and reasonably available for hunting. Access fees continue to rise and many resident hunters feel these access fees are unreasonable. This trend has created problems for the WGFD in their attempt to distribute and control harvest at optimal levels, as well as for sportsmen who desire access to these animals (WGFD 2007a).

Specific details regarding big game herd management objectives within and near the general Wright analysis area are contained in Wyoming Game and Fish Department's (WGFD's) 2007 Big Game Herd Unit Job Completion Reports for the Casper and Sheridan Regions (WGFD 2007a). The WGFD classifies the entire general Wright analysis area as yearlong (a population or substantial portion of a population of animals makes general use of this habitat on a year-round basis, but may leave the area under severe conditions on occasion) and winter/yearlong range (a population or a portion of a population of animals

makes general use of this habitat on a year-round basis, with a significant influx of additional animals onto this habitat from other seasonal ranges in the winter) for pronghorn. The North Hilight Field general analysis area is within the Hilight Herd Unit (Hunt Area 24). In post-season 2007, the WGFD estimated the Hilight Herd Unit population to be approximately 12,397 animals, which is above the WGFD objective of 11,000 (WGFD 2007a).

The North Hilight Field LBA Tract as applied for and the area added by Alternative 2 are located within the WGFD Thunder Basin Mule Deer Herd Unit (Hunt Area 21). No crucial or critical mule deer ranges or migration corridors occur on or within several miles of the tract's general analysis area. Crucial range is defined as any particular seasonal range or habitat component that has been documented as the determining factor in a population's ability to maintain and reproduce itself at a certain level. The WGFD estimated the 2007 post-season mule deer population in this herd unit at 20,980, which is slightly above the current objective of 20,000 (WGFD 2007a).

A resident elk herd resides in the Rochelle Hills, which are located just east of the North Hilight Field LBA Tract. Elk do wander from the protection of the Rochelle Hills to forage in native and reclaimed grasslands in the vicinity of the tract's general analysis area. No portion of the tract's general analysis area is classified by the WGFD as within normal elk use range. As more lands adjacent to the Rochelle Hills are reclaimed from mining, elk are shifting their winter use to these areas. The WGFD has designated an approximately 5 square mile area on reclaimed lands within the Jacobs Ranch Mine permit area as crucial winter habitat for the Rochelle Hills elk herd (Odekoven 1994). Rio Tinto Energy America (RTEA), owner of the Jacobs Ranch Mine, and the Rocky Mountain Elk Foundation (RMEF) finalized a formal agreement that created the Rochelle Hills Conservation Easement. The easement contains nearly 1,000 acres, with 75 percent of that total comprised of reclaimed mining lands on RTEA's Jacobs Ranch Mine. The easement acreage was donated to RMEF by RTEA to ensure that the reclaimed land continues to be used as grazing land and wildlife habitat for the extended future (RMEF 2007). The Jacobs Ranch Mine is located adjacent to the general analysis area for the West Hilight Field LBA Tract (Figure S-1). Elk have been observed within the general Wright analysis area in recent years, but they are typically restricted to the pine breaks east of the Cordero Rojo, Coal Creek, and Jacobs Ranch mines. The WGFD estimated the 2007 post-season elk population for the Rochelle Hills Herd Unit at 600, which is 50 percent above the current objective of 400 animals (WGFD 2007a).

White-tailed deer are generally not managed separately by the WGFD, but are managed and hunted in conjunction with mule deer. The population occupying Hunt Areas 10 and 21 is part of the Central White-tailed Deer Herd Unit. White-tailed deer are seldom observed within the general Wright analysis area due to their preference for riparian woodlands and irrigated agricultural lands. The WGFD classifies the entire general Wright analysis area as out of the normal white-tailed deer use range. A narrow corridor along Antelope

Creek south of the general Wright analysis area is classified as yearlong white-tail range. The WGFD does not have population estimates for this herd unit due to the challenges of obtaining adequate classifications in many hunt areas within the herd unit.

Under natural conditions, the general analysis area for the North Hilight Field tract provides very limited aquatic habitat for waterfowl and shorebirds. The natural aquatic habitat, prior to CBNG development within the Little Thunder Creek drainage basin, was mainly available during spring migration as ponds (primarily stock reservoirs and playa areas), and intermittent and ephemeral streams. Many of these water features generally were reduced to small, isolated pools or were completely dry during summer. The relatively recent development of CBNG within and upstream of the general Wright analysis area has enhanced the surface water resources available for aquatic wildlife use in the area, resulting in somewhat improved habitat for waterfowl and shorebirds.

The lack of deepwater habitat, extensive and persistent water sources, and mesic habitat in general limits the presence and diversity of fish and other aquatic or semi-aquatic species within most of the general Wright analysis area. As discussed above, water discharged from CBNG wells has enhanced the water supply within some drainages in and around the North Hilight Field tract, which has increased potential habitat for some aquatic species. However, those enhanced areas are still relatively limited and/or isolated in nature.

S1-12 CULTURAL RESOURCES

The entire general analysis area for the North Hilight Field LBA Tract has been intensively surveyed at a Class III level. Cultural resource inventories in this area began in the early 1980s and continued with numerous projects associated with oil and gas field development as well as surface mining operations throughout the 1990s and 2000s. Thunder Basin Coal Company, LLC (TBCC) contracted with GCM Services, Inc., of Butte, Montana to perform Class I inventories of all previous surveys and Class III surveys of all unsurveyed areas within the general analysis area for the North Hilight Field LBA Tract. GCM completed the Class III level inventory of the tract's general analysis area in the summer of 2007 (reports not yet accessioned by the SHPO). The 2007 survey included a total of approximately 6,840 acres within the combined general analysis areas for the North, South and West Hilight Field LBA Tracts.

A review of the Wyoming Cultural Resource Information System (WYCRIS) produced information from seven large-scale (40 acres or larger) Class III block inventory projects that cover the general analysis area for the North Hilight Field LBA Tract. In addition, several small-scale inventories were reported in that area. Small-scale inventories include seismic grids, well pads, access routes, utility corridors and drill holes associated with oil and gas development. These small projects were not listed in the large block inventory summary table

Supplementary Information on the Affected Environment

(Table S1-9); however, any sites associated with small projects are included on the site summary table (Table S1-10).

Table S1-9. Large Block Class III Cultural Resource Inventories Within the General Analysis Area for the North Hilight Field LBA Tract.

Accession No.	Survey Organization	Location	Year	Project Name
not accessioned	GCM Services	T44N, R70W, Section 7, SS	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R70W, Section 8, SS	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R70W, Section 9, SWSW	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R70W, Section 15, SS	2007	Thunder Basin Coal N. Hilight Amendment Area
83 1334 04	Western Cultural Resource Management	T44N, R70W, Section 16, WW, SESW, SSE	1983	Keeline Mine
not accessioned	GCM Services	T44N, R70W, Section 17, NN	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R70W, Section 17, SN, SW, SNE, ESE	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N, R70W, Section 17, WSE	2001	South Hilight Field CBM Planning
not accessioned	GCM Services	T44N, R70W, Section 18, NNE	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N R70W Section 18, SE, SNE	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N, R70W, Section 18, W	2001	South Hilight Field CBM Planning
not accessioned	GCM Services	T44N, R70W, Section 19, SWNW, NE	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N R70W Section 19, EW, NWNW	2001	South Hilight Field CBM Planning

Supplementary Information on the Affected Environment

Table S1-9. Large Block Class III Cultural Resource Inventories Within the General Analysis Area for the North Hilight Field LBA Tract (Continued).

Accession No.	Survey Organization	Location	Year	Project Name
99 1820 0	GCM Services	T44N, R70W, Section 19, S	1999	Jacobs Ranch Coal Mine North and East
not accessioned	GCM Services	T44N, R70W, Section 20, NW, SENE	2007	Thunder Basin Coal North Hilight LBA
83 1334 0	Western Cultural Resource Management	T44N, R70W, Section 20, NENE	1983	Keeline Mine
1 728 0	Greer Services	T44N, R70W, Section 20, WE	2001	South Hilight Field CBM Planning
99 1820 0	GCM Services	T44N, R70W, Section 20, S	1999	Jacobs Ranch Coal Mine North and East
not accessioned	GCM Services	T44N, R70W, Section 21, NENW, NWNE	2007	Thunder Basin Coal N. Hilight Amendment Area
83 1334 0	Western Cultural Resource Management	T44N, R70W, Section 21, NENE	1983	Keeline Mine
99 1820 0	GCM Services	T44N, R70W Section 21, S	1999	Jacobs Ranch Coal Mine North and East
not accessioned	GCM Services	T44N, R70W, Section 22, NN, NSENE	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R70W, Section 22, SNW, SWNE, SENE	2007	Thunder Basin Coal North Hilight LBA
99 1820 0	GCM Services	T44N, R70W, Section 22, S	1999	Jacobs Ranch Coal Mine North and East
not accessioned	GCM Services	T44N, R70W, Section 23, WNW	2007	Thunder Basin Coal N. Hilight Amendment Area
99 1820 0	GCM Services	T44N, R70W, Section 23, SWSW	1999	Jacobs Ranch Coal Mine North and East

Supplementary Information on the Affected Environment

Table S1-9. Large Block Class III Cultural Resource Inventories Within the General Analysis Area for the North Hilight Field LBA Tract (Continued).

Accession No.	Survey Organization	Location	Year	Project Name
not accessioned	GCM Services	T44N, R71W, Section 11, SSW	2007	Thunder Basin Coal N. Hilight Amendment Area
1 728 0	Greer Services	T44N, R71W, Section 11, SSE	2001	South Hilight Field CBM Planning
not accessioned	GCM Services	T44N, R71W, Section 12, SSE	2007	Thunder Basin Coal N. Hilight Amendment Area
1 728 0	Greer Services	T44N, R71W, Section 12, SSW	2001	South Hilight Field CBM Planning
not accessioned	GCM Services	T44N, R71W, Section 13, NNE	2007	Thunder Basin Coal N. Hilight Amendment Area
not accessioned	GCM Services	T44N, R71W, Section 13, SE, SNE	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N, R71W, Section 13, W	2001	South Hilight Field CBM Planning
not accessioned	GCM Services	T44N, R71W, Section 14, S, SN	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N, R71W, Section 14, NNE	2001	South Hilight Field CBM Planning
1 1453 0	Pronghorn Archaeological Services	T44N, R71W, Section 14, NNW	2001	Sager Cheyenne POD CBM
not accessioned	GCM Services	T44N, R71W, Section 23, N	2007	Thunder Basin Coal North Hilight LBA
1 1105 0	GCM Services	T44N, R71W, Section 23, SW	2001	North Extension Little Thunder LBA
99 1820 0	GCM Services	T44N, R71W, Section 23, SE	1999	Jacobs Ranch Coal Mine North and East

Supplementary Information on the Affected Environment

Table S1-9. Large Block Class III Cultural Resource Inventories Within the General Analysis Area for the North Hilight Field LBA Tract (Continued).

Accession No.	Survey Organization	Location	Year	Project Name
not accessioned	GCM Services	T44N, R71W, Section 24, NW	2007	Thunder Basin Coal North Hilight LBA
1 728 0	Greer Services	T44N, R71W, NE	2001	South Hilight Field CBM Planning
99 1820 0	GCM Services	T44N, R71W, S	1999	Jacobs Ranch Coal Mine North and East
99 1820 0	GCM Services	T44N, R71W, Section 26, E	1999	Jacobs Ranch Coal Mine North and East
1 1105 0	GCM Services	T44N, R71W, Section 26, W	2001	North Extension Little Thunder LBA
0 1541-3	GCM Services	T44N, R71W, Section 26, SS	2001	Little Thunder Creek Amendment

Note: Some project areas may overlap in spatial extent. This may or may not reflect overlapping pedestrian surveys. Overlapping surveys may occur from unrelated projects (e.g., CBNG and coal mine projects on the same parcel), which occur close in time, delayed report accession, file search error, or intentional re-inspection of a previously surveyed area, due to unevaluated sites, project age, etc.

A total of 24 large-scale Class III cultural resource inventory projects have been conducted within the general analysis areas for the West and South Hilight Field tracts. Sixteen large-scale studies encompass the West Hilight Field tract and 17 studies encompass the South Hilight Field tract (many of these studies occur in both tracts).

Within the general analysis areas for the North, South and West Hilight Field tracts, a total of 147 cultural properties (sites) have been recorded. Of these, 110 sites were previously recorded and were identified during record searches. An additional 37 sites were located during the 2007 Class III inventories of the remaining unsurveyed lands. The State Historic Preservation Office (SHPO) has not made National Register of Historic Places (NRHP) eligibility determinations for these sites at this time. Some of the cultural site's eligibility determinations are pending remote sensing (magnetometer surveys) work and formal testing.

A total of 52 cultural sites have been documented in the North Hilight Field general analysis area. Of these, 39 are prehistoric and 13 are historic. Prehistoric sites consist primarily of lithic scatters and campsites. Historic sites consist primarily of homesteads and trash dumps. Twelve of the prehistoric sites and five of the historic sites have been determined *not eligible* for the NRHP by the SHPO. Eight of the prehistoric sites have been determined to be *eligible* for the NRHP by the SHPO. Nineteen of the prehistoric sites and

Supplementary Information on the Affected Environment

Table S1-10. Cultural Resource Sites in the General Analysis Area for the North Hilight Field LBA Tract.

Site Number	NRHP Status	Recommended	Year	Recorder's Affiliation
Prehistoric sites				
48CA0177	U	Formal testing	2001	Greer Services
48CA0334	NE	No further work	2001	Greer Services
48CA0337	NE	No further work	2002	GCM Services
48CA0339	NE	No further work	2002	GCM Services
48CA0341	U	Formal testing	2002	GCM Services
48CA0343	U	Formal testing	none	Greer Services
48CA0362	NE	No further work	2005	WCRM
48CA0366	NE	No further work	2005	WCRM
48CA0367	U	Request review	none	WCRM
48CA0452	U	Request review	none	BLM
48CA0453	U	Request review	none	BLM
48CA2118	U	Formal testing	none	WCRM
48CA3375	NE	No further work	2001	Greer Services
48CA3514	U	Not found 2007*	none	U. of So. Dakota
48CA3543	NE	No further work	2002	GCM Services
48CA3544	NE	No further work	2002	GCM Services
48CA3545	U	No further work	2002	GCM Services
48CA3547	NE	No further work	2002	GCM Services
48CA3561	NE	No further work	2002	GCM Services
48CA3562	NE	No further work	2002	GCM Services
48CA3845	E	Avoid or mitigate	2001	Greer Services
48CA3846	E	Avoid or mitigate	2001	Greer Services
48CA3849	E	Avoid or mitigate	2001	Greer Services
48CA3850	E	Avoid or mitigate	2001	Greer Services
48CA3851	E	Avoid or mitigate	2001	Greer Services
48CA3853	E	Avoid or mitigate	2001	Greer Services
48CA3854	E	Avoid or mitigate	2001	Greer Services
48CA3855	E	Avoid or mitigate	2001	Greer Services
48CA3857	NE	No further work	2001	Greer Services
48CA6734	U	Formal testing	none	GCM Services
48CA6735	U	Request review	none	GCM Services
48CA6736	U	Request review	none	GCM Services
48CA6737	U	Formal testing	none	GCM Services
48CA6738	U	Formal testing	none	GCM Services
48CA6739	U	Formal testing	none	GCM Services
48CA6740	U	Request review	none	GCM Services
48CA6741	U	Request review	none	GCM Services
48CA6742	U	Formal testing	none	GCM Services
48CA6841	U	Request review	none	GCM Services

Supplementary Information on the Affected Environment

Table S1-10. Cultural Resource Sites in the General Analysis Area for the North Hilight Field LBA Tract (Continued).

Site Number	NRHP Status	Recommended	Year	Recorder's Affiliation
Historic sites				
48CA0373	U	Request review	none	Greer Services
48CA0376	U	Request review	none	WCRM
48CA3546	NE	No further work	2002	GCM Services
48CA3856	NE	No further work	2007	Greer Services
48CA4245	NE	No further work	2006	Arcadis U.S.
48CA5573	NE	No further work	2007	GCM Services
48CA6733	U	Request review	none	GCM Services
48CA3542 - homestead	NE	No further work	2002	GCM Services
48CA6743 - homestead	U	Request review	none	GCM Services
48CA6744 - homestead	U	Request review	none	GCM Services
48CA6745 - homestead	U	Request review	none	GCM Services
48CA6746 - homestead	U	Request review	none	GCM Services
48CA6755 - homestead	U	Request review	none	GCM Services

U = Undetermined or no review by SHPO. Site may have a consultant and/or agency recommendation, but has either not been reviewed by SHPO or SHPO required additional information in order to make a determination. This site must be avoided until a determination is made.

NE = Not Eligible (with SHPO concurrence). This site requires no further consideration.

E = Eligible (with SHPO concurrence). This site will have to be avoided or an approved mitigation plan implemented.

Formal testing: site has potential to meet eligibility criteria, formal testing required to make determination.

Request review: site is recommended not eligible by recorder, no SHPO review as yet, recommend no additional work.

Avoid or mitigate: site is determined eligible for NRHP by SHPO and must be avoided or mitigation plan approved.

* This site was previously recorded but not found by GCM during 2007 inventory (presumed destroyed). No complete site form is on file.

eight historic sites are considered *unevaluated* for eligibility by the SHPO; of which many have never been reviewed, while at least eight will require additional documentation, testing or evaluation in order for the SHPO to make an eligibility determination. Table S1-10 lists the cultural sites, the site type (prehistoric or historic), the NRHP status (eligible, not eligible, or undetermined), the recommended action, and the recorder's affiliation.