Jonathon Limestone Quarry

Environmental Assessment
And
Finding of No Significant Impact

United States Department of the Interior
Bureau of Land Management

July, 2011

BLM

Rawlins Field Office, Wyoming

The BLM's multiple-use mission is to sustain the health and productivity of the public lands for the use and enjoyment of present and future generations. The Bureau accomplishes this by managing such activities as outdoor recreation, livestock grazing, mineral development, and energy production, and by conserving natural, historical, cultural, and other resources on public lands.

BLM/WY/PL-11/043+1330

Environmental Assessment Number

DOI-BLM-WY-030-2011-11210-EA

List of Acronyms

°F	degrees Fahrenheit
µeq/L	micro equivalents per liter
$\mu g/m^3$	micrograms per cubic meter
AAQS	Ambient Air Quality Standards
ACEPM	Applicant Committed Environmental Protection Measures
ANC	acid neutralizing capacity
ANS	artificial nesting structures
APLIC	Avian Power Line Interaction Committee
APO	Aquifer Protection Overlay
AUM	Animal Unit Month
B.P.	before present
BACT	Best Available Control Technology
bcy	bank cubic yards
bgs	below ground surface
BLM	Bureau of Land Management
BMP	Best Management Practice
CAA	Clean Air Act
$CaCO_3$	Calcium Carbonate
CaO	Calcium Oxide
CCR	coal combustion residuals
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
CIAA	Cumulative Impact Assessment Area
CN	curve number
CO	carbon monoxide
CO_2	carbon dioxide
CO2e	carbon dioxide equivalent
DAT	Deposition Analysis Threshold
dBA	decibels on the A-weighted scale
DEQ	Wyoming Department of Environmental Quality
DL	disturbed land
DM	Department Manual
DOI	Department of Interior
EA	Environmental Assessment

EO	Executive Order
ESA	Endangered Species Act
EU	emission unit
f(RH)	relative humidity adjustment factor
FLAG	Federal Land Managers Air Quality Related Values Workgroup
$g/m^2/s$	grams per square meter per second
GCP	good combustion practices
GHG	greenhouse gas
gpm	gallon per minute
gr/dscf	grains per standard cubic foot
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HCl	hydrochloric acid
HNO_3	nitric acid
IM	Instruction Memorandum
in/hr	inches per hour
IPCC	Intergovernmental Panel on Climate Change
IRR	Irrigation
Jonathon Project	Pete Lien Jonathon Project
JPA	Jonathon Project Area
kg/ha/yr	kilograms per hectare per year
km	kilometer
KOP	key observation point
lb/tsf	pounds per stone feed
LKD	Lime kiln dust
LQD	Land Quality Division
LWC	Lands with Wilderness Characteristics
MACT	Maximum Achievable Control Technology
mg/L	milligrams per liter
mg/m^3	micrograms per cubic meter
MMtCO2e	million metric tons of carbon dioxide equivalent
mph	miles per hour
MSHA	Mine Safety and Health Administration
N	nitrogen
NEPA	National Environmental Policy Act
NO_2	nitrogen dioxide
NO_3	nitrates

NOA	Notice of Availability
NO_X	oxides of nitrogen
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NSPS	New Source Performance Standard
NWI	National Wetland Inventory
O_3	ozone
OHV	off-highway vehicle
Pf	Permian Forelle
PLS	Pete Lien and Sons
PM	particulate matter
PM_{10}	particulate matter with an aerodynamic diameter of 10 microns or less
$PM_{2.5}$	particulate matter with an aerodynamic diameter of 2.5 microns or less
PMT	post-mine topography
POD	Plan of Development
ppb	parts per billion
PPcf	Permian/Pennsylvanian Casper Formation
ppm	parts per million
Ps	Permian Satanka Shale
PSD	Prevention of Significant Deterioration
R	Range
RMP	Resource Management Plan
RO	rock outcrop
ROD	Record of Decision
ROW	right-of-way
RUSLE	Revised Universal Soil Loss Equation
S	sulfur
SCS	Soil Conservation Service
SHPO	State Historic Preservation Office
SIA	Significant Impact Area
SIC	Standard Industrial Classification
SIL	Significant Impact Levels
SNOTEL	SNOwpack TELemetry
SO_2	sulfur dioxide
SO_4	sulfates
STO	stock

SWPPP	Storm Water Pollution Prevention Plan
T	township
tph	tons per hour
tpy	tons per year
TR-55	Technical Release 55
TrPc	Triassic Chugwater Formation
U.S.	United States
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VOC	volatile organic compound
VRM	visual resource management
W	west
WA	Wilderness Area
WAQS&R	Wyoming Air Quality Standards and Regulations
WGFD	Wyoming Game and Fish Department
WQD	Water Quality Division
WYDOT	Wyoming Department of Transportation
WYNDD	Wyoming Natural Diversity Database

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1.0 Introduction

1.1 Introduction

Pete Lien and Sons (PLS) is proposing the development of a limestone quarry on public lands administered by the Bureau of Land Management (BLM). The Pete Lien Jonathon Project (proposed project) would involve the open cut mining and processing of limestone. The planned quarry site is located in Albany County approximately 10 miles north of Laramie and 7 miles east of U.S. Highway 287/30 (**Map 1-1**). PLS would mine chemical grade limestone, which would be moved along a haul road to a processing facility. An access road would be constructed from U.S. Highway 287/30 to the processing facility. The proposed quarry site and a portion of the haul road are located on public lands administered by the BLM. The processing facility, an access road, and a portion of the haul road between the quarry and the processing facility would be located on private land. In the Mine Permit Application submitted by PLS to the Wyoming Department of Environmental Quality (DEQ) a permit boundary is delineated within which all project disturbance would be located. The area within the permit boundary is referred to as the Jonathon Project Area (JPA) and is comprised of 779 acres of public lands and 663 acres of private land. The total area to be disturbed is estimated by PLS to be well less than this amount. PLS estimates that approximately 533 acres of public land and 104 acres of private land would be disturbed.

The proposed project would include a Lime Plant and Fine Grind Plant to be located on private lands between the proposed quarry and U.S. Highway 287/30. Note that PLS does not intend to initially construct the Lime Plant. The Lime Plant would be constructed if market demand for lime improves in the region. The primary raw material for the lime manufacturing process would be crushed limestone from the quarry which would be introduced into a coal/coke-fired kiln, where heating action would convert the limestone (primarily calcium carbonate [$CaCO_3$]), to lime (calcium oxide [CaO]). The Fine Grind Plant would be a simple process in which crushed limestone from the quarry would be further processed through a propane-fired dryer, additional screens, classifiers, and/or mills (grinding) as appropriate to meet various product specifications.

1.2 Purpose and Need

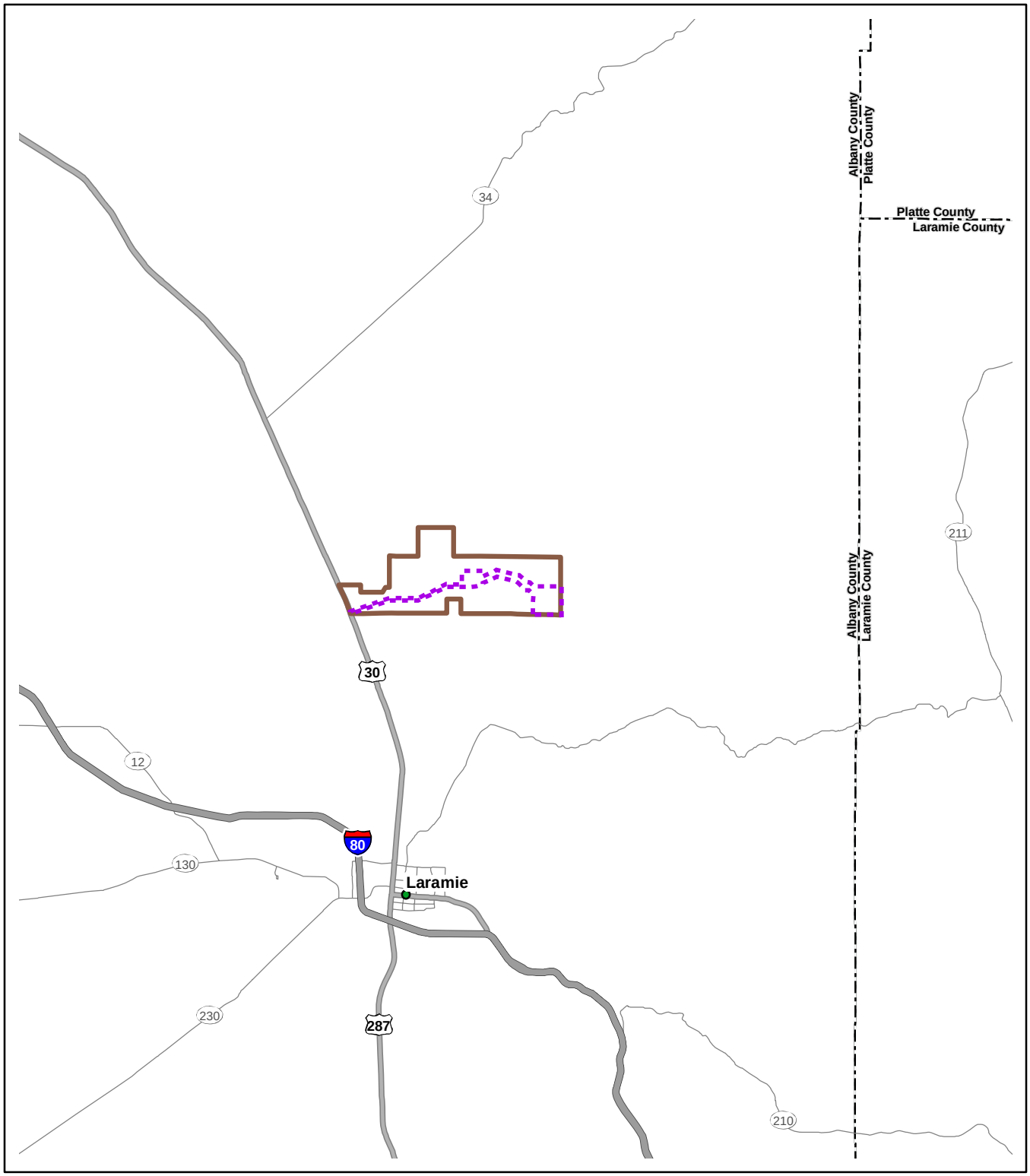
1.2.1 BLM Purpose and Need

The BLM is responsible for managing mineral rights access on certain federal lands as authorized by the General Mining Law of 1872, as amended. Under the law, persons are entitled to reasonable access to explore for and develop mineral deposits on public domain lands that have not been withdrawn from mineral entry.

The purpose of this Environmental Assessment (EA), as provided for in 43 Code of Federal Regulations (CFR) 300, is to allow the Responsible Official to determine whether to prepare an environmental impact statement or a finding of no significant impact.

In order to use public lands managed by the BLM's Rawlins District Office, PLS must comply with the BLM Surface Management Regulations (43 CFR 3809) and other applicable statutes, including the Mining and Mineral Policy Act of 1970 (as amended) and Federal Land Policy and Management Act of 1976. The BLM must review PLS' plans for developing the proposed project to ensure the following:

- Adequate provisions are included to prevent unnecessary or undue degradation of federal lands and to protect the non-mineral resources of the federal lands;
- Measures are included to provide for reclamation of disturbed areas; and
- Compliance with applicable state and federal laws is achieved.



Jonathon Ranch Boundary
Permit Boundary
Interstate
Highways
Secondary Roads
County Boundary

N

0 1 2 4 Miles

Map 1-1

Project Location

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1.2.2 PLS Purpose and Need

PLS is a private company in the business of mining, processing, and selling limestone-based products that are used for environmentally beneficial uses such as:

- Flue gas treatment – lime is used in dry or wet scrubbing to remove acidic gases, (sulfur dioxide [SO_2] and hydrochloric acid [HCl]) and is being evaluated for the removal of mercury from stack gases;
- Treating biosolids and sludges – lime is used for effective treatment of sewage biosolids, as well as industrial sludges and petroleum wastes;
- Treating animal wastes – in support of the U.S. Environmental Protection Agency's (USEPA's) concentrated animal feeding operations rule lime treatment for animal wastes help control excess nutrients (phosphorous and nitrogen), controls pathogens by controlling the environment for bacterial growth, reduces odors (hydrogen sulfide [H_2S]), and is cost effective;
- Treating municipal and industrial wastewater – in water treatment systems to neutralize acidic manufacturing by-products;
- Treating drinking water – layered as a filtration process in purifying water, softening, pH adjustment, controlling pathogen growth, and removing impurities (silica, manganese, fluoride, and organic tannins);
- Treating hazardous wastes – lime stabilizes metals such that they are less likely to leach and also reacts with the soils to solidify materials, further reducing leaching.

In addition, lime and limestone are used in several industrial manufacturing industries such as sugar manufacturing, refractory products, and the food industry.

Currently PLS operates a Fine Grind Plant in Northern Colorado. However, the useful life of the quarry(ies) providing the limestone to the Colorado plant is nearing its end, hence the need for this new quarry and associated processing facility to continue to supply their existing market.

1.3 The Decision to be Made

The BLM will decide whether to approve the proposed action as submitted, to develop alternatives to the proposed action if resource conflicts are identified, or to reject the proposed action.

1.4 Conformance with Rawlins Resource Management Plan

The BLM's Rawlins Resource Management Plan (RMP) and Record of Decision (ROD) (BLM 2008) directs management of BLM-administered lands within the JPA. Limestone can be considered both a locatable and salable mineral depending on the planned end use. Locatable minerals include all minerals subject to exploration, development, and production under the provisions of the Mining Law of 1872. They include both metallic and non-metallic minerals such as gold, silver, specialty clays, and zeolites. Salable minerals or common variety minerals are regulated by the Federal Materials Act of 1947 and the Multiple Surface Act of 1955. Common variety minerals may be obtained by a free use permit by federal, state, and local governments and qualified nonprofit groups. Sales must be obtained for common variety minerals by commercial and private entities. Examples include sand, gravel, pumice, and common dimension stone. The objective for management of locatable minerals is to provide opportunity for location of mining claims and mineral development while prohibiting such activities on lands that are not compatible with these types of activities. The ROD found that the entire planning area is open to location of mining claims and mineral development except for areas that are closed or to be closed and withdrawn from mineral location. The BLM lands within the Jonathon Project boundary are open to location of mining claims and PLS has already filed claims with the BLM.

1.5 Relationship to Other Plans and Documents

This EA is prepared in accordance with National Environmental Policy Act (NEPA) procedures including Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508); U.S. Department of Interior (DOI) Regulations for Implementation of the National Environmental Policy Act of 1969 (43 CFR Part 46); DOI BLM NEPA Handbook, H-1790-1 (BLM January 2008); Guidelines for Assessing and Documenting Cumulative Impacts (BLM 1994); and the Departmental Manual (DM) part 516. This EA assesses the environmental impacts of the proposed action and serves to guide the decision-making process.

In addition, the proposed project is in conformance with the Wyoming Environmental Quality Act and the Wyoming DEQ, Land Quality Division (LQD) Non-coal Rules and regulations. PLS has prepared and submitted a Mine Permit Application to the DEQ–LQD, which details the proposed project components, the sequence of proposed quarrying and reclamation activities, results of baseline resource investigations, reclamation performance bonding, and other site management plans and practices. Since 2008, this document has been available for public review at DEQ-LQD offices in Cheyenne, Wyoming, under DEQ-LQD Temporary Filing Number 4_5/326. A copy of the DEQ Mine Permit Application also is on file at the BLM Rawlins Field Office, in Rawlins, Wyoming. As an industry categorized under Standard Industrial Classification (SIC) Major Group 14, PLS also would comply with requirements for a Mineral Mining General Permit for Storm Water Discharges (WYR32-0000). This permit application, review, and compliance process would be conducted through the DEQ Water Quality Division (WQD). The proposed project would comply with any other relevant local laws and regulations.

2.0 Proposed Action and Alternatives

Two alternatives are evaluated by this environmental assessment. These include the Proposed Action as identified by Pete Lien and Sons, Inc.; and a No Action alternative. The Proposed Action would involve the development of an open-cut limestone quarry, Lime Plant, Fine Grind Plant, and associated infrastructure approximately 10 miles north of Laramie, Wyoming, in Albany County. The No Action alternative would result in denial of the proposed action and no development of the quarry or associated facilities. The Applicant Committed Environmental Protection Measures (ACEPMs), listed in **Appendix A**, would be implemented as part of the proposed action to minimize project-related impacts.

2.1 Proposed Action

PLS is proposing the development of a limestone quarry on private and public lands administered by the BLM. The planned quarry site is located in Albany County approximately 10 miles north of Laramie and 7 miles east of U.S. Highway 287/30. PLS would mine chemical grade limestone which would be moved along a haul road to a processing facility. An access road would be constructed from U.S. Highway 287/30 to the processing facility. The proposed quarry site and a portion of the haul road are located on public lands administered by the BLM. The access road, processing facility and a portion of the haul road between the quarry and the processing facility are located on private land.

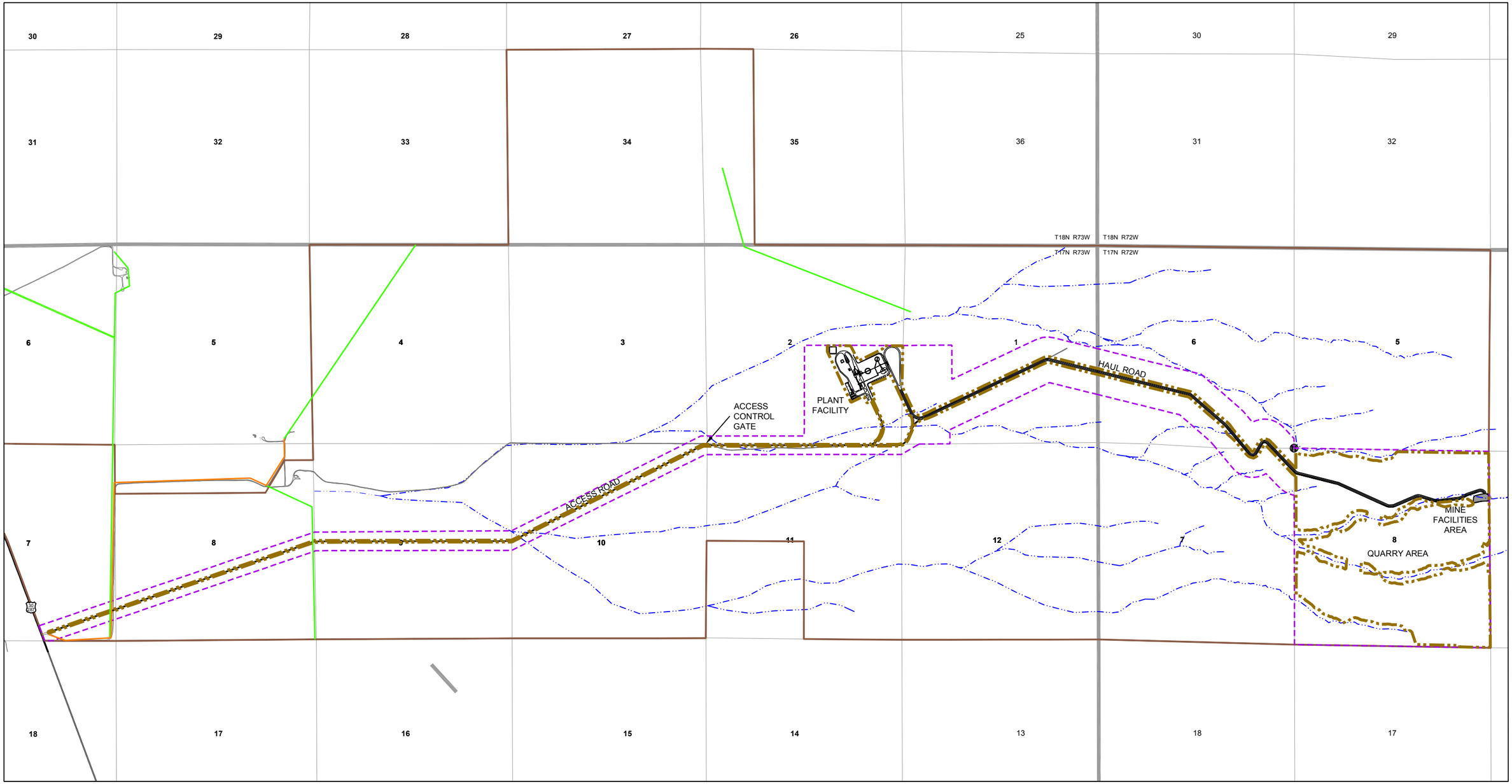
- **Limestone Quarry**: Section 8, Township 17 North (T17N), Range 72 West (R72W).
- **Processing Facility**: SE ¼, Section 2, T17N, R73W.
- **Haul Road**: Extending from the quarry area in Section 8 to the processing facility in Section 2.
- **Access Road**: Extending from the processing facility to U.S. Highway 287/30.

The planned locations of the quarry and related project elements are illustrated on **Map 2-1**. **Table 2-1** shows the JPA and estimates of potential disturbance based on the Jonathon Project Mine Permit Application. The JPA encompasses more acres than that which PLS estimates would be disturbed by the project.

Table 2-1 Project Area and Disturbance Acreage

Feature	Project Area (acres)			Estimated Project Disturbance Area (acres)		
	BLM	Private	Total	BLM	Private	Total
Access Road	---	254	254	---	25	25
Plant and Haul Road	138	409	547	19	79	98
Quarry	641	---	641	514	---	514
Total Areas	**779**	**663**	**1,442**	**533**	**104**	**637**

The proposed Jonathon Quarry area is anticipated to have an estimated life-of-mine of 45 years. Over this period, approximately 100 million tons of limestone would be removed from the quarry area located in Section 8, T17N, R72W (**Map 2-1**). Within the mine area, quarrying activities would proceed across the landscape in sequential stages of clearing and grubbing, topsoil and subsoil salvage, overburden stripping and limestone removal, backfilling of stockpiled waste rock, recontouring, topsoil and subsoil reapplication, and revegetation (**Map 2-2**). These stages would occur repeatedly within smaller “mining blocks” in Section 8 during the proposed life-of-mine. The mining blocks are generally defined on a 5-year basis, and range in size from approximately 30 acres to 65 acres. Under this approach, the overall project phases identified



Section
Township
Jonathon Ranch Boundary
Permit Boundary
Ephemeral Drainage
Area of Disturbance
Power Line Easement
Power Line

N

0 1300 2600 5600 Feet

Map 2-1

Proposed Action

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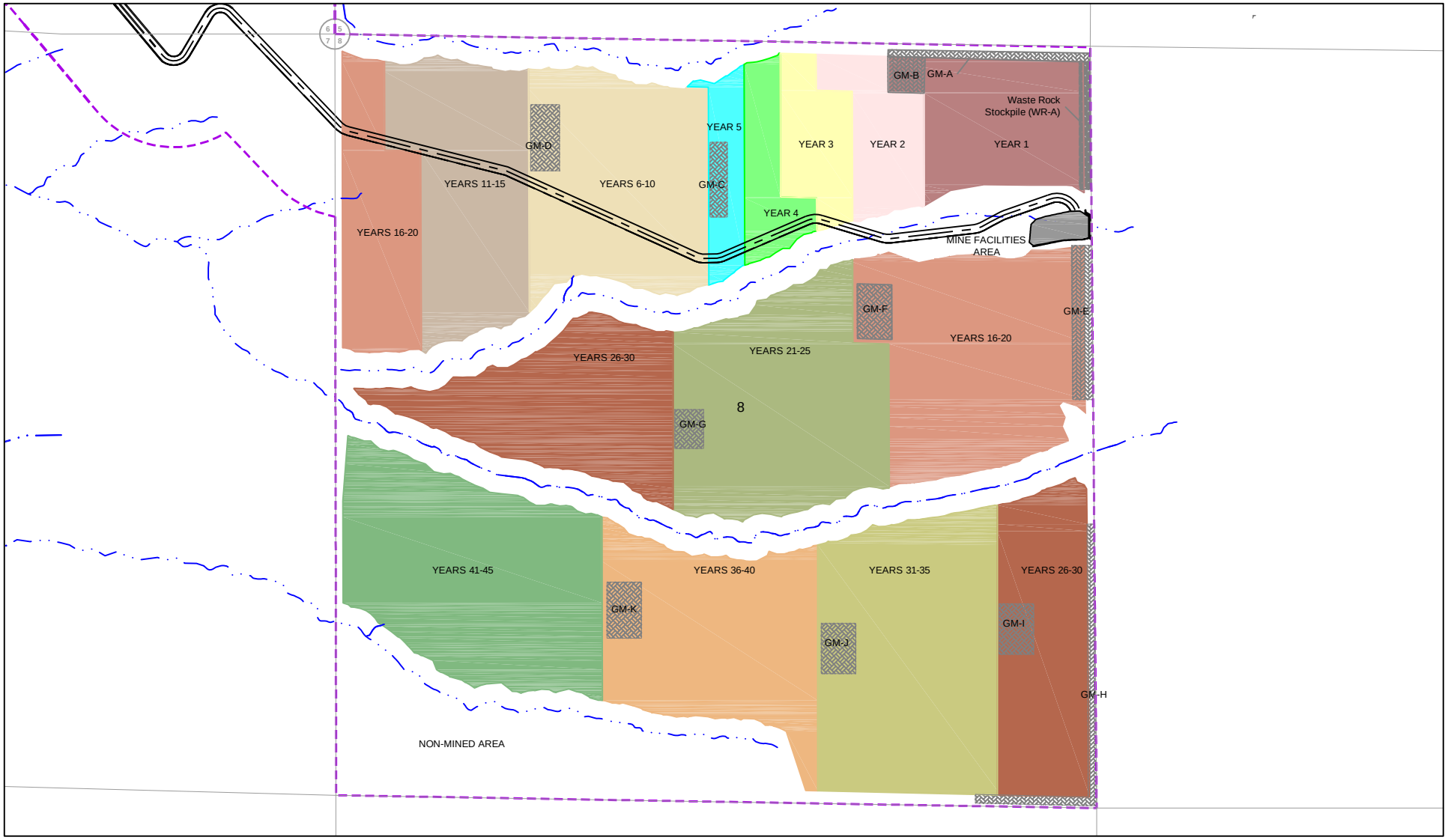

Section
Permit Boundary
Ephemeral Drainage
Soil Stockpiles

N

0 500 1000 2000 Feet

Map 2-2

Quarry Sequencing

File: PLS-EA-MAP_2-2_Quarry Sequencing.dwg

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above would proceed such that reclamation activities at the quarry area would closely accompany the foregoing mining activities.

Existing major drainages within the mine area, consisting of four major ephemeral stream channels (**Map 2-1**), would be avoided by mining during the proposed project. However, some disturbance of the existing major drainages would occur due to road crossings and construction of sediment controls, as discussed later within this document. Site recontouring within the existing major drainages to the approximate original contour would be accompanied by drainageway stabilization and restoration, as well as by seeding and planting to re-establish beneficial post-mining land uses. Subsequent sections of this chapter provide greater detail on these project aspects.

2.1.1 Mine Plan

PLS would follow the procedures outlined below for activities proposed on private and BLM-administered lands. This Mine Plan would serve as the Plan of Development (POD) and was submitted as part of the Mine Permit Application to the Wyoming DEQ, LQD.

The Mine Plan describes in detail the operations of the mine so the BLM and the Wyoming DEQ can evaluate the potential impacts of the proposed project. The Mine Plan describes operations of the mine that take place at the quarry, on quarry haul roads, and within the mine facilities areas.

2.1.2 Quarry Operation

The quarry would be located east of the plant in the foothills of the Laramie Mountains. Limestone would be quarried and crushed at the quarry and hauled via truck to the stone processing area at the plant site. Initially, topsoil and subsoil would be removed by scraping and then stockpiled for future reclamation of previously quarried and backfilled areas. The overburden, consisting of sandstone and low quality limestone, would be drilled to provide blasting holes, or ripped, in which case blasting would not be necessary. Following blasting or ripping, the overburden would be removed by loader and loaded into trucks where it would then be stockpiled. As quarry operations progress, the overburden material would be used to backfill previously quarried areas. After removal of the overburden, the underlying limestone would be drilled to provide blasting holes. Blasted limestone would be loaded into the primary crusher and ultimately transported to the stone processing plant site. The crushing system would be designed to produce minus 2.5-inch product for further processing at the stone plant.

The limestone quarry haul road would be used to transport shot rock from the crusher to the stone processing area at the plant for further processing. The quarry haul road would be treated with a combination of magnesium chloride treatment, watering, gravel surfaces, and administrative speed controls to reduce the generation of fugitive emissions during road usage. The maximum speed limits imposed for safety and to reduce fugitive dust on the haul roads would be 25 miles per hour (mph) for loaded trucks, and 30 mph for empty trucks.

2.1.2.1 Equipment List

Equipment used at the Jonathon Quarry would generally be portable in nature. No permanent facilities or equipment would be constructed at the quarry. A pad would be located at the east end of the quarry area (mine facilities area) for the placement of any desired temporary equipment (**Map 2-1**). Although a list of equipment is presented herein, due to the nature of the commodity being mined, various combinations of equipment can be expected to appear within the mine area at various times. The equipment anticipated to be used at this facility includes:

- Transportable in-pit crusher;
- Aboveground Storage Tank (Diesel);
- 750-kilowatt diesel powered generator;

- Blasting materials storage building (Mine Safety and Health Administration [MSHA] approved);
- Material transfer conveyors ;
- Crushed rock stockpile (approximately 25,000-ton pile at 450 tons per hour [tph]);
- Rolling Stock:
  - 20+ ton haul trucks,
  - Front-end loaders,
  - Motor grader(s),
  - Bulldozer(s),
  - Drill and blast rig; and
- Scrapers, as necessary.

A complete equipment list, including crushers, screens, conveyors, and generator, would be provided in the Wyoming DEQ/Air Quality Division permit.

2.1.2.2 Mine Facilities

Buildings and Processing Plants

Portable scale house(s) and sales/office trailers would be used at the Lime Plant, as necessary. The buildings would be light tan in color and the majority of the buildings would be under 100 feet in size. The tallest building would be approximately 120 feet. The lights on the buildings would be yellow in color and most likely high pressure sodium, 70 watt lights, would be used. At this time it is anticipated that portable water and sewage facilities would be utilized at the Lime Plant and portable sanitary systems would be used at the quarry site. No permanent facilities are anticipated to be constructed within the quarry portion of the project boundary. Should a need for permanent facilities within the quarry area arise in the future, all applicable Wyoming DEQ permitting and guidelines would be met.

Relatively small aboveground storage tanks would be constructed at the Lime Plant. These tanks would be used to dispense diesel and gasoline for equipment used during operations. Secondary containment structures would be constructed to capture any spilled fuel. The explosives storage and handling area on the mine site may store ammonium nitrate fuel oil mixture. Spill prevention and containment of this material would be implemented according to the Oil Spill Prevention Act, and appropriate explosives regulations governing the use of ammonium nitrate.

Access and Haul Roads

A new permanent access road from U.S. Highway 287/30 to the plant, as shown on **Map 2-1**, would be constructed to gain access to the plant. A new haul road would be constructed from the plant to the quarry as shown in **Map 2-1**. Haul trucks would use this road to transport the limestone from the quarry to the plant. It is assumed that the largest truck to operate on the haul road would be a 773E Off-highway Truck (60-ton nominal payload capacity).

The two-lane access road would have a travel width of approximately 20 feet and a total right-of-way (ROW) of 50 feet. For a two-lane haul road, the travel width would be a minimum of 60 feet wide to allow sufficient room for maneuvering and to promote safety and maintain continuity in the haulage cycle. The total ROW width would be 90 feet to allow for drainage channels and/or berms on either side of the road.

A groundwater well would be installed near the plant facility on private land for facility use after appropriate permitting. It is estimated that PLS would use 41,100 gallons of water per day, which is equivalent to a continuous pumping rate of approximately 28.5 gallons per minute (gpm).

Electrical and Communication Lines

Electrical utilities would be coordinated with Carbon Power & Light or an alternate electrical utility. An overhead electrical transmission line would be constructed from U.S. Highway 287/30 along the access road to the plant. All transmission lines would be constructed to the standards approved by the Avian Power Line Interaction Committee ([APLIC] [2006], available online at www.aplic.com). An electrical substation would be constructed in the project boundary to provide electricity to the facility. Telephone and communication services for this area would be provided by an overhead or underground service to the plant. PLS would work with the local providers to find the best solution.

2.1.2.3 Mining Methods and Sequence

Soil Handling

Soil resources (topsoil and subsoil) would be salvaged from the proposed quarry mine blocks. Additionally, PLS would strip topsoil prior to road construction. The topsoil from the road may be used and stored in the quarry area since the road would remain in place even after mining. Data and interpretations from the baseline soil survey (Mine Plan, Appendix D-7) conducted for the project indicate that the average depth of topsoil within the mine blocks ranges from approximately 3 to 6 inches except in areas of rock outcrop at or near the quarry. Suitable subsoil depths range from 15 to 46 inches except in areas of rock outcrop at or near the quarry. Soil resources stripping would be completed either by scraper, dozer, or a motor grader to windrow the materials and then transport them via truck or loader.

Either method would be used to directly place (or “direct-haul”) as much soil as possible onto areas undergoing a suitable reclamation phase within the mining sequence. Topsoil and subsoil to be direct-placed would be collected at the site of removal, hauled to the destination block and spread in sequence with waste rock to the appropriate placement depth. The placement thickness of soil shall be according to the Reclamation Plan (**Appendix B**). Following placement, the soil would be slightly roughened, perpendicular to the slope to prevent erosion. Finally, the soil would be seeded and mulched in accordance with the Reclamation Plan (**Appendix B**).

Where direct placement is not possible (e.g., the first year of mining), topsoil and subsoil would be stockpiled within the associated approved Wyoming DEQ permit boundary until it could be used as backfill in reclamation. Typically stockpiles would be located within the current mining block. Typical stockpile locations are indicated on **Map 2-2**.

Topsoil would be stockpiled or handled separately from subsoil. Topsoil and subsoil stockpiles would be located such that they would not be disturbed by mining operations. Three-foot-deep diversion channels and/or vegetated berms would be constructed around the stockpiles to capture soil that falls from stockpiles and to capture run-off from the stockpiles. Best Management Practices (BMPs) such as stabilized silt fences (stabilized with rock at the bottom and backed by woven wire to stabilize against wind), erosion control blanket or staked wattles would be used as necessary to control erosion and sedimentation from direct run-off. Stockpiles would be identified with a placard located on or adjacent to the stockpiles. Stockpiles would be seeded with the appropriate seed mix identified in the Reclamation Plan (**Appendix B**, **Attachment 1**, if soil would be stockpiled for more than 1 year. The anticipated quantity of topsoil and subsoil to be removed during the first year of mining operations is approximately 19,280 bank cubic yards (bcy). For estimation of stockpile quantities and placement quantities, a swell factor of 15 percent was used to account for expansion of the soils due to mechanical disturbance.

As indicated in the Reclamation Plan, **Appendix B**, due to the shallow and rocky nature of the soils in map units D and RO, the entire soil profile would be salvaged to the extent possible. If it becomes necessary to stockpile soil from map units D or RO, the soil would be stored as subsoil.

Stockpile Conservation Techniques

Stockpile locations would be selected to encourage site stability while minimizing the haul distance to the reclamation site. The initial stockpiles would be placed along the north perimeter of the mine area to help redirect mine-associated noises, including blasting, backup alarms, crusher/screen operations, etc. Appropriate erosion and sediment controls, also known as BMPs, would be used to stabilize topsoil and subsoil stockpiles and would consist of the following:

- Surface roughening;
- Revegetation would be used on all topsoil and subsoil stockpiles left longer than 1 year;
- Diversions or berms would be used around all topsoil and subsoil stockpiles to capture sediment and run-off;
- Sediment controls (such as check dams, silt fence, or wattles) would be used at outlets to diversions or berms; and
- Berms or diversions/swales would be used above all topsoil and subsoil stockpiles to prevent run-on from reaching stockpiles.

All erosion and sediment BMPs would be inspected periodically, maintained in working order, and replaced or modified when necessary. Inspection and maintenance would be performed in accordance with the Wyoming General Permit for Storm Water Discharges (WYR32-0000).

Depth of Mining and Highwall Stability

A total of seven limestone layers have been correlated within the quarry area. Mining activities would remove all seven limestone layers. Each layer would be evaluated as mining progresses and removed in such a way to optimize the recovery of locatable limestone. Layers that are thick enough and possess qualities that make them locatable would be removed separately. The bottom of the mine pit would be bounded by the bottom of the lowest limestone layer. The depth of mining, from the surface to the bottom of the lowest limestone layer, varies from only 10 feet to nearly 250 feet. On average, the depth of mining is approximately 140 feet.

Temporary highwalls (unexcavated face of exposed overburden in a surface mine) would be created during mining, particularly along the edges of the existing drainages. These highwalls are likely to range in height from anywhere between 10 feet to as high as 180 feet.

Stability of rock cuts in sedimentary rocks is dependent on both the slope ratio of the cut face and the dip/strike of the rock formations. In some cases the geometry (dip/strike) of the foundation is the dominant factor. For example, formations that dip steeply toward the cut face can be very unstable, while horizontally bedded formations can be stable at steep cut slope ratios. The limestone strata within the JPA strike north-northwest and dip towards the west-southwest at 6 degrees. The stability of the rock cuts is not anticipated to be a factor at this site due to the gentle dip of the limestone.

Limestone Removal and Handling

The Jonathon Quarry contains approximately 200 million tons of material, which would be removed or relocated during mining activities. Approximately 50 percent of this material (approximately 100 million tons) is estimated to be limestone, which would be crushed and hauled to the plant. The remaining 50 percent of material (approximately 100 million tons) is estimated to consist of waste rock, which would be stockpiled or direct-placed back into the quarry areas undergoing reclamation.

All limestone would be drilled and blasted by a certified blasting contractor. Powder factors would be adjusted to provide adequate fracture of the material without causing extraordinary ground vibration or air blast that may impact adjacent landowners. Records of the blast vibrations would be kept on file by PLS for review by regulatory officials.

Once the material is shot, it would be excavated and loaded by front-end loader and hauled by truck to a crusher hopper and portable crusher, initially located at the mine facilities area just south of the Year 1 Mine Block. After the initial box cut is developed, the portable crusher would move with the active mining face to minimize the amount of rock hauling and rehandling. Alternatively, material would be directly transported to the plant. The pit-run material would be crushed, screened, and segregated into various sizes and types of material based on its chemical properties and operational requirements. A dust suppressant mist would be applied to the limestone during crushing and screening operations to limit detrimental impacts to air quality.

Segregated locatable and non-locatable limestone stockpiles would be maintained in the quarry near the active mining face. Stockpiles would be built around the portable crusher. As the mining face moves, so would the crusher and stockpiles. Once the crusher has moved and the stockpiles originally built in that area are depleted, the area would be available for backfilling and contouring.

Non-locatable material may or may not be crushed and sold depending on market conditions. If the material cannot be sold or used in the plant, it would be transported to the waste rock pile or allowed to be covered as the pit is backfilled. Stockpile quantities would vary depending on operational needs and constraints. During the first year of pit development, approximately 1 to 2 months of inventory (75,000 to 100,000 tons) may be maintained in temporary out-of-pit stockpiles located in the quarry area.

Wash-down of equipment would be necessary periodically. This operation typically only takes place when maintenance on the crusher(s), conveyors, screens, etc. is required. This equipment would be centrally located in the mine facilities area. The ground areas in and around the equipment would either be clean gravel or crushed limestone. A graveled equipment maintenance area also would be located near the crushing operation. Emergency maintenance, including washing of truck boxes, dozer blades, or repair of hydraulic/fuel lines of wheeled and tracked equipment would be completed in this area.

Waste Rock Removal and Handling

PLS would move waste rock by a loader/truck operation to the scheduled destination. If necessary, waste rock would be drilled and blasted by a certified blasting contractor. Powder factors would be adjusted to provide adequate fracture of the material without causing extraordinary ground vibration or air blast that may impact adjacent landowners. Records of the blast vibrations would be kept on file by PLS for review by regulatory officials.

The approximate quantity of waste rock to be moved during each year would be approximately 1 million bcy (or approximately 2 million tons). Waste rock generated in the Year 1 Mine Block would be temporarily stored in the waste rock stockpile. Waste rock produced in subsequent mine blocks would be direct-placed for use in developing post-mine topography (PMT). If the direct placement of waste rock in the PMT is not possible or feasible, waste rock would be stockpiled.

The initial designated waste rock area would be available along the east perimeter of the first year mining area. This stockpile would be a minimum of 6 feet high to help redirect mine-associated noises, including blasting, backup alarms, crusher/screen operations, etc. However, this stockpile also may be a maximum of 50 feet high to store initial waste rock that cannot be direct-placed. If there is not enough waste rock available to achieve the PMT, waste rock from the waste rock area would be used to help achieve that goal. Other waste rock stockpiles, if needed, would be placed in a way to minimize interruption to production and reclamation activities, and to minimize final placement haul distances. In the case where waste rock requires a semi-permanent storage pile, then the surface of the waste rock pile would be reclaimed as indicated in this section. For estimation of stockpile quantities and placement quantities, a swell factor of 25 percent was used to account for expansion due to mining activities and mechanical disturbance.

As mining proceeds in each approved 5-year Mine Plan block, if it is determined that the actual waste rock volume varies considerably from the volume estimated in that block such that the proposed mine topography cannot be developed as designed, then a revised Mine Plan and PMT would be developed for review and approval by Wyoming DEQ, LQD, and BLM.

Mining Hydrology

Prior to any surface disturbance, temporary BMPs would be utilized along all downslope and sideslope edges of the planned disturbance, particularly along existing drainages (see **Appendix A**, **ACEPMs**). The purpose of these temporary controls would be to capture sediment from run-off that may occur during the initial clearing of vegetation and stripping of topsoil and subsoil. Temporary BMPs would consist of the following:

- Berms or diversions/swales located above mined areas to redirect and prevent run-on from reaching mined areas;
- Berms or diversions/swales located below mined area to route run-off to sediment basins; and
- Sediment controls (such as silt fence, wattles, or slash filter berms) to capture sediment within run-off.

BMPs associated with the haul road would consist of the following:

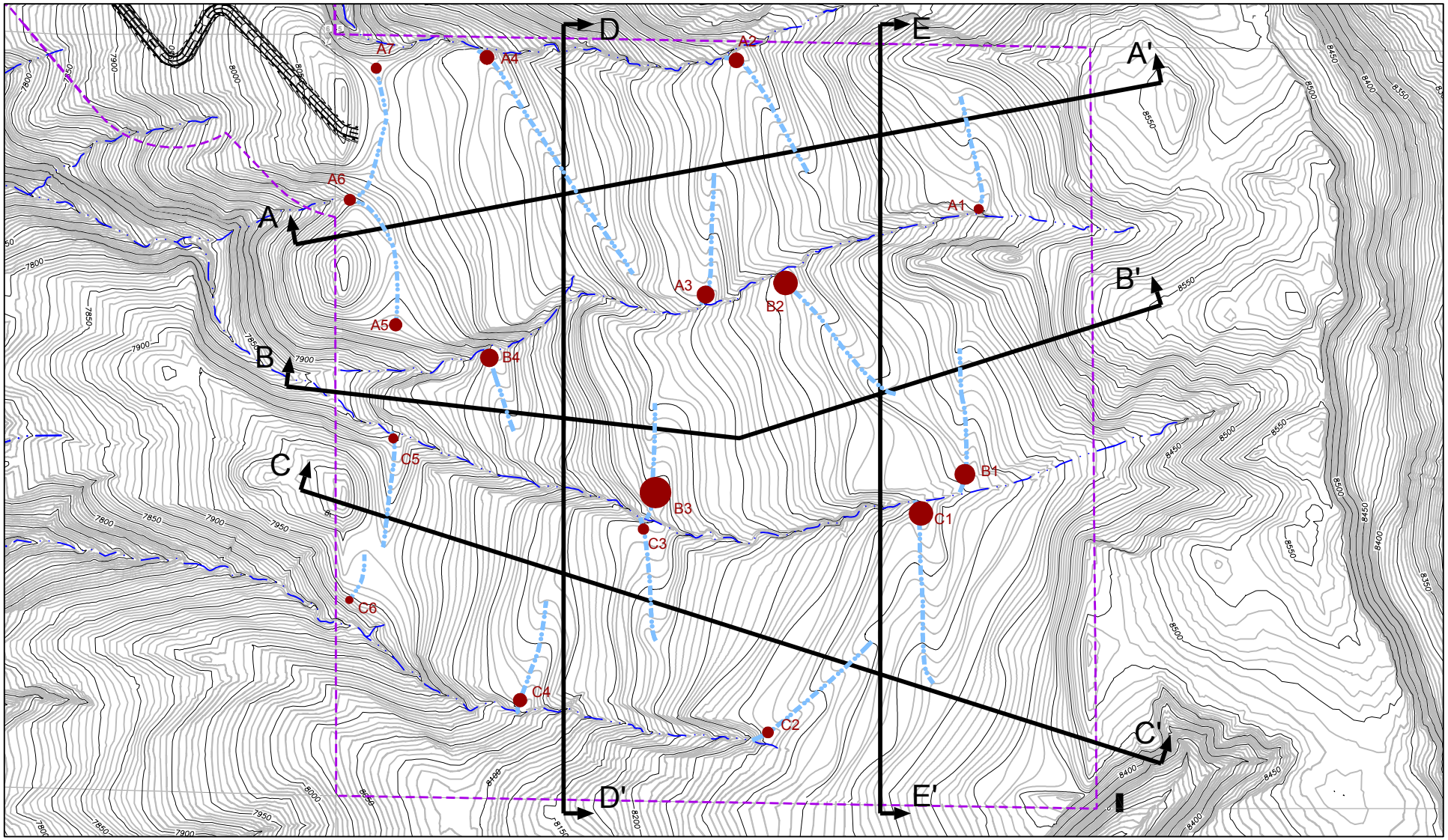
- Roadside ditches would be installed during roadway construction to collect run-off from the haul road and adjacent slopes. Check dams would be used within roadside ditches if necessary to prevent erosion of ditches;
- Wing ditches would periodically relieve roadside drainage ditches by directing run-off to sediment trapping devices (such as check dams) or well-vegetated areas every 500 feet or less (where possible);
- Culverts would be used to route run-off under the haul road as necessary to relieve roadside ditches and where roads cross major existing drainages;
- Riprap would be installed at inlets and outlets to culverts and where roads cross small drainages;
- Diversions would be installed around the mine facilities area at the east end of the haul road; and
- Degradable erosion control blankets would be used on steep road cut/fill slopes, unless cut/fill material is within rock.

In accordance with WYPDES General Permit WYR32-000 all erosion and sediment BMPs would be inspected periodically, maintained in working order, and replaced or modified when necessary.

Excavation for mining operation would not occur within 150 feet of any existing major drainages (see **Map 2-2**). These existing major drainages would only be disturbed at locations used for haul road crossings and at locations used for installation of sediment basins.

The haul road location as currently shown (along with the mine facilities area) would disturb the northeastern headwaters of the ephemeral drainage system in the central part of the mining operation (see **Map 2-2**). This haul road location would be sufficient for mining years 1 through 20. During the mining of subsequent years, two additional haul road crossings would be built to cross over the existing major drainages within the west end of the quarry area between the northern and middle pit and between the middle and southern pit. These future haul road crossings have been included within the estimate project disturbance area, but their alignments within the quarry area would be determined in the future. All haul road crossings would be designed and constructed in accordance with guidelines from the BLM and Wyoming DEQ.

During mining, sediment basins (as described in Section 2.1.4, and as shown on **Map 2-3**) would be constructed periodically along the perimeter of the quarry area adjacent to the existing major drainages. The sediment basins were designed to contain run-off flows from the 10-year, 24-hour storm plus 1 year of sediment storage. The 10-year, 24-hour storm event is in accordance with Wyoming DEQ design guidance



Section
Permit Boundary
Ephemeral Drainage
7900 Post-mining Ground Surface Contour (Contour Interval = 25')
Drainage Channel
B1 Sediment Basin
A A' Cross-section Location

N

0 500 1000 2000 Feet

Map 2-3

Post-mining Topography

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documents and was evaluated as a reasonable design storm for sediment basins that would only be constructed when the area immediately upgradient would be mined.

Where possible, run-on would be diverted around mining activities and run-off from mining activities would be directed to flow into the sediment basins. Otherwise, run-off would be trapped inside the mine pit where infiltration or dewatering (as needed) would occur. It is anticipated that surface water collected within mine pits would infiltrate quickly into the limestone face. Water collecting in the mine pit that does not infiltrate would drain to in-pit sumps for settling and then be used for reclamation or dust control. If not used for those purposes, it would be pumped to the nearest sediment basin. If pumping to a sediment basin becomes necessary, temporary lines would be used to contain drainage and avoid overland flow. There would be no overland flow released from this process.

2.1.3 Processing Operations

2.1.3.1 Stone Plant – Processing and Raw Material Storage

The crushed rock (limestone) from the quarry would be further sized, sorted, and stockpiled prior to transfer to either the Lime Plant or Fine Grind Plant. The limestone from the haul trucks would be dumped into a hopper and fed via covered conveyor to a sizing screen from which the limestone would have the possibility of going three different locations depending on product size, as follows:

- The minus 2.5- to plus 1.75-inch product would be conveyed via stacker conveyor to stockpile No. 1. Limestone from stockpile No. 1 would be reclaimed via a bottom reclaimer and transferred to a covered conveyor and ultimately fed to a 100 percent enclosed screen. From there the limestone would be fed to the preheater stone bin and into the kiln via the stone conveyor.
- The minus 1.25- to plus 0.5-inch product would be stacker conveyed to stockpile No. 2. Limestone from stockpile No. 2 would be reclaimed via a bottom reclaimer and transferred to a covered conveyor and fed to either the roll crusher where it would then be transferred to stockpile No. 3, or to the screen.
- The minus 0.5-inch material would be conveyed via covered conveyor to a stacker conveyor to stockpile No. 3. Limestone from stockpile No. 3 would be reclaimed via a bottom reclaimer and fed to the Fine Grind Plant via covered conveyor. Additionally, in case of an emergency material would be transferred to a hopper via front-end loader to covered conveyor.

BMPs would be used for all material handling operations to limit fugitive particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) emissions within the stone plant. BMPs consist of covered conveyors, enclosed conveyor transfer points, stacker conveyors for stockpiles with maximum 6-foot drop (operation ceases if drop height exceeds 6 feet), belly dump trucks with walls on each side of drop point to limit emissions, and a 100 percent enclosed screen.

2.1.3.2 Fine Grind Plant

The Fine Grind Plant would be a simple process in which minus 0.5-inch limestone would be received via enclosed conveyor from the screen and fed to a propane-fired dryer. After the limestone is dried it would be conveyed via boots, screws, slides, etc. to additional screens, classifiers, and/or mills (grinding) as appropriate to meet product specifications. The conveying, screening, classifying, and grinding operations are 100 percent enclosed and all points would be controlled via baghouses. Baghouses would be employed to control particulate emissions from the milling, primary screening, air classifiers, secondary screening, and blending up to the loading into the nine product silos and the two bagger machines located in the warehouse. Ten separate baghouses would control the product loading and bagger emissions. The refined product would then be stored in silos and loaded into trucks for transportation off site. The fine grind product would be transported by trucks capable of hauling approximately 35 tons of the material and would travel on an unpaved portion of the access road to the access gate, at which point the road is paved to

U.S. Highway 287/30. The unpaved portion of the access road is controlled in the same manner as the quarry haul road.

The dryer would have a rated capacity of 20 million British thermal units per hour and would be propane-fired thereby limiting the gaseous emissions from combustion. The dryer would be equipped with a baghouse for control of particulate emissions.

2.1.3.3 Lime Plant

Kiln Circuit

The primary raw material for the lime manufacturing process would be limestone. From the storage piles the Limestone would pass over a screen and would then be conveyed into the kiln preheater stone bin. The preheater, located above the kiln, would be used to preheat the limestone (using hot gases from the kiln) and to control the feed rate to the kiln. The preheater improves the thermal efficiency and reduces fuel consumption by using heat from the kiln that might otherwise be lost. Burning fuel would enter the slowly rotating kiln cylinder from the lower end, and the pre-heated limestone, added to the upper end of the kiln, would be subjected to heat and a gentle tumbling action. Within the kiln, limestone would be chemically altered by exposure to heat generated from the combustion of coal/coke in the kiln. This heating action would convert the limestone ($CaCO_3$) to equal parts lime (CaO) and carbon dioxide (CO_2) according to the following ideal chemical reaction:

$$CaCO_3 \text{ (Limestone)} + \text{HEAT} \rightarrow CaO \text{ (High Calcium Lime)} + CO_2$$

Once the limestone is calcined (i.e., converted to lime), the lime would enter a counter flow cooler where it would be cooled and conveyed to an associated bucket elevator for product storage and loadout. Exhaust gas particulate from the preheater, cooler, and kiln would be controlled by a baghouse.

Product Lime Load-out

A bucket elevator would transfer and discharge the lime to a product lime screen. Oversize lime would be stored in a kiln run silo while undersize lime would be transferred and stored in lime product bins for load-out. The oversize product lime temporarily stored in the kiln run silo would be fed to a lime crusher to further reduce the size. The crushed lime would be discharged to the bucket elevator for return to the product lime screen and eventually to one of three product load-out silos. The lime product would then be loaded into trucks for transport to various markets. The lime would be transported by trucks capable of hauling approximately 35 tons of lime. The lime product trucks would travel on the same unpaved portion of the access road to the access gate as the Fine Grind product trucks, and on to U.S. Highway 287/30 via the paved access road.

Coal/Coke Transfer

Coal and coke would both be used as the fuel-burning agents for the kiln burner and would be received by truck (belly dump) and discharged to a coal hopper. The coal/coke would then be reclaimed from the storage hopper via an underground reclaim system and conveyed to the coal or coke storage silo, where the coal would be pneumatically fed to the kiln burner. Propane gas would be used as a secondary fuel in critical situations such as start-up.

2.1.4 Reclamation Plan

This section describes the equipment, devices, and practices needed to reclaim the disturbances that are associated with the Jonathon Quarry. The reclamation plan meets the performance standards outlined in the Wyoming DEQ), LQD regulations and BLM Wyoming reclamation requirements as discussed in the Reclamation Plan (**Appendix B**). The Wyoming DEQ, LQD administers and regulates mining and reclamation operations such as the proposed project, in conjunction with the BLM under a current Memorandum of Understanding.

PLS would minimize impacts while conducting operations on public lands by:

- Complying with the terms and conditions of the approved operation and all federal and state laws related to environmental protection;
- Ensuring that operations are "reasonably incident" to mining and processing operations; and
- Attaining the stated level of protection or reclamation required by specific laws in managed areas.

The area of operations is on both private land and public land managed by the BLM. The BLM land is not a specially designated management area, such as the National Wilderness System, BLM-administered National Monuments, or National Conservation Areas.

PLS would employ the following strategies to prevent undue and unnecessary degradation:

- Blend PMT into the surrounding topography;
- Use storm water BMPs to prevent erosion and sediment transport;
- Exclude the existing major drainages in Section 8 from mining or resource recovery;
- Restrict access to the area of operations during reclamation;
- Implement the Weed Management Plan to prevent the establishment and spread of noxious and invasive species; and
- Develop a re-vegetation program that encourages diversity of plant growth and return to similar pre-mine conditions.

Proposed Post-mining Topography

The PMT for the Jonathon Quarry is shown in **Map 2-3** and post-mining cross-sections are shown on **Figures 2-1** and **2-2**. The surface shown was developed based on the anticipated volume of waste rock, topsoil, and subsoil that would be available after the limestone reserves are recovered. The backfilling of waste rock and associated grading would be completed as concurrently as possible to the mining sequence presented in the Mine Plan. On average an additional 8 to 13 acres would be disturbed annually and a similar amount of disturbed land would enter the reclamation process.

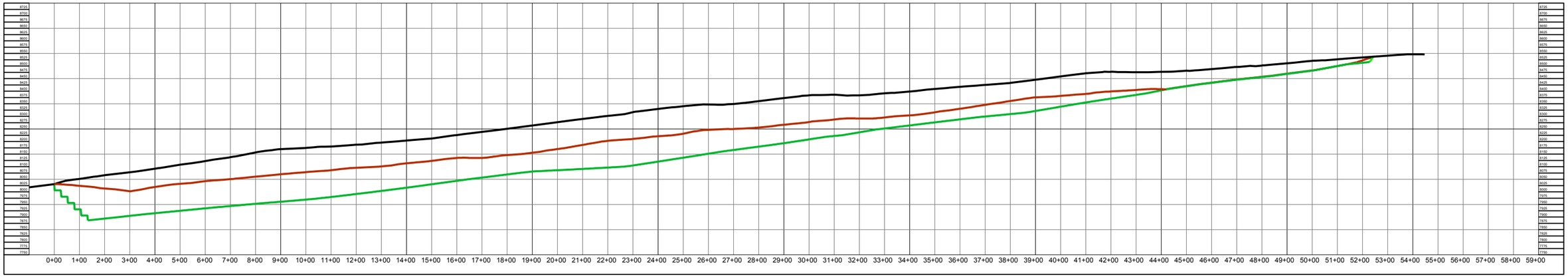
Excavation for mining operation would not occur within 150 feet of the existing major drainages. The pit floor of the mine blocks would extend below the existing drainages in certain areas. Waste rock would be placed in the mine pits to restore the elevation of the reclaimed areas to an elevation slightly above the undisturbed drainages so that runoff would still flow into the drainages. The final PMT contour was developed to include an undulating topography where possible so the final contours naturally blend with the adjacent topography. In addition, the PMT contours were developed to exclude the use of defined bermed channels wherever possible. In order to properly evaluate the development of the PMT, a survey of the PMT would be performed once the mined area is at final grade and prior to permanent seeding.

Proposed Post-mine Drainage

With the completion of mining activities in any given area, temporary BMPs would be removed as appropriate, reclamation activities would begin, and the land would be reshaped to match the PMT. Some temporary BMPs would remain in place until reclamation has started and vegetation has established to stabilize the soil. Surface water is present in the area of operations only during periods of substantial rainfall or snowmelt. However, a surface drainage plan would be implemented to minimize post-mining erosion and sedimentation. Activities would include sloping of the PMT, construction of drainage swales and sediment basins (**Map 2-3**), and revegetation,

A

A'



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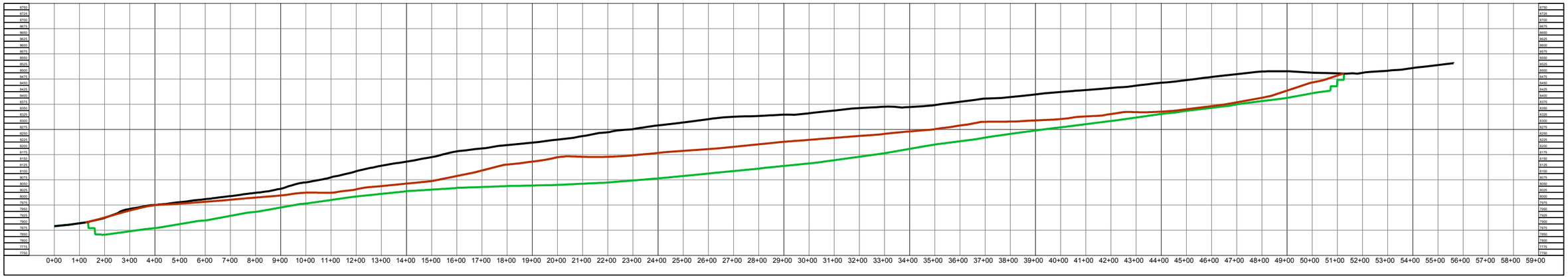

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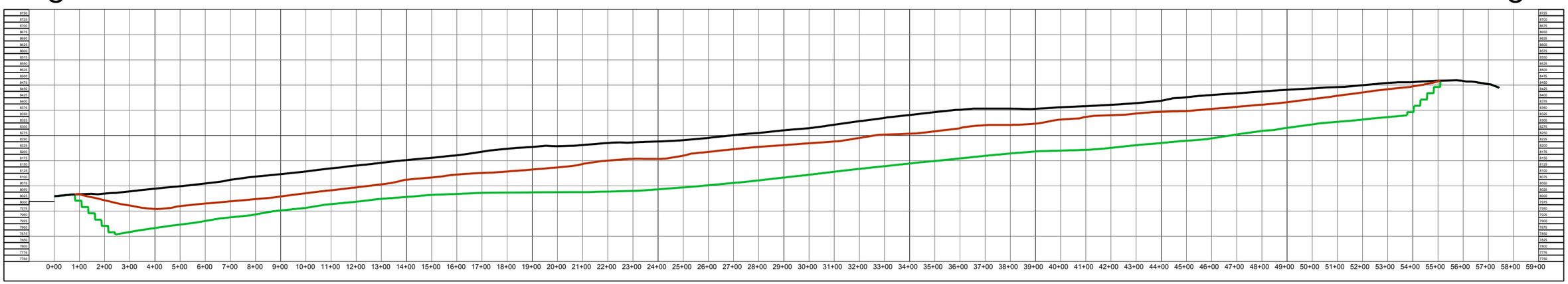

Original Ground Surface

Projected Bottom of Mine

Final Post-Mine Surface

0 200 400 800 Feet

N

Note: See Figure2-2 for Benching Detail.

Figure 2-1

Post-mining Cross-sections (Sheet 1 of 2)

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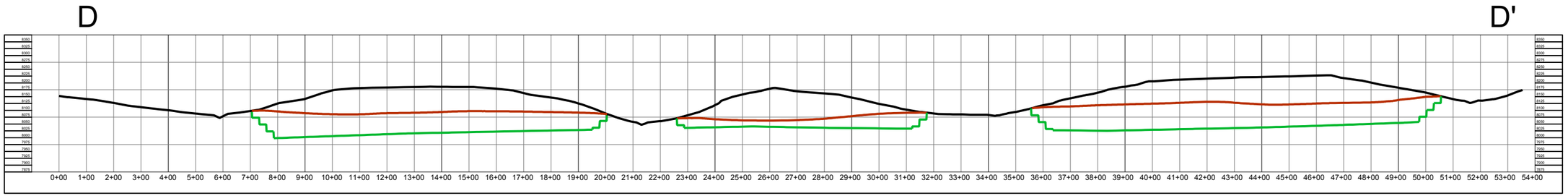
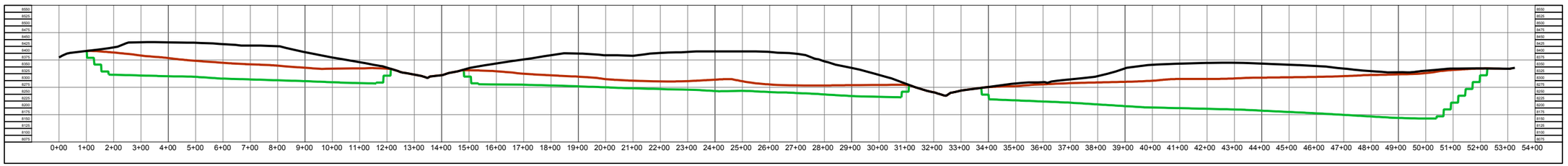
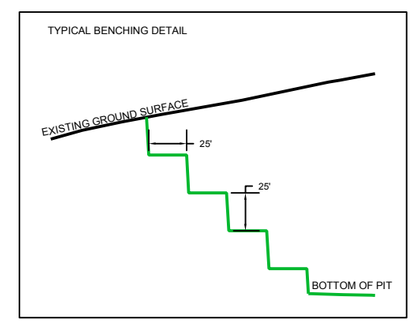






Original Ground Surface

Projected Bottom of Mine

Final Post-Mine Surface

0 200 400 800 Feet

N

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

Figure 2-2

Post-mining Cross-sections (Sheet 2 of 2)

The PMT was developed in such a way as to reduce slope lengths, slow run-off, and direct run-off across slope toward existing drainages via a wide and relatively flat bench (or swale). These drainage swales would be constructed with a deeper layer of topsoil and subsoil and would be a place for run-off to slow its velocity and infiltrate into the reclaimed ground surface. The constructed drainage swales would be large enough to capture the entire 100-year storm, if necessary. A small drainage ditch would be constructed on the far (down-slope) side of each swale to create a low flow path or "pilot" channel for run-off from smaller storms that do not completely infiltrate into the swale. Each drainage swale would slope at approximately 5 percent in order to direct run-off to a sediment basin prior to discharge into existing major drainages, as described in the Mine Plan. Constructed drainages would be revegetated and sediment and or erosion controls (such as degradable erosion control blankets, check dams, or filter berms) would be used during vegetation establishment. All erosion and sediment BMPs would be inspected periodically, maintained in working order, and replaced or modified when necessary.

The sediment basins and constructed drainage swales would be periodically inspected and maintained in working order until all contributing areas are fully revegetated and stabilized, which may take several years after the completion of mining each block. Final treatment of individual sediment basins would be determined and documented through coordination with the BLM. On a case-by-case basis, the sediment basins may be backfilled and regraded to post-mine site land use, within 5 years following reclamation. In such cases, the sediment basins would be covered with subsoil and topsoil and seeded. As a general rule, however, sediment basins would be left in place following reclamation. The sediment basins would naturally silt in over time and would be seeded (or planted) and mulched. This would promote zones of additional soil moisture and opportunities for vegetation requiring higher soil moisture to become established. Remaining sediment basin outlets would be designed to safely overflow and would be stabilized with riprap.

2.1.4.1 Reclamation of the Quarry

The basic objectives for quarry reclamation would include:

- Providing safety to the public;
- Stabilizing quarry walls;
- Minimizing access while enabling safe access to wildlife, livestock, and the public;
- Optimizing use of the topsoil and subsoil in areas of best potential for success; and
- Designing final topography to enhance wildlife habitat (e.g., diverse natural vegetative cover on the final contours).

<u>Reclamation Progression</u>

On average an additional 8 to 13 acres would be disturbed annually and a similar amount of disturbed land would enter the reclamation process. Reclamation of a mine block would occur as soon as possible after mining is completed in that area (approximately 1 year behind mining). The backfilling of waste rock and associated grading would be completed as concurrently as possible to the mining sequence presented in the Mine Plan (**Map 2-2**). After mining has been completed, the quarry area would be re-contoured into two area types termed the upper steep slopes and flat benches.

<u>Stabilizing Quarry Walls or Rock Faces</u>

During mining activities, any highwalls would be backfilled and waste rock would be imported into the area before access to the highwalls is cut off. During reclamation, the waste rock would be distributed to develop topographical contours that approximate the PMT. Prior to re-vegetation, the final grade of the reclaimed area would be established.

Redistribution of Waste Rock and Soil

Waste rock backfill (consisting of soft sandstone or low-grade limestone) is anticipated to be a mix of sizes ranging from 24 inches to individual sand particles. This material is highly crushable. The rock would be crushed by the continuous movement of heavy equipment over the surface.

Approximately 30 to 35 percent of the backfilled quarry area would remain as exposed waste rock (rock-outcrop). The remaining 65 to 70 percent of the backfilled quarry would receive additional selectively graded waste rock crushed to a mix of sizes less than 0.75 inch and placed in an approximately 4-inch-thick layer overlying the minus 24-inch material. These finer waste rock materials would range in sizes from small sand and silt grains up to rocks 0.75 inch in size.

Existing soils information indicates the salvageable volume of soil is limited at the Jonathon Quarry. Consequently, the overall strategy for revegetation efforts would employ redistributing soils in areas where soil moisture is highest and the potential for successful revegetation results is maximized. The remaining soil would be spread on other areas where the ground surface has been disturbed as described in the Reclamation Plan (**Appendix B**).

The replacement of subsoil would occur following the construction of the post-mine contours and placement of the 4-inch-thick layer of crushed 0.75-inch waste rock material. Subsoils within the JPA are generally low in salts and sodium and increase in pH and lime with depth. Soil pH is not anticipated to be a limiting factor in the area because subsoils are generally neutral to moderately alkaline. Topsoil redistribution would occur after subsoil has been replaced. Approximately 123,000 bcy of topsoil is estimated to be available for reclamation from the quarry area. In areas where soil moisture would be highest, such as constructed drainage swales and fairly level areas, topsoil and subsoil would be replaced at a depth of 24 inches. In areas of limber pine reclamation, topsoil and subsoil would be replaced at a depth of 12 inches. In areas reclaimed as rock outcrop, random pockets of soil would be placed at depths of approximately 3 inches. In all other areas, topsoil and subsoil would be replaced to an average depth of 11.5 inches.

Constructing and Maintaining the Means for Restricting Access

During reclamation, access to revegetated areas would be restricted until vegetative growth proves successful. All reclaimed areas would be fenced to exclude cattle until vegetation is fully established for 3 to 5 years. Areas of shrubs and tree plantings may require a smaller exclusion until shrub and tree seedlings are established. Fenced areas would be evaluated annually and the fences removed when unnecessary as indicated in the Reclamation Plan (**Appendix B**).

2.1.4.2 Other Reclamation Activities

The primary areas of disturbance would be in the quarry area. All areas would be reclaimed consistent with the Reclamation Plan (**Appendix B**).

Waste Rock Pile Reduction and Reclamation

Waste rock would be stockpiled in designated areas if the direct placement of these materials in the PMT is not possible or feasible. It is expected that waste rock would be immediately used to begin reconfiguring the PMT. In the case where waste rock requires a semi-permanent storage pile, then the surface of the waste rock pile would be reclaimed as indicated in the Reclamation Plan (**Appendix B**).

Reclamation of Road Features

PLS would reclaim only the section of haul road within the quarry. This road would be reclaimed by removing culverts, blading off the road base, ripping to the depth of compaction, and/or re-contouring to the surrounding topography, placing subsoil (if necessary) and topsoil cover, and seeding with the appropriate seed mix, as described in the Reclamation Plan (**Appendix B**).

Existing roads used by the project, along with the access road and the haul road remaining in Sections 1, 6, and 7 would be left for continued use. The access road from U.S. Highway 287/30 to the northeast corner of Section 10 would be converted to a county road per the county and Wyoming State Grant Board authorization of the project. The remainder of the access road and the haul road would be left as a private road.

Demolition of Buildings Structures

All buildings, pipe, tanks, and structures at the Lime Plant and Fine Grind Plant would remain for future use in an industrial capacity. All buildings and structures associated with the quarry would be demolished and taken off site for disposal. Reclamation of areas disturbed in the quarry would include re-contouring the landscape to similar contours; ripping and scarifying disturbed areas, if necessary; and reseeding.

Drill Hole Plugging

Any groundwater production wells located on the mill site would be plugged and abandoned in accordance with state standards unless a transfer or alternative use of the wells is permitted from the Wyoming State Engineer's Office.

2.1.4.3 Revegetation

As discussed previously, prior to seeding, topsoil and subsoil would be applied to all disturbed areas in accordance with the Mine Plan.

Rationale for the Seed Mix Development

Based on consultation with the Wyoming DEQ, and the BLM, three seed mixes were developed for the proposed project disturbance areas (**Appendix B, Attachment 1**). The seed mixes were developed based on the Wyoming DEQ's and BLM's requirements for seed mixes as described in the Wyoming DEQ Land Quality Division Guideline No. 2, Vegetation (**Appendix B**, **Attachment 4**) and the BLM Rawlins RMP. The seed mixes include native species most of which were identified on the site during the detailed vegetation mapping that was conducted in 2007 and 2009 (Mine Plan, Appendix D-8). If seeds for species listed in the seed mix are not commercially available at the time of seeding, a commercially available species from the Alternate Species List (**Appendix B**, **Attachment 1**) would be used.

The seed mixes were developed for lower and higher elevation areas in the JPA, and the constructed rock outcrop areas. The lower elevation seed mix would be used in the areas ranging in elevation from 7,100 to 7,600 feet, which includes the haul road and process facilities. The higher elevation seed mix would be used areas over 7,600 feet, which is predominantly the mine area. The constructed rock outcrop/shallow soil seed mix would be used in the areas reclaimed as constructed rock outcrop. The higher elevation seed mix includes more forbs and montane shrubs, while the lower elevation seed mix includes more grasses, and grassland shrubs. The rock outcrop/shallow soil seed mix is composed of grasses and forbs that were observed in the rock outcrop areas during the detailed vegetation mapping.

Mountain mahogany and limber pine seeds would be collected in the vicinity of the site and used as the seed source for these species during reclamation. Mountain mahogany seeds would be included in the upper elevation seed mix during seeding. Limber pine also would be planted as seedlings in areas to be reclaimed as pine savanna and pine woodlands.

Seeding

Due to the size of the mining operation, there would be no differentiation between permanent and interim revegetation except in areas being reclaimed with limber pine. Areas being reclaimed as pine savanna and pine woodland would be seeded with a temporary BLM-approved seed mix as described in ACEPM V-1 (**Appendix A**). If large-scale interim revegetation becomes necessary, the Wyoming DEQ and BLM would be contacted for any possible changes in methodology.

All disturbed areas would be seeded with one of three permanent seed mixes upon completion of mining activity and reapplication of subsoil and topsoil. Seeding would most likely occur in the fall. Areas may be seeded by drilling or broadcasting. Drill seeding would occur perpendicular to the slope to prevent erosion. In areas reclaimed as constructed rock outcrop, reseeding would occur by blowing a mixture of soil/mulch/seed over the area of reconstructed rock outcrop using a bark blower or other suitable equipment. The soil/mulch/seed mixes would be spread into patches of soil approximately 3 inches in depth and would not cover the entire constructed rock outcrop areas.

Since native vegetation species would be planted and require substantial time to germinate and develop into a sustained, viable cover, mulching with North American Weed Free Forage Program certified weed free straw mulch or hydromulch would be completed after seeding to prevent erosion due to wind and rainfall. If straw mulching is used, the straw would be crimped into the soil after the application of seed. Vegetative material cleared on-site during pre-mining clearing activities also may be used as mulch, if available.

Nitrogen fertilizer would not be applied to prevent enhancement of weed growth. Prior to seeding, if necessary, soil samples can be analyzed for fertility parameters, such as phosphorus, and results can be used to determine application rates if soil amendments are needed.

Limber Pine Replanting

Limber pine is a BLM sensitive species and to assist in reclamation of the limber pine, the BLM and PLS developed a limber pine replanting program (ACEPMs V-1 to V-3, **Appendix A**). As part of the limber pine replanting program, limber pine seeds would be collected in the vicinity of the site during years a limber pine cone crop is available. In addition, limber pine seedlings would be obtained from local nurseries, or the local county extension office and other available sources as directed by the BLM.

If seedlings are unavailable for transplanting, areas that are to be reclaimed as pine savanna or pine woodland would be temporarily revegetated with a BLM-approved seed mix or mulched until seedlings are available. Available seedlings within the quarry area that have not yet been cleared may be directly transplanted into areas that are being reclaimed as pine savanna and pine woodlands. Reclamation of limber pine would be modified as necessary based on observations of seedling success in the areas being reclaimed with limber pine.

Quaking Aspen Monitoring

PLS has committed to protecting two, small quaking aspen stands located in Section 8 near the mine facility area from mine disturbance. A portion of the large aspen stand in the north-central portion of Section 8 also would be protected from mine disturbance. Protection would consist of fencing at a buffer distance wide enough to protect the roots from being damaged during mine construction and operation activities

The large quaking aspen stand disturbed by mining activities would be monitored annually as that mining block moves into the reclamation phase. Aspen trees are expected to propagate through sprouting and spread into the reclaimed disturbed areas. As described in ACEPM V-11 (**Appendix A**), if during monitoring it is documented that quaking aspen seedlings are not recolonizing previously disturbed areas, additional BLM reclamation techniques may be required.

2.1.4.4 Post-mining Reclamation Monitoring and Evaluation

Inspection, maintenance, and monitoring activities would be performed quarterly in the first 2 years, and semi-annually thereafter, until the bond release conditions have been satisfied. As discussed in the Reclamation Plan, **Appendix B**, this includes 5 years of revegetation monitoring reported on a quarterly basis in the first 2 years and semi-annually thereafter in coordination with the stormwater management inspections.

PLS would restore the land to a condition equal to or greater than the “highest previous use” in accordance with Wyoming DEQ guidelines (**Appendix B, Attachment 3**) and in accordance with the RMP. These

guidelines outline specific vegetation parameters, which are used to compare reclaimed areas against control areas or reference areas that were identified during baseline vegetation surveys. The control areas or reference areas would be used to determine revegetation success goals when reclaimed lands are considered for full bond release. The vegetation parameters to be used to compare reclaimed areas against the control or reference areas include:

- Percent vegetation cover (absolute value);
- Percent total ground cover (absolute value);
- Total production for herbaceous species (absolute value);
- Density of full shrub and subshrub species (post-mining shrub habitat);
- Areal extent of dense shrub mosaics;
- Density of trees;
- Species diversity and species composition;
- Ability to withstand grazing pressure; and
- Attainment of these parameters for the last 2 consecutive years of the bonding period.

The results of the baseline vegetation inventory, the identification of control and reference areas, and more detail on the quantitative and qualitative vegetation success goals are provided in Mine Plan, Appendix D-8. PLS would follow the applicable regulatory methods for evaluating attainment of these goals as outlined in the Wyoming DEQ guidelines and BLM Rawlins RMP.

In addition, post-mine inspections of the vegetative cover and soil would be completed to identify and correct features such as subsidence, vegetative failure, establishment of undesirable vegetation, and excessive erosion should these conditions be present. Wherever possible, corrective measures would be instituted immediately and may include additional seeding, restriction of livestock grazing, erosion control measures, and fertilizing, as needed, to facilitate permanent vegetative growth.

Temporary erosion control BMPs necessary to control post-mine erosion and sediment during each phase of reclamation would include the following:

- Snow fence to minimize wind erosion (would be removed once vegetation is fully established);
- Berms or diversions/swales to prevent run-on from reaching reclaimed/disturbed areas (would be removed once vegetation is fully established); and
- Sediment controls (such as silt fence, wattles, slash filter berms, or check dams) to capture sediment within run-off (would be removed once vegetation is fully established).

All erosion and sediment BMPs would be inspected periodically, maintained in working order, and replaced or modified when necessary.

2.2 No Action Alternative

Under the No Action Alternative, mining, processing, and resource disturbance would not occur.

2.3 Alternatives Considered but not Analyzed in Detail

Several alternatives to the Proposed Action were considered but for the reasons outlined below were not carried forward for detailed impact analysis in this EA.

- **Alternate Access Road Alignment:** PLS considered aligning the access road along the southern boundary of the ranch property prior to turning to the northeast at the southwest corner of

Section 10. This alignment would have disturbed a small transitional wetland area along the south side of Section 9 and for this reason was not considered for detailed analysis in this EA.

- **Alternate Facility Location:** PLS considered locating the processing facilities farther east of the current proposed location in order to reduce the haul road distance to the quarry. However, the plant site was moved further to the west where the Satanka Formation provides a protective layer of more than 75 feet thickness above the Casper Formation. This is a requirement for development in the Aquifer Protection Area located further south. While not a requirement at the project location, PLS relocated the facility to this location to provide additional protection to the Casper Formation.
- **Waste Disposal on BLM Lands:** PLS considered disposing of lime kiln dust (LKD) generated at the mill site back into the quarry. The company proposed to use coal to heat the limestone in a process designed to generate lime. Burning coal would create “fly ash” or coal combustion residuals (CCR). The company proposed to discard CCR along with the LKD into the quarry. The disposal of these materials would include a risk of monitoring obligations and site management/maintenance requirements at some time in the future.

The NEPA directs the BLM to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal that involves unresolved conflicts concerning alternative uses of available resources (NEPA Section 102[2][E]). No other unresolved resource conflicts were identified.

3.0 Affected Environment

Chapter 3.0 of this EA presents the existing baseline environmental conditions within the area potentially impacted by the proposed project.

3.1 Climate and Air Quality

3.1.1 Climate

Climatology data for the site was obtained from National Climatic Data Center records for the following stations:

- Lookout Mountain, located approximately 40 kilometers (km) north-northeast of the site. The period of record for this station was from 1961 through 1990 (temperature and precipitation) and 1947 through 1965 (snowfall).
- General Brees Field, located approximately 25 km south-southwest of the site. The period of record for this site was from 1961 through 1990 for temperature and precipitation, and 1947 through 2000.

In addition, on-site data collected from November 2006 through September 2007 were used. The annual mean temperature is approximately 40 degrees Fahrenheit (°F), with average annual high and low temperatures in the low 50s and mid-20s, respectively. Expected extreme high and low temperatures are approximately 80°F and 5°F, respectively.

The average total precipitation amount is about 12 inches per year, with the bulk of the precipitation occurring in the late spring and summer months. Total snowfall is about 50 inches to 70 inches per year. Climatological data from General Brees Field suggest that typical snow depths are on average only a few inches, although in extreme cases snow depth can exceed 1.5 feet.

Winds measured at General Brees Field for calendar years 2001, 2003, and 2004 show a strong southerly component, with winds most frequently from the southeast through west-southwest. In contrast, on-site wind data from November 2006 through October 2007 indicate that the winds are most frequently from the southwesterly through southerly directions. A wind rose for General Brees Field is shown in **Figure 3-1**. Wind rose for the on-site data collected from November 2006 through October 2007 for the 10-meter level is presented in **Figure 3-2**. The 30-meter and 60-meter levels are presented in **Appendix C**.

3.1.1.1 Climate Change

Climate change refers to any significant change in measures of climate (e.g., temperature or precipitation) lasting for an extended period of time (decades or longer). Global mean surface temperatures have increased nearly 1.8°F from 1890 to 2006. Models indicate that average temperature changes are likely to be greater in the Northern Hemisphere. Northern latitudes (above 24°N) have exhibited temperature increases of nearly 2.1°F since 1900, with nearly a 1.8°F increase since 1970 alone. Temperature in southwestern Wyoming is expected to increase by 0.25 to 0.40°F per decade. Precipitation across western Wyoming is expected to decrease by 0.1 to 0.6 inches per decade, with the largest decrease expected in southwestern Wyoming.

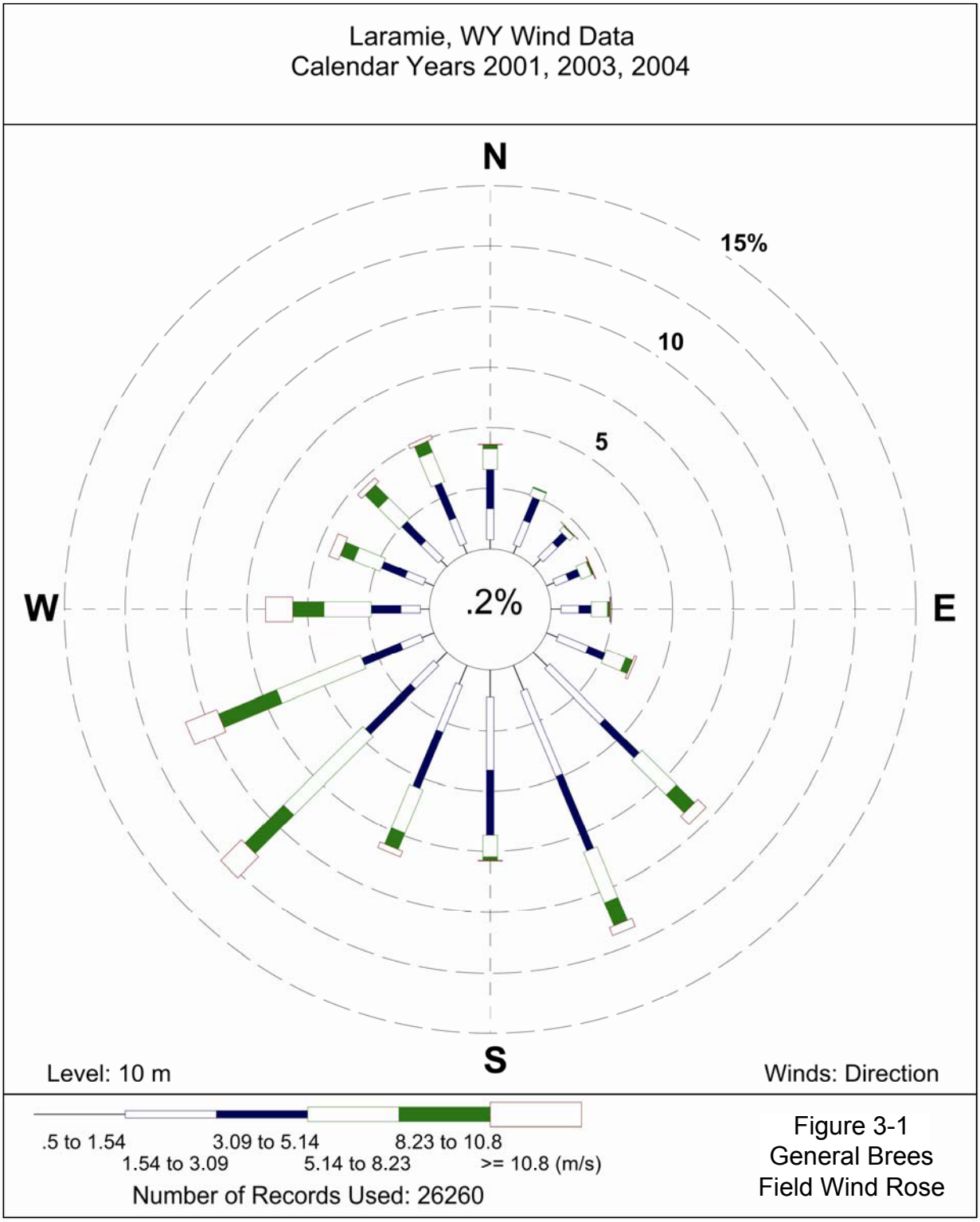


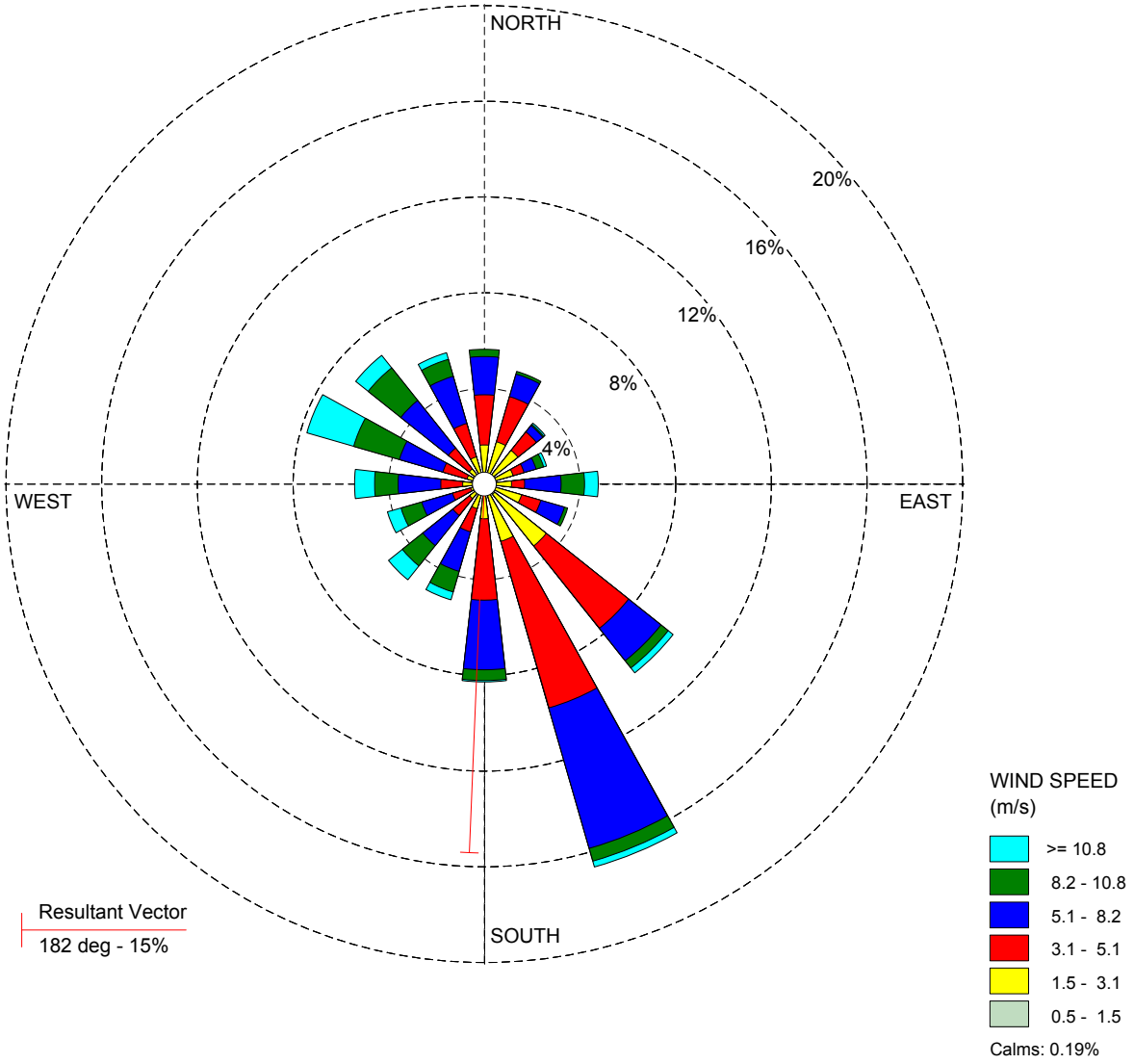
Figure 3-1
General Brees
Field Wind Rose

WIND ROSE PLOT:

Laramie, Wyoming Monitoring Station

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:
10-meter level
Nov 10, 2006 through
Oct 31, 2007

CALM WINDS:
0.19%

AVG. WIND SPEED:
5.49 m/s

TOTAL COUNT:
8274 hrs.

Figure 3-2
On-site Wind Rose
(10-meter Level)

WRPLOT View - Lakes Environmental Software

Climate change may result from natural processes, such as changes in the sun's intensity; and from human activities that change the atmosphere's composition (such as burning fossil fuels) and the land surface (such as urbanization) (Intergovernmental Panel on Climate Change [IPCC] 2007). Some authorized activities within the Rawlins Field Office area generate greenhouse gas (GHG) emissions. Oil and gas development activities can generate CO_2 and ammonium (during processing) as can limestone quarrying operations and chemical lime processing and creation. Carbon dioxide emissions result from the use of combustion engines for off-highway vehicle (OHV) and other recreational activities. Wildland fires also are a source of CO_2 and other GHG emissions, and livestock grazing is a potential source of methane. Other activities in the area with the potential to contribute to climate change include soil erosion from disturbed areas and fugitive dust from roads, which have the potential to darken snow-covered surfaces and cause faster snow melt. It is important to note that neither the USEPA nor the Wyoming DEQ has established limits for GHG emissions.

3.1.2 Air Quality

Federal and state regulations are designed to ensure that ambient air quality, including background, existing, and new sources are in compliance with the ambient standards. The USEPA has designated all areas of the U.S. as "attainment," "nonattainment," or 'unclassified" with respect to ambient air quality standards. Albany County has been determined to be in attainment with respect to all state and federal ambient air quality standards. The relative importance of pollutant concentrations can be determined by comparison with appropriate national and state Ambient Air Quality Standards (AAQS). National and state AAQS are presented in **Table 3-1**. An area is designated by the USEPA as being in attainment for a pollutant if ambient concentrations of that pollutant are below the national AAQS. An area is not in attainment if violations of national AAQS for that pollutant occur. Areas where insufficient data are available to make an attainment status designation are listed as unclassifiable and are treated as being in attainment for regulatory purposes.

PLS completed a 1-year pre-construction ambient air quality and meteorological monitoring program that was designed to establish current baseline ambient air quality conditions at the plant site, and to collect meteorological data for use in future modeling in support of the Prevention of Significant Deterioration (PSD) permit application. Monitoring was conducted under a plan approved by Wyoming DEQ and from November 11, 2006 until November 10, 2007. The data has been approved by the Wyoming DEQ (Wyoming DEQ 2008). Details of the monitoring program, including data recovery statistics and calibration/audit results, can be found in the various quarterly data reports provided to Wyoming DEQ. Copies of these reports are available from the Wyoming DEQ, Air Quality Division by contacting (307) 777-7391.

Background NO_2, SO_2, O_3, and PM_{10} concentrations (**Table 3-2**) were obtained from the 1-year on-site meteorological and ambient air quality monitoring data previously described, and represent the highest concentrations for each averaging period measured from November 11, 2006 through November 10, 2007. As shown in the tables, the area is in attainment.

Table 3-1 National and Wyoming Air Quality Standards

Pollutant	Averaging Time	National AAQS						Wyoming AAQS		
		Primary			Secondary			Primary		
		(ppm)	(ppb)	($\mu g/m^3$)	(ppm)	(ppb)	($\mu g/m^3$)	(ppm)	(ppb)	($\mu g/m^3$)
CO	1-hour	**35** [(a)]	35,000	40,000	None			35	35,000	**40 (mg/m^3)**
	8-hour	**9** [(a)]	9,000	10,000	None			9	9,000	**10 (mg/m^3)**
NO_2	1-hour	0.1	**100** [(b)]	188	None			---	---	---
	Annual (Arithmetic Mean)	**0.053**	53	100	Same as Primary			0.05	50	**100**
PM_{10}	24-hour	---	---	**150** [(c)]	Same as Primary			---	---	**150** [(c)]
	Annual (Arithmetic Mean)	None			None			---	---	**50**
$PM_{2.5}$	24-hour	---	---	**35** [(d)]	Same as Primary			---	---	**35** [(d)]
	Annual (Arithmetic Mean)	---	---	**15.0** [(e)]	Same as Primary			---	---	**15.0** [(e)]
O_3	8-hour	**0.075** [(f)]	75	147	Same as Primary			**0.08**	80	157
SO_2	1-hour	0.075	**75** [(g)]	196	None			---	---	---
	3-hour	None			**0.5** [(a)]	500	1,300	0.50	500	**1,300** [(a)]
	24-hour	**0.14** [(a)]	140	365	None			0.10	100	**260** [(a)]
	Annual (Arithmetic Mean)	**0.03**	30	80	None			0.02	20	**60**

[(a)] Not to be exceeded more than once per year.

[(b)] To attain this standard, the 3-year average of the 98th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 100 ppb.

[(c)] Not to be exceeded more than once per year on average over 3 years.

[(d)] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$.

[(e)] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.

[(f)] To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.075 ppm.

[(g)] To attain this standard, the 3-year average of the 99th percentile of the daily maximum 1-hour average at each monitor within an area must not exceed 75 ppb.

Note: **Bold** indicates the standard as written in the corresponding regulation. Other values are conversions.

$PM_{2.5}$ = particulate matter with an aerodynamic diameter of 2.5 microns or less; ppm = parts per million; ppb = parts per billion; $\mu g/m^3$ = micrograms per cubic meter; CO = carbon monoxide; NO_2 = nitrogen dioxide; O_3 = ozone; mg/m^3 = milligrams per cubic meter.

Table 3-2 Background Pollutant Concentrations

Pollutant	Averaging Period	Background Concentration[1]	
		(ppm)	(µg/m^3)
NO_2	Annual	0.002	3.8
SO_2	3-hour	0.004	10.5
	24-hour	0.002	5.2
	Annual	0.000	0.0
O_3	1-hour	0.061	n/a
	8-hour	0.057	n/a
PM_{10}[2]	24-hour	n/a	68
	Annual	n/a	11

[1] Data from the Mine Plan, Appendix D-4. Values represent the highest concentration for each averaging period measured from November 11, 2006 through November 10, 2007.

[2] PM_{10} concentrations measured at standard conditions.

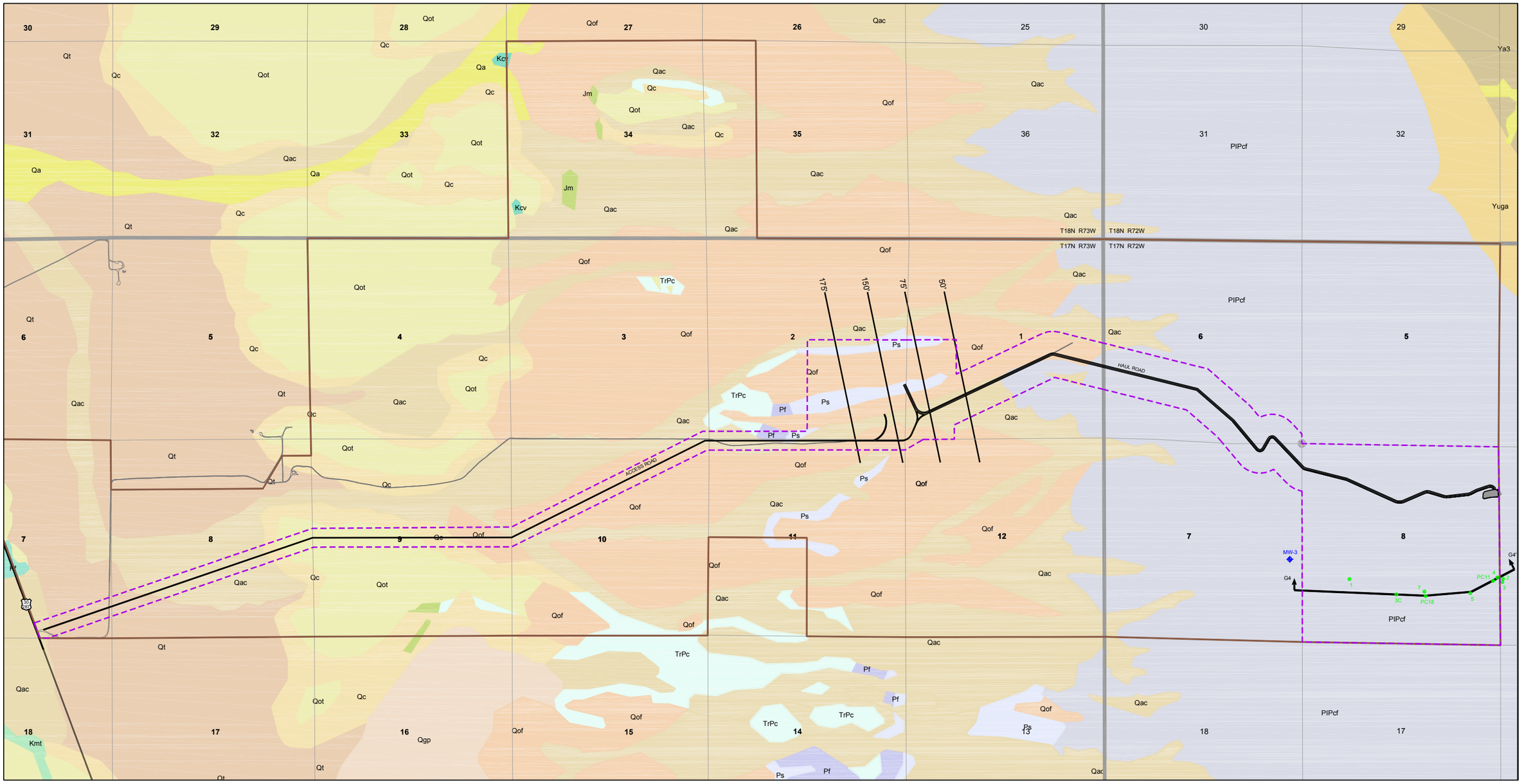
3.1.2.1 Regulatory Framework

Air emission sources in Wyoming are regulated at the federal level by the Clean Air Act (CAA), as amended, and at the state level by the Wyoming Air Quality Standards and Regulations (WAQS&R). The significant federal regulations established as a result of the CAA and incorporated in the WAQS&R that are potentially applicable to the project include:

- New Source Review/PSD;
- New Source Performance Standards (NSPS);
- Title V Operating Permits;
- National Emission Standards for Hazardous Air Pollutants; and
- Federal Class I Area Protection.

3.2 Geology and Topography

The site is situated on the western flank of the north-south trending Laramie Range. The range is an asymmetric fold with a steep eastern flank and a gently sloped western flank that dips into the Laramie Basin to the west of the site (Blackstone 1996). Precambrian crystalline basement rocks are exposed in the core of the range with sedimentary rocks exposed along the flanks. The eastern side of the range is bounded by thrust faults, while the western flank is relatively undeformed with minor monoclinal and anticlinal folding expressed in the sedimentary rock cover. **Map 3-1** shows the bedrock geology of the JPA. **Figure 3-3** shows the geologic cross-section of the JPA.



Map 3-1

Geology of the JPA

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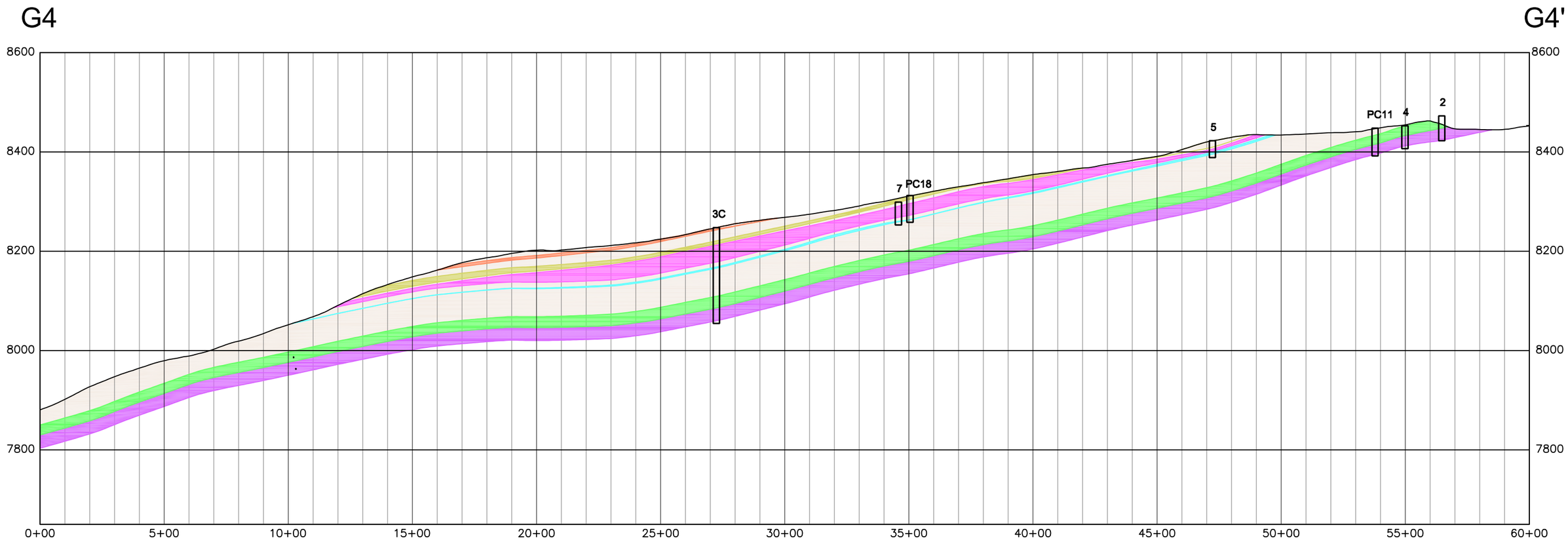

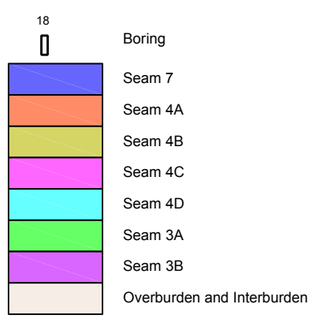

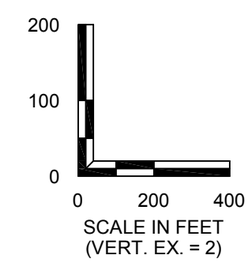

Figure 3-3

Geologic Cross-section

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Near the eastern portions of Sections 5 and 8 is the unconformable geologic contact between Precambrian crystalline rocks and Paleozoic sedimentary rocks. Sedimentary strata at the site strike north-northwest and dip at 6 degrees to the west-southwest. The sedimentary formations from oldest to youngest underlying the JPA include:

- Permian/Pennsylvanian Casper Formation (PPcf);
- Permian Satanka Shale (Ps);
- Permian Forelle Limestone (Pf); and
- Triassic Chugwater Formation (TrPc).

Based on local exploration work and measured stratigraphic sections, the Casper Formation is about 700 feet thick at the site and consists of interbedded sandstones and limestones (Lundy 1978). The sandstones are sub-arkosic and predominantly cemented with calcite. Limestones within the formation are microcrystalline and within the basal portion of the formation dolomitic. The base of the PPcf includes interfingered, poorly sorted arkosic sandstone of the Fountain Formation. The outcrop width of the PPcf spans over 2.5 miles across the JPA from approximately 0.5 mile east of the plant site to about 0.25 mile east of the eastern boundary of the quarry. The upper portion of the PPcf includes three prominent limestone units identified as limestones 7, 4, and 3 in descending order determined to be viable chemical grade limestones identified as quarry targets in the Mine Plan. The Mine Plan subdivides the limestones 3 and 4 into alpha-numeric sub-units and includes geologic cross-sections to show the spatial distribution and reserves across the JPA.

Overlying the PPcf are Permian to Triassic-aged sedimentary rocks including the Satanka Shale, Forelle limestone, and Chugwater Formations. Combined, these formations are collectively referred to as “redbeds.” These rocks consist of interbedded shale, sandstone, limestone, and gypsum. The redbeds are finer-grained and less permeable than the PPcf and form a confining layer above it. Overall stratigraphic thickness of the redbeds is about of 1,000 feet.

The plant site is positioned on redbed shales of the Ps formation. Geotechnical assessment of the Ps was conducted in November 2006 in part to verify the plant site was underlain by a minimum thickness of 75 feet of Ps shale. Currently, the City of Laramie has an Aquifer Protection Overlay (APO) (2002) that extends to within 2 miles of the JPA that provides guidance for aquifer protection in the Casper Aquifer. Although outside of the APO, the plant site location meets the APO development requirement of the minimum of 75 feet of shale for development.

3.2.1 Surficial Geology

The majority of the access road and plant site area is covered by quaternary alluvium and colluvium deposits. They consist of unconsolidated sand and gravel veneers above the sedimentary bedrock.

3.2.2 Geologic Hazards

Potential geologic hazards within the JPA include earthquakes, landslides, and flash flooding.

3.2.2.1 Seismicity

The JPA is in an area of relatively low seismic activity but there have been historic seismic events recorded nearby. The most recent event was a magnitude 4.5 event approximately 60 miles north of the JPA. No active faults are located in Albany County although several inactive faults have been identified within 10 miles of the JPA (Case and Green 2000).

3.2.2.2 Landslides

The JPA is located in an area of low to moderate landslide incidence and low susceptibility (Radbruch et al. 1982). According to the Albany County Hazard Mitigation Plan (Albany County 2004), no areas of the Howell Quad including the JPA contain landslide hazards.

3.2.2.3 Flooding

Flooding is highly unlikely to occur within the existing dry washes and ephemeral drainages within the JPA. Any flooding that might occur would be localized and short-term in response to localized high intensity storm events. However, there is no evidence of any recent flooding in the JPA.

3.2.3 Topography

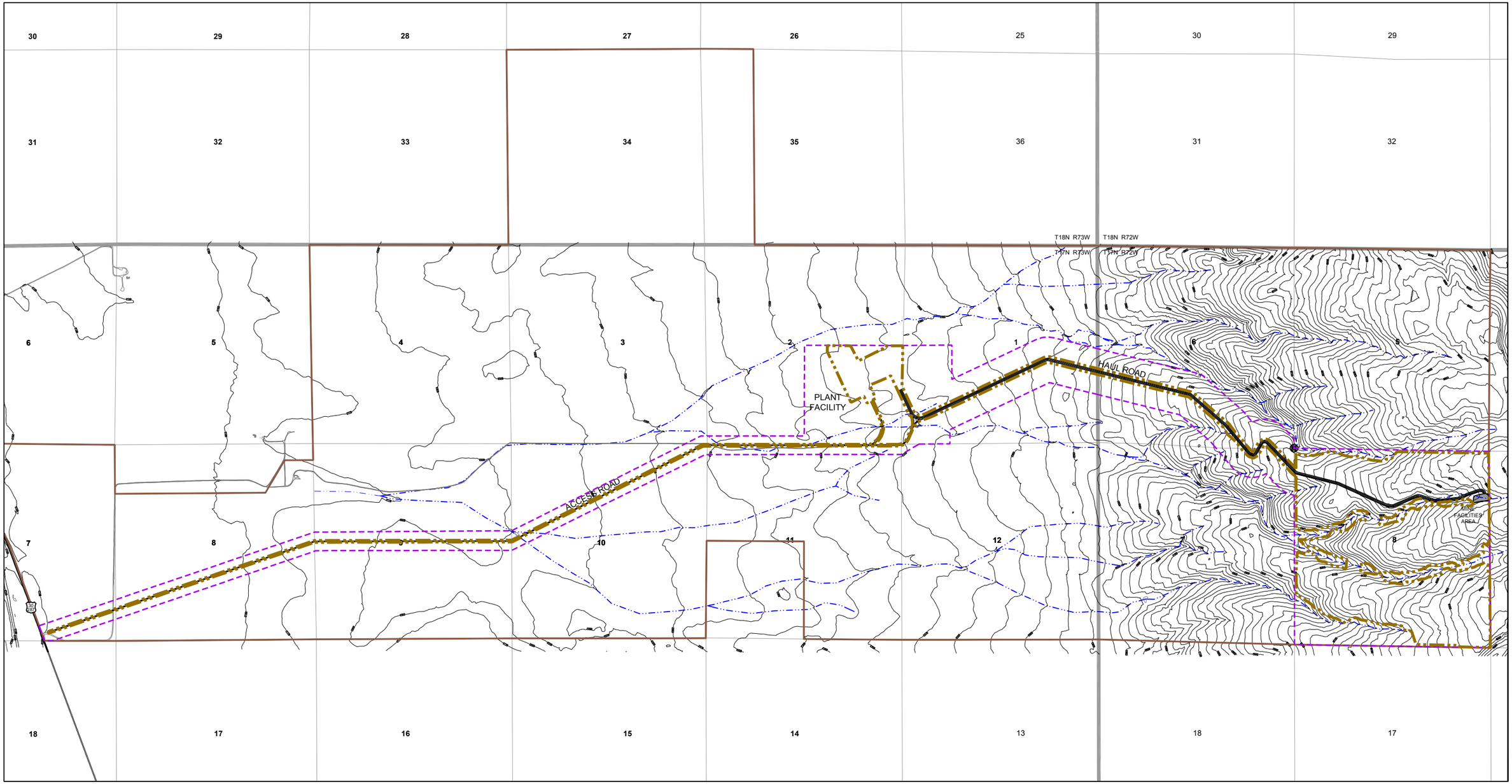
The slope of the mountain front east of the plant site correlates to the regional bedrock dip of 6 degrees west. The slope eases at the base of the mountain front to about 3 degrees near the plant site and tapers to less than 3 degrees along the access road toward U.S. Highway 287/30. Steeper slopes are present along the margins of the ephemeral drainages that dissect the resistant limestone cap rock along the mountain front. Slope analysis indicates that approximately 70 percent of the JPA has a slope less than 15 percent. Areas with slopes greater than 15 percent are restricted to the canyon sidewalls within portions of Sections 6, 7, and 8 of T17N, R72W. **Map 3-2** shows pre-mining topography of the JPA.

3.3 Paleontological Resources

BLM has classified geologic formations within the area managed by the field office according to the Potential Fossil Yield Classification. This is a planning tool whereby geologic units are classified according to the probability of yielding paleontological resources that are of concern to land managers. These classifications of paleontological resources determine the procedures to be followed before a paleontological clearance to proceed with a project can be granted.

- Class 1 – Igneous and metamorphic (tuffs are excluded from this category) geologic units or units representing heavily disturbed preservational environments that are not likely to contain recognizable fossil remains.
- Class 2 – Sedimentary geologic units that are not likely to contain vertebrate fossils or scientifically significant invertebrate fossils.
- Class 3 – Fossiliferous sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence. Also sedimentary units of unknown fossil potential.
- Class 4 – Class 4 geologic units are Class 5 units (see below) that have lowered risks of human-caused adverse impacts and/or lowered risk of natural degradation.
- Class 5 – Highly fossiliferous geologic units that regularly and predictably produce invertebrate fossils and/or scientifically significant invertebrate fossils, and that are at risk of natural degradation and/or human-caused adverse impacts.

The Chugwater Group is classified as Class 3. The redbeds of the Chugwater Group contain few fossils. Vertebrate tracks have been observed on Chugwater Group beds in the eastern Bighorn Basin (Branson 1947). The overlying Morrison Formation is well known for vertebrate fossils. Near Medicine Bow, Wyoming, to the north, fossil beds of dinosaur bones were discovered in 1877 at Como Bluff from the Morrison. Morrison Formation exposure is limited in the JPA as subcrops along a shallow drainage in the southern portion of Section 9 of T73W, R17N. A site walk of this area with Paleontologist Dr. Robert Bakker, PhD, resulted in observation of one thin limestone layer within the lower Morrison Formation. The remainder of the area was covered by a layer of colluvium and playa sediments. No vertebrate or invertebrate fossils were identified in this area during the site walk.



Section
Township
Jonathon Ranch Boundary
Permit Boundary
Ephemeral Drainage
Area of Disturbance
7900 Existing Ground Surface Contour (Contour Interval = 25')

N

0 1300 2600 5600 Feet

Map 3-2

Pre-mining Topography

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The quarry and plant sites would overlie the Casper Formation and the Satanka Shale, respectively. The access road from U.S. Highway 287/30 to the plant would be constructed largely on a thin layer of Quaternary alluvium (devoid of fossils) that may cover bedrock units including the Forelle Limestone, Chugwater group and the Morrison Formation. The paleontological resources for each of these bedrock units are described below. **Map 3-1** illustrates the geologic map units in the JPA.

The Casper Formation is classified as Class 3. Invertebrate fossil occurrences across the Casper Formation in southern Wyoming including brachiopods and crinoids range from common to rare (Thomas et al. 1953). In the vicinity of the JPA, the carbonate rocks are largely devoid of these invertebrate species. The primary fossils identified in the Casper Formation include fusulinid foraminifera, which have been utilized in age determination of the Casper Formation. Fusulinids are present in the basal portion of the formation at Rogers and Wall Rock Canyons located immediately south and north of the JPA, respectively (Thomas et al.1953). The same canyons also contain Fusulinids in the upper cherty limestones of the formation. The middle portions of the formation do not contain documented occurrences of Fusulinids. Based on the systematic paleontology of the area, the age of the Casper Formation in the JPA spans from the Desmoinian age (308-306.5 Ma) of the Pennsylvanian Period to the Wolfcampian age (299-280 Ma) of the Permian Period.

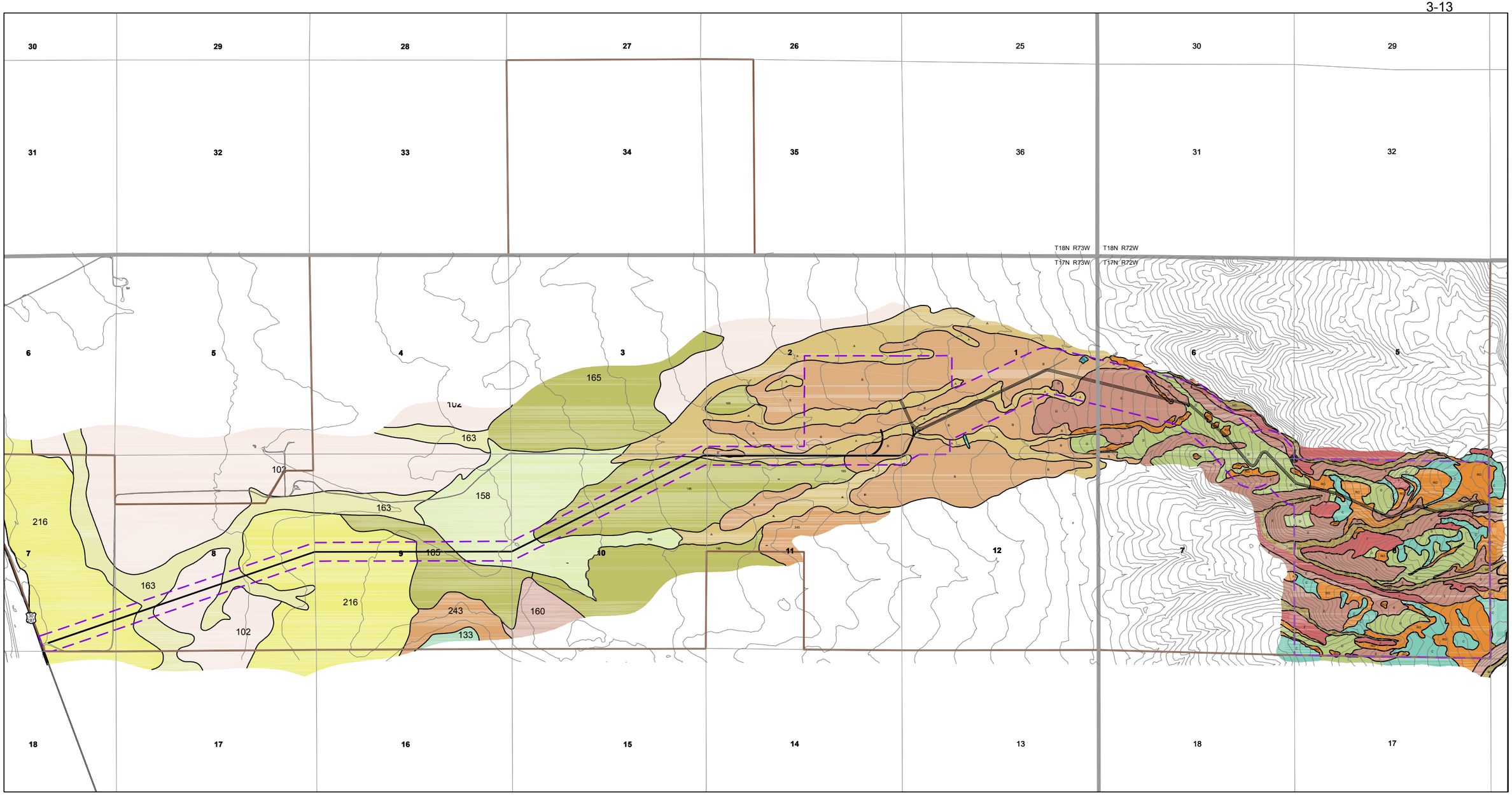
The Satanka and Forelle Formations are classified as Class 2. The upper portion of the Satanka Shale and overlying Forelle Limestone contain marine invertebrate fossils. Within the Satanka Shale near Laramie, pelecypods, gastropods, and scaphopods, and foraminifera have been identified in the upper 1.5 meters of the formation (Chen and Boyd 1997). Locally, the overlying Forelle Limestone contains algal stromatolites. Exposures of these units are limited across the access road area and largely covered by alluvium and colluvium.

3.4 Soils

A detailed Order 1-2 soil survey was conducted on all portions of the JPA, approximately 1,442 acres in size. The JPA includes all of Section 8 (T17N, R72W), approximately 640 acres within which the proposed limestone mining would occur; portions of Sections 6 and 7 (T17N, R72W) and Sections 1, 2, and 11 (T17N, R73W), approximately 555 acres within which the haul road study corridor and proposed plant site are located; and approximately 247 acres containing the access road corridor. Some lands adjacent to the JPA also were included in the detailed soils mapping.

The JPA is located within Major Land Resource Area “34A,” Cool Central Desertic Basins and Plateaus (U.S. Department of Agriculture [USDA]-Natural Resources Conservation Service [NRCS] 2006). It is within two soil temperature regimes – a “frigid” regime on the access road corridor, plant site, and lower part of the haul road corridor; and a “cryic” regime on the higher elevation quarry. The frigid area has an average annual air temperature of about 40°F to 45°F, an “ustic-aridic” soil moisture regime (mean annual precipitation about 10 to 14 inches), and a frost-free period of about 85 to 110 days (Reckner 1998). The colder “cryic” regime has an average annual air temperature of about 38°F to 40°F, an “ustic” soil moisture regime (mean annual precipitation about 15 to 19 inches), and a frost-free period of less than 60 days.

Map 3-3 illustrates soil map units in and adjacent to the JPA and access road corridor. **Table 3-3** describes all map units delineated on the access road corridor, mine area, haul road corridor, and plant site. The following text is a description of the JPA soil map units and their component soils presented in alphabetic order by map unit symbol.



Section
Township
Jonathon Ranch Boundary
Permit Boundary

Map Unit	Description
A	Ryan Park fine sandy loam, 1 to 8% slopes
B	Fiveoh, cobbly substratum, fine sandy loam, 2 to 12% slopes
C	Splitro-Miracle complex, 2 to 16% slopes
D	Cheadle-Rock Outcrop complex, 6 to 40% slopes
E	Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex, 6 to 60% slopes
F	Cryorthents, 6 to 60% slopes
G	Pilot Peak-Canwall complex, 3 to 20% slopes
MD	Telecan sandy loam, 2 to 16% slopes
RO	Rock Outcrop-Cheadle complex, 4 to 50% slopes
DL	Disturbed Land

Map Unit	Description
102	Alcova-Borollic Camborthids complex, 0 to 8% slopes
133	Cantle loam, 0 to 3% slopes
158	Fiveoh-Fiveoh, cobbly Substratum-Ryan Park complex, 1 to 8% slopes
160	Fiveoh, cobbly substratum-Joemre fine sandy loams, 1 to 5% slopes
163	Forelle loam, 0 to 6% slopes
165	Forelle-Diamondville association, 3 to 15% slopes
216	Rock River sandy loam, 2 to 6% slopes
243	Wycolo-Tieside sandy loams, 3 to 10% slopes
244	Wycolo-Thermoplois-Rock outcrop complex, 10 to 50% slopes

N

0 1300 2600 5600 Feet

Map 3-3

Soil Map Units

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Table 3-3 Soil Map Units and Salvage Depths

Map Unit Symbol	Map Unit Name	Total Soil Depth (inches)	Topsoil/ Subsoil Salvage (inches)
A	Ryan Park fine sandy loam,1 to 8 percent slopes	40+	4 / 55
B	Fiveoh, cobbly substratum, fine sandy loam, 2 to 12 percent slopes	40+	4 / 56
C	Splitro-Miracle complex, 2 to 16 percent slopes (Sp=60 percent, Mi=40 percent)*	Sp: 10-20 Ave=15 Mi: 20-26 Ave=23.5	4 / salvage to bedrock contact
D	Cheadle-Rock Outcrop complex, 6 to 40 percent slopes (Ch=75 percent, RO=25 percent)*	Ch:10-20 Ave=15 RO: 0”	Ch: 15 RO: 0, 0
E	Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex, 6 to 60 percent slopes (Ch=40 percent, Pa=35 percent, RO=25 percent)*	Ch: 10-20 Ave=18 Pa: 20-26 Ave=22 RO: 0	Ch: 4 / salvage to bedrock contact Pa: 4/ salvage to bedrock contact RO: 0, 0
F	Cryorthents, 6 to 60 percent slopes	14-26 Ave=21	4 / salvage to bedrock contact
G	Pilot Peak-Canwall complex, 3 to 20 percent slopes (Pi=65 percent, Ca=35 percent)*	Pi: 4-20 Ave=16 Ca: 20-30 Ave=24	Pi: 4 / salvage to bedrock contact Ca: 4/ salvage to bedrock contact
MD	Telecan sandy loam, 2 to 16 percent slopes	40+	6 / salvage to bedrock contact
RO	Rock Outcrop-Cheadle complex, 4 to 50 percent slopes (RO=80 percent, Ch=20 percent)*	RO: 0 Ch: 2-6 Ave=3.5	Ch: salvage to bedrock contact RO: 0, 0
DL	Disturbed Land	0	0, 0

* Percent of map unit that each listed component comprises (for example, Splitro comprises about 60 percent of Map Unit C and Miracle about 40 percent).

Map Unit A: Ryan Park fine sandy loam, 1 to 8 percent slopes

Ryan Park fine sandy loam (Map Unit A) is mapped on gently sloping upland drainageways located on the eastern portion of the access road, in the plant site area and lower end of the haul road corridor. Ryan Park also is mapped in a small portion of the access road corridor. The map unit is similar to NRCS Map Unit 158 (Fiveoh-Fiveoh, cobbly substratum-Ryan Park complex, 1 to 8 percent slopes) except field and laboratory data indicate only Ryan Park is present in this map unit in the JPA. Map Unit A comprises approximately 79 acres of the 1,442-acre JPA, about 5 percent of the total area.

Ryan Park fine sandy loam is a deep, well-drained soil that is forming in coarse-textured local alluvium. Ryan Park is classified as a coarse-loamy, mixed, superactive, frigid Ustic Haplargid. Ryan Park is an established soil series of moderate extent mapped in the high intermountain valleys of southern Wyoming, and south-central and northwest Colorado. The most recent NRCS official soil series description for Ryan Park, dated February 1999, is on file.

Map Unit B: Fiveoh, cobbly substratum, fine sandy loam, 2 to 12 percent slopes

Fiveoh, cobbly substratum, fine sandy loam (Map Unit B) is mapped on gently to moderately sloping low upland ridges located on the eastern portion of the access road, in the plant site area and lower end of the haul road corridor. Fiveoh, cobbly substratum, also is mapped in a small portion of the access road corridor. The map unit is similar to NRCS Map Unit 160 (Fiveoh, cobbly substratum-Joemre fine sandy loams, 1 to 5 percent slopes) except field and laboratory data indicate only Fiveoh, cobbly substratum, is present in this map unit in the JPA. Map Unit B comprises approximately 194 acres of the 1,442-acre JPA, about 13 percent of the total area.

Fiveoh, cobbly substratum, fine sandy loam, is a deep, well-drained soil that is forming in coarse-textured local alluvium. Fiveoh is classified as a coarse-loamy, mixed, superactive, frigid Ustic Haplocalcid. Fiveoh is an established soil series of moderate extent mapped in southern Wyoming. The most recent NRCS official soil series description for Fiveoh, dated May 2005, is on file.

Map Unit C: Splitro-Miracle complex, 2 to 16 percent slopes

Splitro-Miracle complex (Map Unit C) is mapped on gently sloping cuesta dip slopes in the limestone-dominated higher elevation areas within the quarry, mainly in Section 8 (T17N, R73W). Splitro and Miracle soils are located on narrow, arcuate-shaped, red sandstone areas (bands) that are interbedded with limestone and outcrop in a stair-step pattern as you go up in elevation to the east across Section 8. Splitro and Miracle soils are developing in moderately coarse-textured residuum from the red sandstone. Map Unit C comprises approximately 109 acres of the 1,442-acre JPA, about 8 percent of the total JPA. Although small in acreage, both Splitro and Miracle soils are entirely suitable for salvage to the sandstone bedrock contact, and should be fully salvaged where projected to be disturbed.

Splitro is a shallow, well-drained soil, averaging 15 inches to red sandstone. Miracle is a moderately deep, well-drained soil averaging 23 inches to red sandstone. These soils are considered small inclusions in Map Unit 141 (Cheadle-Passcreek, cobbly subsoil-Rock Outcrop complex, 5 to 25 percent slopes) in the less detailed NRCS Order 3 soil survey (Reckner 1998). They are delineated as a separate map unit (Map Unit C) in the current more detailed Order 1-2 survey.

Map Unit D: Cheadle-Rock Outcrop complex, 6 to 40 percent slopes

Cheadle-Rock Outcrop complex (Map Unit D) is mapped on gently sloping dip slopes and ridge sideslopes in the limestone-dominated higher elevation areas of the quarry and haul road corridor, mainly in Section 8 (T17N, R73W). Cheadle gravelly sandy loam comprises about 75 percent of Map Unit D, and Rock Outcrop about 25 percent. Map Unit D comprises approximately 182 acres of the 1,442-acre JPA, about 13 percent of the total JPA. Cheadle gravelly sandy loam is a shallow, well-drained soil developing in thin residuum and colluvium primarily from limestone but in some areas from thin sandstone lenses. Cheadle is a primary component of Map Unit 141 (Cheadle-Passcreek, cobbly subsoil-Rock Outcrop complex, 5 to 25 percent slopes) in the less detailed NRCS Order 3 soil survey (Reckner 1998). Map Unit D is mapped in areas where Passcreek, cobbly subsoil, is not present. This map unit contains soils with limited revegetation potential. The Cheadle soils are droughty with 25 percent or more rock fragments in the soil profile and are interspersed within the limestone rock outcrop, making these soils difficult to salvage with traditional methods. Biological crusts were evident on the soil surface and these soils support cushion plant communities.

Map Unit E: Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex, 6 to 60 percent slopes

Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex (Map Unit E) is mapped on gently sloping dip slopes and steeply sloping ridge sideslopes in the limestone-dominated higher elevation areas within the proposed mining area and haul road corridor, mainly in Section 8 (T17N, R73W). Map Unit E is very similar to Map Unit 141 (Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex, 5 to 25 percent slopes) in the less detailed NRCS Order 3 soil survey (Reckner 1998), except the percent compositions of the primary components (Cheadle, Passcreek, and Rock Outcrop) are slightly different and the slope range is greater. In Map Unit E, Cheadle gravelly sandy loam comprises about 40 percent; Passcreek, cobbly substratum, about 35 percent; and Rock Outcrop about 25 percent. Map Unit E comprises approximately 226 acres of the 1,442-acre JPA, about 16 percent of the total JPA.

Cheadle gravelly sandy loam was previously described in Map Unit D above. The “C” horizon substratum of Cheadle in Map Unit E also has between 35 and 45 percent coarse fragments (gravel and cobble size limestone fragments) and therefore is considered “loamy-skeletal.” The additional profile description for Cheadle follows below. Descriptive information and profile descriptions for Passcreek, cobbly substratum, subsequently follow.

Passcreek, cobbly substratum, gravelly sandy loam is a moderately deep, well-drained soil developing in slopewash alluvium, colluvium, and residuum primarily from limestone but also including sandstone in some areas. Passcreek, cobbly substratum, was a primary component of Map unit 141 in the less detailed Order 3 soil survey (Reckner 1998). Passcreek is classified as a fine-loamy, mixed, superactive Ustic Argicryoll, and is an established soil series of moderate extent mapped in the mountains of Wyoming and Colorado. The most recent NRCS official soil series description for Passcreek, dated August 2002, is on file.

Map Unit F: Cryorthents, 6 to 60 percent slopes

Cryorthents (Map Unit F) are mapped on gently sloping to steeply sloping ridge sideslopes scattered across the higher elevation areas within the proposed mining area and haul road corridor, mainly in Section 8 (T17N, R73W). Map Unit F (Cryorthents) is somewhat similar to Map Unit 208 (Rimton-Passcreek, cobbly subsoil-Miracle complex, 10 to 60 percent slopes) in the less detailed NRCS Order 3 soil survey (Reckner 1998). Both map units are on north-facing mountain and canyon sideslopes with diverse vegetation including trees (limber pine and aspen), shrubs and grasses. In Map Unit F, Cryorthents are shallow to moderately deep, well-drained soils developing in slopewash alluvium, colluvium, and residuum from both sandstone and limestone bedrock.

Map Unit F comprises approximately 89 acres of the 1,442-acre JPA, about 6 percent of the total JPA. Cryorthents comprise about 85 percent of Map Unit F with Rock Outcrop comprising about 15 percent as a map unit inclusion. Because Cryorthents include more than one central soil series concept, general soil characteristics are not presented. The closest soil series is the Rimton soil, which is the primary component of NRCS Map Unit 208. Rimton is a moderately deep, well-drained soil forming in colluvium and residuum from interbedded sandstone and limestone. Rimton is both non-saline and non-sodic and has moderate permeability. Available water capacity is low and the effective rooting depth is the depth to bedrock. Run-off is rapid, the hazard of water erosion is severe, the hazard of wind erosion is moderate, and the hydrologic group number is “C.”

Map Unit G: Pilot Peak-Canwall complex, 3 to 20 percent slopes

Pilot Peak-Canwall complex (Map Unit G) is mapped on gently sloping to moderately steep cuesta dip slopes in the slightly lower elevation areas within the proposed haul road corridor in portions of Section 1 (T17N, R73W) and Section 6 (T17N, R72W). The general elevation of Map Unit G ranges from about 7,400 to 7,700 feet and the soils are considered to be in the “frigid” soil temperature regime, as opposed to the slightly higher, colder “cryic” regime (Reckner 1998). The Albany County soil survey uses approximately the 7,800 feet contour to separate “frigid” Aridisols receiving 10 to 14 inches of precipitation from “cryic” Mollisols receiving 15 to 19 inches of precipitation (Moore 1982). Map Unit G comprises approximately 75 acres of the 1,442-acre JPA, about 5 percent of the total JPA.

Pilot Peak is a shallow, well-drained soil averaging 16 inches to bedrock. Canwall is a moderately deep, well-drained soil averaging about 24 inches to bedrock. Both soils are developing in slopewash alluvium and residuum primarily from limestone but also from weathered sandstone in some areas. Map Unit G is the same as Map Unit 193 in the Order 3 NRCS soil survey (Reckner 1998) except the percent composition of Pilot Peak and Canwall are higher. Pilot Peak comprises about 65 percent of Map Unit G and Canwall about 35 percent. Small areas of sandstone and limestone rock outcrop also are present in Map Unit G.

Map Unit MD: Telecan sandy loam, 2 to 16 percent slopes

Telecan sandy loam (Map Unit MD) is mapped on narrow mountain drainages which traverse through canyons in the higher elevation areas within the quarry and upper portion of the proposed haul road corridor, mainly in Section 8 (T17N, R73W). The narrow mountain drainages were not separately delineated in the less detailed NRCS Order 3 soil survey (Reckner 1998). However, the drainages are present and were separately delineated as Map unit MD in the current Order 1-2 survey. Map Unit MD comprises approximately 61 acres of the 1,442-acre JPA, about 4 percent of the total JPA. Mountain drainages are not currently projected to be disturbed by mining activities.

Telecan is a deep, well-drained soil forming in slopewash and streamlain alluvium from interbedded sandstone and Limestone materials. Telecan is typically mapped in lower elevation (6,000 to 7,800 feet), “frigid” areas; however, there is not a “cryic” counterpart in the Albany County survey, so the Telecan series was extended for use in mountain drainages in the current survey.

Map Unit RO: Rock Outcrop-Cheadle complex, 4 to 50 percent slopes

Rock Outcrop-Cheadle complex (Map Unit RO) is mapped on gently sloping to steeply sloping, limestone-dominated dip slopes and ridge sideslopes in the higher elevation areas of the quarry and haul road corridor, mainly in Section 8 (T17N, R73W). Limestone Rock Outcrop comprises about 80 percent of Map Unit RO and Cheadle very gravelly sandy loam about 20 percent. The hard limestone bedrock, located throughout most of Section 8, is part of the “Pennsylvanian” age (300 to 275 million years old) Casper Formation (Benniran 1970).

Map Unit RO comprises approximately 209 acres of the 1,442-acre JPA, about 15 percent of the total JPA. The Cheadle soil in Map unit RO is very shallow to limestone bedrock (about 3 to 4 inches thick). This map unit contains soils with limited revegetation potential. Rock outcrop comprises the majority of this map unit with smaller areas of Cheadle soils interspersed between the outcroppings. Cheadle soils have 25 percent or more rock fragments in the soil profile making these soils difficult to salvage with traditional methods. Biological crusts were evident on the soil surface and these soils support cushion plant communities.

Map Unit DL: Disturbed Land

One small delineation of Disturbed Land (Map Unit DL) is located within the haul road corridor study area. This is an area, approximately 0.5 acre, where soil was excavated (prior to year 2000) to a depth of several feet. It remains disturbed although the previously salvaged topsoil remains stockpiled on the site. This small area was not sampled for laboratory characterization, and if re-disturbed, the stockpiled soil could be reused as salvaged material. No additional topsoil is available for salvage. There are no other areas of Disturbed Land in the JPA.

Map Unit 102: Alcova-Borollic Camborborthids

Alcova-Borollic Camborborthids complex (Map Unit 102) is mapped on alluvial fans and low terraces of the western portion of the access road in Section 8, (T17N, R73W). Alcova soil makes up approximately 45 percent of the complex and Borollic Camborborthids make up approximately 35 percent of the complex. Both soils are sandy loams. Map Unit 102 comprises approximately 20 acres of the 1,442-acre JPA, about 1 percent of the total JPA.

Map Unit 216: Rock River sandy loam

Rock River sandy loam (Map Unit 216) is mapped on gently sloping alluvial fans and terraces of the western portion of the access road in Sections 7, 8, and 9 (T17N, R73W). Rock River sandy loam comprises 80 percent of the map unit and approximately 85 acres of the 1,442-acre JPA, about 6 percent of the total JPA.

Map Unit 158: Fiveoh-Fiveoh, cobbly substratum-Ryan Park complex

Fiveoh-Fiveoh, cobbly substratum-Ryan Park complex is mapped on alluvial fans and terraces of the central portion of the access road in Sections 9 and 10 (T17N, R73W). The soil components are described above in Map Units A and B. Fiveoh-Fiveoh, cobbly substratum makes up approximately 60 percent of the complex and Ryan Park makes up 25 percent of the complex. Map Unit 158 comprises 27 acres of the 1,442-acre JPA, about 2 percent of the total JPA.

Map Unit 163: Forelle loam

Forelle loam is mapped on alluvial fans and fan aprons of the western portion of the access road in Section 8, (T17N, R73W). Forelle loam makes up 75 percent of the map unit. Map Unit 163 comprises 15 acres of the 1,442-acre JPA, about 1 percent of the total JPA.

Map Unit 165: Forelle-Diamondville association

Forelle-Diamondville association is mapped on gently sloping low hills and alluvial fans of the central and eastern portions of the access road in Sections 9 and 10 (T17N, R73W). Forelle loam makes up about 45 percent of the association and Diamondville makes up about 35 percent of the association. Map Unit 165 comprises 70 acres of 1,442-acre JPA, about 5 percent of the total JPA.

3.5 Water Resources

3.5.1 Surface Water

The JPA is located in the North Platte River Basin. The watershed containing the JPA consists of 18 sub-basins that constitute a different section or reach of a drainage channel. Surface water features in the JPA are limited to ephemeral drainages. These ephemeral streams typically only discharge storm water following high precipitation events or snowmelt events. There are no recorded springs in the JPA. Because no perennial waters or springs exist within the JPA, representative water quantity and quality are not available. No stock ponds occur within the proposed quarry area in Section 8. Two stock ponds are located on the valley floor, one in the southwest quarter of Section 1 (T17N, R73W), and one near the east quarter-corner of Section 4 (T17N, R73W). At higher elevations, another pond occurs in the southwest quarter of Section 7 (T17N, R72W), and two ponds occur in the east half of Section 5 (T17N, R72W). All of these relatively small features are supplied by drainage from ephemeral tributary channels, and are typically dry by late summer or autumn. In the existing condition, run-off leaves the site quickly, in rapid response to snowmelt or rainfall. Once the available soil moisture is lost due to evapotranspiration, drier conditions return to the existing upland positions that dominate the watershed.

The topography within the JPA varies from the steep terrain and deep drainages on the east side of the site to the gently rolling hills near the Lime Plant to the relatively flat terrain and shallow drainage swales on the west side of the site. While there are distinct gullies and drainages through the steep eastern side of the JPA, the drainages become shallow and less pronounced in the western downgradient side of the JPA. On the west side of the JPA, the hillslope drainages disperse onto the valley floor. Because of this, the vegetation, shallow slopes, and well-drained soils on the west side of the JPA create a condition where surface water is easily infiltrated and storm water run-off is normally not observed. **Table 3-4** shows the 24-hour run-off volumes and associated peak discharges for the drainage sub-basins as shown on **Map 3-4**.

Table 3-4 24-hour Run-off Volumes and Peak Flows for Routed Sub-basins

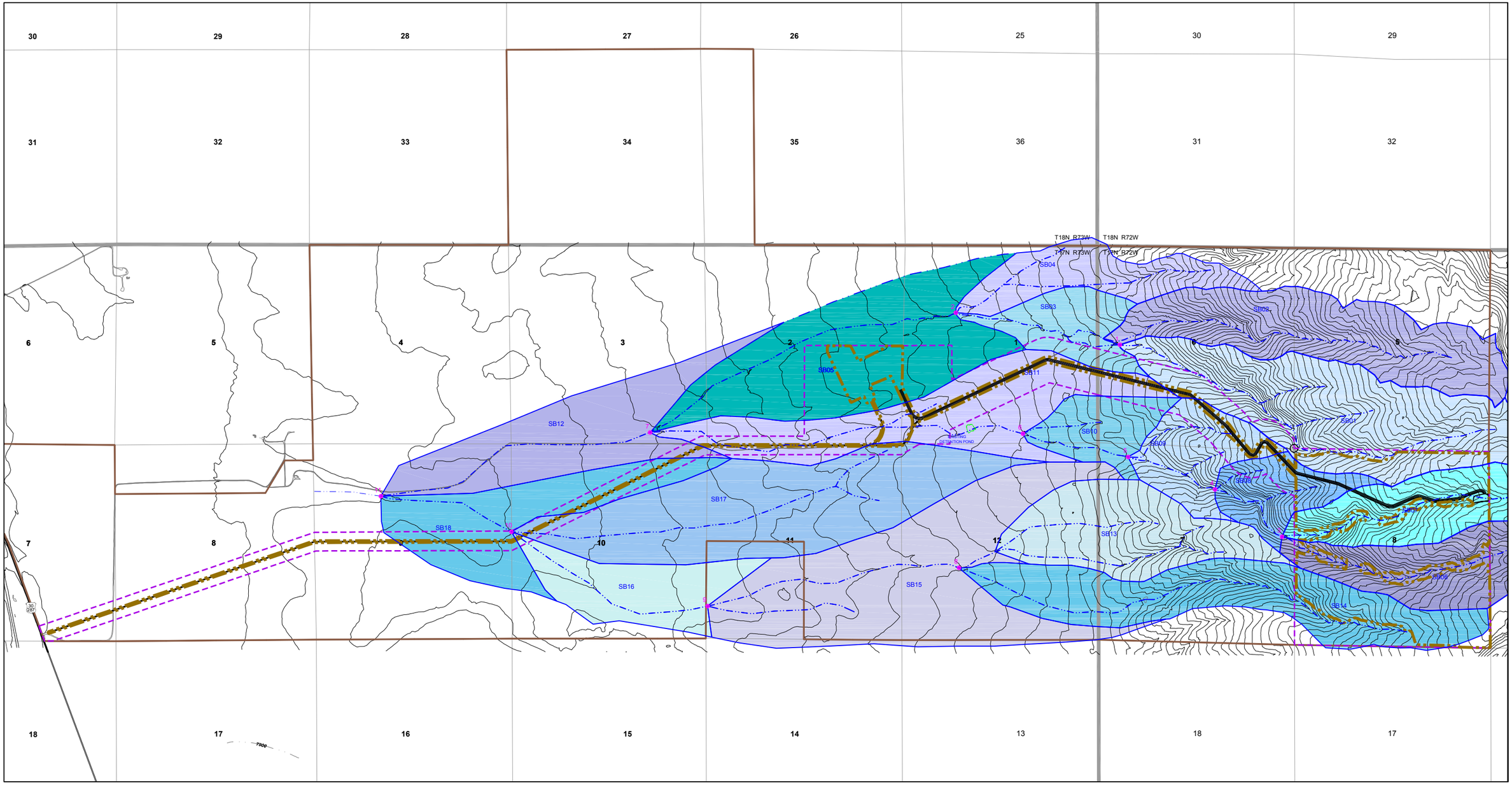
Node	Contributing Sub-basins	2-year, 24-hour		10-year, 24-hour		25-year, 24-hour		100-year, 24-hour	
		Total Run-off Volume (acre-feet)	Routed Peak Flow (cfs)	Total Run-off Volume (acre-feet)	Routed Peak Flow (cfs)	Total Run-off Volume (acre-feet)	Routed Peak Flow (cfs)	Total Run-off Volume (acre-feet)	Routed Peak Flow (cfs)
1	01 to 02	0	0	2.97	3.74	8.03	14.97	15.23	47.24
2	01 to 04	0.17	0.25	5.61	6.75	13.34	28.48	23.96	78.48
3	06 to 07	0	0	2.28	3.20	5.45	14.32	9.76	45.47
4	06 to 08	0	0	2.76	3.79	6.69	17.21	12.05	56.21
5	06 to 09	0	0	3.37	4.55	8.25	20.86	14.94	68.96
6	06 to 10	0.39	0.55	5.55	11.72	11.95	42.30	20.45	112.24
7	01 to 11	0.17	0.25	5.94	6.75	20.31	28.21	43.85	79.65
8	13 to 14	0.17	0.32	4.71	8.03	10.08	31.87	17.12	76.78
9	13 to 15	0.16	0.31	4.85	8.02	11.64	31.78	21.47	77.09
10	13 to 17	0.50	0.78	10.57	16.41	23.39	46.37	41.03	103.23
11	01 to 18	0.66	1.26	18.29	23.86	48.68	75.33	94.51	186.26

cfs = cubic feet per second.

Pre-mine hydrologic calculations were completed using Eagle Point Watershed Modeling module. The Technical Release 55 (TR-55) method within Eagle Point assumes a 24-hour Type I, IA, II, or III Rainfall Hyetograph and that the study area has received 1.4 to 2.1 inches of rain prior to the design storm. TR-55 determines a hydrograph from each individual drainage basin within the JPA in order to route storm water run-off through these drainage basins to the outlet point(s).

Based on the hydrologic analysis, further hydraulic calculations were performed for the 100-year, 24-hour peak flows in the ephemeral channels that transect the central part of the quarry. Based on a site visit, channel geometries and roughness conditions were estimated for input. Results indicate that the peak flows would remain within the existing channel banks, and not expand out beyond the tops-of-banks into the proposed 150-foot buffer zones.

All drainages within the JPA are ephemeral and only contain surface flow during snowmelt or heavy rainfall events. These drainages were evaluated during the field surveys to determine if they would qualify as other waters of the U.S. as defined by the U.S. Army Corps of Engineers (USACE). Some of the drainages exhibited a defined bed and bank at the higher elevations, but none exhibited a continuous defined bed or bank at the lower elevations. At the lower elevations all drainages within proposed disturbed areas of the JPA also were vegetated entirely by upland vegetation species once they reached flatter terrain in the western portion of the JPA. As a result, the USACE would not likely classify any of the drainages that would be disturbed within the JPA as jurisdictional.



Section
Township
Jonathon Ranch Boundary
Permit Boundary
Ephemeral Drainage
Area of Disturbance
Existing Ground Surface Contour (Contour Interval = 25')
Drainage Node
Pre-mine Sub-basin

N

0 1300 2600 5600 Feet

Map 3-4

Pre-mine Surface Water Drainages and Sub-basins

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

3.5.2 Groundwater

Groundwater occurs within three formations in the JPA. The Casper, Satanka, and Chugwater Formations receive recharge along the western margin of the Laramie Range including the area near the proposed plant site. Recharge to the aquifers within these formations occurs primarily through infiltration of precipitation. Groundwater flow is generally from east to west under a horizontal gradient of about 120 feet per mile. Flow direction is controlled largely by the westerly dip of sedimentary bedrock and the surface topography. Regionally, the Casper Aquifer is the most prominent aquifer with wells that typically produce 50 to 100 gpm. Wells screened across fracture zones can produce 1,000 gpm under confining conditions.

In May 2007, well MW-3 (**Map 3-1**) was drilled near the boundary of Sections 7 and 8 (T17N, R72W) (approximately 500 feet southwest of the east ¼ corner of Section 7). The well was completed to a depth of 620 feet below ground surface (bgs) and screened from 496 to 616 feet bgs. This screen interval bracketed the lower Casper Formation to the top of the crystalline basement rocks. At the time of pump installation, the static level in the well was measured at 500 feet bgs; it was not clear at that time if the water was in the well from the drilling process or groundwater. The well was pumped dry after pump installation and groundwater did not recover. To confirm the lack of recovery, the well was pumped again in July with no discharge from a pump installed at 610 feet bgs.

The log of MW-3 includes an interbedded assemblage of limestones and fine-grained buff, pink, and red-colored calcareous sandstones. The key limestone units from MW-3 that correspond to target units identified in the mine project and confirmed against exploration cores include:

- Limestone #7 (surface to 20 feet);
- Limestone #4 (87 to 106 feet and 116 to 142 feet); and
- Limestone #3 (204 to 250 feet).

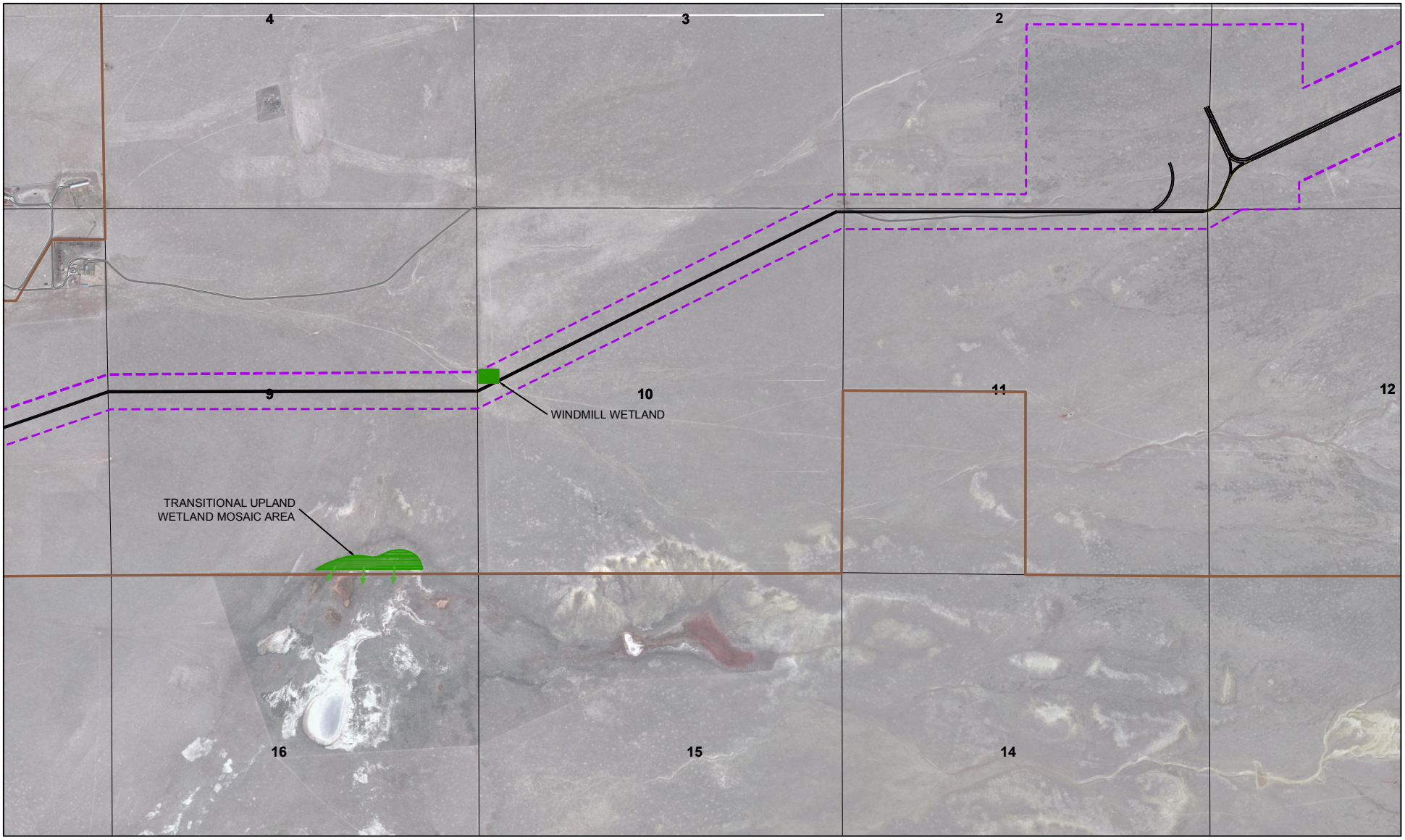
The results from MW-3 show that the static groundwater is more than 610 feet bgs and below the Casper Formation in the proposed quarry area.

A geotechnical assessment of the proposed plant area in Section 2 (T17N, R73W) was completed in November 2006. As part of the assessment several soil borings were advanced into the Satanka Formation to depths of up to 125 feet bgs with no evidence of groundwater (Inberg-Miller Engineers 2007). Well records obtained from the Wyoming State Engineer's Office indicate static levels of groundwater are approximately 180 feet bgs in the plant area. Static water levels decrease in depth to the west to less than 50 feet bgs.

3.5.3 Wetlands

U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory (NWI) mapping does not show any wetlands within the JPA. A field reconnaissance of the JPA was completed on August 10, 2006, and again on September 25, 2007, to locate any possible wetlands within the JPA not shown on NWI mapping (Cedar Creek Associates 2007). Two wetlands were found within or near the JPA as shown on **Map 3-5**.

One small (0.2 acre) wetland was supported in a small depression that receives windmill pump overflow. This wetland is within the JPA near the access road at the west edge of Section 10 (T17N, R73W). This area consists of a shallow, open-water pond with a shoreline fringe of wetland vegetation. Dominant species around the perimeter of the pond were Baltic rush (*Juncus balticus*), foxtail barley (*Critesion jubatum*), and bulrush (*Schoenoplectus palustris*). Soil moisture conditions were very dry at the time of the August 10, 2006 survey and these wetland-associated species were mostly dormant. When this wetland was revisited on September 25, 2007, open water was present, but fringe wetland vegetation was essentially non-existent



Section
Jonathon Ranch Boundary
Permit Boundary

N

0 1000 2000 4000 Feet

Map 3-5

Wetland Areas

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

due to cattle grazing and trampling. Soils beneath open water were gleyed and exhibited a matrix chroma of 2.5/N (gley chart 2) and had a sulfidic odor. Soils in the shoreline zone exhibited a matrix color of 10 YR 3/2 with common and distinct mottles (5 YR 5/6). This wetland had no drainage or wetland connection to other wetlands or waters of the U.S. and would be classified as an isolated wetland by the USACE (Cowardin et al. 1979).

The second area (9.2 acres) is transitional emergent wetland with 85 percent of the area classified as upland and is located south of the JPA boundary at the southern edge of Section 9 (T17N, R73W).

No other wetlands were observed within or near the JPA. Stock ponds present within or near the proposed mine portion of the JPA were totally dry during both field surveys, and there were no remnant stands of any wetland associated vegetation supported within or around the perimeter of these ephemeral ponds. Section 3.10, Land Use, provides a more detailed discussion regarding stock ponds and other water-related range improvements.

3.5.4 Water Rights

The Wyoming State Engineer's Water Rights Database has been searched for overall surface water and groundwater appropriations information in and near the mine area. The surface water and groundwater appropriations within the JPA are listed in **Table 3-5**.

3.6 Vegetation

The JPA is divided between two ecoregions, the Wyoming Basin and the Southern Rockies (Chapman et al. 2004). The eastern portion of the JPA is located in the mountains of the Laramie Range, while the western portion of the JPA is the located in the plains of the Laramie Basin. Detailed mapping and site-specific surveys of the JPA were conducted in 2007 and 2009. The survey methodology, species lists, and representative photographs are included in the Mine Plan, Appendix D-8. The surveys identified five major vegetation communities and two minor communities, plus one larger ecotonal type within the JPA. These include: 1) big sagebrush steppe, 2) dwarf sagebrush/grassland, 3) mixed-grass prairie, 4) mountain mahogany shrubland, 5) rocky/cushion plant, 6) aspen woodland (minor), 7) pine woodland (minor), and 8) pine savanna (ecotonal). **Table 3-6** lists the acres of each vegetation community type and ecotone in the JPA, and **Map 3-6** for a map of the vegetative mapping of the vegetation communities and ecotones.

The site-specific surveys also established control areas and references areas (reference areas) for each of the major communities identified during the survey. The reference areas are intended to be used for comparisons with the reclaimed quarry area in the determination of the success of revegetation goals when the reclaimed lands are considered for full bond release. The reference areas were validated based on sampling of quantitative variables, and statistical testing against the baseline area's variables as outlined in Wyoming DEQ Land Quality Division Guideline No. 2 Vegetation (**Appendix B**, **Attachment 4**). For a summary of the statistical analysis see the Mine Plan, Appendix D-8.

Table 3-5 Water Rights on File with the Wyoming State Engineer's Office (within JPA)

Appropriation	Priority	TWP	RNG	Sect	Quarter	QtrQtr	Status	Uses[1]	Facility Name	Applicant Name	Amount (gpm)	Permit Well Depth	Permit Static Well Depth
P395C	12/31/1905	17 N	73 W	10	7	SWNW	UNA	STO	TREGONING CORRAL WELL	KING BROTHERS CO.	5	125	85
P55225W	12/30/1980	17 N	73 W	8	16	SESE	UNA	IRR	NEEDMORE #3	NEEDMORE LAND & CATTLE CORP.	1600	--	--
P55225W	12/30/1980	17 N	73 W	8	15	SWSE	UNA	IRR	NEEDMORE #3	NEEDMORE LAND & CATTLE CORP.	1600	--	--
P55225W	12/30/1980	17 N	73 W	8	11	SWSW	UNA	IRR	NEEDMORE #3	NEEDMORE LAND & CATTLE CORP.	1600	--	--
P55225W	12/30/1980	17 N	73 W	8	12	SESW	UNA	IRR	NEEDMORE #3	NEEDMORE LAND & CATTLE CORP.	1600	--	--
P392C	12/31/1940	17 N	72 W	6	7	SWNW	UNA	STO	NORTH CORRAL #2 WELL	KING BROTHERS CO.	5	225	190

[1] STO = Stock; IRR = Irrigation.

Table 3-6 Vegetation Community Types and Ecotones Within the JPA

Vegetation Communities and Ecotones	Acres	% of JPA
Major Vegetation Communities		
Big Sagebrush Steppe	57	4
Dwarf Sagebrush/Grassland	677	47
Mixed-grass Prairie	297	21
Mountain Mahogany Shrubland	163	11
Rocky/Cushion Plant	90	6
Minor Vegetation Communities		
Aspen Woodland	6	< 1
Pine Woodland	7	< 1
Ecotonal Vegetation Communities		
Pine Savanna	145	10
Total	**1,442**	**100**

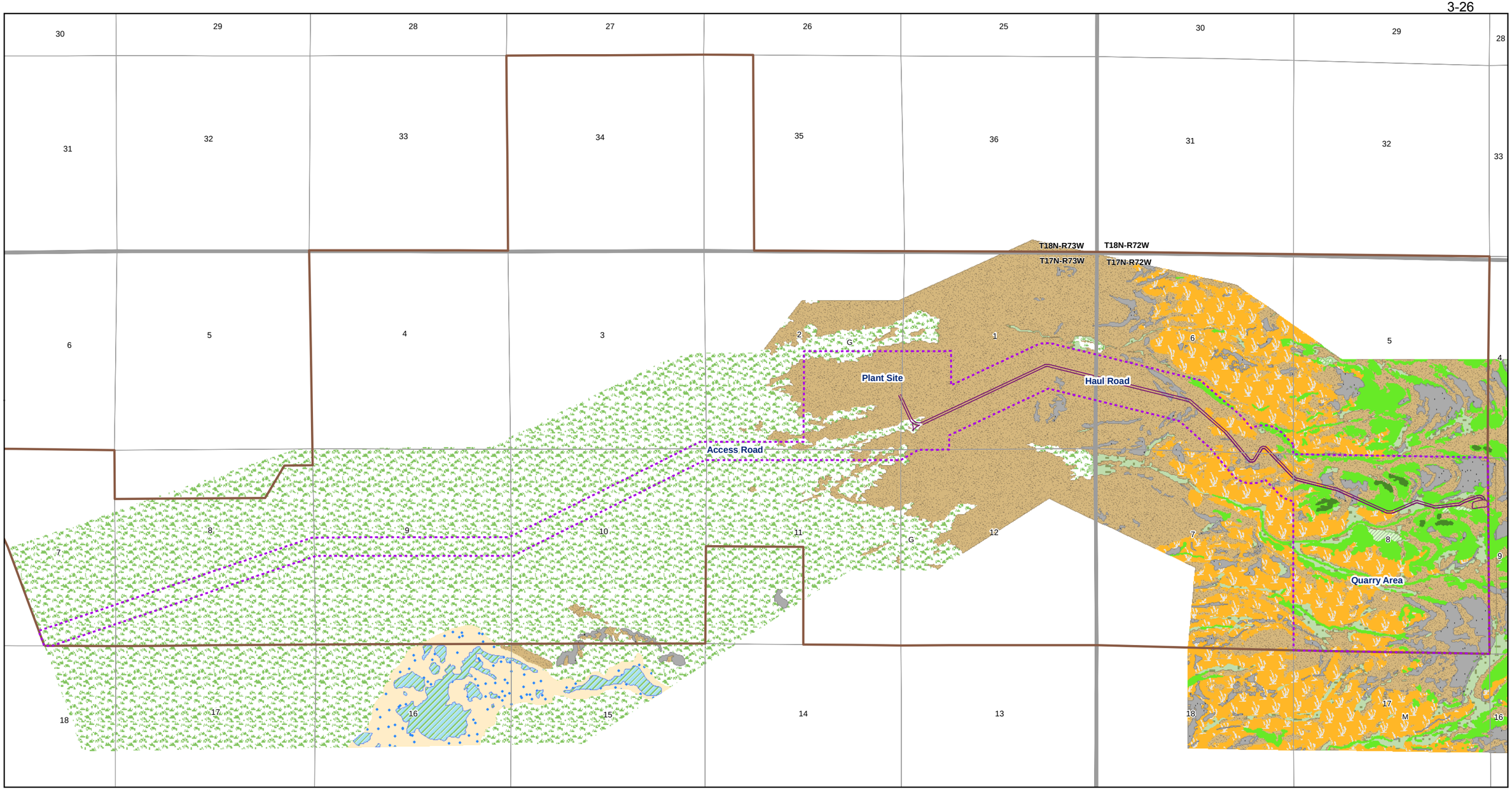
3.6.1 Vegetation Communities and Ecotone Descriptions

Big Sagebrush Steppe Community

This community type comprises 57 acres (4 percent) of the JPA as indicated on **Map 3-6**. The big sagebrush steppe community is generally found in areas of deeper, finer grained soils that exhibit elevated available moisture for plant use. These areas include drainage bottoms, areas immediately below rock outcrops, and areas where wind-deposited snow accumulates (snow catchments). A total of 66 and 32 plant species were intercepted by quantitative measures within this community type within the baseline study area and reference area, respectively. With regard to special status plant species, no threatened or sensitive species were observed during field evaluations within this community. However, the noxious weed, Canada thistle (*Cirsium arvense* var. *horridum*), was occasionally observed, typically in areas that were grazed by livestock. In addition, invasive species of concern, Japanese brome (*Bromus japonicus*), and cheatgrass (*Bromus tectorum)* were observed in the big sagebrush steppe communities in the JPA.

Dwarf Sagebrush/Grassland

This community type comprises 677 acres (47 percent) of the JPA as indicated on **Map 3-6**. The dwarf sagebrush/grassland community is visually dominated by two diminutive sagebrush species, black sagebrush (*Artemisia nova*) and three-tip sagebrush (*Artemisia tripartita* var. *rupicola*). Mixed-grass species are prevalent throughout this community and may dominate the floral composition in areas where the soil layer is thinner. Black sagebrush is the dominant sagebrush species at lower elevations (access and haul roads) and three-tip sagebrush is more dominant at high elevations (quarry area). A total of 64 and 23 plant species were observed in this community within the baseline study area and reference areas, respectively. With regard to special status plant species, no threatened or sensitive species, nor any noxious weeds, were observed during field evaluations within this community. An invasive species of concern, cheatgrass, was observed in the dwarf sagebrush/grassland communities in the JPA.



- Jonathon Ranch Boundary
- Permit Boundary
- Haul Road and Mine Facility Area

Vegetation Type

- Aspen Woodland
- Big Sagebrush Steppe
- Dwarf Sagebrush / Grassland
- Mixed Grass Prairie
- Mountain Mahogany Shrubland
- Pine Woodland
- Rocky / Cushion Plant
- Pine Savanna
- Transitional Upland-Wetland
- Wetland

N

0 1,300 2,600 5,200 Feet

Map 3-6

Vegetation Types

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

Mixed-grass Prairie

This community type comprises 297 acres (21 percent) of the JPA as indicated on **Map 3-6**. The mixed-grass prairie community is found along the access road (western portion) at the lowest elevations of the study area. This community type is comprised of a mix of short- and mid-grass species, along with the relatively flat or gentle topography. Grazing by cattle and occasional antelope occurs extensively in this community type. A total of 34 and 21 plant species were observed in this community type in the baseline study area and reference area, respectively. With regard to special status plant species, no threatened or sensitive species were observed during field evaluations within this community. However, the noxious weed, Canada thistle was occasionally observed.

Mountain Mahogany Shrubland

This community type comprises 163 acres (11 percent) of the JPA as illustrated on **Map 3-6**. The mountain mahogany shrubland community is found throughout the upper elevations of the JPA and is one of the dominant communities of mid-elevation slopes. This community is usually found on thin, dry, and skeletal soils. A total of 51 and 36 plant species were observed within this community in the baseline study and reference areas, respectively. This community has been heavily used by wildlife as observed during the site visits. Mountain mahogany communities provide cover and forage for wildlife. No threatened taxa, sensitive species, or noxious weeds were observed in this community. However, an invasive species of concern, cheatgrass, was observed in the mountain mahogany shrubland communities in the JPA.

Rocky/Cushion Plant

This final major community type comprises 90 acres (6 percent) of the JPA as illustrated on **Map 3-6**. A majority of the rocky/cushion plant community is located along the highest elevations (eastern portions) of the mine area. Soils are thin to non-existent in much of this community as most of the vegetation grows in depressions or cracks in the exposed limestone bedrock. Where soil deepens, a transition quickly occurs to the dwarf sage/grassland, pine savanna, or mountain mahogany types. A total of 67 and 38 plant species were observed from this community type in the baseline and reference areas, respectively. No threatened taxa, sensitive species, or noxious weeds were observed in this community.

Aspen Woodland

There are four distinct patches of aspen woodland community located in the JPA that in total encompass 6 acres (<1 percent of the area) combined (**Map 3-6**). They are located on relatively steep, north-facing slopes in the main mine area. A total of 44 plant species were intercepted from this community type in the baseline study area. No threatened or sensitive species were observed in this community. However, the noxious weed, Canada thistle, was occasionally observed in the understory.

Pine Woodland

There are four distinct patches of the pine woodland community located within the JPA that in combination encompass 7 acres (<1 percent of the area) (**Map 3-6**). They are located on relatively low-gradient, north facing slopes below the ridgelines in the main mine area. The understory vegetation cover in this community is relatively low due to the semi-closed canopy of the overstory and extensive use by cattle in the summer for forage and shade. Limber pine, a BLM sensitive species, is the dominant tree in this community as mature ponderosa pines were only found in the large woodland patch near a centrally located water tank. No young ponderosa pines were observed anywhere within the JPA. A total of 56 plant species were observed in this community type in the baseline study area. Furthermore, no threatened taxa, sensitive species other than limber pine, or noxious weeds were observed. However an invasive weed species of concern, German mad-wort (*Asperugo procumbens*) has overtaken approximately 0.5 acre of the woodland near the water tank. In addition, cheatgrass was observed in the pine woodland communities in the JPA.

Pine Savanna

The Pine Savanna is a transitional area (ecotone) between the shrub and grass communities and the established pine communities and encompasses 145 acres (10 percent) of the JPA. Limber pine, a BLM sensitive species, is the visually dominant plant in these areas although environmental conditions have limited the density of trees thereby leaving these areas with a very open canopy. The big sagebrush steppe, dwarf sagebrush/grassland, mountain mahogany, and rocky/cushion plant communities can be found between and among the trees and it can be argued that the limber pine is "invading" these communities. A total of 32 plant species were observed in this ecotonal type in the baseline study area. No threatened species, sensitive species other than limber pine, or noxious weeds were observed in this area. An invasive weed species of concern, cheatgrass was observed in the pine savanna communities in the JPA.

3.6.2 Noxious Weeds

Noxious and invasive weeds are a threat to native ecosystems and biological diversity based on their ability to increase in cover relative to surrounding vegetation and exclude native plants from an area. They impact the ability of the BLM to manage for multiple use, contribute to the loss of rangeland productivity, cause increased soil erosion, reduce native species diversity, cause loss of wildlife habitat and, in some instances, are hazardous to human and animal health and welfare. The Federal Plant Protection Act of 2000 (formerly the Noxious Weed Act of 1974) and Executive Order (EO) 13112 of February 3, 1999, require cooperation with state, local, and other federal agencies in the application and enforcement of all laws and regulations relating to the management and control of noxious weeds. Recognizing these regulations, the BLM has established a goal that NEPA documents consider and analyze the potential for the spread of noxious weed species and provide preventative rehabilitation measures for each management action involving surface disturbance.

For the Rawlins BLM Field Office, while the primary concern is the designated noxious weeds identified by the State of Wyoming (BLM 2008), a secondary concern is the control of invasive species (e.g., halogeton, henbane, and cheatgrass) that can impede successful reclamation and impact management of livestock, wildlife, and human activities. The State of Wyoming has defined noxious weeds as weeds, seeds, or other plant parts that are considered detrimental, destructive, injurious or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within the state, and are on the list designated by the Wyoming Statutes (Title 11, Chapter 5, Section 102.a.xi). The State of Wyoming list of Designated Noxious Weeds .S. 11-5-102 (a)(xi) and Prohibited Noxious Weeds W.S. 11-12-104 is on the Wyoming Weed and Pest Council website (http://www.wyoweed.org/statelist.html).

Of the prohibited and restricted noxious weed species found on the State of Wyoming list of Designated Noxious Weeds and Prohibited Noxious Weeds, only one species (Canada thistle) was encountered within the JPA and/or reference areas. Canada thistle, was found in small quantities in the Big Sagebrush Steppe, Aspen Woodland, and Mixed-grass Prairie communities. There were no large patches of this species found in the JPA.

Other weedy or invasive species that are of concern to the BLM due to their potential to impede reclamation were encountered during field surveys. These species include German-madwort, Japanese brome, cheatgrass, bull thistle (*Cirsium vulgare*), and curlycup gumweed (*Grindelia squarrosa*).

3.7 Terrestrial Wildlife

As described in Section 3.6, Vegetation, the major vegetation communities within JPA that are considered wildlife habitat are big sagebrush steppe, dwarf sagebrush/grassland, mixed-grass prairie, mountain mahogany shrubland, and rocky/cushion plant. Minor vegetation communities that are considered wildlife habitat include aspen woodland and pine woodland which account for less than 1 percent of the total JAP. An ecotonal vegetation community is also present within the JPA (pine savanna), this community is a transition area between the shrub and grass communities and the established pine communities. A field reconnaissance of the JPA was completed on August 10, 2006 and again on August 21, 2007. The

Wyoming Game and Fish Department (WGFD) was consulted regarding the potential presence of important habitats and wildlife or fisheries resources in the JPA. The Wyoming Natural Diversity Database (WYNDD) (2005) also was contacted to collect pertinent existing information on sensitive wildlife species and other species of concern in the JPA region. **Appendix D**, **Table D-1** lists all species potentially occurring on or near the JPA.

3.7.1 Big Game

The WGFD has mapped the JPA as winter-yearlong range for mule deer (*Odocoileus hemionus*) and spring-summer-fall range for pronghorn (*Antilocapra americana*). Field surveys documented the presence of both species. Mule deer observations were restricted to the higher elevation shrub and woodland habitats while pronghorn were observed in grassland habitats at both the higher and lower elevations of the JPA. No portions of the proposed project are located within mule deer or pronghorn crucial winter range or concentration areas. In addition, the WGFD has mapped winter/yearlong range east of the Lime Plant including the mine area and haul road (**Map 3-7**). Elk may be found within the JPA year-round but are probably more common during the winter/spring months when weather conditions force elk to migrate down from the higher elevations east of the JPA. The vegetation field survey crew also documented the presence of three elk (*Cervus elaphus*) during the June 2007 field survey.

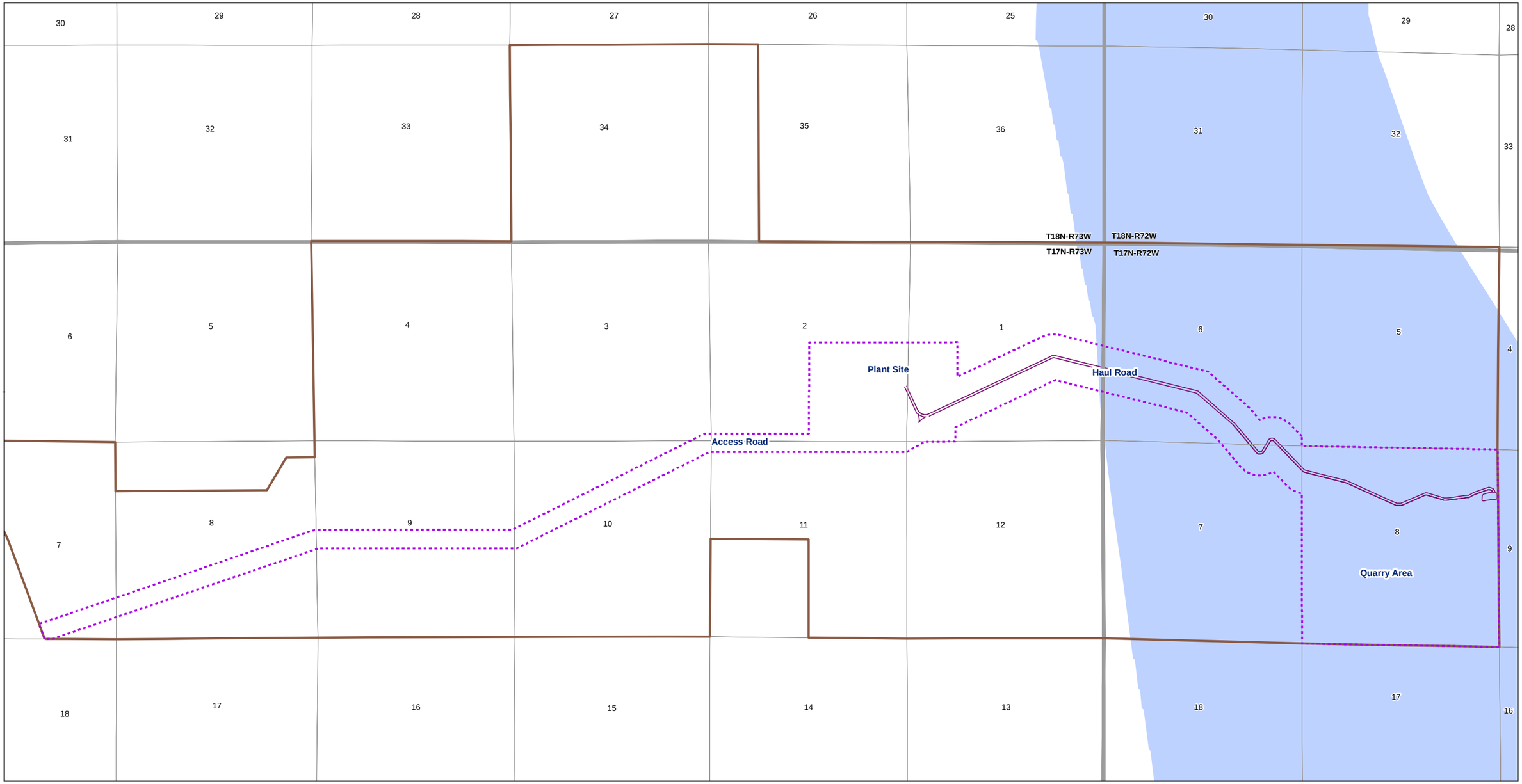
Mountain lion (*Felis concolor*) prey primarily on mule deer in the JPA region and, like their prey, are typically wide-ranging. Mountain lions would follow their prey's seasonal movement and inhabit summer range or winter range in conjunction with mule deer. They are typically shy and avoid areas with human activity. Like mountain lion, black bears (*Ursus americanus*) are wide ranging. Prime black bear habitat is characterized by relatively inaccessible terrain, thick understory vegetation, and abundant sources of shrub or tree borne soft or hard mast (Pelton 1982). Neither mountain lion nor black bear are likely to be common in the JPA. However, the vegetation field survey crew documented a single black bear in the JPA during the June 2001 field survey.

3.7.2 Predators, Furbearers, and Small Mammals

Due to the secretive nature and nocturnal habits of many furbearers and other small mammals, the specific distribution and population densities within the JPA are unknown. Furbearers and predators known or likely to occur in the area include coyote (*Canis latrans*), badger (*Taxidea taxus*), red fox (*Vulpes vulpes*), swift fox (*Vulpes velox*), long-tailed weasel (*Mustela frenata*), striped skunk (*Mephitus mephitus*), and bobcat (*Lynx rufus*). All of these species are adapted to a wide range of grassland and shrubland habitats. Field surveys documented the presence of coyote and badger. Further discussion of swift fox is provided under Special Status Species.

Other small mammals known or likely to be common inhabitants of the JPA include western small-footed myotis (*Myotis ciliolabrum*), long-eared myotis (*Myotis evotis*), little brown myotis (*Myotis lucifugus*), big brown bat (*Eptesicus fuscus*), desert cottontail (*Sylvilagus audubonii*), Wyoming ground squirrel (*Spermophilus elegans*), thirteen-lined ground squirrel (*Spermophilus tridecemlineatus*), least chipmunk (*Tamius minimus*), pine squirrel (*Tamiasciurus hudsonicus*), northern pocket gopher (*Thomomys talpoides*), deer mouse (*Peromyscus maniculatus*), olive-backed pocket mouse (*Perognathus fasciatus*), Ord's kangaroo rat (*Dipodomys ordii*), and bushy-tailed woodrat (*Neotoma cinerea*).

Black-tailed prairie dog (*Cynomys ludovicianus*) is known to inhabit grassland habitats in the region, but no prairie dog towns were observed in the JPA during the field surveys.



Permit Boundary
Jonathon Ranch Boundary
Township
Section
Haul Road and Mine Facility Area
Elk Yearlong/Winter Range

N

0 1,320 2,640 5,280 Feet

Map 3-7

Elk Yearlong/ Winter Range

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3.8 Special Status Species

3.8.1 Animals

The listing of species obtained from the WYNDD (WYNDD 2005) for the JPA and vicinity was reviewed to determine the potential presence of threatened, endangered, or BLM sensitive species within or near the JPA. This section focuses on animals as site-specific surveys have determined that no special status plant species are located in the JPA. Species on the WYNDD list with habitat requirements not present in the JPA were eliminated from this discussion. Based on this review and a review of the USFWS Mountain-Prairie Region list of threatened and endangered species, a listing of threatened, endangered, or BLM sensitive species potentially occurring in the JPA was developed (**Table 3-7**). **Table 3-7** also provides a summary of habitat requirements of these species as well as an evaluation of their potential presence in the JPA. None of the species listed in **Table 3-7** have known occurrence records within the JPA boundaries and only one, mountain plover, has a WYNDD occurrence record near the JPA (WYNDD 2005). It should be noted, however, that absence of species occurrence in the WYNDD listing is not proof that a species in question does not exist there. It is highly possible that investigations have not been conducted or reported, for species of concern within the JPA or surrounding region. However, based on species habitat requirements and field evaluation of habitat conditions within the JPA, ferruginous hawk, greater sage-grouse, sage thrasher, loggerhead shrike, Brewer's sparrow, swift fox, and northern leopard frog (all BLM sensitive species), are potential residents of the JPA.

<u>Greater Sage-grouse Management in Wyoming</u>

BLM Instruction Memorandum (IM) WY-2010-012 provides guidance to Wyoming BLM Field Offices on greater sage-grouse habitat management for proposed activities and resource management planning. The IM also provides consistency in management practices for Wyoming BLM Field Offices for the conservation of greater sage-grouse and their habitats. This IM is consistent with guidelines provided in the Governor's Sage-Grouse Implementation Team's Core Population Area strategy and the Governor's EO (2008-2). The IM also is consistent with the BLM National Sage-grouse Habitat Conservation Strategy and national policy issues for the 2009 wildfire season that provided guidance for conservation of sage-grouse "Key Habitats." Wyoming BLM sage-grouse Key Habitat Areas correspond to the State of Wyoming's Core Population Areas (Core Areas).

Core Areas were first developed in 2008 by the Wyoming Sage-grouse Implementation Team and local sage-grouse working groups and signed into effect by the Wyoming Governor at that time. The Core Areas establish boundaries based on high-resolution aerial photos, current breeding data, a statewide sagebrush cover map, actual permitted activity, and all other information available (including valuable anecdotal knowledge) relevant to local greater sage-grouse populations. The Core Area boundaries were modified further in 2010 based on the criteria listed above and released to the public on June 28, 2010. Current Core Area boundaries in the JPA are shown on **Map 3-8**. The Lime Plant and much of the access road are within the sage-grouse Core Breeding Area, while the quarry area and most of the haul road are outside of the Core Breeding Area.

3.8.2 Plants

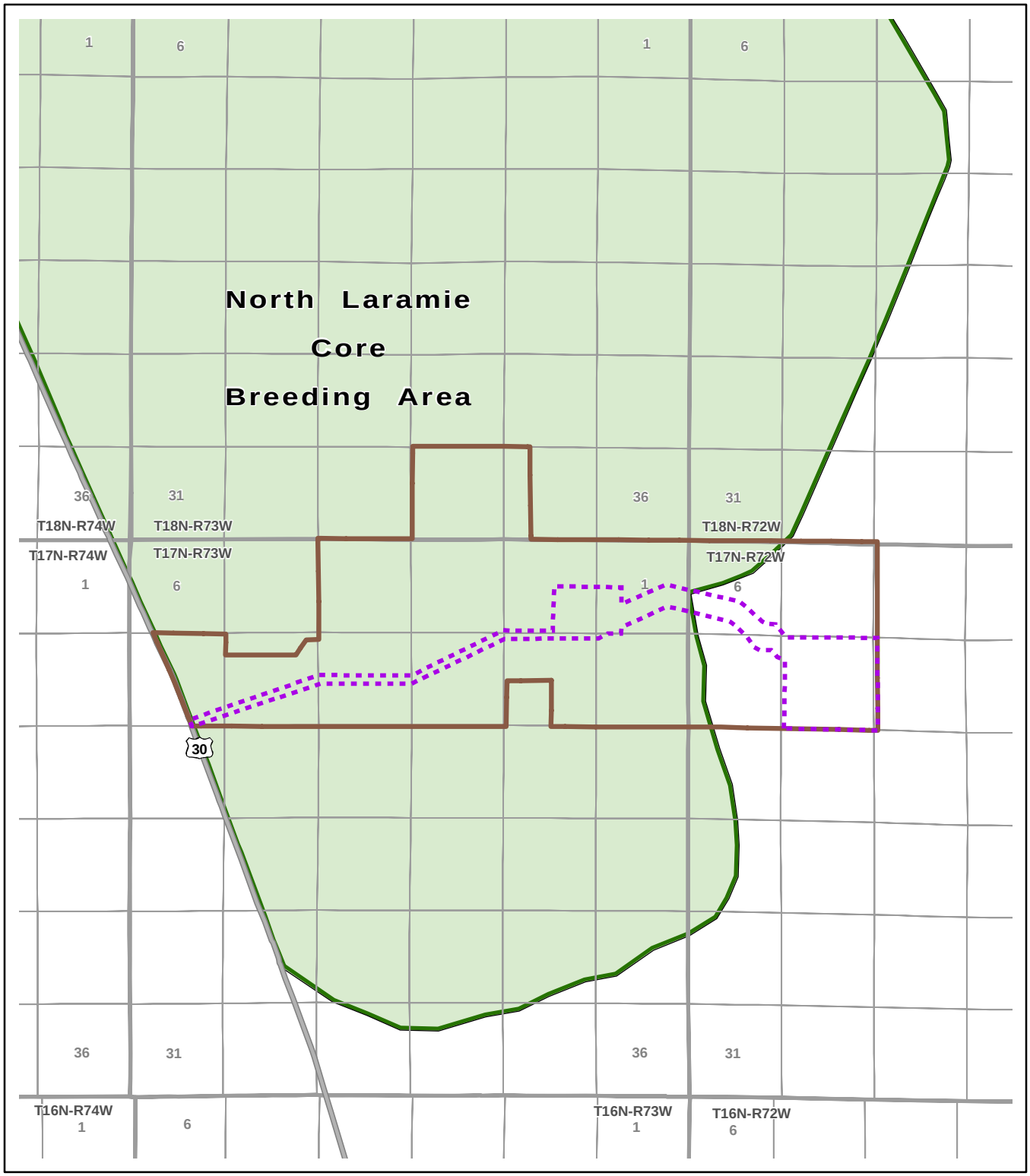
Field surveys were conducted monthly from April to September 2007 for sensitive, rare, threatened or endangered plant species on or near the JPA. No sensitive, rare, threatened or endangered plant species were observed to occur on or near the JPA other than limber pine (see Section 3.6.1).

Table 3-7 Wildlife Species of Concern Potentially Occurring Within the JPA

Common Name	Scientific Name	Status	Habitat	Comments
Greater sage-grouse	*Centrocercus urophasianus*	Wyoming BLM Sensitive; Federal Candidate Species	Sagebrush grasslands. Leks are located in open areas in close proximity to escape cover. Nests are located in sagebrush habitat, typically within 2 miles of the lek. Broods are raised in wet, grassy areas near sagebrush. Winter habitat consists of south and east facing slopes with minimal snow cover.	Potential habitat exists in grasslands surrounded by sagebrush shrublands. Nearest occupied lek is approximately 4 miles north of the JPA. A majority of the JPA is within the North Laramie Core Breeding Area and therefore, contains important habitat for this species.
Wyoming toad	*Bufo baxteri*	Endangered Species Act (ESA) listed as Endangered	Formerly associated with the floodplains of the Big and Little Laramie Rivers. Now restricted to a 2-square-mile area associated with a lake (Mortenson Lake) and surrounding wet meadows in the Laramie Basin of Albany County (USFWS 1991).	Former distribution never included the JPA vicinity and suitable breeding habitat is not supported within the JPA.
Ferruginous hawk	*Buteo regalis*	Wyoming BLM Sensitive	Arid grassland and shrubland habitats. Nests typically occur on rocky knolls, in trees, on cliffs, and occasionally can be found on the ground.	Potential habitat exists in mid-elevation mountain mahogany shrubland and big sage steppe habitats.
Mountain plover	*Charadrius montanus*	Wyoming BLM Sensitive; USFWS listing by ESA denied	Prefers sparsely vegetated grasslands/short-grass prairie; often in association with prairie dog towns or disturbed areas.	Potential habitat exists at lower elevation mixed-grass prairie habitats, but sparsely vegetated areas and prairie dog towns were not observed within the JPA.
Burrowing owl	*Athene cunicularia*	Wyoming BLM Sensitive	Grasslands and open shrublands; usually in association with prairie dog towns.	Potential habitat exists in lower elevation mixed grassland habitats, but no prairie dog towns were located in the JPA.
Logger head shrike	*Lanius ludovicianus*	Wyoming BLM Sensitive	Sagebrush foothills and medium-height sagebrush in basins and mountain mahogany hills.	Potential habitat exists in mid-elevation mountain mahogany shrubland and big sage steppe habitats.
Sage thrasher	*Oreoscoptes montanus*	Wyoming BLM Sensitive	Large, undisturbed tracks of tall, dense sagebrush, and mountain foot hill shrub habitats.	Potential habitat exists in mid-elevation mountain mahogany shrubland and big sage steppe habitats.
Brewer's sparrow	*Spizella breweri*	Wyoming BLM Sensitive	Sagebrush foothills and medium-height sagebrush in basins. Also, mountain mahogany hills.	Potential habitat exists in mid-elevation mountain mahogany shrubland and big sage steppe habitats.
Sage sparrow	*Amphispiza belli*	Wyoming BLM Sensitive	Large, undisturbed tracks of tall, dense sagebrush and mountain foothill shrub habitats.	Potential habitat exists in mid-elevation mountain mahogany shrubland and big sage steppe habitats.
Black-tailed prairie dog	*Cynomys ludovicianus*	USFWS listing by ESA denied	Short-grass prairie with friable soils. Usually forms dense colonies.	Potential habitat exists in lower elevation grasslands, but no prairie dog colonies were observed within the JPA.

Table 3-7 Wildlife Species of Concern Potentially Occurring Within the JPA

Common Name	Scientific Name	Status	Habitat	Comments
Swift fox	*Vulpes velox*	Wyoming BLM Sensitive; USFWS listing by ESA denied	Short-grass prairie, sage-grasslands, and agricultural areas.	Potential habitat exists in lower elevation short-grass prairie habitat.
Black-footed ferret	*Mustela nigripes*	ESA listed as Endangered	Short-grass and mid-grass prairie always in association with prairie dog towns.	No prairie dog towns were located in JPA.



Permit Boundary
Jonathon Ranch Boundary
Sage-grouse Core Breeding Area
Highway

N

0 0.5 1 2 Miles

Map 3-8

Sage-grouse Core Breeding Areas

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

Since the 2007 and 2009 plant surveys, limber pine (*Pinus flexilis*) was added to the BLM Rawlins Field Office sensitive species list. Limber pine was observed throughout the JPA, but was predominantly found in the pine savanna and pine woodland vegetation communities.

3.9 Cultural Resources

As defined in BLM Manual 8100, "Cultural resources are definite locations of human activity, occupation, or use identifiable through field inventory (survey), historical documentation, or oral evidence. The term includes archaeological, historic, or architectural sites, structures, or places with important public and scientific uses, and may include definite locations (sites or places) of traditional, cultural, or religious importance to specified social and/or cultural groups. Cultural resources are concrete, material places and things that are located, classified, ranked, and managed through the system of identifying, protecting, and utilizing for public benefit."

3.9.1 Overview of Prehistory and History

3.9.1.1 Prehistory

The prehistoric culture history of the Northwestern Plains, of which the current JPA is a part, has been defined by Frison (1991). The following summary is drawn from a previous study completed in southeastern Wyoming (Kennedy et al. 2006). Frison identifies six periods of human occupation that span approximately 12,000 years: Paleoindian, Early Plains Archaic, Middle Plains Archaic, Late Plains Archaic, Late Prehistoric, and Protohistoric. The hunter-gatherer lifestyle was predominant throughout this time. The Paleoindian period dates from ca. 12,000 B.P. (before present) to 8,000/7,500 B.P. and coincides generally with the terminal stages of the Pleistocene climatic episode and the onset of warmer conditions at the beginning of the Holocene. The Northwestern Plains Paleoindian period is distinguished in the archaeological record by a sequence of large, lanceolate projectile points often exhibiting precision flaking and morphologically consistent traits. Corresponding with the projectile point sequence is a series of cultural complexes consisting of – in chronological order but with a considerable degree of overlap, especially toward the more recent end of the sequence – Clovis, Goshen, Folsom, Agate Basin, Hell Gap, Cody-Alberta, Frederick, Lusk, James Allen, and Angostura. Subsistence practices during the Paleoindian period were geared toward exploitation of large game animals including some species that became extinct by the end of the Pleistocene.

The Early Plains Archaic period (ca. 8,000/7,500 – 5,000 B.P.) is roughly contemporaneous with the Altithermal climatic episode, a period marked by conditions of extreme drought. Previous Northwestern Plains investigators believed that the Altithermal coincided with a cultural hiatus across the region (Mulloy 1958). More recent evidence indicates that the region was inhabited during the Early Plains Archaic, but to what extent remains largely unknown. Frison (1991) suggests that the extreme episodes of erosion and deposition related to the drought may be partially responsible for removing or obscuring archaeological sites. It also is likely that prehistoric peoples during this period sought out the cooler, moister conditions of the foothills and high mountains adjacent to the Northwestern Plains. Known sites of this period include evidence of basin houses, communal hunting, grinding stones, and stylized food preparation features.

The Middle Plains Archaic period (5,000 – 3,000 B.P.) coincides with the appearance of the McKean Complex. This complex was named for a northeastern Wyoming site and refers specifically to a series of stylistically related projectile points. The stemmed-indented base and lanceolate McKean Complex projectile points represent a morphological change from the side and corner-notched varieties of the Early Plains Archaic period. Sites exhibiting Middle Plains Archaic radiocarbon dates and tool assemblages are widespread throughout the Northwestern Plains and are evidence of exploitation of the complete range of habitats available in the plains and adjacent upland areas (Frison 1991).

The Late Plains Archaic period (3,000 – 1,500 B.P.) is identified archaeologically by the replacement of McKean Complex projectile points with generally smaller, corner-notched varieties. Specific cultural complexes include Pelican Lake, Yonkee, and Besant. This period witnessed the continuation of a long

tradition of broad-spectrum hunting and gathering, but very likely with increased communal hunting of bison as evidenced by numerous kill sites in the archaeological record. Sites with Late Plains Archaic affiliations display a wider variety of artifacts than is known from previous periods including basketry, woodworking debris, sinew, hide, shell, and atlatl fragments. As is the case with the previous period, Late Plains Archaic sites are found in a wide variety of ecological niches in the plains and adjacent areas (Frison 1991).

The beginning of the Late Prehistoric period (1,500 – 300 B.P.) coincides with the appearance of very small projectile points that indicate the introduction to the region of bow-and arrow technology. During the early part of the period projectile points are generally corner notched and are essentially scaled-down versions of Late Plains Archaic dart point. Over the course of the period corner-notched are replaced by side-notched forms, with tri-notching (side notches plus basal notch) appearing at the end of the period. The Late Prehistoric period represents an economic extension of the generalized adaptive strategies that typified the Archaic periods. Artifact assemblages reveal diverse cultural materials and occasionally include pottery.

Longer-term habitation sites are evident, as well as increasing complexity in communal hunting systems, for example, bison jumps and traps. In addition, stone circles are common across the Northwestern Plains, and numerous human burial sites are known archaeologically (Frison 1991).

The Protohistoric period (300 – 150 B.P.) spans the time from initial European contact to the era of Anglo-American expansion across the North American continent in the mid-19th century. The single most important event was the introduction of the horse to American Indian occupants of the Southwest and Plains. Resulting changes included increasingly sophisticated hunting strategies and heightened interregional exchange. Sites dating to the Protohistoric period exhibit a variety of European trade goods. Artifact assemblages include early glass trade beads, ceramics, horse bones, decorative items such as shell beads, tumblers, and pendants, metal projectile points and knives, basketry, and carved steatite items (Zier et al. 1997). Distinct ethnic groups, for example Crow and Shoshone, are first recognizable during the Protohistoric period (Frison 1991; Metcalf 1987; Kalasz et al. 1990).

3.9.1.2 History

The first Anglo-Americans to traverse southeastern Wyoming may have been members of a party led by Robert Stuart, who crossed the continent from west to east in 1812-1813 in the employ of the American Fur Company, and in doing so pioneered much of the route that would eventually become the Oregon Trail. French fur trappers and traders were in the area around the Laramie Mountains by the 1830s, and in 1834 Fort William was established by William Sublette and Robert Campbell at the confluence of the North Platte and Laramie Rivers (Marmor 1997; Gantt et al. 2004; Hafen and Young 1938). As Fort William – a log stockade or “picket post” – began to deteriorate it was replaced by Fort John in 1841, which was built of adobe. Fort John soon became known as Fort Laramie, and an intense but short-lived rivalry was established between this post and Fort Platte, which was established at about the same time a mile north on the North Platte River by Lancaster Lupton (Hafen and Young 1938).

The great overland migration along the Oregon Trail is generally considered to have begun in 1843 although the route of the trail had become well known to missionaries, traders, trappers, and scientific exploration parties during the previous decade. In 1843, however, use of the trail by West Coast-bound emigrants increased substantially, and traffic remained high until the mid-1860s. The trail not only led settlers to the Pacific Coast but also became the principal route of travel for miners headed to the California gold fields and Mormons bound for the Great Basin. Fort Laramie’s importance grew as a result of the westward migration despite the waning of the fur trade, and the post was a principal stopping place and supply point along the route (Marmor 1997; Hafen and Young 1938). The original, privately owned Fort Laramie was purchased by the U.S. Army in 1849 and the facility was expanded greatly. The justification for this process was protection of travelers along the Oregon Trail. Fort Laramie outlived the Oregon Trail and continued in importance during the Indian Wars of the Civil War and post-Civil War era and the Black Hills gold rush of the mid-1870s. The Cheyenne to Deadwood stage route made a stop at Fort Laramie, and a bridge over the North Platte River (which still stands today) was built by the military in the winter of 1875-1876. The fort’s

importance diminished in the 1880s as the Indian Wars waned and the era of settlement took hold. Fort Laramie was abandoned by the U.S. Army in 1890 (Hafen and Young 1938).

Construction of the transcontinental railroad was facilitated by passage of the Pacific Railroad Acts of 1862 and 1864. The route of the Union Pacific Railroad (UPRR) in Wyoming was surveyed between 1863 and 1865, and the line was constructed across the state in 1867 and 1868. Cheyenne was established as a railhead town in November of 1867 although the principal year of construction in Wyoming was 1868 (Ambrose 2000; Marmor 1997). Wyoming Territory was organized during the following year and Cheyenne was established as its temporary capital. Cheyenne's importance grew as it became a jumping-off point and major supply hub for miners and materials bound for the Black Hills during the 1870s and 1880s. Wyoming became the nation's forty-fourth state in 1890, with Cheyenne as its capital (Larson 1965).

Cattle were first brought into Wyoming for commercial purposes in the early 1860s (to the Fort Laramie area) although it should be noted that livestock were herded through the state by travelers along the Oregon Trail beginning as early as the 1840s. Settlement and the livestock industry were encouraged by the establishment of Wyoming Territory, completion of the transcontinental railroad, and passage of three federal homestead laws: the Homestead Act of 1862, the Timber Culture Act of 1873, and the Desert Land Act of 1877. The open range cattle industry became well established on the southeastern Wyoming plains in the 1870s and Cheyenne had developed into an important regional center by 1875 by virtue of its location along the UPRR. The industry suffered a major blow during the extremely harsh winter of 1886-1887, and much of the range was fenced after that time in order to establish boundaries and prevent cattle from straying.

Sheep raising began on the Laramie Plains and in the Cheyenne area in the early 1870s, and the industry found itself in competition with cattle operators by 1890. Conflicts between sheepmen and cattlemen were common and abated only after 1910 as the range was progressively fenced and the sheep industry came under increasing federal regulation. The last great period of homesteading occurred between the end of World War I and the mid-1930s in response to passage of the Stock-Raising Homestead Act of 1916, which expanded the size of homesteads that could be claimed to 640 acres, or one square mile. This homesteading boom terminated in a wave of failures related to the Great Depression. A period of consolidation of land holdings ensued, and the total number of private property holdings declined as the average size of ranches increased (Marmor 1997; Larson 1965).

The coast-to-coast Lincoln Highway was proposed in 1912-1913. In 1913, the route of the Lincoln Highway in Wyoming followed the basic course of the Overland Trail (which was established in 1862 and roughly parallels present-day I-80) and later the UPRR grade. Between 1919 and 1924, Wyoming completed its portion of the Lincoln Highway which realigned the 1913 route in many places. The Lincoln Highway entered Wyoming east of Pine Bluffs and followed county roads through Egbert and Hillsdale to Archer where it rejoined U.S. Route 30. It followed U.S. Route 30 (now largely I-80) through Cheyenne, Laramie, Medicine Bow, and Rawlins to Granger Junction. From there, it followed former U.S. Route 30 South and U.S. Route 530 (now I-80) to the Utah state line.

3.9.2 Class I and Class III Inventories

A Class I file search was conducted through the Wyoming State Historic Preservation Office (SHPO) Cultural Records Office in May of 2007, prior to the beginning of fieldwork. Four previous investigations are on record within the sections traversed by the JPA corridor. The previous undertakings consist of Class III inventories conducted for three fiber optic lines and a road. These investigations resulted in the recording of four historic sites, all of which are related to transportation.

In May and June 2007, a Class III (pedestrian) inventory was conducted for the proposed project. The inventory included proposed road corridors, processing plant location, and quarry. A total of four sites and seven isolated finds were recorded during the inventory. One of the four sites is a previously recorded non-contributing segment of the Lincoln Highway, which has been evaluated by the Wyoming SHPO as eligible for inclusion on the National Register of Historic Places (NRHP). The three remaining sites consisted of two

newly recorded prehistoric lithic scatters and a newly recorded historic cabin. The isolated finds included three occurrences of prehistoric artifacts, three occurrences of historic artifacts, and one occurrence of a historic metal water tank. All of the sites were recommended as not eligible for the NRHP; isolated finds by definition are not eligible for the NRHP. No further work is recommended for these sites.

At the request of the BLM Rawlins Field Office, the historic cabin was revisited in June 2011 to re-evaluate the site for eligibility to the NRHP. As part of the re-evaluation, the records at the Albany County Clerk and Recorder and Assessor offices in Laramie, as well as census reports, land patent records, historic maps, and historic aerial imagery were reviewed to collect site-specific historic information on the site. In addition, the owner of the property where the cabin was originally situated was interviewed to ascertain the history of the cabin and why it was moved to its current location on BLM land. Based on the site visit, records review, and interview, the cabin was evaluated as not eligible for inclusion on the NRHP. No further work is recommended at the site.

3.10 Land Use

The JPA includes a mix of BLM and private surface ownership. Existing land uses of private land in the JPA primarily include ranching, agriculture, and wildlife habitat. The existing use of BLM-managed land in Section 6 and Section 8 is multiple-use as defined by the BLM. Current uses in these areas include recreation, livestock grazing, and wildlife habitat. Recreation in the JPA has historically consisted primarily of hunting for big game species (i.e., elk, deer, and pronghorn antelope).

3.10.1 Livestock Grazing

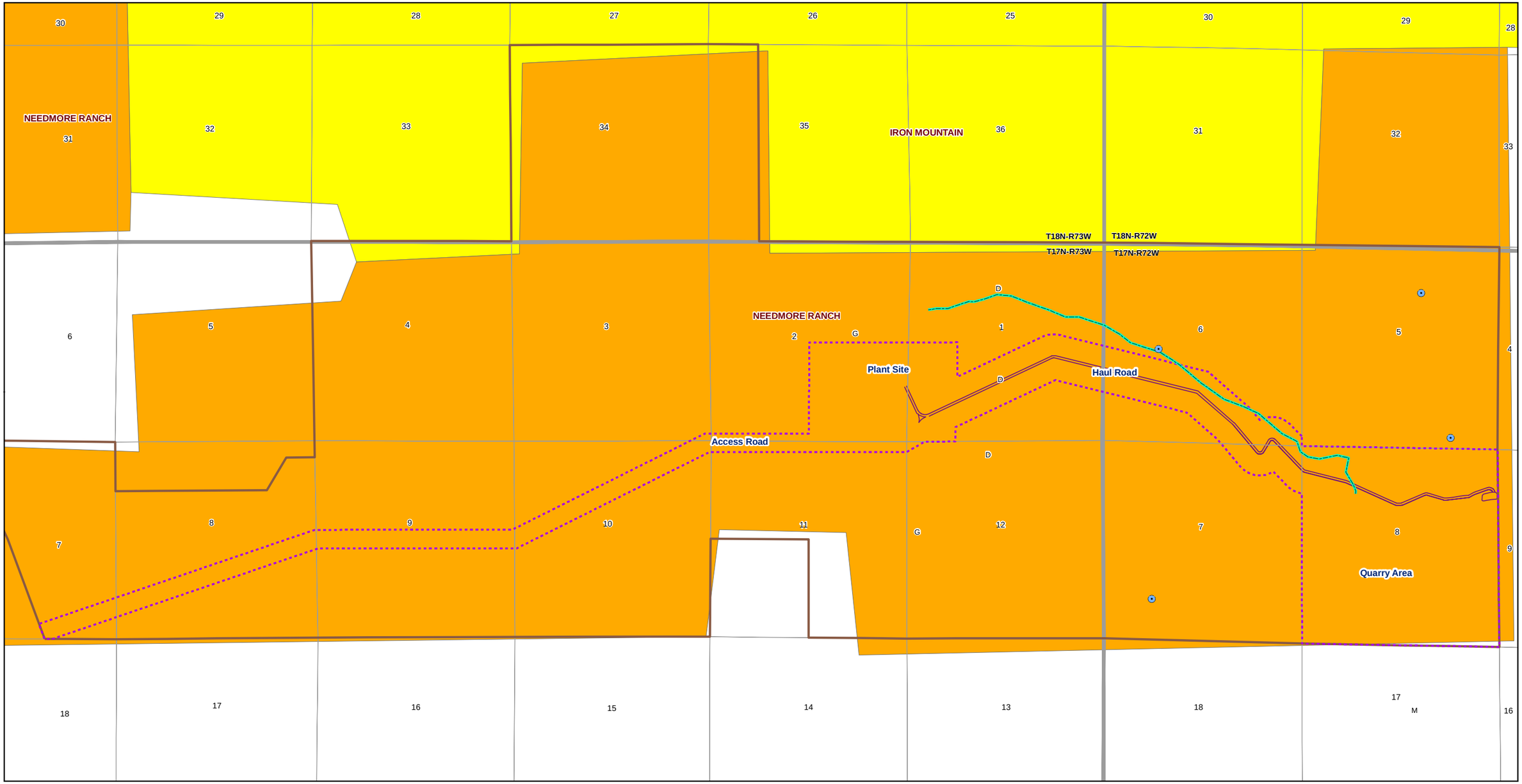
One BLM grazing allotment, Needmore Ranch, is located in the JPA. **Table 3-8** provides a summary of the Needmore Ranch Allotment, including total acreage, current livestock numbers, and permitted use in Animal Unit Months (AUMs). **Map 3-9** illustrates the BLM grazing allotment in the JPA.

Table 3-8 Grazing Allotment Within the JPA

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs	Allotment Acreage Within JPA	Projected Active AUMs Within JPA	Livestock		Grazing Period	
					Type	No.	Begin	End
Needmore Ranch	1,570	136	1,442	125	Cattle	77	6/1	9/30

Cattle grazing occurs from June 1 through September 30 in the Needmore Ranch Allotment. The level of annual use is determined by the current climatic conditions and availability of forage resources. Forty-four percent of the allotment is private land.

Range improvements predominantly consist of stock ponds, a water pipeline, and fencing. A pond that is utilized by cattle and located along the haul road, formed in a small depression that receives windmill pump overflow. Other stock ponds are located within or near the mine area. The stock ponds were observed to be totally dry during two wetland field surveys. The ephemeral draws in the JPA occasionally flow to provide water for livestock. A water pipeline extends from north of the proposed plant site southeast to the northwest corner of Section 8. Fences are located throughout the JPA both in the vicinity of the proposed haul road and quarry area. **Map 3-9** illustrates range improvements located within the JPA.



Reservoirs
Pipeline
Permit Boundary
Jonathon Ranch Boundary
Township
Section
Haul Road and Mine Facility Area

Grazing Allotment

NEEDMORE RANCH
IRON MOUNTAIN

N

0 1,300 2,600 5,200 Feet

Map 3-9

Grazing Allotments

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

3.10.2 Lands with Wilderness Characteristics

Federal Land Policy and Management Act of 1976 section 201(a) and 603 directed the BLM to manage the public lands and their resources under principles of multiple use and sustained yield. Wilderness is one of the multiple use values.

Section 2(c) of the Wilderness Act of 1964 requires that in order to be considered to have wilderness characteristics, an area must meet all of the following criteria:

(1) "generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable;" This is commonly referred to as naturalness.

(2) "has outstanding opportunities for solitude or a primitive and unconfined type of recreation;"

(3) "has at least five thousand acres of land or is of sufficient size as to make practicable its preservation and use in an unimpaired condition;" The Wilderness Act further states areas with wilderness characteristics "may also contain ecological, geological, or other features of scientific, educational, scenic, or historical value." These are commonly referred to as supplemental values and are not required to be present.

The proposed project encompasses 1,280 acres of contiguous federally managed surface and therefore does not meet the 5,000 acres of contiguous public lands required.

3.11 Noise

Ambient noise levels in the JPA of the proposed subject facilities are expected to be typical of a rural setting. No sensitive receptors are located within the JPA and the nearest residence is approximately 2.5 miles from the proposed Lime Plant and over 5 miles from the proposed quarry area.

Sources of ambient noise include vehicular traffic (cars, trucks, farm equipment), people (schools, community gatherings, etc.), recreational noise (such as hunting), infrequent sirens and vehicle noise from emergency vehicles, weather disturbances, trains, occasional aircraft flying over, and natural sources (e.g., wildlife, wind). Because the JPA is rural, sources of loud noises are generally few and intermittent. Typical baseline noise levels in the JPA likely range from approximately 38 average day-night sound levels measured in A-weighted decibels (dBA) to 48 dBA (USEPA 1971).

3.12 Visual Resources

The BLM manages visual resource values in accordance with the Visual Resource Management (VRM) discussion in the Rawlins Resource Management Plan, which designates a VRM management class for all BLM land, based on visual resource valuesand management considerations for other land uses. Land is classified into four visual management categories (Classes I through IV) based on scenic quality, visual sensitivity levels, and viewer distance zones. Each VRM classification has a management objective, as described below.

Class I. The objective of Class I is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activities. The level of change to the characteristic landscape should be very low and should not attract attention.

Class II. The objective of Class II is to retain the existing character of the landscape. The level of change to the landscape should be low. Management activities may be seen but should not attract the attention of the casual observer. Any changes to the landscape must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III. The objective of Class III is to partially retain the existing character of the landscape. The level of change to the landscape should be moderate. Management activities may attract the attention of the casual observer but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

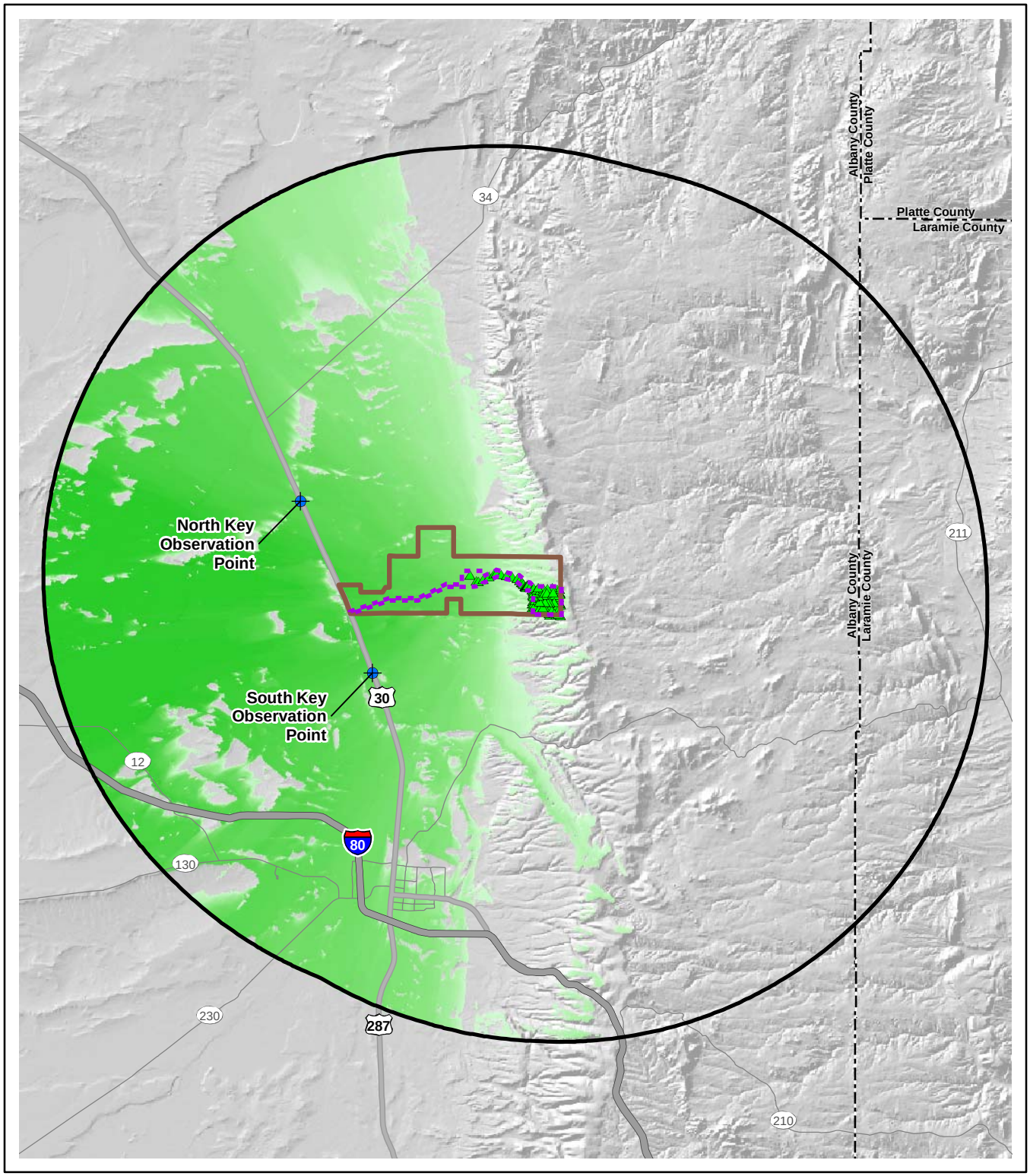
Class IV. The objective of Class IV is to provide for management activities that require major modifications to the existing character of the landscape. The level of change to the landscape can be high. The management activities may dominate the view and may be the major focus of viewer attention. Every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repetition of the basic visual elements of form, line, color, and texture.

The JPA has been classified as VRM Class III. The visual resource inventory's scenic quality rating units and sensitivity level rating units in the vicinity of the JPA are mapped in two units as follows: 1) the Laramie Plains, which includes the western segment of the access road and Lime Plant; and 2) the Laramie Mountain Front, which includes the eastern segment of the haul road and quarry. The broad, open landscape of the Laramie Plains unit is classified as scenic quality class C and moderate value public sensitivity and concern for maintenance of visual quality. The landscape of the access road from U.S. Highway 287/30 to the Lime Plant is relatively flat with slopes of less than 3 percent with mixed-grass prairie as the dominant vegetation. The Lime Plant site and western portion of the haul road are characterized by steeper slopes and dwarf sagebrush – grassland vegetation. The mountainous landscape of the Laramie Mountain Front unit is classified as scenic quality class B and high value public sensitivity and concern for maintenance of visual quality. The eastern portion of the JPA, including the haul road and quarry, is characterized by steep slopes with aspen, mountain mahogany shrubland, pine savannah, pine woodlands and rocky areas with cushion plants. The visual resource inventory distance zone associated with the JPA is foreground-middleground, with visibility within five miles of observers.

Observations from two Key Observation Points (KOPs) were made and results recorded on a Visual Contrast Rating Form (Form 8400-4). KOP 1 is a point on northbound U.S. Highway 287/30 adjacent to a residential area and south of the JPA. KOP 2 is a point on southbound U.S. Highway 287/30 north of the JPA. Locations of the KOPs are shown on **Map 3-10**. A copy of the Visual Contrast Rating Forms and photos from each KOP are provided in **Appendix E**. Observations from both KOPs were similar. Land/water features are planar and pyramidal in form with horizontal and curvilinear lines, and with color ranging from light tans to dark grays, and with fine to medium texture in the foreground to background. Vegetative forms consist of irregular spheres and planes with angular concave and convex lines. Vegetation color ranges from light to medium olives and beiges with fine to medium texture in the foreground to background. Existing structures appear in the form of blocks and rectilinear fences with horizontal, vertical and angular lines with fine to medium texture.

3.13 Socioeconomics

This section summarizes socioeconomic conditions in Albany County, Wyoming, the county which would be affected by the proposed project. Elements reviewed include population, economic conditions, income, employment, housing, local government facilities and services, and local government fiscal conditions. **Table 3-9** summarizes baseline conditions within Albany County.



Point of Visible Project Feature
15-mile Buffer of Observation Points
Jonathon Ranch Boundary
Permit Boundary

Degree of Line of Sight Visibility

High : 107

Low : 0

Road Classification

Interstates
Highways
Secondary Roads

N

0 1 2 4 Miles

Map 3-10

15-Mile Line of Sight Visibility

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Table 3-9 Albany County Economic/Demographic Profile

	2003	2004	2005	2006	2007	2008	Percent Change 2003-2008
Total Population[1]	32,436	32,681	32,507	32,613	32,288	32,758	1.0
Percent Change/Previous Year	0.6	0.8	0.5	0.3	-1.0	1.5	--
Labor Force[2]	18,627	19,699	19,478	18,854	18,787	18,945	1.7
Percent Change/Previous Year	1.5	5.8	-1.1	-3.2	-0.4	0.8	--
Employment	17,990	19,104	18,925	18,351	18,322	18,448	2.5
Unemployment	637	595	553	503	465	497	-22.0
Unemployment Rate	3.4	3.0	2.8	2.7	2.5	2.6	-23.5
Farm Employment[3]	481	472	457	443	497	503	4.6
Total Non-agricultural Employment[1]	19,870	20,088	20,469	20,445	21,053	21,539	8.4
Mining	45	50	40	(D)	49	61	35.6
Construction	954	1,000	1,047	1,157	1,263	1,301	36.4
Manufacturing	669	638	618	675	616	526	-21.4
Retail Trade	2,177	2,198	2,237	2,159	2,179	2,159	-0.8
Transportation and Warehousing	(D)	(D)	(D)	(D)	300	303	NA
Finance and Insurance	606	615	609	615	638	673	11.1
Real Estate and Rental and Leasing	470	493	548	580	643	690	46.8
Professional, Scientific, and Tech Services	1,225	1,167	1,275	1,330	1,389	1,394	13.8
Administrative and Waste Services	(D)	(D)	(D)	(D)	(D)	(D)	NA
Health Care and Social Assistance	1,306	1,338	1,389	1,405	1,410	1,779	36.2
Accommodation and Food Services	1,679	1,730	1,746	1,730	1,768	1,934	15.2
Other Services, Except Public Administration	1,233	(D)	(D)	(D)	1,180	916	-25.7
Government and Government Enterprises	7,236	7,456	7,599	7,444	7,679	7,834	8.3
Personal Income (Million $)	$923.7	$943.5	$990.0	$1,078.6	$1,135.3	1,191.3	29.0
Per Capita Income	$28,437	$28,807	$30,359	$32,927	$34,955	$35,993	26.6[4]
Gross Sales Tax (Thousand $)[4]	$15,692	$16,896	$17,262	$18,368	$17,512	$18,347	16.9

[1] U.S. Census Bureau 2008.

[2] Wyoming Department of Employment 2008.

[3] U.S. Bureau of Economic Analysis 2008.

[4] Wyoming Department of Revenue 2008.

3.13.1 Population

The study area consists of rural ranchland and an urban area, the city of Laramie. With the exception of the city of Laramie, most of the study area is predominantly rural and sparsely populated. The estimated population in Albany County has increased 1 percent from 2000 to 2008. The largest municipality in Albany County is Laramie, with an estimated 2008 population of 26,942, a 1 percent decrease from the year 2000 population. The only other incorporated municipality in Albany County is Rock River. According to the U.S. Census Bureau, Rock River had a population of 265 in 2000. Albany County contains 4,273 square miles, which equates to approximately 7.7 individuals per square mile (U.S. Census Bureau 2008).

3.13.2 Economic Conditions

The basic industries in Albany County are government, retail trade, accommodation and food services, and health care and social assistance. The University of Wyoming in Laramie is the largest employer in the county with 5,225 employees, followed by Albany County Schools (896 employees), and Ivinson Memorial Hospital (473 employees). University of Wyoming student enrollment as of the fall semester 2009 was 13,476 students. Albany County depends to some extent on the tourist industry, which is reflected in the retail trade and service sectors. The presence of Interstate 80 within the county and the City of Laramie, as well as the university, also contributes to a strong retail trade and service sector. As detailed in **Table 3-9**, the economy in Albany County appeared to be improving from 2003 to 2008 with a 29 and 27 percent increase in personal income and per capita income, respectively; however, current conditions are sure to have deteriorated somewhat given the existing economic downturn (U.S. Bureau of Economic Analysis 2008).

3.13.3 Income

Table 3-9 shows estimated personal and per capita income Albany County. Both personal and per capita income showed increases in county-wide income from 2003 to 2008. Average weekly wages in the mining and construction sectors are shown in **Table 3-10**. Wage rates in both sectors have increased through the period. Mining is considered one of the highest paying sectors for wage and salary employment. Median family income also showed an increase, from 2000 to 2008, rising 56 percent to $69,103. Again, wage rates in both sectors and the median family income may have suffered in the existing economic downturn.

Table 3-10 Average Weekly Wage for the JPA

County and Sector	(Dollars)					
	2003	2004	2005	2006	2007	2008
Albany						
Construction	545	549	562	576	621	648
Mining	842	NA	766	NA	NA	1073

Source: Wyoming Department of Employment 2008.

3.13.4 Employment

Total employment throughout Albany County has increased from 2003 through 2008. As shown in **Table 3-9**, total non-agricultural employment has increased by 8.4 percent. Employment in real estate, construction, health care, and mining showed the greatest increases. Employment in other services and manufacturing declined sharply from 2003 through 2008, at -25.7 and -21.4 percent, respectively. The unemployment rate has generally trended down between 2003 and 2008; however, the latest data available for March 2010 shows the unemployment rate at 5.2 percent, a substantial increase from 2.6 percent during 2008, but still 32 percent lower than the March 2010 Wyoming state average of 7.7.

3.13.5 Housing

Statistics from 2006-2008 show Albany County had 17,150 total housing units. A majority of housing in the JPA was owner-occupied, rather than renter-occupied, based on the 2006-2008 census estimates, the most recent data available. Owner-occupied housing represented 55.9 percent of the housing units in Albany County. The relatively low percentage of owner-occupied units can be attributed to the presence of the University of Wyoming with its high demand for rental housing. This can be seen in the owner-occupied housing percentage for the City of Laramie, which stands at 50.9 percent, which essentially splits the percentage between owner occupied and renter occupied housing. At 18.7 percent, housing vacancy rates in Albany County area are slightly higher than the state average of 17.7 percent, while the vacancy rate for the City of Laramie, 15.4 percent, is slighter lower than the state average.

3.13.6 Local Government Facilities and Services

Albany County's government and the City of Laramie, provide a wide array of governmental services including general county government, law enforcement, fire protection, road and bridge infrastructure, solid waste disposal, medical and ambulance, and education. Most public facilities and services, particularly the infrastructure, adequately serve the existing population and could support future growth.

3.13.7 Local Fiscal Conditions

As shown in **Table 3-9** gross sales tax receipts have increased 16.9 percent during the period 2003-2008 (Wyoming Department of Revenue 2008). For 2008 the total locally assessed valuation for Albany County stood at $287,736,925, and produced property tax revenue of $22,145,929 (Wyoming Department of Revenue 2008). Property taxes are a primary source of county and school district revenue, and tax revenues are allocated to county funds, school districts, special districts, and municipalities.

3.14 Transportation and Access

There are no known access easements through the JPA. U.S. Highway 287/30 at the west edge of the JPA is the primary access to the JPA. This portion of the two-lane paved highway is classified by the Wyoming Department of Transportation (WYDOT) as a rural, minor arterial road. WYDOT data indicates that this stretch of U.S. Highway 287/30 had an average daily traffic volume of 1,380 vehicles in 2008. Of this number, an estimated 190 vehicles were trucks (WYDOT 2010).

3.15 Health and Safety

Due to the relatively undeveloped nature of the JPA, there is a low level of concern regarding health and safety impacts to the human population under existing conditions. Activities conducted under current land use include occupational hazards associated with ranching and recreation as well as risks associated with vehicular traffic on improved and unimproved private, county, and BLM roads.

4.0 Environmental Consequences

This section describes the potential impacts that may occur to natural and human resources as a result of the implementation of the Proposed Action and alternatives.

4.1 Climate and Air Quality

The discussion in the air quality impact section includes the use of the word "significant," which has specific meaning in the context of the permitting process under the CAA. The word is used in this section to maintain consistency with the air permitting process and where used, does not have the same meaning as under NEPA.

4.1.1 Proposed Action

The emissions from the proposed project would consist primarily of oxides of nitrogen (NO_X), CO, SO_2, PM_{10}, $PM_{2.5}$, with lesser emissions of VOC. The area surrounding the proposed project has been classified as attainment for all pollutants. The proposed project is expected to trigger review under PSD regulations with respect to NO_X, CO, SO_2, and PM_{10} emissions. A PSD construction permit application would be required to be prepared and submitted following the guidelines outlined in Chapter 6, Section 4, of the WAQS&R, and previously discussed in Section 3.1.2.1 (Regulatory Framework).

4.1.1.1 Sources of Air Pollutants

The proposed project would involve the construction and operation of a Lime Plant, Fine Grind Plant, and the associated Limestone Quarry and stone processing operations.

Temporary air pollutant emissions would occur from project during construction. These emissions would include NO_X, CO, SO_2, PM_{10}, $PM_{2.5}$, and VOC from ground clearing, use of heavy equipment, and construction of access and haul roads. These emissions are temporary in nature and would occur in isolation.

Potential emissions (point and fugitive) from the entire proposed project would total 643.9 tons per year (tpy) for NO_X, 494.4 tpy for CO, 238.2 tpy for SO_2, 367.1 tpy for PM_{10} (total - point and fugitive), 65.7 tpy for $PM_{2.5}$ (total – point and fugitive), and lesser amounts (27.3 tpy) of VOC. Emissions of NO_x, CO, SO_2, and smaller amounts of VOC would result from the combustion sources (primarily the future lime kiln, and lesser amounts from propane-fired fine grind dryer and diesel-fired electric generator). PM (PM_{10} and $PM_{2.5}$) emissions would be emitted from various process operations at the proposed plant. Sources of PM emissions include roads, storage piles, conveying systems, grinding systems, classifying systems, raw material and product loading and unloading systems, and the combustion sources (kiln, dryer, and generator).

No individual hazardous air pollutant (HAP) emissions would be emitted in a quantity greater than the major source limit of 10 tpy. Also, the combined HAP emissions would be less than the major source limit of 25 tpy. Therefore, the proposed project would not constitute a major HAP source.

Potential HAP emissions that may be emitted from the kiln and the diesel-fired electric generator were estimated using emission factors from AP-42 (USEPA 1998a) Chapters 11.6 *"Portland Cement Manufacturing"* and 3.4 *"Large Stationary Diesel And All Stationary Dual-fuel Engines."*

An exhaustive search was conducted in an effort to obtain HAP emission factors for combustion sources burning propane as the primary fuel. This included USEPA's CHIEF and ATW databases, other USEPA regions, the California Air Toxics Emission Factor database, and numerous other databases and state or USEPA regional websites. The result was there are no published HAP emission factors for combustion

sources burning propane as the primary fuel. As discussed with Wyoming DEQ and agreed upon, it can only be assumed that propane burns so clean that there are no HAP emissions emitted or they are insignificant, as such HAP emissions were not quantified for the propane-fired dryer.

There also are no published HAP emission factors for lime kilns, therefore for conservatism HAP emissions factors were obtained from AP-42 Chapter 11.6 *"Portland Cement Manufacturing"* Table 11.6-9 - Summary of Noncriteria Pollutant Emission Factors for Portland Cement Kilns using kilns with fabric filter for control. Emission factor units were changed from pounds per ton clinker (CL) to pounds per ton lime (L). Hourly emission rates for each of the compounds were estimated by multiplying the listed emission factor, expressed as lb/ton L, by the maximum hourly lime production rate from the kiln. Annual emissions were estimated by assuming continuous operation of the kiln, 8,760 hour per year. PLS believes the facility would not be major for HCl emissions and per the Lime Manufacturing Maximum Achievable Control Technology (MACT) testing would be conducted after start-up to confirm this, therefore, for HCl emission estimating purposes an emission factor was developed such that total HCl emissions would be less than 10 tpy. Potential HAP emissions from the kiln total 12.1 tpy, of which 9.3 tpy is HCl.

Potential HAP emissions from the diesel-fired electric generator total 0.05 tpy. Potential HAP emissions from the entire facility total 12.13 tpy. Calculated HAP emissions confirm that the proposed facility would not be a new major HAP source subject to pre-construction permitting under 40 CFR 63 (MACT). However, as stated HCl emission measurements would be conducted on the kiln after start-up to confirm that it is not a major source of HAPs.

The facility-wide potential to emit shown in **Table 4-1** is a summary of all stationary sources and fugitive emissions.

Table 4-1 Facility-wide Potential to Emit

Process	Pollutant Emission Rate (tpy)					
	NO_X	CO	SO_2	VOC	PM_{10}	$PM_{2.5}$
Lime Kiln	584.0	467.2	236.5	21.9	--[1]	--[1]
Fine Grind Dryer	13.6	1.8	0.02	0.3	--[1]	--[1]
Generator	46.4	25.4	1.6	5.1	--[1]	--[1]
Point Sources	--	--	--	--	71.4	35.7
Fugitive Sources	--	--	--	--	294.8	39.4
Total	643.9	494.4	238.2	27.3	367.1	75.2

[1] PM_{10} and $PM_{2.5}$ emissions from lime kiln, dryer, and generator included in point source PM_{10} and $PM_{2.5}$ emissions.

4.1.1.2 Air Pollution Control Measures

The proposed project would be required to apply best available control technology (BACT), which will be described in the Wyoming DEQ/Air Quality Division permit for each pollutant emitted. As shown in **Table 4-1** emissions of NO_X, CO, VOC, and SO_2 from the propane-fired dryer would be minimal as the dryer would be equipped with a low emission burner which would minimize NO_X, CO, and VOC emissions. The diesel-fired generator would be required to meet emission limits as established per Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (NSPS Subpart IIII). These emission controls are equivalent to Wyoming DEQ BACT if not more stringent.

The proposed lime kiln would be a direct-fired preheater type lime kiln design with inherent reduction in fuel consumption and emissions. The preheater kiln design consumes 30 percent less fuel than a conventional

rotary kiln per ton of lime product produced. This reduction in fuel consumption would result in a 30 percent reduction in NO_X generated per ton of lime produced. In addition, the kiln would incorporate features such as "proper kiln design and operation," or "good combustion practices" (GCP). Control of the process to reduce the formation of CO and VOCs would include the use of the newer preheater process which is considered the state-of-the-art technology for lime production. SO_2 in the lime kiln is generated by the oxidation of sulfur compounds in the raw materials and fuels during the calcination process. The lime kiln system itself would act as a control device for SO_2 due to its highly alkaline internal environment, the normal presence of controlling reagents, and the inherent process conditions that enhance absorption reactions. This situation provides a direct means of removing potential SO_2 emissions from process gases before they are exhausted to the atmosphere. The absorption of SO_2 within the process is termed inherent dry scrubbing. In addition, rotary kilns that have a stone pre-heater and fabric filter baghouse (as proposed for this Lime Plant) typically achieve SO_2 removal efficiency of 90 percent to 95 percent. **Table 4-2** summarizes the proposed BACT emission limits for the lime kiln.

Table 4-2 Summary of Lime Kiln Proposed BACT Emission Rates

Pollutant	lb/tsf	lb/hr	tpy	Control Technology
NO_X	2.0	133.3	584	Preheater Lime Kiln and GCP
CO	1.60	106.7	467.2	Preheater Lime Kiln and GCP
VOC	0.08	5.0	21.9	Preheater Lime Kiln and GCP
SO_2	0.81	54.0	236.5	Inherent Dry Scrubbing
PM_{10}	0.01 gr/dscf	6.15	26.9	Baghouse
$PM_{2.5}$	0.005 gr/dscf	3.10	13.5	Baghouse

lb/tsf = pounds per stone stone feed.

gr/dscf = grains per standard cubic feet.

PM_{10} would be emitted from various process operations at the proposed facility. Non-fugitive (point) sources of PM_{10} include crushing/grinding systems, classifying systems, raw material and product loading and unloading systems, and the lime kiln system. Baghouses are the most effective method of controlling point source PM (PM_{10}/$PM_{2.5}$) emissions from this installation. Baghouses would be installed to control emission from each point source. These baghouses would be designed to have a maximum PM_{10} and $PM_{2.5}$ outlet concentration of 0.01 gr/dscf and 0.005 gr/dscf filterable PM, respectively. The proposed fabric filtration systems for all of the proposed point sources would be chosen to achieve the best possible performance for the facility due to their state-of-the-art design. To achieve this low concentration, the vendors recommend different fabric filter media for different processes. These bags are the best currently available for each process and would provide the highest level of particulate control achievable. As shown in **Table 4-2**, a filterable particulate matter emission limit of 0.01 gr/dscf for the lime kiln system equates to 6.15 lb/hr, 26.94 tpy, and 0.092 lb/tsf, which is less than the NSPS Subpart HH allowable emission limit of 0.6 lb/tsf as well as the MACT Subpart AAAAA allowable emission limit of 0.10 lb/tsf. Baghouses constitute BACT for these sources.

Fugitive PM (PM_{10}/$PM_{2.5}$) emissions in the quarry and stone plant would be generated from drilling, blasting, crushing, screening, material handling and drop/transfer points (truck loading/unloading, conveyor transfer, etc.), road dust (haul trucks), and wind erosion (storage piles and exposed areas).

The mobile drill rig would be equipped with a sleeve and paper filter (baghouse). There are no controls available for the blasting operations. Emissions from the primary quarry crusher and associated screen and conveyor drop points would be controlled via baghouse. Emissions from the other conveyor transfer points within the quarry would be controlled by water spray when necessary (i.e., when opacity exceeds

20 percent) and appropriate (non-freezing conditions) and limiting the drop heights to storage piles (i.e., less than 6 feet). Wind erosion would be controlled by limiting the amount of exposed acreage through the use of BMPs and re-seeding of these areas. The limestone quarry haul road would be used to transport shot rock from the crusher to the stone processing area at the plant for further processing. PLS plans to employ a combination of magnesium chloride treatment, watering, gravel surfaces, and administrative speed controls on the quarry haul road in order to reduce the generation of fugitive emissions during road usage. Road speeds would be limited to an average of 30 mph empty and 25 mph full within the quarry. Water and chemical treatment application would vary depending upon specific circumstances such as the location and duration of mining activities, the amount of precipitation, and residual chemicals remaining from prior treatments. Application of magnesium chloride would occur at least three times a year and would be applied at the manufacturer's recommended rate.

BMPs would be used for all material handling operations to limit fugitive PM (PM_{10}/$PM_{2.5}$) emissions within the stone plant and consist of covered conveyors, enclosed conveyor transfer points, stacker conveyors for stockpiles with maximum 6-foot drop, and truck dumping to belowground hopper with walls on each side of drop point to limit emissions. Unpaved product haul roads would be controlled by employing the same method as the unpaved quarry haul road described above. All of these controls constitute BACT for fugitive emissions.

4.1.1.3 Air Quality Modeling Results

A PSD permit application was submitted to the Wyoming DEQ in March 2008 for the proposed project. The applicant subsequently withdrew the application in 2009 during the review process due to uncertainty of the construction and timeline of the permit issuance. However, Wyoming DEQ conducted a thorough review of the Wyoming AAQS, PSD increment, and Class II and Class I analyses that were performed as part of the PSD permit application package, and concurred with the results of these analyses. The following subsections discuss the results of the Class II and Class I impact analyses from that application.

Class II Area Ambient Air Quality Impact Analysis

A significant impact analysis was made to determine whether the proposed project emission units (EUs) could exceed the Wyoming DEQ's modeling significance levels for any pollutant.

Modeling significance levels for PM_{10} were exceeded, but were not exceeded for NO_X, SO_2, and CO. Since modeling significance levels were not exceeded for NO_X, SO_2, and CO, no further analyses were conducted for these pollutants. Therefore, it was only necessary to perform a Wyoming AAQS and PSD increment analysis for PM_{10}. The Wyoming AAQS are the maximum concentrations allowed in terms of total pollutant levels in ambient air and PSD increments are the maximum increase in concentrations allowed above baseline concentrations. For purposes of this analysis, it was conservatively assumed that all off-site sources consume PSD increment. The results of the Wyoming AAQS and PSD increment analyses are provided in **Table 4-3** and **Table 4-4**, respectively. These results show that maximum model-predicted impacts, when added to background concentrations, were well below all applicable Wyoming AAQS, and that the maximum predicted annual and 24-hour PM_{10} increment impacts were below the PSD increments.

Class II Area Additional Impact Analysis

In addition to the Wyoming AAQS and PSD increment analysis, an additional impact analysis also was performed. This analysis assesses the potential impact on soils, vegetation, and visibility in the Significant Impact Area (SIA) caused by the net change in impacts due to the proposed project.

Table 4-3 Maximum Predicted Impacts Compared to Wyoming AAQS

Pollutant	Averaging Period	Maximum Predicted PLS Impact[1] (µg/m^3)	Predicted Off-site Source Impact[1] (µg/m^3)	Background Concentration (µg/m^3)	Maximum Total Impact [1] (µg/m^3)	Wyoming AAQS (µg/m^3)	Percent of Wyoming AAQS
PM_{10}	24-hour	11.35	0.01	68	79.36	150	53
	Annual	14.08	0.03	11	25.11	50	50

[1] High-first-high model predicted impact.

Table 4-4 Maximum Predicted Impacts Compared to PSD Increments

Pollutant	Averaging Period	Maximum Predicted PLS Impact[1] (µg/m^3)	Predicted Off-site Source Impact[1] (µg/m^3)	Maximum Total Impact[1] (µg/m^3)	Class II PSD Increment[2] (µg/m^3)	Percent of Increment
PM_{10}	24-hour	11.35	0.01	11.36	30	38
	Annual	14.08	0.03	14.11	17	83

[1] High-first-high model predicted impact. Assumes that all emissions from PLS and off-site sources are increment consuming.

[2] PSD increments are published in 40 CFR 51.166(c).

Soils and Vegetation Impact Analysis

Impact to soils and vegetation in the significant impact area were based on a comparison of the modeled maximum net change in ambient impacts due to the project (high-first-high) to USEPA-published thresholds (USEPA 1980) provided in **Table 4-5**. From the vegetation survey conducted in support of the proposed project (Mine Plan, Appendix D-8), no sensitive, rare, threatened or endangered plant species were identified. Maximum predicted impacts for all pollutants were found well below even the sensitive vegetation screening threshold values. As a result, impacts to vegetation in the SIA due to PLS emissions are expected to be insignificant.

A soil map of the JPA shows that the predominant soil types in the SIA contain significant limestone and sandstone formations, both of which are at least slightly alkaline. Due to the very low levels of expected NO_X and SO_2 emissions from the PLS facility, and the potential buffering capacity of the nearby soils, adverse impacts to soils in the SIA are not expected.

Class I Area Impact Analysis

A list of Class I areas that the U.S. Forest Service (USFS) requested be considered in the Class I impact analysis is provided in **Table 4-6** (USFS 2007). This list includes all Class I areas located within approximately 150 km of the JPA. Air quality impact and air quality related values analyses were performed for these listed areas only. The National Park Service (NPS) was contacted to inquire if any NPS Class I areas, particularly Rocky Mountain National Park, required a modeling analysis. The NPS stated that CALPUFF modeling was not required for any NPS Class I areas (NPS 2007).

Table 4-5 Vegetation Exposure Screening Thresholds

Pollutant	Averaging Period	Model Predicted Impact ($\mu g/m^3$)[1,2,3]	Sensitive Vegetation Threshold Value ($\mu g/m^3$)	Intermediate Vegetation Threshold Value ($\mu g/m^3$)	Resistant Vegetation Threshold Value ($\mu g/m^3$)
SO_2	1-hour	30	917	---	---
	3-hour	30	786	2,096	13,100
	Annual	0.23	18	18	18
NO_2[4]	4-hours	90	3,760	9,400	16,920
	8-hours	90	3,760	7,520	15,040
	1 month	90	564	564	564
	Annual	0.86	94-188	94-188	94-188
CO	1 week	20	1.8×10^6	---	1.8×10^6

[1] High-first-high model-predicted impact.

[2] Short-term threshold values are all compared to 1-hour average impacts.

[3] Annual threshold values are compared to modeled annual impacts.

[4] Assumes that 100 percent of NO_X impacts are in the form of NO_2.

Source: A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals (USEPA 450/2-81-078), dated 12/12/1980.

Table 4-6 Potentially Affected Class I Areas

Class I Area (Responsible Agency)	State	Approximate Distance and Direction from PLS Facility
Savage Run Wilderness (USFS)	WY	70 km WSW
Rawah Wilderness (USFS)	CO	75 km SSW
Mount Zirkel Wilderness (USFS)	CO	110 km SW

A significant impact analysis was conducted to determine whether the proposed project EUs could cause a significant ambient air quality impact at any potentially affected Class I area. A significant impact is defined as an impact that exceeds 4 percent of the PSD Class I increments, as proposed by USEPA (61 *Federal Register* 38250 July 23, 1996). The applicable Class I Significant Impact Levels (SILs) and PSD increments are shown in **Table 4-7**, and are compared to the model-predicted impacts in **Table 4-7**. Since the maximum predicted impact for all modeled pollutants and averaging periods was found to be below each applicable Class I SIL, impacts due to the proposed project would not cause or contribute to any potential Class I area increment exceedences.

Table 4-7 Maximum Predicted Impacts Compared to Significant Impact Levels

Savage Run Wilderness Area (WA)

Pollutant	Averaging Period	Maximum Predicted Impact				Class I SIL ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Max Impact Exceeds SIL or Increment?
		2003 ($\mu g/m^3$)	2004 ($\mu g/m^3$)	2005 ($\mu g/m^3$)	All Yrs ($\mu g/m^3$)			
NO_2	Annual	0.0005	0.0014	0.0005	0.0014	0.1	2.5	No
SO_2	3-hour	0.0720	0.1233	0.1358	0.1358	1.0	2.0	No
	24-hour	0.0155	0.0329	0.0229	0.0329	0.2	5.0	No
	Annual	0.0005	0.0008	0.0004	0.0008	0.1	25.0	No
PM_{10}	24-hour	0.0067	0.0278	0.0095	0.0278	0.3	4.0	No
	Annual	0.0002	0.0003	0.0002	0.0003	0.2	8.0	No

Rawah WA

Pollutant	Averaging Period	Maximum Predicted Impact				Class I SIL ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Max Impact Exceeds SIL or Increment?
		2003 ($\mu g/m^3$)	2004 ($\mu g/m^3$)	2005 ($\mu g/m^3$)	All Yrs ($\mu g/m^3$)			
NO_2	Annual	0.0013	0.0012	0.0009	0.0013	0.1	2.5	No
SO_2	3-hour	0.1006	0.1311	0.2050	0.2050	1.0	2.0	No
	24-hour	0.0233	0.0318	0.0398	0.0398	0.2	5.0	No
	Annual	0.0009	0.0007	0.0008	0.0009	0.1	25.0	No
PM_{10}	24-hour	0.0148	0.0151	0.0213	0.0213	0.3	4.0	No
	Annual	0.0004	0.0004	0.0004	0.0004	0.2	8.0	No

Mt. Zirkel WA

Pollutant	Averaging Period	Maximum Predicted Impact				Class I SIL ($\mu g/m^3$)	Class I Increment ($\mu g/m^3$)	Max Impact Exceeds SIL or Increment?
		2003 ($\mu g/m^3$)	2004 ($\mu g/m^3$)	2005 ($\mu g/m^3$)	All Yrs ($\mu g/m^3$)			
NO_2	Annual	0.0003	0.0006	0.0002	0.0006	0.1	2.5	No
SO_2	3-hour	0.0779	0.0550	0.0576	0.0779	1.0	2.0	No
	24-hour	0.0132	0.0176	0.0132	0.0176	0.2	5.0	No
	Annual	0.0003	0.0004	0.0002	0.0004	0.1	25.0	No
PM_{10}	24-hour	0.0051	0.0057	0.0040	0.0057	0.3	4.0	No
	Annual	0.0001	0.0001	0.0001	0.0001	0.2	8.0	No

Regional Haze

Light is scattered and/or absorbed by components of the atmosphere, the total contribution of scattered and absorbed light is called "light extinction". Increases in air emissions would increase the amount of light extinction. The impacts to regional haze are typically presented in terms of the percent change in light extinction due to project emissions. A 5 percent change in light extinction has been found to be "just noticeable" to the average person (Federal Land Managers Air Quality Related Values Workgroup [FLAG] 2000).

An analysis was conducted to estimate the maximum change in light extinction (Δb_{ext}) at each potentially affected Class I area over a 24-hour period due to emissions from the proposed facility. The regional haze analysis proceeded in a two-step process. Both steps use the CALPUFF model to estimate the change in light extinction due to the proposed project. The first step uses CALPUFF with Method 2, whereby the change in light extinction is calculated using an hourly relative humidity adjustment factor [f(RH)]. The second step uses the CALPUFF model with Method 6, whereby the change in light extinction is calculated using FLAG-recommended monthly f(RH).

The results of the Step 1 regional haze analysis are provided in **Table 4-8**. As shown in this table, the maximum change in light extinction is predicted to be less that 5 percent at both Savage Run WA and Mt. Zirkel WA over all 3 years modeled.

Table 4-8 Regional Haze Analysis Results – Step 1

MVSBK = 2

Class I Area	2003			2004			2005			All Years		
	Days >		Max %	Days >		Max %	Days >		Max %	Days >		Max %
	$5\%\Delta B_{ext}$	$10\%\Delta B_{ext}$	ΔB_{ext}	$5\%\Delta B_{ext}$	$10\%\Delta B_{ext}$	ΔB_{ext}	$5\%\Delta B_{ext}$	$10\%\Delta B_{ext}$	ΔB_{ext}	$5\%\Delta B_{ext}$	$10\%\Delta B_{ext}$	ΔB_{ext}
Savage Run WA	0	0	1.74	0	0	2.48	0	0	0.95	0	0	2.48
Rawah WA	0	0	3.53	0	0	4.47	1	0	**5.76**	1	0	**5.76**
Mt. Zirkel WA	0	0	1.73	0	0	1.77	0	0	0.96	0	0	1.77

Note: Maximum predicted ΔB_{ext} occurs on March 24, 2005.

There was 1 day (March 24, 2005) where the maximum change in light extinction was predicted to be greater than 5 percent at Rawah WA. To determine likely weather conditions at Rawah on this day, the following information was collected:

- Hourly weather observations for March 24 from the Laramie General Brees Airport (Brees Field), located approximately 40 km northeast of Rawah WA.
- Surface and precipitation maps for 0500 MST March 24 and 0500 MST March 25.

Observations from Brees Field show that light snow occurred most of the day, and reported visibility was frequently less than 5 km. The surface weather map and Brees Field observations show a cold frontal passage through the area during the early morning, with light snow falling behind the front. The precipitation maps show that between 0500 on March 24 and 0500 on March 25, light precipitation was occurring throughout the area. In the presence of snow, rain, or high humidity, the background meteorological conditions reduce the visual range (e.g., a human eye cannot see as far); however these day-specific events are not explicitly included in the model-predicted percent change in visibility impacts. To account for these types of naturally occurring low visibility conditions, the USEPA allows modeled visibility impacts to be compared to the 98th percentile threshold (40 CFR Part 51), which is calculated using CALPUFF Method 6.

Therefore, for the second step of the analysis, the analysis method is consistent with the Best Available Retrofit Technology method, whereby CALPUFF Method 6 is used along with monthly average f(RH) values and reports the 98th percentile day (8th highest for each year, and 22nd highest over 3 years).

The results of the Step 2 regional haze analysis are provided in **Table 4-9**. The maximum change in light extinction was predicted to be about 3.5 percent, while the 8th highest change was predicted to be about 0.6 percent, which is approximately one order of magnitude below the 5 percent threshold. In other words, the project impacts are not expected to contribute to a change in visibility that is perceptible to the human eye.

Table 4-9 Regional Haze Analysis Results – Step 2

MVISBK = 6, 20% Best Natural Background

Class I Area	2003		2004		2005		All Years	
	Max % ΔB_{ext}	8th Highest % ΔB_{ext}	Max % ΔB_{ext}	8th Highest % ΔB_{ext}	Max % ΔB_{ext}	8th Highest % ΔB_{ext}	Max % ΔB_{ext}	8th Highest % ΔB_{ext}
Savage Run WA	1.21	0.30	1.21	0.34	1.03	0.30	1.21	0.34
Rawah WA	1.30	0.61	1.51	0.38	3.59	0.57	3.59	0.61
Mt. Zirkel WA	0.74	0.19	0.89	0.31	0.59	0.19	0.89	0.31

Acid Deposition

Upper limit estimates of annual wet and dry deposition of sulfur (S) and nitrogen (N) compounds associated with emissions from the proposed project at each potentially affected Class I area were determined. Specifically, both wet and dry deposition of SO_2, ammonium sulfate (as SO_4), ammonium nitrate (as NO_3), and nitric acid (HNO_3) as well as dry deposition of NO_X were modeled using CALPUFF. The POSTUTIL post-processing routine was used to calculate total N and S deposition from each modeled chemical species.

The results of the deposition analysis are provided in **Table 4-10**. As shown in this table, the maximum predicted N and S deposition due to project emissions is well below the levels of concern published by Fox et al. (1989).

Acid Neutralizing Capacity

An analysis of the percent change in acid neutralizing capacity (ANC) at selected Class I area lakes was conducted according to procedures described in USFS (2000). The purpose of this analysis is to determine whether predicted impacts from new or modified sources may be considered insignificant. USFS (2000) provides a method to conservatively estimate impacts from new or modified sources. The threshold for significance is based on a 10 percent change in ANC for lakes with a baseline ANC of 25 micro equivalents per L (µeq/L) or greater and a 1 µeq/L threshold change for lakes with a baseline ANC value of less than 25 µeq/L. The percent change in ANC is calculated for each lake by dividing the modeled project's acid deposition by the baseline ANC and multiplying by 100 to convert into a percent.

Baseline ANC and watershed area values were provided by the USFS for lakes located in Rawah WA and Mt. Zirkel WA and are shown in **Table 4-11**. Note that the baseline ANC is above 25 µeq/L for all lakes analyzed; therefore, the threshold for significance is a 10 percent change in ANC. Annual average precipitation was obtained from SNOwpack TELemetry (SNOTEL) data collected at each Class I area. The results of the ANC analysis for these lakes is provided in **Table 4-11**. The maximum percent change in the ANC at each lake was predicted to be on the order of 0.05 percent, which is well below the 10 percent change threshold.

The results of the deposition analysis are provided in **Table 4-12**. As shown in this table, the maximum predicted N and S deposition due to project emissions is well below the Deposition Analysis Threshold (DAT).

Table 4-10 Deposition Analysis Results

Savage Run WA

Pollutant	Averaging Period	Maximum Predicted Impact 2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	Level of Concern (kg/ha/yr)	Max Impact Exceeds Threshold?
N	Annual	1.47E-12	3.63E-12	1.09E-12	0.0011	3.0	No
S	Annual	1.18E-12	3.03E-12	7.78E-13	0.0010	5.0	No

Rawah WA

Pollutant	Averaging Period	Maximum Predicted Impact 2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	Level of Concern (kg/ha/yr)	Max Impact Exceeds Threshold?
N	Annual	2.62E-12	2.98E-12	1.89E-12	0.0009	3.0	No
S	Annual	2.17E-12	2.53E-12	1.47E-12	0.0008	5.0	No

Mt. Zirkel WA

Pollutant	Averaging Period	Maximum Predicted Impact 2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	Level of Concern (kg/ha/yr)	Max Impact Exceeds Threshold?
N	Annual	1.36E-12	2.75E-12	5.78E-13	0.0009	3.0	No
S	Annual	1.05E-12	2.23E-12	4.56E-13	0.0007	5.0	No

$g/m^2/s$ = grams per square meter per second.
kg/ha/yr = kilograms per hectare per year.

Table 4-11 ANC Analysis Results

Class I Area	Lake Name	Baseline ANC [1] (μeq/l)	Watershed Area [1] (ha)	Avg. Annual Precip [2,3] (m)	Deposition Sulfur (kg/ha/yr)	Deposition Nitrogen (kg/ha/yr)	Baseline ANC (eq)	Acid Deposition (eq)	% ANC Change (%)
Rawah WA	Island	64.6	51	0.70	0.0008	0.0009	15452	6	0.04
Rawah WA	Rawah Lake #4	41.2	71	0.70	0.0008	0.0009	13720	8	0.06
Mt. Zirkel WA	Summit Lake	49.0	9	1.10	0.0007	0.0009	3058	1	0.03
Mt. Zirkel WA	Seven Lakes	35.7	60	1.10	0.0007	0.0009	15787	6	0.04
Mt. Zirkel WA	Lake Elbert	59.0	101	1.10	0.0007	0.0009	43871	11	0.02

[1] Provided by USFS
[2] Average annual precipitation data for Rawah WA from SNOwpack TELemetry (SNOTEL) Site 1023 (Rawah)
Data available at http://www.wcc.nrcs.usda.gov/snotel/Colorado/colorado.html

Water Year	Total Precip (inches
2003	30.0
2004	25.4
2005	25.9
2006	26.5
2007	30.0
Average	**27.6**

Note: Water year runs from October through September

[3] Average annual precipitation data for Mt. Zirkel WA from SNOwpack TELemetry (SNOTEL) Site 1033 (Zirkel)
Data available at http://www.wcc.nrcs.usda.gov/snotel/Colorado/colorado.html

Water Year	Total Precip (inches
2003	39.7
2004	44.8
2005	39.7
2006	50.1
2007	41.4
Average	**43.1**

Note: Water year runs from October through September

Table 4-12 Deposition Analysis Results

Savage Run WA

Pollutant	Averaging Period	Maximum Predicted Impact				DAT	Max Impact Exceeds DAT?
		2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	(kg/ha/yr)	
N	Annual	1.47E-12	3.63E-12	1.09E-12	0.0011	0.005	No
S	Annual	1.18E-12	3.03E-12	7.78E-13	0.0010	0.005	No

Rawah WA

Pollutant	Averaging Period	Maximum Predicted Impact				DAT	Max Impact Exceeds DAT?
		2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	(kg/ha/yr)	
N	Annual	2.62E-12	2.98E-12	1.89E-12	0.0009	0.005	No
S	Annual	2.17E-12	2.53E-12	1.47E-12	0.0008	0.005	No

Mt. Zirkel WA

Pollutant	Averaging Period	Maximum Predicted Impact				DAT	Max Impact Exceeds DAT?
		2003 ($g/m^2/s$)	2004 ($g/m^2/s$)	2005 ($g/m^2/s$)	All Yrs (kg/ha/yr)	(kg/ha/yr)	
N	Annual	1.36E-12	2.75E-12	5.78E-13	0.0009	0.005	No
S	Annual	1.05E-12	2.23E-12	4.56E-13	0.0007	0.005	No

4.1.1.4 Greenhouse Gas Emissions and Climate Change

Wyoming's gross GHG emissions are expected to continue to grow to 69 million metric tons of carbon dioxide (MMtCO2e) by 2020, 56 percent above 1990 levels. As of 2008, the Wyoming GHG Inventory indicates that there are over 33,000 active gas and oil wells in the State, 45 operational gas processing plants, 5 oil refineries, and over 9,000 miles of gas pipelines. There are significant uncertainties associated with estimates of Wyoming's GHG emissions from this sector, which is compounded by the fact that there are no regulatory requirements to track CO_2 or methane emissions. Therefore, estimates based on emissions measurements in Wyoming are not possible at this time. (Wyoming GHG Inventory and Reference Case Projection CCS, Spring 2007).

Year-to-year fluctuations in temperature are due to natural processes, such as the effects of El Niños, La Niñas, and the eruption of large volcanoes are summarized in the Climate Change SIR report (2010). Yearly fluctuations in temperature contribute to the difficulty of predicting actual regional or site-specific changes or conditions which may be due to climate change during any specific time frame.

Ongoing scientific research has identified the potential impacts of anthropogenic GHG emissions and changes in biological sequestration due to land management activities on global climate. Through complex interactions on a regional and global scale, these GHG emissions and net losses of biological carbon sinks cause a net warming effect of the atmosphere, primarily by decreasing the amount of heat energy radiated by the earth back into space. Although GHG levels have varied for millennia, recent industrialization and burning of fossil carbon sources have caused carbon dioxide equivalent (CO2e) concentrations to increase dramatically, and are likely to contribute to overall global climatic changes. The IPCC recently concluded that "warming of the climate system is unequivocal" and "most of the observed increase in global average temperatures since the mid-20th century is very likely due to the observed increase in anthropogenic greenhouse gas concentrations" (IPCC 2007). Without additional meteorological monitoring systems, it is difficult to determine the spatial and temporal variability and change of climatic conditions, but increasing concentrations of GHGs are likely to accelerate the rate of climate change.

The proposed project would generate GHGs from the burning of fossil fuels by vehicles and quarry equipment and by the processing of limestone into chemical lime, which would contribute to an increase in existing regional greenhouse gas levels. The specific increase would be almost immeasurable.

The assessment of GHG emissions and climate change is in its formative phase. It is currently not feasible to know with certainty the net impacts from the proposed project on climate. The inconsistency in results of scientific models used to predict climate change at the global scale coupled with the lack of scientific models designed to predict climate change on regional or local scales, limits the ability to quantify potential future impacts of decisions made at this level.

4.1.2 Additional Mitigation Measures

Since the Proposed Action and alternatives would comply with air quality standards, no additional mitigation measures were deemed necessary. As stated previously, the proposed project would be required to apply BACT for each pollutant emitted for each source of emissions. There are three combustion sources proposed as part of this action which would emit gaseous pollutants (NO_X, CO, VOC, and SO_2) in addition to particulate matter (PM). The three combustion sources consist of the lime kiln, propane-fired dryer, and the diesel-fired generator (CI-ICE). **Table 4-13** summarizes the control measures proposed for the three combustion sources.

Table 4-13 Summary of Proposed BACT for Combustion Sources

Pollutant	Control Technology		
	Lime Kiln	**Dryer**	**Generator**
NO_X	Preheater Lime Kiln and GCP	Low Emission Burner and GCP	GCP according to the manufacturer's recommendations and design – comply with NSPS IIII
CO			
VOC			
SO_2	Inherent Dry Scrubbing	Low Sulfur Fuel	Low Sulfur Fuel
PM (PM_{10}/$PM_{2.5}$)	Baghouse	Baghouse	Positive Crankcase Ventilation, GCP, and low-sulfur fuel

The remaining sources of emissions associated with the proposed project are sources of PM in the form of either non-fugitive (point) sources (e.g., crushing/grinding systems, classifying systems, raw materials and product loading and unloading systems), or fugitive sources occurring in the quarry and stone plant such as drilling, blasting, screening, material handling, and drop/transfer points (truck loading/unloading, conveyor transfers, etc.) haul trucks, and wind erosion (storage piles and exposed areas). All of the point sources would be controlled via baghouses. Several different mechanisms or techniques would be implemented to reduce fugitive PM emissions, these consist of:

- Emissions from the other conveyor transfer points within the quarry would be controlled by water spray when necessary and appropriate and limiting the drop heights to storage piles.
- Wind erosion would be controlled by limiting the amount of exposed acreage through compacting and re-seeding of these areas.
- A combination of magnesium chloride treatment, watering, gravel surfaces, and administrative speed controls on the quarry and product haul road would be employed in order to reduce the generation of fugitive emissions during road usage. Road speeds would be limited to an average of 30 mph empty and 25 mph full within the quarry. Water and chemical treatment application would vary depending upon specific circumstances such as the location and duration of mining activities, the amount of precipitation, and residual chemicals remaining from prior treatments. Application of

magnesium chloride would occur at least three times a year and would be applied at the manufacturer's recommended rate.

- Conveyors would be covered.
- Conveyor transfer points would be enclosed.
- Stacker conveyors for stockpiles would have maximum 6-foot drop.
- Trucks would dump to belowground hopper with walls on each side of drop point to limit emissions.

All of these controls constitute BACT for point and fugitive emissions.

4.1.3 Residual Impacts

No residual impacts to air quality from the proposed project would occur since BACT would be implemented for each pollutant emitted for each source of emissions, and non-fugitive and fugitive sources of PM emissions as described above.

4.1.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no increased project-related air pollutant emissions would be generated.

4.2 Geology and Topography

4.2.1 Proposed Action

The proposed quarry contains approximately 100 million cubic yards (200 million tons) of material, which would be removed or relocated during mining activities. Approximately 50 percent of this material is estimated to be chemical grade limestone, which would be crushed and hauled to the plant. This material (approximately 50 million cubic yards or 100 million tons) would be permanently removed from the JPA for commercial sale and would not be available for future development. The remaining 50 percent of material is estimated to consist of waste rock and subsoil, which would be stockpiled for use as backfill or direct-placed back into the quarry.

The proposed project is located in an area of relatively low seismic activity. Likewise, impacts to landslide susceptibility are anticipated to be low due to the lack of landslide hazards in the JPA. The reclamation of mined areas would minimize or eliminate this impact through regrading of stored overburden to low-angle slopes.

Although flooding is possible along dry washes and ephemeral drainages within the JPA, proposed mining would not occur within 150 feet of the major drainages in Section 8. There would be road crossings across the major drainages and there would be roads, a mine facilities area, and sediment basins constructed within 150 feet of drainages. A storm water management plan, as required by Wyoming DEQ, would be implemented in accordance with applicable regulations.

The removal of limestone and waste rock would have a permanent impact on the topography of the quarry area. During reclamation the temporary quarry impacts would be reduced by re-contouring of backfilled waste rock. While similar contours would be restored and blended with undisturbed topography, the area mined would see a net reduction in elevations on the average of about 150 feet. The drop in elevation would cause the slope of the drainage area to change. A change in slope would cause a change in the stormwater runoff regime which over time could cause a change in the basic drainage pattern.

No permanent facilities are anticipated to be constructed within the quarry area in the JPA. Portable scale house(s) and sales/office trailers would be used at the Lime Plant as necessary. The haul road outside of the quarry area, access road and processing area would not be reclaimed and would result in permanent

disturbance. This disturbance would not affect geology and would not have an impact on topography in the JPA.

4.2.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for geology or topography.

4.2.3 Residual Impacts

Mining would be expected to continue for 45 years. Approximately 100 million tons of limestone would be permanently removed from the resource base. The quarry area would be backfilled and re-contoured with waste rock, subsoil, and topsoil. The reclaimed areas would have similar contours to existing topography and would be blended with undisturbed topography. The PMT of the quarry area would be permanently altered from the original contours.

4.2.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to geology and topography would occur, resulting in conditions found in the existing environment.

4.3 Paleontological Resources

4.3.1 Proposed Action

The proposed project could potentially impact paleontological resources through surface disturbance of 637 acres. This acreage encompasses the quarry, haul road, processing area, and access road. Indirect impacts also could occur due to private collection or vandalism related to increased human presence in the area.

Due to the occurrence of geological formations with a potential fossil yield of Class 2 and 3 in the JPA, there would be few if any impacts to paleontological resources. In the quarry area, the Casper Formation is classified as Class 3; however, the formation is largely devoid of invertebrate fossils in the JPA. The Morrison Formation is known for the occurrence of vertebrate fossils but the portion of the JPA where this formation is exposed would not be disturbed by project activities.

4.3.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for paleontological resources.

4.3.3 Residual Impacts

There would be no anticipated residual impacts to paleontological resources as a result of construction and operational activities.

4.3.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to paleontological resources would occur resulting in conditions found in the existing environment.

4.4 Soils

4.4.1 Proposed Action

The proposed project would result in approximately 637 acres of new disturbance to soils. Soil units that are located in proposed disturbance areas are shown in **Map 3-3**.

Replacement of soil is proposed for major disturbances associated with the proposed project. The recommended salvage depth for native soil material is identified in **Table 3-3**. Based on the availability of topsoil, and subsoil a total volume of 623,553 bcy is estimated to be available for reclamation in the quarry area. Because topsoil media is not distributed evenly throughout the area, topsoil and subsoil salvaged from each 5-year block of mining would be stockpiled, inventoried, and returned to that same area. In areas where soil moisture would be highest, topsoil and subsoil would be placed at a depth of 24 inches. In areas of limber pine re-establishment, topsoil and subsoil would be placed at a depth of 12 inches. In all other areas (except for areas of constructed rock outcrop), topsoil and subsoil would be spread to an average depth of 11.5 inches. Areas of constructed rock outcrop would have pockets of shallow soils interspersed approximately 3 inches deep. Overall site productivity is primarily a matter of revegetation success. Productivity varies with vegetation community, but more importantly, with land management objectives as they relate to the establishment of desirable or productive vegetation types. In contrast, soil quality is an inherent soil resource characteristic involving aeration, permeability, texture, salinity and alkalinity, microbial populations, fertility, and other physical and chemical characteristics that are accepted as beneficial to overall plant growth and establishment. Based on this concept, there would be impacts to the existing quality and productivity of native soils from project-related disturbance.

Soil excavation, transport, storage, and redistribution would modify existing soil structure, generating adverse impacts relative to aeration and permeability. It is likely that some mixing of topsoil and subsoil would occur. Existing microbial populations and organic matter levels would likely decrease during stockpiling and storage. However, in most cases topsoil and subsoil would be direct hauled and replaced in areas being reclaimed. If it becomes necessary to store topsoil for more than 1 year, stockpiles would not exceed 2 feet in depth (including the existing native topsoil beneath the stockpile) and would be seeded and identified with a sign or placard.

Soil compaction from vehicular traffic would occur on the proposed haul and access roads, in addition to around the processing facility. Soil compaction decreases infiltration and accelerates run-off and erosion. Implementation of ACEPM S-6 would minimize this impact.

Fine sandy and silty textured, sparsely vegetated soils are prone to wind erosion. Although accelerated erosion due to mining-related soil disturbance could occur at any stage of the proposed project, the maximum potential for erosion within the JPA would be expected while soils are loose, with no vegetative cover. Erosion of soil by wind or water also would be of concern after reclamation work has occurred but before a vegetative cover has been re-established. If the ground surface is left smooth and barren during this period, winds could dislodge soil particles and rainfall intercepting barren surfaces could result in increased erosion. Implementation of ACEPMs S-1, S-2, S-3, S-9, S-10, and S-11 would minimize this impact by protecting the soil surface using BMPs and monitoring for erosion while encourage vegetative establishment.

Soil run-off potential would be modified in the reclaimed landscape due to the porous reconstructed bedrock and soil profile redistribution. Infiltration of precipitation would increase and run-off would decrease resulting in a slight drying effect to the deeper soils within the ephemeral drainages.

Isolated spill accidents if they occur, would result in soil contamination and loss of native soils for reclamation. Spills would be handled and reported according to Wyoming DEQ and BLM requirements. ACEPMs H-1 through H-3 would minimize the potential for impacts associated with spills.

State and federal regulatory programs that address project reclamation are administered by the Wyoming DEQ and BLM. Under the applicable regulations, mining companies must develop detailed reclamation plans and establish financial assurances for their successful implementation. Such plans address concurrent reclamation and stabilization practices that are implemented as a project proceeds, as well as post-mining practices that are implemented during the final stages of project completion. Concurrent reclamation typically consists of revegetation, erosion controls, and associated drainage practices that

minimize the impacts of clearing and accelerated erosion during project activities. Final reclamation is conducted following completion of mining and processing activities.

Final reclamation programs are oriented to control accelerated erosion, sedimentation, and drainage, as well as restore approved productive land uses. Typically, to address this latter objective, productive vegetation communities must be successfully re-established as an outcome of recontouring, soil application, and revegetation efforts.

4.4.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for soil resources.

4.4.3 Residual Impacts

Residual impacts to soils would consist of the permanent loss of soils due to the Lime Plant and access road that would be left on site. There would be a loss of soil productivity and soil to erosion in disturbed areas while implemented reclamation measures take effect. Successful reclamation for most areas resulting from implementation of appropriate soil reclamation measures (**Appendix B**) would mitigate other key soil conditions of affected, disturbed soils to stabilize the soil materials, thus preventing accelerated soil erosion, loss, and down-gradient sedimentation. It also would restore protective vegetative cover and productivity that benefit other environmental resources.

4.4.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to soils would occur, resulting in conditions found in the existing environment. Natural erosion rates and impacts associated with current land uses would continue.

4.5 Water Resources

The following subsections discuss the potential for impacts to water resources, both surface water and groundwater, associated with the proposed project.

4.5.1 Proposed Action

4.5.1.1 Surface Water

Hydrology of the quarry area would be temporarily impacted due to the removal of vegetation. Removal of vegetation would temporarily increase stormwater runoff volumes, erosion, and sedimentation. These temporary impacts would be mitigated through reseeding and replanting of vegetation and other stormwater control BMPs.

Hydrology of the quarry area would be permanently impacted due to excavation of overburden and limestone, and the subsequent replacement of overburden. This would cause a permanent change in topography and would impact surface hydrology by decreasing the potential for run-off, erosion, and/or sedimentation to occur. The PMT for the quarry is shown in **Map 2-3** and post-mining cross-sections are shown on **Figures 2-1** and **2-2**. It is anticipated that post-mining conditions would experience less run-off through the existing major drainages as well as less sedimentation. Drainage channels would naturally readjust their morphology in order to balance themselves with the altered runoff and sediment volumes. Changes to surface water conditions would result from proposed mining activities, but these are expected to be limited due to the existing ephemeral nature of streamflows and the proposed site reclamation.

Water yield is somewhat reduced by winter winds removing snow from the surfaces of the Cheadle and Passcreek soils (Reckner 1998), and probably from the rock outcrop areas as well. Downslope surface run-off and subsurface interflow drains from these higher landscape positions and through zones of deeper, more permeable soils on toeslopes and along the major ephemeral drainages. These zones would remain

throughout the project life. Due to backfilling of the quarry with crushed overburden after mining and reclamation, some upland parts of the watershed would have greater infiltration capacities than in the existing condition. This would provide additional on-site soil moisture for revegetation. However, these post-mining conditions may somewhat reduce the amount of moisture that moves into the deeper soils remaining along the major ephemeral drainages. However, soil moisture along these channels is currently limited by their existing deep incision.

Prior to any surface disturbance, temporary BMPs would be installed along all downslope and sideslope edges of the planned disturbance, particularly along existing drainages. The purpose of these temporary controls would be to capture sediment from run-off that may occur during the initial clearing of vegetation and stripping of topsoil and subsoil. Temporary BMPs would consist of the following:

- Berms or diversions/swales located above mined areas to redirect and prevent run-on from reaching mined areas.
- Berms or diversions/swales located below mined area to route run-off to sediment basins.
- Sediment controls (such as silt fence, wattles, or slash filter berms) to capture sediment within run-off.

The proposed project would develop and implement a Storm Water Pollution Prevention Plan (SWPPP) in accordance with state regulations under General Permit WYR32-0000. All erosion and sediment BMPs would be inspected periodically, maintained in working order, and replaced or modified when necessary in accordance with storm water permit requirements under WYPDES General Permit WYR32-0000.

The proposed project would not impact any permanent surface waters, and excavation for mining operation would not occur within 150 feet of any existing major drainages. These existing major drainages would only be disturbed at locations used for haul road crossings and at locations used for installation of sediment basins. During mining, the sediment basins discussed in Section 2.1.4 would be constructed periodically along the perimeter of the quarry area adjacent to the existing major drainages. The sediment basins were designed to contain run-off flows from the 10-year, 24-hour storm plus 1 year of sediment storage. The sediment basins would allow sediment to settle out of the storm water run-off. Water within the sediment basins would either infiltrate into the sub-surface, evaporate, or would discharge, via a stabilized spillway, to the existing major drainages.

The Revised Universal Soil Loss Equation (RUSLE) was utilized to determine potential sediment yield from areas disturbed by mining. RUSLE is an erosion-rate model used by the NRCS to estimate annual erosion rates. This equation is a simplified form of the natural process that incorporates the effects of rainfall, soil erodibility, topographic features, ground cover, and management practices in the following form:

$$A = R*K*LS*C*4P$$

where,

A = Sediment Yield (tons per acre year)
R = Rainfall-Run-off Erosivity Factor
K = Soil Erodibility Factor
LS = Slope Length and Steepness Factor
C = Cover Management Factor
P = Support Practice Factor

Table F-1 in **Appendix F** provides RUSLE results and sediment basin sizing.

Run-off volumes and peak flows would be calculated using the Soil Conservation Service (SCS) Curve Number method. The SCS method is dependent on classifying the land use and soil type by a single, weight-averaged parameter called the curve number (CN). SCS TR-55 contains several tables with published CN values that depend on the cover type, the hydrologic condition, and hydrologic soil group. The CN development approach for existing conditions and for post-mine (reclaimed) conditions is discussed below.

Existing Conditions Curve Number for Quarry Area:

As shown within **Map 3-6**, vegetation types within the quarry area consist primarily of Mountain Mahogany Shrubland, Dwarf Sagebrush/Grassland, Pine Savanna, and Rocky/Cushion Plant, with small areas of Aspen Woodland, Big Sagebrush Steppe, and Pine Woodland.

CNs were obtained from TR-55 Table 2-2d for arid and semiarid rangelands. This table offers CNs for four different cover types that are applicable to the JPA: Herbaceous – mixture of grass, weeds, and low-growing brush; Oak-aspen – mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, other brush; Pinyon-juniper with grass understory; and Sagebrush with grass understory. A hydrologic condition of Fair (30 to 70 percent ground cover) was used for existing conditions. Existing rock outcrop was assigned a CN of 91 (from TR-55 Table 2-2a for "Newly graded areas" and Type C soil). These CNs are listed in **Table 4-14**.

Table 4-14 Curve Numbers

Cover Type – Fair Condition	Curve Numbers for Hydrologic Soil Group						
	A	A/B[1]	B	B/C[1]	C	C/D[1]	D
Herbaceous	-	-	71	76	81	85	89
Oak-Aspen	-	-	48	53	57	60	63
Pinyon-Juniper (with grass understory)	-	-	58	66	73	77	80
Sagebrush (with grass understory)	-	-	51	57	63	67	70
Rock outcrop	91						

[1] Values for soil group A/B, B/C, and C/D are linearly approximated from the published TR-55 values.

Assuming that approximately 30 to 35 percent of the area is existing rock outcrop, a type B/C soil type (consistent with the USDA soil survey for soil numbers 141 and 191 from the site soil survey), and assuming that the remaining area is a combination of oak-aspen, pinyon-juniper, and sagebrush, the weighted CN for existing conditions is 68. The Herbaceous cover type was used only for existing conditions within lower elevations to the west of the quarry area.

Post-Mine (Reclaimed) Conditions CN for Quarry Area (used to calculate size of sediment basins)

Approximately 30 to 35 percent of the quarry area would be reclaimed as rock outcrop (approximately the same percentage as existing rock-outcrop areas prior to mining). This area would consist of backfilled waste rock and much of the precipitation that falls on this area is expected to infiltrate. Soil Group A was used for soils with low run-off potential and high infiltration rates such as excessively drained sand or gravel with greater than 0.3 inch per hour (in/hr) water transmission. The water transmission rate is anticipated to be well above 0.3 in/hr. There is no CN value listed in any of the TR-55 tables for such an area. It is believed that the CN would be less than 30 (a CN of 30 has been used within TR-55 Table 2-2c for Type A soils in areas of meadow, brush, or woods). A note in TR-55 Table 2-2c states, "Actual curve number is less than

30; use CN = 30 for run-off computations." Therefore, a CN of 30 was assigned to the reclaimed rock-outcrop areas.

The remaining 65 to 70 percent of the quarry area would be reclaimed with a 4-inch layer of crushed waste rock placed over the backfilled waste rock, and then a layer of topsoil and subsoil with a minimum thickness of 10 inches. These areas were assigned a Hydrologic Soil Group B, as documented for the BLM in separate technical submittals.

Each sediment basin collects drainage from approximately 3 years of mining area. The worst-case scenario would consist of reclamation combination of a newly graded area, 1-year reclaimed area, and 2-year reclaimed area, each comprising approximately one-third of the total area. The CN for a newly graded area (TR-55 Table 2-2a) is 86 for Type B soil. For both 1 year and 2 years into reclamation, the herbaceous cover type (Table 2-2d) and a poor hydrologic condition would be used. The CN is 80 for Type B soil. Therefore, this area was assigned a weighted CN of 82.

The contributing area into each sediment basin would be reclaimed with differing percentages of rock outcrop and topsoil/subsoil, depending on the location within the quarry and the existing cover type prior to mining. **Table 4-15** shows approximate percentages of each reclaimed cover type for the area contributing to each sediment basin. These percentages were used only for the purpose of generating approximate site specific curve numbers for each sediment basin, and actual percentages may vary during reclamation.

Table 4-15 Sediment Basins and Reclaimed Surface Types

Sediment Basin	Reclaimed Rock-Outcrop %	Reclaimed with Topsoil/Subsoil %	Weighted CN
A1	70	30	46
A2	30	70	66
A3	20	80	72
A4	45	55	59
A5	40	60	61
A6	45	55	59
A7	25	75	69
B1	10	90	77
B2	5	95	79
B3	0	100	82
B4	20	80	72
C1	15	85	74
C2	55	45	53
C3	50	50	56
C4	35	65	64
C5	60	40	51
C6	50	50	56

In addition to RUSLE results, **Table F-1** in **Appendix F** also provides the peak flow (discharge) into each sediment basin, the trapping efficiency of each basin, the influent and effluent sediment concentrations for each basin, and the approximated pre-mine sediment concentration for comparison purposes. These values were calculated using SEDCAD™ Version 4 and depend on flow length, slope, land cover, particle size distribution, the configuration of the sediment basin, and the curve numbers previously discussed.

The trapping efficiency calculations indicate that approximately 91.0 to 99.8 percent of sediment entering the sediment basins (all of the suspended sand and silt and a small portion of the suspended clay) would be captured by the sediment basins, and approximately 0.2 to 9.0 percent of sediment (most of the suspended clay) would pass through the sediment basins, via a riprap stabilized spillway, and enter the existing major drainages. The clay that enters the existing major drainages would likely remain in suspension until the water infiltrates or evaporates downstream of the quarry area. This assumes a worst-case scenario where the sediment basins are completely full of water prior to the run-off event. If the sediment basins were empty prior to a run-off event, all water and 100 percent of the sediment would be captured by the basin as long as the storm event was smaller than the 10-year, 24-hour design storm.

As shown in **Table F-1** in **Appendix F**, the peak effluent sediment concentrations from the 10-year, 24-hour storm event range from approximately 1,000 to 76,000 milligrams per liter (mg/L) and the pre-mine peak effluent sediment concentrations range from approximately 192,000 to 986,000 mg/L. Therefore, it is estimated that run-off released from the sediment basins would contain lower sediment concentrations than run-off from pre-mine (existing) conditions. Furthermore, these conservative calculations do not account for other temporary storm water control BMPs that would be constructed (such as silt fence, wattles, filter berms, check dams, etc.).

Where possible, run-on would be diverted away from mining activities and run-off from mining activities would be directed to flow into the sediment basins. Otherwise, run-off would be trapped inside the mine pit where infiltration or dewatering (as needed) would occur. It is anticipated that surface water collected within mine pits would infiltrate quickly into the limestone face. Sediment is the only anticipated water quality impact to storm water run-off that leaves the quarry area. Water collecting in the mine pit that does not infiltrate would drain to in-pit sumps for settling and then be used for reclamation or dust control. If not used for those purposes, it would be pumped to the nearest sediment basin. If pumping to a sediment basin becomes necessary, temporary lines would be used to contain drainage and avoid overland flow. There would be no overland flow released from this process.

Due to changes in topography (decreased slopes) and reclaimed conditions. It is anticipated that post-mining conditions would experience less run-off through the existing major drainages as well as less sedimentation. The existing major drainages, however, eventually fan out as the slopes decrease downstream of the quarry area and runoff infiltrates into the soil before reaching U.S. Highway 287/30. There are no evident receiving waters located beyond U.S. Highway 287/30 that are impacted by mining activities.

Reclamation activities would include the development of the PMT, the replacement of topsoil/subsoil, and revegetation. Mining and reclamation would occur concurrently throughout the life of the mine. On average, 8 to 13 acres would be disturbed and mined annually and an equal amount of disturbed land would undergo reclamation. The average slope of the PMT within the reclaimed areas of the site would be less than the existing (pre-mine) average slope. Therefore, once vegetation has established and reclamation is complete, post-mine hydrology of the area is anticipated to be just as stable (or more stable) than existing hydrology. Decreased slopes would lead to decreased run-off quantities (increased infiltration) as well as decreased erosion and sedimentation.

Control of storm water discharge also would be in accordance with the Jonathon Quarry SWPPP. Spill prevention and response procedures would be defined as part of the SWPPP, and in a Spill Prevention, Control, and Countermeasure Plan, as appropriate. These documents would be prepared, maintained on site, and provided to Wyoming DEQ and/or BLM upon request.

4.5.1.2 Groundwater

As discussed in Chapter 3.0, groundwater is located more than 610 feet bgs in the quarry area, and as discussed in Chapter 2.0 the average mining depth would be about 140 feet with a maximum depth of about 250 feet. Therefore, the minimum depth of groundwater below the deepest part of the proposed quarry would be about 360 feet. Based on this depth, there would be no need for dewatering of the quarry and no impacts to groundwater depths from the proposed quarry operation.

Precipitation that falls on the reclaimed surface of the quarry area would infiltrate through the crushed overburden material placed as backfill within the mine pit. Because the overburden material would be pulverized during mining and backfilling, there would be a larger surface area of this material to interact with water percolating through the backfill. This increased interaction could cause more rapid reaction of the overburden with water; however, the solubility of limestone would limit this interaction and the pH of the percolating water is likely to be similar to that of pre-mining conditions. In addition, analysis of overburden material (Table D-5.2 of the Mine Permit Application) indicates that the material is acceptable for reclamation, including an analysis showing the material does not have an acid forming potential. Therefore, impacts to groundwater quality are not anticipated.

A limited amount of kiln/raw mill baghouse dust (LKD) that is not recycled, returned to the lime production process, or sold for beneficial uses such as soil conditioner or remediation treatment material would not be returned to the quarry as backfill. Instead, these materials would be removed from the site and sold. PLS estimates that the project operation would generate approximately 3 tph of LKD. LKD is composed of primarily limestone, along with a lesser amount of “dead” lime. Approximately 1 to 2 percent of the LKD would consist of interspersed fly ash generated by the combustion of coal in the lime kiln. PLS would sell the LKD for a number of beneficial uses.

PLS would install a groundwater supply well at the proposed plant site. Impacts from any new well would be evaluated by the Wyoming State Engineer’s Office prior to approval. Given the low volumes of water to be used by the facility (28.54 gpm) and the distance to existing groundwater rights (at least 1 mile away) impacts to groundwater use from the proposed well are not anticipated.

As discussed in Chapter 3.0, the groundwater depth at the proposed plant site is more than 125 feet bgs. This thickness of geological material between the plant site and groundwater provides sufficient protection of the groundwater quality from any spills at the facility. This would be further mitigated by the implementation of the facility spill prevention and response practices identified in the SWPPP, to be developed prior to construction.

4.5.1.3 Wetlands

Based on field delineations, two wetlands were found within or near the JPA. Only one area, the wetland related to the windmill is within the JPA. This wetland is adjacent to the access road and would not be directly impacted by construction and operation of the access road.

The construction and operation of the proposed access road from U.S. Highway 287/30 to the Lime Plant would potentially impact one small wetland located at the western edge of Section 10 (T17N, R73W). The small (0.2 acre) wetland was supported in a small depression that receives windmill pump overflow. This area consists of a shallow, open-water pond with a shoreline fringe of wetland vegetation. This wetland had no drainage or wetland connection to other wetlands or waters of the U.S. and would be classified as an isolated wetland by the USACE. A second transitional area to the south of the proposed access road was avoided by relocating the access road further north.

4.5.2 Additional Mitigation Measures

4.5.2.1 Surface Water

No additional mitigation measures were deemed necessary for surface waters.

4.5.2.2 Groundwater

No additional mitigation measures were deemed necessary for groundwater impacts.

4.5.2.3 Wetlands

The following additional mitigation measure would reduce impacts associated with one wetland in the JPA.

WET-1: The construction and operation of the proposed access road from U.S. Highway 287/30 to the Lime Plant would avoid the wetland located in Section 10. A buffer of 75 feet would be established around the wetland during construction activities. If the wetland cannot be avoided, consultation with the USACE would be initiated.

4.5.3 Residual Impacts

4.5.3.1 Surface Water

Residual impacts to water resources primarily would consist of changes in infiltration rates, and run-off due to changes in PMT. Some of the sediment basins would be left on site, where they would silt in over time. These impacts are expected to be slight due to the existing ephemeral nature of streamflows and the proposed site reclamation.

4.5.3.2 Groundwater

There are no anticipated residual impacts to groundwater as a result of construction and operational activities.

4.5.3.3 Wetlands

There are no anticipated residual impacts to wetlands based on implementation of the proposed mitigation measure.

4.5.4 No Action Alternative

4.5.4.1 Surface Water

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to surface waters would occur, resulting in conditions found in the existing environment.

4.5.4.2 Ground Water

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to groundwater would occur, resulting in conditions found in the existing environment.

4.5.4.3 Wetlands

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to wetlands would occur, resulting in conditions found in the existing environment.

4.6 Vegetation

The primary issues associated with vegetation resources include direct and indirect impacts to vegetation cover and diversity, BLM sensitive species, and impacts associated with the potential introduction and/or spread of noxious weeds and invasive species.

4.6.1 Proposed Action

Under the proposed project, an estimated 637 acres of vegetation would be removed or disturbed due to surface disturbance activities associated with construction and operation activities, including the access

road, haul road, plant site, quarry area, and mine facility area. ACEPMs (**Appendix A**), the Reclamation Plan including the Weed Management Plan (**Appendix B**), BLM and Wyoming DEQ requirements and regulations were assumed to be implemented in determining potential impacts. **Table 4-16** identifies acreages of vegetation affected under the proposed project. The majority of the temporary disturbance would occur in the dwarf sagebrush/grassland and the mountain mahogany shrubland vegetation communities. The majority of the long-term impacts associated with the haul road, access and project facilities would occur in the dwarf sagebrush grassland vegetation community.

Table 4-16 Acreages of Affected Vegetation by the Proposed Project

Vegetation Community Type	Acres of Short-term Impacts	Percent of JPA	Acres of Long-term Impacts	Percent of JPA
Major Vegetation Communities				
Big Sagebrush Steppe	32	2	0	0
Dwarf Sagebrush/Grassland	257	15	58	4
Mixed-grass Prairie	29	2	16	1
Mountain Mahogany Shrubland	116	8	1	<1
Rocky/Cushion Plant	75	5	< 1	<1
Minor Vegetation Communities				
Aspen Woodland	5	<1	0	0
Pine Woodland	7	<1	0	0
Ecotonal Vegetation Communities				
Pine Savanna	116	8	0	0
Total	**637**		**76**	

[1] Includes long-term impact acres. Short-term impacts include the construction and operation surface disturbance associated with the quarry area, access road, haul road, and plant facility.

[2] Long-term impacts are associated with the placement of project facilities, access road, and haul road up to Section 8, which would be left on-site.

Short-term impacts from project-related activities would include the trampling of herbaceous vegetation, clearing of vegetation for mining, and the conversion of tree and shrub-dominated vegetation communities to grass/forb-dominated vegetation communities in the short term. Over the long term, shrubs would become re-established and increase in abundance within the majority of disturbed areas as a result of reclamation and natural re-colonization. Long-term impacts would result from the permanent loss of vegetation from the placement of project facilities, access road, and haul road and potential impacts to surface water flow and infiltration based on the post-mine substrate. Long-term impacts from the project facilities, access road, and haul road would result in the loss of 16 acres of mixed-grass prairie, and 58 acres of dwarf sagebrush/grassland. Less than 1 acre of rocky/cushion plant vegetation community, and approximately 1 acre of mountain mahogany shrubland would be permanently impacted by the project facilities. The two smaller aspen stands in Section 8 would be protected from mining activities (**Map 3-6**). A portion of the large aspen stand would be protected from mining activities.

As discussed in Section 2.1.4 and Section 4.5.1.1, post-mine substrates would be composed of crushed limestone in place of bedrock. Due to these changes in substrates, some upland parts of the watershed would have greater infiltration capacities than in the existing condition. While this could provide additional on-site soil moisture for revegetation, however, there also could be a decrease in the amount of moisture

that moves into the deeper soils remaining along the major ephemerals. However, the overall impact on channel flow is anticipated to be minor due to the ephemeral and deeply incised nature of the channels.

Vegetation community recovery would be achieved through successful reclamation as described in the Mine Plan Appendix D-8. Mining would disturb approximately 8 to 13 acres annually. To mitigate impacts to vegetation, reclamation would be conducted as soon as possible after mining is completed in each area. Reclamation would occur as described in the Reclamation Plan (**Appendix B**) and would focus on restoring pre-mine vegetation communities. Vegetation success would be determined based on comparisons with the established reference areas as described in the Mine Plan, Appendix D-8 and the Reclamation Plan (**Appendix B**). Portions of the quarry area would be reclaimed as constructed rock outcrop and seeded with the rock outcrop/shallow soil seed mix (**Appendix B**, **Attachment 1**). The remainder of the quarry area would be revegetated with the high elevation seed mix, while the disturbed areas below 7,600 feet would be revegetated with the lower elevation seed mix (**Appendix B**, **Attachment 1**). The seed mixes consist of native grasses, forbs and shrubs most of which were observed on-site during vegetation mapping that was conducted in 2007 and 2009. PLS also has committed to a limber pine replanting program and mountain mahogany seed collection as described in ACEPMs V-1 to V-4. Limber pine areas would be temporarily revegetated with a BLM-approved seed mix or mulched until limber pine seedlings are available for transplanting.

The large quaking aspen stand disturbed by construction and operation activities would be monitored annually after mining activities have stopped and reclamation has been started in the vicinity of the aspen stand. Aspen trees are expected to propagate through sprouting and spread into the reclaimed disturbed areas. As described in ACEPM V-11, if during monitoring it is documented that quaking aspen seedlings are not recolonizing previously disturbed areas, additional BLM reclamation techniques may be required.

The herbaceous-dominated plant communities would establish adequate ground cover to prevent erosion and provide forage for wildlife species and limited grazing operations in 3 to 5 years. The shrub-dominated plant communities would require 20 to 50 years recolonize, while the recolonization of the woodlands would take 25 to 75 years. The reclaimed landscape mosaic would consist of native grassland, shrublands, and woodland communities.

Following surface disturbance activities, noxious weeds, and invasive species may readily colonize areas that typically lack or have sparse vegetative cover. The implementation of the Reclamation Plan and the Weed Management Plan would prevent the establishment and spread of noxious and invasive species.

4.6.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for vegetation.

4.6.3 Residual Impacts

Residual impacts to vegetation would consist of the long-term loss of vegetation since the Lime Plant and access road would remain on site after mining operations have been completed; potential loss of native species diversity; and potential conversion of vegetation communities. Implementation of the ACEPMs (**Appendix A**), Reclamation Plan (**Appendix B**), Integrated Weed Management Plan (**Appendix B**, **Attachment 2**) would minimize residual impacts from noxious weeds and invasive species as well as impacts on native vegetation and suitable habitat.

4.6.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to vegetation would occur, resulting in conditions found in the existing environment.

4.7 Terrestrial Wildlife

4.7.1 Proposed Action

The proposed project could potentially impact wildlife including mule deer (*Odocoileus hemionus),* pronghorn (*Antilocapra americana),* elk (*Cervus elaphus),* mountain lion (*Felis concolor)* black bear (*Ursus americanus*), and a variety of other small mammal and avian species. The WGFD has mapped the JPA as winter-yearlong range for mule deer and elk and spring-summer-fall range for pronghorn. Effects on wildlife include the physical loss of habitat, displacement, habitat fragmentation, increased competition for existing resources in unaffected areas, and direct mortality. These effects can be classified as short-term and long-term. Short-term impacts arise from habitat removal and disturbance, as well as from activities associated with construction, mining, and processing. These impacts would cease upon project closure and completion of successful reclamation. Long-term impacts would consist primarily of permanent changes to habitats in the quarry area and the wildlife populations dependent on those habitats.

Direct habitat losses would result from access road, processing plant, and quarry development, and indirectly from increased human presence. Acreages of direct habitat loss are provided in Section 4.6.1. Reclamation would be implemented after project closure and would focus on replacement of existing grassland and shrub communities.

The most common wildlife responses to noise and human presence are avoidance and accommodation. Avoidance of disturbed areas would result in wildlife displacement from an area larger than the actual disturbance sites. The extent of displacement would be related to the duration, magnitude, and the visual prominence of the activity, as well as the extent of construction and operational noise levels above existing background levels. Displacement would result in local reductions in wildlife populations if adjacent, undisturbed habitats are at carrying capacity. In this situation animals are either forced into less than optimal habitats or they compete with other animals that already occupy unaffected habitats. Possible consequences of such displacement are lower survival, lower reproductive success, lower recruitment, and ultimately lower carrying capacity and reduced populations (WGFD 2010). The extent of wildlife displacement is impossible to predict for most species since the response severity varies from species to species and can even vary between different individuals of the same species. After initial avoidance, some wildlife species (usually certain birds and rodents and to a lesser extent deer and pronghorn) may acclimate to the activity and begin to re-occupy areas previously avoided.

Habitat fragmentation is difficult to assess and may vary from species to species. The plant site and quarry would create barriers to wildlife movement through these areas, but the extent of similar, undisturbed, surrounding habitats should be able to accommodate changes in wildlife movement patterns associated with the development of these facilities. Habitat fragmentation and isolation can be most problematic in areas of limited habitat such as crucial big game winter range and reproduction habitats. The JPA is not within any crucial big game winter range or within 4 miles of a sage-grouse lek.

During construction and operation, most larger, mobile wildlife species would be displaced to adjacent undisturbed habitats, although, direct habitat disturbance would result in some direct losses of smaller, less mobile species of wildlife, such as small mammals, reptiles, and ground nesting birds (if construction occurs during the breeding season). Increased human presence and subsequent related increases in traffic levels on U.S. Highway 287/30 and project access roads could result in more animal-vehicle collisions. The potential for animal-vehicle collisions is typically highest in the early morning and evening hours and where roads traverse areas where big game concentrate. The risk of animal-vehicle collisions is expected to be relatively low for the proposed project because of the relative open nature of habitats surrounding nearby and JPA roadways as well as the lack of any big game concentration areas near the JPA.

4.7.2 Additional Mitigation Measures

The following additional mitigation measures would reduce impacts associated with terrestrial wildlife for the proposed project.

W-1: If dead or injured raptors, big game, migratory birds, or unusual wildlife are observed on the JPA, PLS will contact the appropriate BLM and WGFD offices. Under no circumstances will dead or injured wildlife be approached or handled by PLS personnel or their contractors.

W-2: PLS shall notify the BLM immediately if raptors are found during the annual raptor survey nesting on or within 1,200 feet of project facilities and assist the BLM as necessary in erecting artificial nesting structures (ANSs) as appropriate. The use of ANSs will be considered as a last resort for raptor protection. If nest manipulation or a situation requiring a "taking" of a raptor nest becomes necessary, a special permit will be obtained from the Denver USDI-FWS Office, Permit Section and will be initiated with sufficient lead time to allow for development of mitigation. Required corresponding permits will be obtained from the WGFD in Cheyenne. Consultation and coordination with the USDI-FWS and WGFD shall be conducted for all protection activities relating to raptors.

W-3: Employee and contractor education will be conducted regarding wildlife laws. If violations are discovered on the JPA, PLS will immediately notify the appropriate agency. PLS will implement policies designed to control off-site activities of personnel, that may result in littering or resource damage.

W-4: Company and contractor employees operating motorized equipment will undergo training describing the types of wildlife in the area, the circumstances under which collisions are likely to occur and the measures that can be employed to minimize collisions.

4.7.3 Residual Impacts

Residual impacts to wildlife would consist of the long-term loss of habitat since the Lime Plant and access road would be left on site after mine operations have been completed and the potential conversion of vegetation communities that are native habitat. Implementation of the ACEPMs (**Appendix A**) and Reclamation Plan (**Appendix B**) would minimize residual impacts to wildlife resources.

4.7.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to terrestrial wildlife would occur, resulting in conditions found in the existing environment.

4.8 Special Status Species

4.8.1 Proposed Action

4.8.1.1 Animals

The listing of species obtained from the WYNDD (WYNDD 2005) for the JPA and vicinity was reviewed to determine the potential presence of threatened, endangered, or BLM sensitive species within or near the JPA. Based on this review and a review of the USFWS Mountain-Prairie Region list of threatened and endangered species, no threatened or endangered species are likely to occur in or near the JPA.

Three BLM sensitive species (greater sage-grouse, Brewer's sparrow, and sage sparrow) may occur within the JPA based on their distribution and habitat preferences. Greater sage-grouse also is a federal Candidate for listing as threatened or endangered. The greater sage-grouse Core Breeding Area mapping provided by the WGFD in 2010 indicates the proposed Lime Plant area and much of the access road are within the Laramie Core Breeding Area for sage-grouse (**Map 3-8**), including a small portion (approximately 7 acres) of BLM-administered land along the haul road. The closest sage-grouse lek is over 4 miles from the proposed JPA; therefore, impacts to sage-grouse are limited to habitat loss and fragmentation. Brewer's sparrow and sage sparrow are primarily obligates of large, dense stands of Wyoming sagebrush. They also may occur, to a lesser extent, in mountain shrub habitats such as mountain mahogany. As indicated in Section 4.6.1 no tall sagebrush habitats would be impacted by project development. There would be a temporary loss of approximately 116 acres of mountain mahogany habitat associated with quarry development. These areas would be reclaimed as described in Section 2.1.4, the ACEPMs (**Appendix A**),

and the Reclamation Plan (**Appendix B**). This temporary loss of mountain mahogany habitat may reduce the total extent of suitable habitat available for Brewer's sparrow and sage sparrow in the JPA until successful reclamation is achieved. Neither species was documented in the JPA during the field surveys.

4.8.1.2 Plants

Based on field surveys conducted throughout 2007, no sensitive plant species were identified in the JPA and no impacts are expected other than for limber pine, a sensitive species. The JPA contains a mixture of vegetation types, including those that have limber pine in them. Most, if not all of these stands are exhibiting serious limber pine mortality attributed to bark beetle and blister rust infestations. Limber pine, along with the rest of the vegetation, would be removed during the quarrying process. PLS recognizes the additional challenges restoration of conifers adds to reclamation, and has committed to successfully restoring limber pine back into the quarry area in the same approximate extent as exists today (see Appendix B).

4.8.2 Additional Mitigation Measures

4.8.2.1 Animals

The following additional mitigation measures would reduce impacts associated with special status species for the proposed project.

<u>Greater Sage-grouse</u>

SSS-1: Construction, reclamation, and other potentially disruptive activities in identified greater sage-grouse nesting and early-brood rearing habitat shall be prohibited from March 1 to July 15.

SSS-2: Construction, reclamation, and other potentially disruptive activities in identified mountain plover habitat shall be prohibited from April 10 to July 10.

<u>Mountain Plover</u>

SSS-3: Mountain plover nest surveys will be conducted in suitable mountain plover habitat if construction occurs during the mountain plover breeding season (March 15 – July 31). If a mountain plover nest is found, a 0.25-mile buffer around the nest will be implemented until the young have fledged.

4.8.2.2 Plants

Impacts to special status plant species are not anticipated; therefore, mitigation measures were not developed.

4.8.3 Residual Impacts

4.8.3.1 Animals

Residual impacts to special status animal species would consist of the long-term loss of habitat since the Lime Plant and access road would be left on site after mining operations have been completed; potential habitat fragmentation; and the potential conversion of vegetation communities that are native habitat. Implementation of the ACEPMs (**Appendix A**), and Reclamation Plan (**Appendix B**) would minimize residual impacts special status animal species.

4.8.3.2 Plants

There would be no anticipated residual impacts to special status plant species.

4.8.4 No Action Alternative

4.8.4.1 Animals

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to special status animal species would occur, resulting in conditions found in the existing environment.

4.8.4.2 Plants

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to special status plant species would occur, resulting in conditions found in existing environment.

4.9 Cultural Resources

4.9.1 Proposed Action

Evidence of both historic and prehistoric occupation has been documented in the JPA. Three sites and seven isolates were newly recorded within the project boundaries. None of the sites is assessed as eligible for inclusion on the NRHP. In addition, a segment of the previously recorded Lincoln Highway traverses the JPA. The segment was evaluated as a non-contributing element of the highway, and therefore would not be affected by the proposed project.

4.9.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for cultural resources.

4.9.3 Residual Impacts

No residual impacts to cultural resources would occur as a result of the proposed project.

4.9.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to cultural resources would occur, resulting in conditions found in the existing environment.

4.10 Land Use

4.10.1 Proposed Action

Impacts associated with the proposed project on land use include direct and indirect impacts to grazing, recreation, and agriculture land uses. ACEPMs (**Appendix A**), the Reclamation Plan including the Weed Management Plan (**Appendix B**), BLM and Wyoming DEQ requirements and regulations were assumed to be implemented in determining potential impacts. The proposed project would change the current land use on private land at the JPA from primarily ranching, agriculture, and wildlife habitat to mixed grazing and transportation along the access road and haul road.

Under the proposed project, 637 acres of vegetation would be removed within the Nelson Ranch grazing allotment. Based on the loss of 637 acres due to surface disturbance activities within the Nelson Ranch grazing allotment, 55 AUMs (40 percent of total allotment active AUMs) would be temporarily lost over the lifetime of the project, and 7 AUMs (5 percent of total allotment active AUMs) would be permanently lost due to the construction of the plant site, the access road, and haul road. Direct impacts to rangeland improvements would include the loss of the water pipeline and water reservoir due to the construction of the haul road. PLS has committed to replace and/or mend damage to range improvements (ACEPM L-1) and the relocation of the water pipeline and water reservoir (ACEPM L-3).In addition, PLS also has committed to the bracing or relocation of pasture fences if they are to be partially or completely removed due to mining activities (ACEPM L-4).

Vegetation community recovery would be achieved through successful reclamation as described in the Mine Plan Appendix D-8. Mining would disturb approximately 8 to 13 acres annually. To mitigate impacts to vegetation, reclamation would be conducted as soon as possible after mining is completed in each area. Reclamation would occur as described in the Reclamation Plan (**Appendix B**) and would focus on restoring pre-mine vegetation communities. Once the successful restoration of vegetative cover and vegetation that is capable of supporting grazing is achieved, livestock grazing could be resumed in disturbed areas. Livestock grazing would not be allowed in shrub and woodland areas in the first 3 to 6 years after seeding/replanting to allow the successful establishment of seedlings.

The access road, plant facility, and haul road up to Section 8 would remain on site. The access road from U.S. Highway 287/30 to the northeast corner of Section 10 would be converted to a county road. The haul road would remain a private road. The land use of the quarry area following reclamation would revert to the pre-mine multiple land uses including wildlife habitat, grazing, and recreation.

4.10.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for land use.

4.10.3 Residual Impacts

Residual impacts would consist of the permanent loss of seven AUMs; long-time loss of land use associated with the Lime Plant, access road, and portions of the haul road; and changes in land use.

4.10.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to land use would occur, resulting in conditions found in the existing environment.

4.11 Noise

4.11.1 Proposed Action

4.11.1.1 Construction

Construction of the access road, plant site, and haul road would generally take place only during the daylight hours and would be of short duration. Noise impacts would occur sporadically over the construction period. The nearest sensitive receptors (homes, schools, etc.) are located 2.3 miles west and 3.4 miles southwest of the plant site. It is expected that noise levels would attenuate to background levels within 0.5 mile from the source.

Based on the daylight-only construction period, and the rural nature of the proposed project, these noise levels should not be disruptive to other activities in the vicinity.

4.11.1.2 Operation

Noise impacts from limestone processing would be mainly due to conveyors, fine grinding of the limestone and handling of the unprocessed and processed material. Additional noise sources would include trucks and other vehicles. Processing plant noise levels as measured at similar operations would be expected to range from 65 to 83 dBA (including ambient noise) depending on operating processes. These measurements were collected approximately 50 feet from the source. The nearest sensitive receptors are located 2.3 miles west and 3.4 miles southwest of the plant site. Based on a decrease of 6 dBA for every doubling of distance, it is expected that noise levels would attenuate to background levels of approximately 45 dBA within 0.5 mile from the source.

Based on the rural nature of the proposed JPA and lack of sensitive receptors such as residences, schools, and hospitals, noise levels from processing operations would not be disruptive to other activities in the vicinity.

Noise impacts from quarry operations would primarily be from operation of dozers, front end loaders, scrapers and other loading equipment as well as a portable crusher. This equipment typically produces noise up to approximately 85 dBA as measured 50 feet from the source (USEPA 1971). The nearest sensitive receptors are located 2.3 miles west and 3.4 miles southwest of the plant site. It is expected that noise levels would attenuate to background levels within 0.5 mile from the source. An additional noise source would be intermittent blasting as needed during quarry operations.

Based on the rural nature of the proposed JPA and lack of sensitive receptors, noise levels from quarry operations would not be disruptive to other activities in the vicinity.

4.11.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for impacts from noise.

4.11.3 Residual Impacts

There are no anticipated residual impacts associated with noise levels from quarry and plant operations.

4.11.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts from additional noise would occur, resulting in conditions found in the existing environment.

4.12 Visual Resources

4.12.1 Proposed Action

Impacts to the visual landscape from the proposed project would result from the construction and operation of the access and haul roads, Lime Plant, and quarry facilities, and removal of the vegetation and overburden and mining in the quarry area. Impacts to dark sky views would result from night-time lighting for structures, roads, and quarry operation areas. The Lime Plant would be located on private land, therefore not subject to BLM approval. Operations in the quarry area would result in a visible change in form with a cylindrical stack, planar roads, and quarry. Lines would be vertical and angular. Color would be tans and grays with fine textures. These changes would be visible from both KOPs and would be representative of views from the residential area and along portions of Rogers Canyon Road as well as the view from U.S. Highway 287/30. Visual impacts in the foreground-middleground (0 to 5 miles) and background (5 to 15 miles) would be moderate but would be within the objectives for VRM Class III to partially retain the existing visual character (**Appendix E**). The overall level of change to the landscape would be moderate and, with implementation of the Reclamation Plan (**Appendix B**) and ACEPMs (**Appendix A**) for vegetation, would not dominate the view of the casual observer.

4.12.1 Additional Mitigation Measures

No additional mitigation measures have been developed for impacts to visual resources.

4.12.2 Residual Impacts

Residual impacts to visual resources would result from the permanent placement of the Lime Plant. The visual effects on the quarry site would diminish over time through reclamation (**Appendix B**) and establishment of vegetative cover.

4.12.3 No Action Alternative

Under the No Action Alternative, the proposed mining and processing operations would not occur thereby avoiding impacts to visual resources.

4.13 Socioeconomics

4.13.1 Proposed Action

This section evaluates the beneficial and adverse effects of the proposed project within the context of social and economic changes in the study area.

4.13.1.1 Population

The population of the study area would not be expected to change measurablely as a result of developing the Jonathon Project. The relatively small amount of construction and permanent workers would provide no impetus for measureable population growth. Approximately 49 permanent workers and their families would be added to the local population; however, these permanent workers more than likely would come from the local population. It is expected if any workers move to the JPA they would find ample permanent housing in the City of Laramie. The estimated 49 permanent workers and associated family members would potentially add 0.4 percent to the existing city population, based on the assumption each permanent workers would bring two family members. It is expected most of the permanent and temporary workers would come from the local work force.

4.13.1.2 Employment

It is anticipated that a short-term work force of 29 workers would be needed for construction of the roads, Lime plant and development of the quarry. Once the proposed project is in operation, there would be a permanent workforce of approximately 49 workers. Temporary construction workers and permanent staff would provide an increase in commercial activity and sales tax revenues in the JPA; however, they would not be expected to have an effect on the area economy or the employment level. Both the temporary and permanent workforce is expected to come locally from the surrounding population centers, such as Laramie and potentially Cheyenne. A local worker is identified as a worker who is able to commute to and from his permanent place of residence on a daily basis. A non-local worker is identified as a worker who has moved into the construction area for the duration of the project. The construction period is projected to begin in 2012, with normal operations slated to start 24 to 30 months later. No reductions to employment are anticipated.

4.13.1.3 Income

The estimated labor cost for construction is $4,212,704. This cost would be spread over the 24- to 30-month construction period and includes salaries for contract supervisors' wages, benefits and overtime for skilled and unskilled labor, and rental on labor force trade equipment. The average monthly payroll during construction is estimated at $117,020. The average monthly payroll for permanent workers is expected to increase to $837,373. The increase in income is expected to have beneficial impacts to the local communities and city and state tax bases.

4.13.1.4 Housing

Because a change in population is not anticipated in the JPA, it is unlikely that housing demand in the study area would change to any noticeable degree. The high percentage of vacant housing units would ensure that housing is available for the temporary and permanent work force; however, as most of the workforce would be of local origin, extra housing would not be needed or would be needed only to meet demand from a small number of workers who may move to the JPA.

4.13.1.5 Local Government Facilities and Services

The proposed permanent project work force would not be large enough to place a permanent demand on local services such as police, medical facilities, fire or educational services; nor would the short-term construction work force cause any detrimental effects to community social well-being due to the local origin of much of the work force. No measurable impact on the existing infrastructure would occur.

4.13.1.6 Local Fiscal Conditions

Initial construction costs for development of the proposed project would include an estimated $3,150,325 in 2012 for the construction of the haul road and the limestone quarry. These costs would be capitalized and depreciated out over the life of the mine. Development of the proposed project would add additional value to the tax base of Albany County. Current 3-year projections estimate total local tax revenue of $2,553,824. When local tax revenues are calculated to 7 years out, this number increases to $4,815,686. State tax revenues for the first 3 years of operation would be $2,166,008. This number increases to $3,295,047 when calculated for 7 years. It is assumed that as many materials as possible would be locally purchased. These expenditures would include tools, fuel, oil, parts, and repairs. Increased spending in the local areas would result in amplified retail sales to merchants, as well as increased sales tax to local taxing jurisdictions, as indicated above. The overall impact of this local spending and tax generation would be positive.

4.13.1.7 Environmental Justice

Since publication of EO 12898, Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations in the *Federal Register* on February 11, 1994 (59 *Federal Register* 7629), federal agencies have been developing a strategy for implementing the order. Currently, the federal agencies rely on the Environmental Justice Guidance under the NEPA prepared by the CEQ (the guidance) (USEPA 1997), in implementing EO 12898 in preparing NEPA documents.

Minorities include individuals who are members of the following population groups: American Indian or Alaskan Native; Asian, Pacific Islander; African American, Hispanic; or persons reporting two or more races. The U.S. Census Bureau 2008 poverty threshold definition for a 3-person household was $17,163 (U.S. Census Bureau 2008).

For the purpose of this EA analysis, the “affected area” is defined as Albany County. A population with a ‘meaningfully greater’ than minority population or ‘meaningfully greater’ than percentage of families below the poverty level is defined as a percentage that is 1.5 times or more greater than the state average.

According to the estimated 2008 U.S. Census Bureau statistics the population of Albany County was primarily white, with the largest minority population as Hispanic, followed by Asian, those claiming two or more races, African American, American Indian, and Pacific Islander. The Asian population in Albany County is greater than 1.5 times the Wyoming state average, resulting in a meaningfully greater minority population in the JPA. The increased Asian population may be attributed to the presence of the University of Wyoming, which may bring greater diversity to the county. Furthermore, the location of the proposed project was not selected due to demographic dynamics, but the presence of limestone. As is indicated in **Table 4-17**, there is not a meaningfully greater percentage of families below the poverty level in Albany County when compared to the state average. In fact, the 2008 median family income for Albany County ($69,103) indicates a general level of income for the county that was well above the poverty threshold ($17,163). Disproportionate impacts to minority and/or low income populations are not anticipated.

Table 4-17 State and County Income by Ethnicity

County/ State	2008 Ethnic Populations (percent)							Families Below Poverty Level (%)	Median Family Income ($)
	American Indian/ Alaska Native	Asian	Pacific Islander	African American	Hispanic	Two or More Races	White		
Wyoming Average	2.5	0.7	0.1	1.3	7.7	1.5	86.8	5.5	64,874
Albany	1.1	1.8*	0.1	1.6	7.9	1.7	86.6	7.8	69,103

4.13.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for socioeconomics.

4.13.3 Residual Impacts

The residual impacts include all of the effects described in the previous sections.

4.13.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to socioeconomics would occur, resulting in conditions found in the existing environment.

4.14 Transportation and Access

A dirt road runs from U.S. Highway 287/30, east across the southern boundary of Section 7 then north along the east boundary of Section 7 approximately 0.75 mile then east approximately 0.75 mile before turning northeast to a residence in the southeast quarter of Section 5. One power line follows this road. A power line is located in Sections 1 and 2, north of the proposed Lime Plant location but north of the JPA.

4.14.1 Proposed Action

U.S. Highway 287/30 would be used to ship finished product to market. Approximately 75 percent of the product would be shipped on south bound U.S. Highway 287/30 using the bypass to avoid downtown Laramie while the remainder would be shipped northward.

The access road from U.S. Highway 287/30 to the plant would be used to gain access to the plant. A new haul road would be constructed from the plant to the quarry. Haul trucks would use this road to transport the limestone from the quarry to the plant. It is assumed that the largest truck to operate on the haul road would be a 773E Off-highway Truck (60-ton nominal payload capacity).

Primary impacts to transportation would be increased vehicle traffic on U.S. Highway 287/30, particularly between Laramie and the quarry/plant area. Based on production estimates, it is anticipated that the proposed project would require approximately 100 trucks per day when the fine grind and Lime Plant are at full operation. This number would include vendor traffic as well as trucks moving processed product to market. In addition to the truck traffic, the proposed project would result in an additional 40 personal vehicles for employees. It is anticipated that approximately 75 percent of the truck traffic and all of the personal vehicles would travel between the plant site and Laramie to the south. The remainder of the trucks would travel north on U.S. Highway 287/30. This increase in traffic would result in a 10 percent increase in traffic (primarily trucks) and is not anticipated to change the classification of the highway.

Once mining is complete, the access road and the haul road remaining in Sections 1, 6, and 7 would be left for continued use. PLS would reclaim only the section of haul road within the quarry. The access road from U.S. Highway 287/30 to the northeast corner of Section 10 would be converted to a county road per the county and Wyoming State Grant Board authorization of the project. The remainder of the access road and the haul road would be left as a private road.

4.14.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for transportation or access.

4.14.3 Residual Impacts

Residual impacts consist of the access road and haul road remaining for continued use after mining operations have been completed.

4.14.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to transportation or access would occur, resulting in conditions found in the existing environment.

4.15 Health and Safety

4.15.1 Proposed Action

Potential health and safety impacts from implementation of the proposed project would include an increased risk of industrial accidents and a slight increase in risk of traffic accidents for project workers. The proposed quarry and processing plant would be operated under MSHA regulations. At the top of the mined area, access to the quarry from recreational vehicles would be prevented by using a minimum 6-foot-high safety berm with a trench on the side away from the mine pit. Before the berm, signs would be posted to warn the public of the hazard of accessing the site.

4.15.2 Additional Mitigation Measures

No additional mitigation measures were deemed necessary for health and safety.

4.15.3 Residual Impacts

There would be no anticipated residual impacts to health and safety.

4.15.4 No Action Alternative

Under the No Action Alternative, the proposed mining and processing would not occur and no impacts to health and safety would occur, resulting in conditions found in the existing environment.

4.16 Cumulative Impacts Assessment

4.16.1 Past, Present, and Reasonably Foreseeable Future Actions

This section provides a discussion of cumulative impacts for each resource analyzed in Sections 4.1 through 4.15. Cumulative impacts are those impacts to the environment resulting from the incremental impacts when added to past, present, and reasonably foreseeable future actions. Cumulative impact assessment areas (CIAAs) or cumulative domains vary among resources and are generally based on relevant landscape, resource, project and/or jurisdictional boundaries (**Table 4-18**).

Table 4-18 Cumulative Impacts Assessment Areas

Resource	CIAA
Climate and Air Quality	Approximately 8-km radius from the JPA
Geology and Topography	JPA
Paleontological Resources	JPA
Soils	JPA
Water Resources	Local watershed as defined in the Mine Plan for storm water impacts
Vegetation	JPA

Table 4-18 Cumulative Impacts Assessment Areas

Resource	CIAA
Terrestrial Wildlife	JPA
Special Status Species	JPA
Cultural Resources	JPA
Land Use	JPA
Noise	JPA and 1-mile radius
Visual Resources	West and south of JPA
Socioeconomics	Albany County
Transportation and Access	U.S. Highway 287/30
Health and Safety	JPA

4.16.2 Climate and Air Quality

The CIAA for Climate and Air Quality is an area with a radius of approximately 8 km from the JPA. Within the CIAA for air quality and climate, past, present, and reasonably foreseeable projects include the University of Wyoming Central Heating Plant in Laramie, Colorado Interstate Gas Compressor Station located about 30 km west of the JPA, and the Mountain Cement Plant located immediately south of Laramie. The air quality impact assessment for the proposed project is discussed in Section 4.1 and the permit application for the Lime Plant and Fine Grind Plant, which was submitted to the Wyoming DEQ Air Quality Division in March 2008. As described in the Section 4.1.1.4, the proposed project may contribute to the effects of climate change to some extent through GHG emissions. However, it is not currently possible to associate any of these particular actions with the creation of any specific climate-related environmental effects. The lack of scientific tools designed to predict climate change at regional or local scales limits the ability to quantify potential future impacts. It is currently beyond the scope of existing science to predict climate change on regional or local scales resulting from specific sources of GHG emissions.

Computer model forecasts indicate that increases in temperature would not be evenly or equally distributed, but are likely to be accentuated at higher latitudes. Warming during the winter months is expected to be greater than during the summer, and increases in daily minimum temperatures is more likely than increases in daily maximum temperatures.

IPCC also discloses that significant uncertainties remain with respect to the estimates of the current level of emissions and projections of future production of fossil fuels as the oil and gas industry is difficult to forecast with the mix of drivers: economics, resource supply, demand, and regulatory procedures. The assumptions used for the projections, based on recent trends or State production trends in the near-term, and AEO 2006 growth rates through 2020, do not include any significant changes in energy prices, relative to today's prices. Large price swings, resource limitations, or changes in regulations could significantly change future production and the associated GHG emissions. Based on the impact analysis, the proposed project is not expected to have a significant effect on existing air quality in the CIAA.

4.16.3 Geology and Topography

The CIAA for Geology and Geological Hazards is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on the lack of project impacts, no cumulative impacts to geology and topography are anticipated.

4.16.4 Paleontological Resources

The CIAA for Paleontological Resources is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on the low potential for project impacts, no cumulative impacts to paleontological resources are anticipated.

4.16.5 Soils

The CIAA for Soils is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on BLM and Wyoming DEQ reclamation requirements that require backfilling of the pit, reapplication of soil resources, and revegetation standards no cumulative impacts to soil resources are anticipated.

4.16.6 Water Resources

The CIAA for Water Resources is the JPA and its primary watershed system as indicated on **Map 3-4**. Immediately adjacent and associated ephemeral or intermittent drainages extending westward from headwaters within the JPA boundary also are included in the CIAA. All of these features reach the valley floor in T17N, R73W. Most channels disperse on the valley floor, and flows infiltrate into the alluvium or are retained in small evaporative depressions before reaching the North Platte River west of the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. No direct project impacts to groundwater are anticipated, and the Casper Aquifer protection zone for the City of Laramie ends approximately 3.5 miles south of the JPA (Wittman Hydro Planning Associates 2008). Given that groundwater flow is dominantly from east to west in the local water-bearing zones, no groundwater impacts would occur outside the CIAA. Similarly, because no wetlands would be impacted under the proposed project, and no reasonably foreseeable future projects are planned within this area, no cumulative impacts to wetlands are anticipated. Based on these factors and the lack of direct project impacts, no cumulative impacts to water resources are anticipated.

4.16.7 Vegetation

The CIAA for Vegetation is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on BLM and Wyoming DEQ reclamation requirements, and revegetation standards, no cumulative impacts to vegetation resources are anticipated.

4.16.8 Terrestrial Wildlife

The CIAA for terrestrial wildlife is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. The proposed project would have no direct impact on terrestrial wildlife but small scale loss of habitat may shift mobile species outside the JPA during the life of the project. Based on BLM and Wyoming DEQ reclamation requirements, and revegetation standards, no cumulative impacts to terrestrial wildlife resources are anticipated.

4.16.9 Special Status Species

The CIAA for Special Status Species is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. No special status species were identified in the JPA under the proposed project; no cumulative impacts to special status species are anticipated.

4.16.10 Cultural Resources

The CIAA for Cultural Resources is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. One non-contributing portion of an eligible site was identified in the JPA under the proposed project and based on the lack of project impacts; no cumulative impacts to cultural resources are anticipated.

4.16.11 Land Use

The CIAA for Land Use is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on BLM and Wyoming DEQ reclamation requirements, and revegetation standard, no cumulative impacts to land use are anticipated.

4.16.12 Noise

The CIAA for Noise is the JPA and 1 mile surrounding the JPA. Projected noise levels would not present an impact on the CIAA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on the lack of project impacts and no past or future projects, cumulative noise impacts are not anticipated.

4.16.13 Visual Resources

The CIAA for Visual Resources is that portion of Albany County south and west of the JPA. Based on the lack of access to the JPA, visual impacts would be minor and within BLM VRM Class 3 guidelines. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on the proposed project impacts described in Section 4.12 and lack of past or future development, no cumulative impacts to visual resources are anticipated.

4.16.14 Socioeconomics

The CIAA for Socioeconomics is Albany County. Past projects have been and reasonably foreseeable future projects would be constructed within Albany County as described in Section 4.13. The positive impacts to socioeconomics from the proposed project would contribute to any cumulative socioeconomic impacts within the county.

4.16.15 Transportation and Access

The CIAA for Transportation and Access is the JPA and U.S. Highway 287/30 located west of the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. The proposed project would impact transportation and access by the addition of vehicle traffic but these additional traffic levels would be well within the WYDOT planning levels. Based on the proposed project impacts described in Section 4.14 and lack of past or future development, no cumulative impacts to transportation and access are anticipated.

4.16.16 Health and Safety

The CIAA for Health and Safety is the JPA. No past development within the JPA has occurred. No reasonably foreseeable future projects are planned within this area. Based on the lack of project impacts, no cumulative impacts to health and safety are anticipated.

5.0 Consultation and Coordination

5.1 Public Participation

Notification of this EA was made on the BLM NEPA Register: http://www.wy.blm.gov/nepa/search/. As required by BLM regulations, the Rawlins Field Office issued a "Notice of Availability" (NOA) for the Jonathon Mine Plan in February of 2010 when it began the EA preparation process. The BLM issued a news release and the NOA was posted on the internet at the RFO website and printed in the local Laramie newspaper two times during the comment period. Hardcopies of the Mine Plan were made available to the public at the Rawlins Field Office public room and in Laramie at the Albany County Planning Office. The comment period ran for 30 days. No comments to the Mine Plan were received either by mail, by fax, or by email. The EA and unsigned finding of no significant impacts would be made available for public comments for a 15-day period. Comments received to the package would be reviewed by the BLM and substantive comments responded to in a subsequent Decision Record, if any.

5.2 Consultation and Coordination

During the preparation of this EA, the BLM and consultant team contacted and received input from the following federal, state, and local agencies.

Federal Government Agencies

- U.S. Fish and Wildlife Service

State Government Agencies

- Wyoming Department of Environmental Quality, Land Quality Division
- Wyoming Department of Environmental Quality, Air Quality Division
- Wyoming Game and Fish Department

County Government Agencies

- Albany County Planning and Economic Development Department

5.3 List of Preparers

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Finding of No Significant Impact (FONSI)
Pete Lien & Sons
Jonathon Quarry

U.S. Department of the Interior

Bureau of Land Management

Rawlins Field Office

July, 2011

Finding of No Significant Impact (FONSI)

Jonathon Limestone Quarry

Environmental Assessment No.: DOI-BLM-WY-030-2011-11210-EA

Finding of No Significant Impact:

Based on the analysis of potential environmental impacts contained in the attached Environmental Assessment (DOI-BLM-WY-030-2011-11210-EA) (EA); dated July, 2011, I have determined that the Proposed Action will not have significant environmental impacts. Since there are no significant impacts an environmental impact statement is not required. None of the effects of implementing this Proposed Action would have sufficient context and intensity, as defined in section 7.3 of the BLM National Environmental Policy Act Handbook (Manual H-1790-1, page 70), to be considered significant.

The considerations listed in 40 CFR 1508.27(b) (1-10) were used to evaluate the intensity of the effects described in the EA:

1. There would be no significant effects as a result of approving the proposed action. The proposed action would result in both beneficial and adverse impacts.

2. The public's health and safety would not be adversely affected. There would be no adverse social or economic effects beyond those provided for in the EA.

3. Neither the Rawlins Resource Management Plan review nor interdisciplinary review found any unique characteristics in the geographic area or ecologically critical areas which would be adversely affected.

4. The effects of the proposal on the human environment are not expected to be highly controversial.

5. The effects of constructing, operating and reclaming the actions proposed, as described in the EA, are well known. There would not be a high uncertainty of the effects, nor any unique or unknown risks.

6. This proposal does not set a precedent for future actions with significant effects and does not represent a decision in principle about a future consideration.

7. This proposal is not related to other actions or proposals that combined with this Proposal would result in cumulatively significant impacts.

8. The proposal will not adversely affect districts, sites, highways, structures or objects listed in the National Register of Historic Places.

9. The Proposed Action will not adversely affect endangered or threatened species or their habitat that has been determined to be critical under the Endangered Species Act of 1973.

10. Approving the Proposed Action would not violate any Federal, State, or local laws or regulations imposed for the protection of the environment.

Authorized Official:

Dennis Carpenter Rawlins Field Manager	Date

Appendix A

Applicant Committed Environmental Protection Measures

Applicant Committed Environmental Protection Measures

During construction and operation of the proposed project, Pete Lien would implement these environmental protection measures to mitigate potential impacts to air, land, water, wildlife, cultural resources, and human resources to prevent undue or unnecessary degradation of the environment as part of the proposed project's standard operating procedures. Pre-development planning, pollution prevention measures, and pollution control measures and equipment would be used to reduce potential project-generated environmental impacts. These measures are discussed in the following sections.

No.	Topic(s)	Final Applicant Committed Measure
C-1	Climate and Air Quality	Haul roads, work areas, stockpile accesses, commodity stockpiles and other disturbed areas will be sprayed with a dust palliative (water or chemical dust suppressant) on a schedule sufficient to control fugitive dust. - Water will be used as the dust palliative for work areas, commodity stockpiles and other incidental disturbance areas and will be applied depending on ambient climactic conditions. - Chemical dust suppressant (magnesium chloride solution) will be applied twice a year and will be maintained continuously so that the suppressant remains a viable control measure.
C-2	Climate and Air Quality	Particulate matter emissions from the primary crusher operated in the Jonathon Quarry will be controlled via baghouse, while the conveyor transfer points and screens will utilize water spray control measures as necessary to limit particulate matter and visible emissions as required by the Wyoming Air Quality Standards and Regulations and federal standards set forth in 40 CFR Part 60.(*The fugitive dust control measures presented above represent the "best available control technology" (BACT) for quarry operations as set forth by the WDEQ Air Quality Division*.)
S-1	Soils	Crimped certified weed-free straw mulch, certified weed-free hydromulch, and mulch from vegetative material cleared on-site during mining activities will be used on areas where soil has been respread to a depth of greater than 4 inches and seeded to reduce runoff and erosion and maintain soil moisture.
S-2	Soils	Prior to any surface disturbance, temporary Best Management Practices (BMPs) will be installed along all downslope and sideslope edges of the planned disturbance, particularly along existing drainages. Temporary BMPs may consist of stabilized and reinforced silt fence (stabilized with rock at the bottom and backed with woven wire fence against the wind), staked wattles, diversion ditches, and/or any other appropriate temporary BMP *The list of Storm Water Erosion/Sediment/Runoff Control BMPs and a short description of each is provided at the end of this table.*
S-3	Soils	Riprap will be installed at culvert inlets and outlets and at sediment basin inlets and outlets. Erosion control blankets (that will degrade over time) and/or check dams will be installed within constructed drainages. Diversions will be installed around the mine facilities area and around stockpiles as necessary. Diversions would be designed to adequately handle expected runoff flows from the 50-year, 24-hour storm for both pre-mine and post-mine conditions.
S-4	Soils	Topsoil and subsoil stockpiles would be located such that they would not be disturbed by mining operations. Three-foot-deep diversion channels and/or vegetated berms would be constructed around the stockpiles to capture soil that falls from stockpiles and to capture runoff from the stockpiles. BMPs such as stabilized silt fences (stabilized with rock at the bottom and backed by woven wire to stabilize against wind), erosion control blanket or staked wattles would be used as necessary to control erosion and sedimentation from direct runoff. Stockpiles will be identified with a placard located on or adjacent to the stockpiles.
S-5	Soils	Soils to be direct-placed will be collected (scraper/truck) at the site of removal, hauled to the destination block and spread to the appropriate placement depth as specified in the Reclamation Plan (Appendix B). Following placement, the soil will be slightly roughened, perpendicular to the slope to prevent erosion.
S-6	Soils	The access road and haul road to the mine facilities area will be surface treated after demolition and decommissioning to facilitate seeding. If vegetation is not established by the growing season following seeding, areas might need to be harrowed and reseeded. Areas of deep soils that receive repeated heavy traffic would be ripped to the depth of compaction by ripping with a tool that has at least three to four shanks to a depth of at least 14 inches. This would help to prepare the seedbed, encourage infiltration, and help to prevent accelerated runoff and erosion. Scarification would be used on areas of shallow soils.
S-7	Soils	The backfilling of waste rock and associated grading will be completed as concurrently as possible to the mining sequence presented in the Mine Plan. Reclamation of a mine block will occur as soon as possible after mining is completed in that area (approximately 1 year behind mining).
S-8	Soils	Surface soils within the reclaimed areas will be monitored on a semi-annual basis over the long-term for uneven or inconsistent settling, which will be based on comparisons with the post-reclamation elevations. If uneven or inconsistent settling of surface soils is observed during the monitoring period, appropriate mitigation measures will be implemented to prevent additional soil loss. These measures would include applying additional waste rock layers of graduated sizes below the topsoil and subsoil layers and placement of additional subsoil and topsoil in order to achieve post-reclamation elevations.
S-9	Soils	Snow fences will be used as appropriate to minimize wind erosion and collect additional snow on-site.
S-10	Soils/Vegetation	All reclaimed areas will be fenced to exclude cattle until vegetation is fully established for 3 to 5 years. Areas of shrubs and tree plantings may require a smaller exclusion for a longer duration.

No.	Topic(s)	Final Applicant Committed Measure
S-11	Soils/Vegetation	Post-mine inspections of the vegetative cover and soil will occur quarterly for the first 2 years, and then semi-annually in coordination with stormwater management inspections. If issues are identified, (e.g., subsidence, vegetative failure, establishment of undesirable vegetation and erosion), wherever possible, corrective measures will be implemented immediately. Corrective measures may include additional seeding, erosion control measures, and fertilizing as needed to facilitate permanent vegetative growth.
W-1	Water Resources	The decision to leave sediment basins in place or backfill and regrade them to post-mine land use will be made on a case-by-case basis in conjunction with the BLM and will be documented in writing for the agency and operator files. Sediment basins would be stabilized within 5 years following reclamation. As a general rule, sediment basins would be left in place following reclamation. The sediment basins will naturally silt in over time and would be seeded (or planted) and mulched. Remaining sediment basin outlets would be designed to safely overflow and would be stabilized with permanent rip-rap. For the sediment and storm water ponds that will be backfilled and regraded to post-mine land use, the sediment ponds would be covered with subsoil and topsoil and seeded.
W-2	Water Resources	Disturbances in the ephemeral drainages will also be restored to the natural gradient.
W-3	Water Resources	Grab samples will be collected periodically from any constructed sediment basin capturing runoff from open quarry areas or from recently reclaimed quarry areas, as dictated by the presence of runoff in those sediment basins. If possible, sampling will also occur at locations with no upstream disturbance, as dictated by the presence of runoff in natural swales and gulches. Such locations may include existing drainages within Section 8 prior to upstream mining or similar existing drainages within adjacent sections. The purpose of the sampling will be to determine if any impacts to surface waters can be attributed to the mining operation. Any additional monitoring will occur as directed by the WY DEQ in accordance with Land Quality Guideline 8 (Hydrology).
W-4	Water Resources	In coordination with the stormwater management program, selected portions of the major undisturbed channels within the stream buffer zones in Section 8 would be visually inspected on a semi-annual basis. Sites for inspections will be determined in conjunction with the BLM. Baseline conditions and any signs of accelerated channel downcutting, widening, or sediment accumulations observed during the semi-annual inspections would be recorded, and photographed. If project-related channel instabilities are observed, additional stormwater control practices would be implemented after further consultation with the BLM.
W-5	Water Resources	*The list of Storm Water Erosion/Sediment/Runoff Control BMPs and a short description of each is provided at the end of this table.*
W-6	Water Resources	During mining, sediment basins will be constructed periodically along the perimeter of the quarry area near the existing drainages. Where possible, runoff from mining activities will be directed to flow into the sediment basins. Otherwise, runoff will be trapped inside the mine pit where infiltration or dewatering (as needed) will occur. Most water collecting in the mine pits is expected to infiltrate. Water collecting in the mine pit that does not infiltrate would drain to in-pit sumps for settling and then be used for reclamation or dust control. If not used for those purposes, it would be pumped to the nearest sediment pond. If pumping to a sediment pond becomes necessary, temporary lines would be used to contain drainage and avoid overland flow. There would be no overland flow released from this process.
W-7	Water Resources	Turnouts (also called wing ditches) will periodically relieve roadside drainage swales by directing runoff to sediment trapping devices or well-vegetated areas every 500 feet or less (where possible).
W-8	Water Resources	Roadside swales will be installed during roadway construction to collect runoff from the haul road and adjacent slopes.
W-9	Water Resources	Temporary culverts will be used to route runoff under the haul road, where necessary. These culverts will be removed during reclamation. After culverts are removed, areas will be re-contoured and armored to minimize potential erosion. Removed culverts will be hauled off site and disposed of in a licensed waste disposal area.
W-10	Water Resources	Stormwater that comes into contact with manufacturing operations (e.g., road surfaces, raw material areas, and finished product unloading) will be routed to a detention pond located near the plant. The detention pond will be designed to capture sediment in runoff from the plant. If necessary, storm water run-on controls will be constructed to divert surface water away from the plant.
W-11	Water Resources	The four primary existing intermittent or ephemeral channels in Section 8 will be excluded from mining or resource recovery. Mining operation will not occur within 150 feet of these existing major drainages. This does not include the construction of sediment basins, however, which may be constructed within 150 feet of existing major drainages.
V-1	Vegetation	Areas that are to be reclaimed as pine savanna or pine woodland would be temporarily revegetated with a BLM-approved seed mix or mulched until seedlings are available for transplanting. Limber pine revegetation would use native seeds collected in the vicinity of the site. If native seeds are not available, seedlings would be obtained from local nurseries, the local county extension office and other available sources as directed by the BLM. Seedlings established on other parts of the mine that are to be disturbed at a later date may be directly transplanted into areas that are being reclaimed as pine savanna and pine woodlands.

No.	Topic(s)	Final Applicant Committed Measure
V-2	Vegetation	Limber pine seedlings cultivated from seeds collected in the vicinity of the site would be replanted during reclamation of the pine savanna and pine woodlands. Seeds would be collected using the following guidelines: - Native limber pine seeds would be collected (on-site or in the general vicinity of the project site) during years a limber cone crop is available. - Seeds would be collected in late August or early September.
V-3	Vegetation	Limber pine replanting would be completed according to the following BLM guidelines: - Planting would occur in the fall. - Limber pine seedlings (2 years old) will be used. - Seedlings should be planted at a rate of 175-225 stems per acre with 3 - 5 inch spacing between planted seedlings. - Reclamation of limber pine will be modified as necessary based on observations of seedling success in the areas being reclaimed with limber pine.
V-4	Vegetation	Mountain mahogany seeds would be collected on-site and in the local vicinity to be used as the seed source during reclamation of the mountain mahogany shrubland. Mountain mahogany replanting would be completed according to the following guidelines: - Areas where seeds have been sown will be fenced as appropriate for 4-6 years to protect seedlings from livestock and wildlife grazing. - Reclamation of mountain mahogany will be modified as necessary based on observations of seedling success in the areas being reclaimed with mountain mahogany seeds.
V-5	Vegetation	Restrict access to the area of operations during reclamation.
V-6	Vegetation	Develop a re-vegetation program that encourages diversity of plant growth and return to pre-mine conditions.
V-7	Vegetation	The following BMPs will be included as part of the Weed Management Plan: • Prior to the use of pesticides, the Operator would obtain written approval from the BLM - meaning an approved Pesticide Use Proposal form - showing the type and quantity of material(s) to be used, pest(s) to be controlled, method of application, etc. • Pesticide Use Proposals shall be submitted to and approved by the BLM Weed Coordinator, prior to any application of any herbicide on the BLM lands. Pesticide Use Proposals will be tiered to the approved Reclamation Plan/Weed Management Plan. • Copies of daily Pesticide Application Records (required by the State of Wyoming) and Summary Herbicide Use Reports are due monthly to the BLM Weed Coordinator.
V-8	Vegetation	Fire prevention and suppression would be part of construction and operation activities. During conditions of extreme fire danger, a water truck will be located on site, and surface use operations related to vegetative clearing may be either limited or suspended in specific areas, or additional measures may be implemented in coordination with the BLM. Should a fire occur, it would be immediately reported to the BLM Rawlins field office.
V-9	Vegetation	All disturbed areas will be seeded with one of the three permanent seed mixtures upon completion of mining activity and reapplication of subsoil and topsoil. If seeds are not commercially available, a species from the Alternative Species List (see Appendix B) that is commercially available will be used instead.
V-10	Vegetation	The seed mix to be used to reclaim rock outcrop/shallow soil areas will include native forb species that were observed on site during the pre-construction surveys (Section D-8 of the Mine Plan) that are commercially available in the year reclamation is occurring in those areas. The application rate for this seed mix will be approximately 4 lbs of Pure Live Seed (PLS)/ac.
V-11	Vegetation	In locations where quaking aspens communities are disturbed by construction and operation activities, during reclamation, quaking aspen regeneration success would be monitored annually after reclamation. If during monitoring it is documented that quaking aspen seedlings are not recolonizing previously disturbed areas, additional BLM reclamation techniques to re-establish quaking aspens would be required. These may include the planting of quaking aspen seedlings, transplanting of aspen suckers from existing aspen stands, caging of suckers/seedlings to prevent wildlife and livestock grazing, and modification of the soil, litter and vegetative cover around aspen suckers/seedlings to promote successful aspen recolonization of disturbed areas.
V-12	Vegetation	The two smaller aspen stands in the north-east quarter of Section 8, and a portion of the large aspen stand in the north-central part of Section 8 will be protected from mine disturbance. Protection will consist of fencing at a buffer distance wide enough to protect the roots from being damaged during mine construction and operation activities.

No.	Topic(s)	Final Applicant Committed Measure
T-1	Terrestrial Wildlife	All transmission lines will be constructed to the standards approved by the Avian Power Line Interaction Committee (APLIC 2006, available online at www.aplic.com).
T-2	Terrestrial Wildlife	PLS will notify the BLM and the USFWS: - prior to construction if a road must be constructed through a prairie dog town. - prior to disturbance of any eagle or migratory bird nests.
T-3	Terrestrial Wildlife	PLS will conduct an annual survey for raptors and migratory birds.
CR-1	Cultural Resources	If previous undocumented cultural resources (including human remains) are discovered during construction, construction in the area of the discovery shall halt immediately, and the Wyoming DEQ and the BLM Authorized Officer would be contacted to evaluate the find. If human remains are discovered, the Albany County Sheriff would be notified immediately. If the site is evaluated as eligible for inclusion on the NRHP, impacts would be mitigated through a data recovery program or appropriate mitigation measures developed by the BLM in consultation with the Wyoming SHPO.
CR-2	Cultural Resources	Pete Lien would inform construction and operations personnel that they would be subject to prosecution for damaging, altering, excavating or removing any archaeological, historical, or vertebrate fossil objects or site. If archaeological, historical, or vertebrate fossil materials are discovered, operations in the area around the discovery would be suspended, and the BLM would be notified. Operations would not resume until written authorization to proceed is issued by the BLM.
L-1	Land Use	If a fence or water source is damaged during construction and operation activities, Pete Lien replace and/or mend the damaged portions of the fence or water source. Damage to livestock and livestock facilities would be reported as quickly as possible to the affected livestock operator.
L-2	Land Use	Wildlife or domestic livestock would not be intentionally harmed or harassed.
L-3	Land Use	A water pipeline and water reservoir are located in the vicinity of the haul road and quarry. These features would be relocated to an alternate location per the BLM guidance agreement between the livestock operator and the company. Prior to disturbance, pre-construction surveys would be conducted to identify range improvements, including livestock and wildlife water sources/systems, in the vicinity of the proposed disturbance. If the disturbance is within 200 meters of the range improvement, features would be relocated to an alternate location per the BLM guidance
L-4	Land Use	If partial or complete removal of an existing pasture fence cannot be avoided, the fence would be either braced and tied off per the BLM guidance standards or relocated to an alternate location. Where the fence is crossed by a road, the fence would be braced and a cattleguard and gate installed. All cattle guards would be designed and maintained consistent with the BLM standards
V-1	Visual Resources	Blend post-mine topography into the surrounding topography.
V-2	Visual Resources	No permanent facilities or equipment will be constructed within the quarry area in Section 8. A pad will be located at the east end of the quarry area (mine facilities area) for the placement of any desired temporary equipment.
V-3	Visual Resources	All facilities associated with the lime manufacturing facility will remain for future use. All buildings and structures associated with the quarry in Section 8 will demolished and taken off site for disposal
V-4	Visual Resources and Noise	Wasterock and/or topsoil and subsoil stockpiles a minimum of six feet in height will be used along the east side of the mine perimeter to limit potential visual and noise impacts of the mining operation to passersby and adjacent properties.
TA-1	Transportation and Access	The maximum speed limits imposed for safety and fugitive dust purposes on the haul roads will be 25 mph for loaded trucks, and 30 mph for empty trucks.
HS-1	Health and Safety	The operations of the quarry and plant will comply with the Oil Spill Prevention Act, passed in 1990 (Code of Federal Regulations Title 4, Subchapter D, Part 112). A final SPCC Plan will be developed for the plant and mine facilities area and will outline procedures for preventing spills, remedying the effects of spills, and reporting spills to the BLM and all other pertinent regulatory agencies.
HS-2	Health and Safety	Management of hazardous waste from the laboratory will be small and implemented according to the Department of Transportation (DOT) and the Environmental Protection Agency (EPA) under small quantity generator regulations as defined by the EPA. The Operator would comply with the Hazardous Materials Management Plan/Summary in the RMP ROD (Appendix 32) including requirements to transport, store, utilize and dispose of hazardous substances. The Operator would maintain a hazardous substances release contingency plan that would include, among other things, provision to notify the BLM in the event of any release of hazardous substances associated with project operations.

No.	Topic(s)	Final Applicant Committed Measure
HS-3	Health and Safety	Management of the solid waste that is directly related to the office waste stream (i.e., miscellaneous trash, plastics, paper, food wastes, etc) will be managed with an outside solid waste hauler and sent to a local landfill. Solid waste refuse disposal at the site will be maintained by having on-site commercial-type solid waste collection facilities, such as covered dumpsters. The remaining inert waste will be disposed of in accordance with WDEQ regulations on adjacent land owned by Pete Lien & Sons in a location approved by the DEQ. No waste-ash will be disposed of on-site.
HS-4	Health and Safety	The plant and mine facilities area will be constructed to limit public access to all areas of operation. All visitors will be required to check in at the main office. Fencing will be installed around the plant with front gate access controlled by the front office.
HS-5	Health and Safety	Three-strand wire fences will erected at the boundary of the project site and will be used to control unwanted access to the site and also restrict internal movement within the active mine area to limit disturbance to natural and cultural resources.

W-5 Storm Water Erosion/Sediment/Runoff Controls (BMPs)

Prior to Mining or During Mining BMPs

Along Roadways

- Erosion Control Blankets - will be used on steep road cut/fill slopes, unless cut/fill material is rock
- Roadside Ditches and Turnouts (Wing Ditches) - will be used along all roadways, except those roadways located within the mine pit
- Check Dams - will be used within roadside ditches if erosion is noted within ditches
- Culverts - will be used to relieve roadside ditches and where roads cross major drainages
- Riprap - will be used at inlets and outlets to culverts and where roads cross small drainages

Topsoil/Subsoil Stockpiles

- Surface Roughening - will be used on all topsoil/subsoil stockpiles
- Revegetation - will be used on all topsoil/subsoil stockpiles left longer than one year
- Diversions or Berms - will be used around all topsoil/subsoil stockpiles to capture sediment and runoff
- Sediment Control - Check dams, Silt Fence or Wattles will be used at outlets to diversions or berms
- Berms or Diversions/Swales - will be used above all topsoil/subsoil stockpiles to prevent run-on from reaching stockpiles

Sediment Basins (according to **Map 2-3**)

Above Mined/Disturbed Areas (run-on controls)

- Berms or Diversions/Swales - to prevent run-on from reaching mined and disturbed areas

Below Mined/Disturbed Areas (run-off controls)

- Berms or Diversions/Swales - to route run-off to sediment basins
- Sediment Control - Silt Fence, Wattles or Slash Filter Berms

Mine Facilities Area Storm Water Erosion/Sediment/Runoff Controls (BMPs)

Diversions/Swales (to route run-on around the area)

- Sediment Control (silt fence or wattles) (will be used down-slope of the area to capture sediment within run-off)
- Erosion Control Blankets (will be used on steep cut/fill slopes, unless cut/fill material is rock)
- Gravel/Aggregate Surfacing (to stabilize the surface of the area)

During Reclamation BMPs

All areas ready to be reclaimed (applies only to areas receiving topsoil and subsoil)

- Surface Roughening
- Revegetation
- Mulching
- Slash
- Snow Fence
- Constructed Drainages

All Areas Ready to be Reclaimed

- Surface Roughening
- Revegetation
- Mulching

- Slash
- Constructed Drainages (according to **Map 2-3**)

Above Reclaimed/Disturbed Areas (run-on controls)

- Berms or Diversions/Swales - to prevent run-on from reaching reclaimed/disturbed areas; will be removed once vegetation is fully established

Below Reclaimed/Disturbed Areas (run-off controls)

- Constructed Drainages (according to **Map 2-3**)
- Sediment Control (Silt Fence, Wattles, or Slash Filter Berms) - will be removed once vegetation is fully established

Within Constructed Drainages

- Revegetation - all constructed drainages will be vegetated
- Sediment/Erosion Control (Erosion Control Blankets, Check Dams, or Filter Berms) - will be used during vegetation establishment

Outlets of Constructed Drainages

- Sediment Basins - already constructed prior to or during mining
- Erosion Control Blankets or Riprap - will be used at inlets and outlets to sediment basins

Other Controls used Site-Wide

- Dust Control – will be used along roads and for all disturbed areas if wind/dust becomes a problem
- Good Housekeeping Techniques and Waste Management
- Spill Prevention and Control
- Vehicle and Equipment Maintenance

Appendix B

Reclamation Plan

1.0 Pre-disturbance Site Characterization

- **A description of the extent of project area covered by the reclamation plan.**

  This reclamation plan covers reclamation of all disturbances on BLM-managed lands located in Section 8, Township 17 North (T17N), Range 72 West (R72W), within the project area.

- **Soil testing results, including: pH, Electrical Conductivity (EC), texture, topsoil and soil depth, and reactivity and possibly lab testing (e.g., organic matter and Sodium Absorption Ratio [SAR]).**

  Soil testing results, including organic matter percent, SAR, EC, pH and topsoil depths are provided in the Mine Permit Application, Appendix D-7.

- **Soil movement noted: rills, gullies, wind, or water erosion.**

  While this was not identified during the Order 2 soil survey, a site visit conducted on May 16, 2011, indicated that erosion was not a significant problem due to the surface rock fragments and loamy to coarse-textured soils. Significant areas of rills, gullies, headcuts, or sheet erosion were not evident.

- **Ecological Site(s) identified.**

  Ecological sites are identified in the Order 3 soil survey data. The vegetation mapping, as provided in the Mine Permit Application, Appendix D-8, provides a detailed description and illustration of vegetation communities in the project area.

- **Erosion potential identified.**

  Water erosion potential of the soils within the project area is low to moderate due to loamy to coarse-textured soils (as described in the Mine Permit Application, Appendix D-7) and the high percentage of rock fragments on the soil surface and within the soil profiles. Wind erosion potential is moderate to high. Soil vegetative cover and slope are the primary factors that affect erosion potential in the project area.

- **Soil mapping for topsoil salvage depth.**

  Order 2 Soil Mapping is provided in Mine Permit Application, Appendix D-7. Topsoil would be salvaged separately from subsoil except in map units RO and D.

  Map units D and RO have shallow, rocky soil profiles that were not included in the salvageable soil volumes. However, any soil that is possible to collect from map units D and RO will be salvaged to the extent possible. The topsoil will not be segregated from subsoil in map units D and RO but will be stockpiled separately from the topsoil only stockpiles or direct placed in the reclaimed shallow soil areas.

  Table 1 provides the soil volumes available from the quarry area and depths to be applied for reclamation of the quarry area. Topsoil depths generally range from 4-6 inches in the quarry area, except in areas of shallow soil and rock outcrop. During reclamation topsoil would be respread to these approximate depths in constructed areas of deeper soils (not rock outcrop).

  Although rock outcrop areas are described as having 1 inch of soil for calculation purposes, these areas will generally consist of constructed rock areas with pockets of soil 3 inches in depth. These pockets of soil will be reconstructed as described in the Mine Permit Application, Reclamation Plan, Section 2.3 or reapplied by another acceptable method. These shallow soil

areas will be seeded with the Constructed Rock Outcrop Seed Mix as described in **Attachment 1**.

Table 1 Reclamation Soil Depths and Volumes

Soil Restoration Areas	Depth (inches)	Acreage	Volume (CY)
Limber pine	12	152	245,227
Constructed drainages	24	29	93,573
Rock outcrop/shallow soil	1	170	21,914
Other quarry area	11.5	168	262,839
Total		**514**	**623,553**

- **Unique topographic features present, steep slopes, aspect.**

  See Appendix D-5 of the Mine Permit Application for a description of topographic features and steep slopes within the project area. Aspect is described in Appendix D-7 of the Mine Permit Application.

- **Drainages affected by the project.**

  Surface water features are limited to four (major) ephemeral drainages. See Appendix D-6 of the Mine Permit Application for further description of the surface water features within the project area.

- **Cross sections and longitudinal profiles on channels and waterways that would be directly disturbed by the proposed action.**

  Detailed survey data will be provided with profiles and/or cross sections, prior to constructing any road crossing through major ephemeral drainages.

  In addition, a hydrologic analysis will be completed when designing road crossings. This will include the baseline characterization of channel width, depth (flow cross-section), slope, and storm discharge. Additional analysis would be conducted to specify the size and type of culvert installation and adjacent stabilization, in accordance with the BLM guidelines.

- **Vegetation and weeds: species, composition, and density.**

  See Appendix D-8 of the Mine Permit Application for a detailed description of vegetation (including weeds) within the project area.

- **Weed management plan, if weed species noted as present.**

  The Weed Management Plan is provided in **Attachment 2** of this document.

- **Diagrams and schematics showing important features pertaining to operations, construction and reclamation of the site.**

  The Mine Permit Application, Appendix D, provides diagrams and schematics of important features. Major features include an access road to the site from U.S. Highway 287, a lime processing plant, quarry and mine facilities, and an associated haul road.

- **Limited Reclamation Potential sites, defined in the WY BLM Reclamation Policy (IM WY-2009-022).**

Limited Reclamation Potential sites within the project area include the following soil map units:

1. RO: Rock outcrop-Cheadle Complex; and
2. D: Cheadle-Rock Outcrop.

Map units RO and D have shallow to bedrock soils with 25 percent or more rock fragments mapped with areas of rock outcrop. Biological crusts were evident on the soil surface. These soils support cushion plant communities.

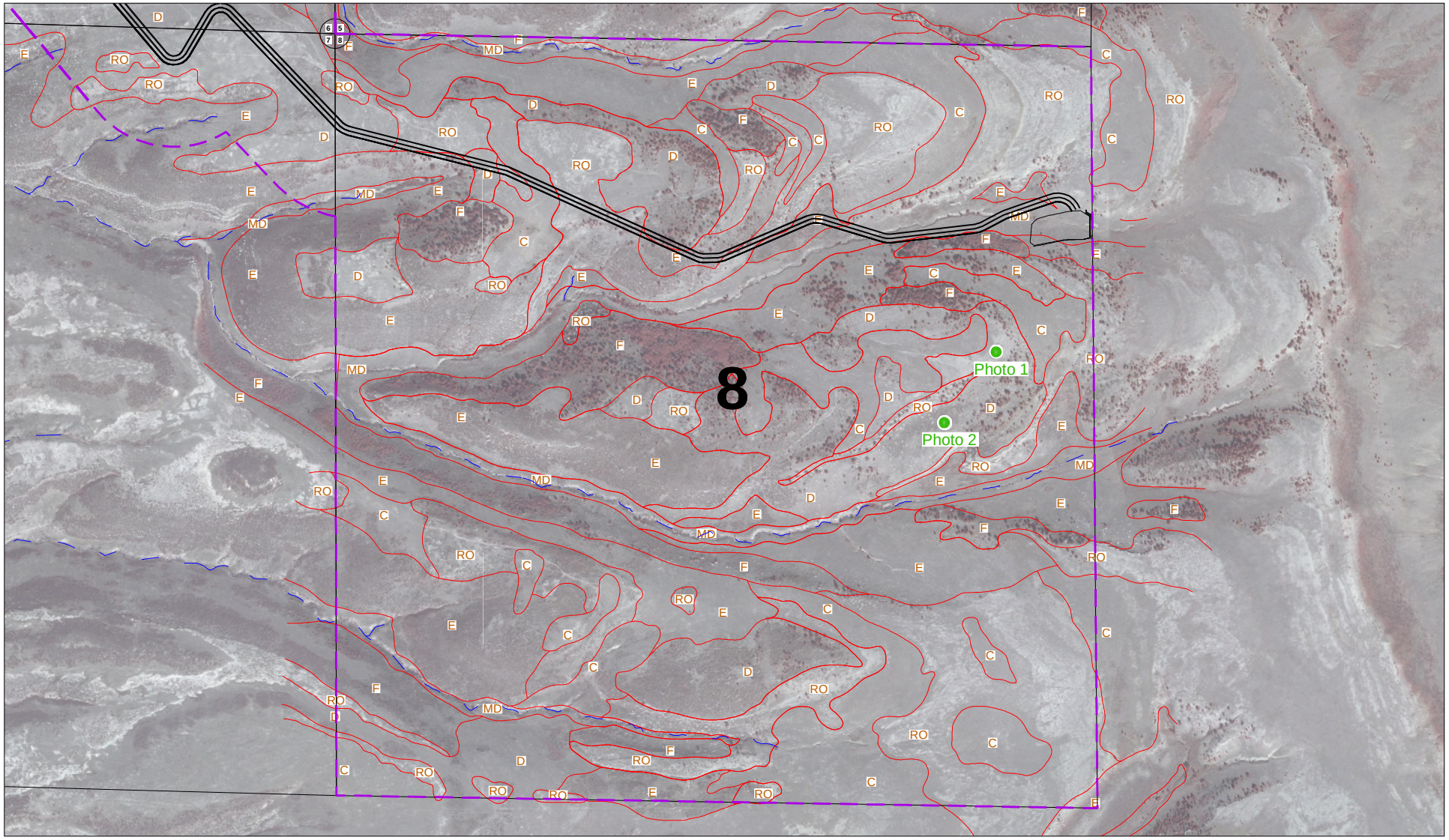
- **Photos of soil test pit(s).**

  Limited photos are available of the test pits, due to surveying with a bucket auger and tile spade. Two photos were taken during the site visit of surface soil profiles.

Photo 1: Map Unit D, Cheadle-Rock Outcrop complex

Photo 2: Map Unit D, Cheadle-Rock Outcrop complex

- **Photo reference points**.
  Map B-1 illustrates the location of the soil pits examined in photos 1 and 2 above.



Section

Permit Boundary

Ephemeral Drainage

Photo 1 Soil Pit Photograph Reference Point

Map Unit	Description
A	Ryan Park fine sandy loam, 1 to 8% slopes
B	Fiveoh, cobbly substratum, fine sandy loam, 2 to 12% slopes
C	Splitro-Miracle complex, 2 to 16% slopes
D	Cheadle-Rock Outcrop complex, 6 to 40% slopes
E	Cheadle-Passcreek, cobbly substratum-Rock Outcrop complex, 6 to 60% slopes
F	Cryorthents, 6 to 60% slopes
G	Pilot Peak-Canwall complex, 3 to 20% slopes
MD	Telecan sandy loam, 2 to 16% slopes
RO	Rock Outcrop-Cheadle complex, 4 to 50% slopes
DL	Disturbed Land

N

0 500 1000 2000 Feet

Map B-1

Soil Pit Photograph Reference Points

File: PLS-EA-MAP_B-1_Soil Pit Photo Reference.dwg

NO WARRANTY IS MADE BY THE BUREAU OF LAND MANAGEMENT FOR USE OF THE DATA FOR PURPOSES NOT INTENDED BY BLM.

2.0 Surface-disturbing Activities

Manage all waste materials (Reclamation Requirement #1 From IM WY-2009-022).

- **Segregate, treat, and/or bio-remediate contaminated soil material.**

  This measure is addressed in the Mine Permit Application, Mine Plan, Sections 5.3 and 5.4.

  In addition, Applicant Committed Environmental Protection Measures (ACEPMs) HS-1 through HS-4 address this requirement. In addition, a Spill Prevention Control and Countermeasure (SPCC) Plan will be developed and submitted to BLM for approval prior to any surface disturbing activities.

- **Bury only authorized waste materials on site. Buried material must be covered with a minimum of 3 feet of suitable material or meet other program standards.**

  ACEPM HS-4 addresses this requirement. Inert waste materials, such as waste rock, would be buried/backfilled within the quarry area. No lime kiln dust will be buried on-site.

Ensure all waste materials moved off-site are transported to an authorized disposal facility. Ensure subsurface integrity, and eliminate sources of ground and surface water contamination (Reclamation Requirement #2 From IM WY -2009-022).

- **Properly plug all drill holes and other subsurface openings (mine shafts, adits etc.).**

  As discussed in the Mine Permit Application, Section 2.10 of the Reclamation Plan, the groundwater production wells located on the mill site will be plugged and abandoned in accordance with State standards. The plugging and abandonment would be delayed if it is found that a transfer or alternative use of the wells is permitted from the State engineer's office.

- **Stabilize, properly backfill, cap, and/or restrict from entry all open shafts, underground workings, and other openings**.

  No open shafts are anticipated for this project. The quarry will be backfilled with waste rock to the approximate original contour as described in the WDEQ Mine Permit Application.

- **Control sources of contamination and implement best management practices to protect surface and ground water quality.**

  All major ephemeral drainages will be avoided and buffered during mining operations except at road crossings. Best management practices listed in the ACEPMs will be utilized to protect surface and ground water quality. In addition, a Spill Prevention Control and Countermeasure (SPCC) Plan will be developed and submitted to BLM for approval prior to any surface disturbing activities.

Maintain the biological, chemical, and physical integrity of the topsoil and subsoil (where appropriate) (Reclamation Requirement #5 From IM WY-2009-022) Identify, delineate, and segregate all salvaged topsoil and subsoil based on a site specific soil evaluation, including depth, chemical, and physical characteristics.

- **Timing of construction (e.g., winter construction).**

  Mining will occur year-round. However, soil handling will not occur when the soils are frozen or saturated.

- **Protect all stored soil material from erosion, degradation, and contamination.**

  ACEPMs S-1 through S-10 and H-1 through H-3 will be implemented to protect the soils from erosion, degradation, and contamination.

- **Incorporate stored soil material into the disturbed landscape.**

  Topsoil and subsoil materials would be stockpiled or direct placed during reclamation of the mine blocks, as described in **Section 1.0, Table 1**, following recontouring and crushing of the backfilled waste rock.

  As stated in **Section 1.0**, constructed rock outcrop will consist of constructed rock areas with pockets of soil 3 inches in depth. These pockets of soil will be reconstructed as described in the Mine Permit Application, Reclamation Plan, Section 2.3 or reapplied by another acceptable method. These shallow soil areas will be seeded with the Constructed Rock Outcrop Seed Mix as described in **Attachment 1**.

- **Placement of stockpiles to minimize disturbance during interim and final reclamation.**

  As described in ACEPM S-4, topsoil and subsoil stockpiles would be located such that they would not be disturbed by mining operations. Three-foot-deep diversion channels and/or vegetated berms would be constructed around the stockpiles to capture soil that erodes from the stockpiles. Best Management Practices (BMPs), such as stabilized silt fences, (stabilized with rock at the bottom and backed by woven wire to stabilize against wind), erosion control blanket or staked wattles, would be used as necessary to control erosion and sedimentation from direct runoff. Following heavy precipitation events, topsoil and subsoil stockpile conditions would be monitored for erosion.

- **Seed topsoil piles to be stored beyond one growing season, with desired vegetation.**

  Topsoil stockpiles will be seeded with one of the seed mixes described in **Attachment 1**, if stockpiles are required for more than one growing season.

- **Identify stockpiles with appropriate signage.**

  As stated in ACEPM S-4, stockpiles will be identified with a placard located on or adjacent to the stockpiles.

- **Piles left for more than two years should be no deeper than two feet, including the native topsoil underneath.**

  In general, soil would be direct placed. When direct placement is not possible, topsoil stockpiles left for more than two years will not exceed two feet in depth including the native topsoil beneath the stockpile.

- **Use of brush-hogging, matting, or other suitable BMPs to protect and/or promote vegetation re-growth.**

  BMPs, as listed in the ACEPMs, would be applied as necessary to promote vegetative establishment.

Re-establish slope stability, surface stability, and desired topographic diversity (Reclamation Requirement #3 From IM WY-2009-022)

- **Re-construct the landscape to the approximate original contour or consistent with the land use plan.**

As stated in the Mine Permit Application, Reclamation Plan, during reclamation, the waste rock will be distributed to develop topographical contours that approximate the post-mine topography prior to redistribution of subsoil and topsoil.

- **Maximize geomorphic stability and topographic diversity of the reclaimed topography.**

  As stated in the Mine Permit Application, Reclamation Plan, during reclamation, the waste rock will be distributed to develop topographical contours that approximate the post-mine topography prior to redistribution of subsoil and topsoil. Topographic diversity would be maintained by re-creating swales that drain to the natural undisturbed channels. These drainage swales will be constructed with a deeper layer of subsoil and topsoil, which will slow runoff and allow water to infiltrate into the reclaimed ground surface.

- **Eliminate highwalls, cut slopes, and/or topographic depressions on site, unless otherwise approved.**

  As stated in Section 2.2 of the Reclamation Plan, during mining activities, any highwalls will be leveled and waste rock will be imported into the area before access to the highwalls is cut off. The waste rock will then be distributed to develop topographical contours that approximate the post-mine topography.

- **Work surface compaction testing, moisture content, ripping, aeration.**

  As described in ACEPMs, S-6, areas of deep soils that receive repeated heavy traffic would be ripped to the depth of compaction by ripping with a tool that has at least three to a depth of at least 14 inches. This would help to prepare the seedbed, encourage infiltration, and help to prevent accelerated runoff and erosion. Scarification would be used on areas of shallow soils.

- **Engineered drawings including cross sections and longitudinal profiles to explain how channels will be restored to original plan form and profile.**

  Detailed survey data will be provided with profiles and/or cross-sections, prior to constructing any road crossing through major ephemeral drainages.

  In addition, a hydrologic analysis will be completed when designing road crossings. The analysis will include the baseline characterization of channel width, depth (flow cross-section), slope, and storm discharge. Additional analysis would be conducted to specify the size and type of culvert installation and adjacent stabilization, in accordance with the BLM guidelines.

  Prior to reclamation of stream channel crossings, a site-specific reclamation plan would be submitted to BLM for approval, outlining the techniques for restoration.

- **Schematic of interim and final reclamation topography.**

  This information is available in the Mine Permit Application, Reclamation Plan, Figure RP-1 and RP-1A.

- **Downsizing of disturbance/roads.**

  Roads will be kept to the minimum size necessary for mining related activities and haul trucks.

Re-establish complementary visual composition (Reclamation Requirement #8 From IM WY-2009-022)

- **Ensure the reclaimed landscape features blend into the adjacent area and conform to the land use plan decisions.**

  As stated in the Mine Permit Application, Reclamation Plan, during reclamation, the waste rock will be distributed to develop topographical contours that approximate the post-mine topography prior to redistribution of native subsoil and topsoil.

- **Ensure the reclaimed landscape does not result in a long-term change to the scenic quality of the area.**

  The restoration of topography to the approximate post-mine topography, construction of a similar acreage of rock outcrop, and restoring patchy areas of limber pine, mountain mahogany, and grass and forbs would facilitate the long-term scenic quality of the area.

Minimize sheet and rill erosion on/or adjacent to the reclaimed area. There shall be no evidence of mass wasting, head cutting, large rills or gullies, down cutting in drainages, or overall slope instability on/or adjacent to the reclaimed area.

- **Develop criteria for how and when waterbars, slope breakers, erosion control blankets, fencing, mulch, straw bales and rolls, etc. will be used.**

  Refer to the ACEPMs, and the Mine Permit Application (Mine Plan and the Reclamation Plan) for a description of when and how erosion control BMPs would be used.

- **Culverts, wing ditches, channels and other water management features.**

  Refer to Section 3.3 of the Mine Permit Application, Mine Plan, for a description of water management features to be utilized. In addition, ACEPM W-5 provides information on other water management features to be utilized.

Reconstruct and stabilize water courses and drainage features (Reclamation Requirement #4 From IM WY-2009-022)

- **Reconstruct drainage basins and reclaim impoundments to maintain the drainage pattern, profile, and dimension to approximate the natural features found in nearby naturally functioning basins.**

  Refer to ACEPM W-6 for a description of how sediment basins will be reclaimed.

- **Engineered drawings including cross sections and longitudinal profiles to explain how channels will be restored to original plan form and profile.**

  Detailed survey data will be provided with profiles and/or cross-sections, prior to constructing any road crossing through major ephemeral drainages.

  In addition, a hydrologic analysis will be completed when designing road crossings. This will include the baseline characterization of channel width, depth (flow cross-section), slope, and storm discharge. Additional analysis would be conducted to specify the size and type of culvert installation and adjacent stabilization, in accordance with the BLM guidelines.

  Prior to reclamation of stream channel crossings a site-specific reclamation plan would be submitted to BLM for approval, outlining the techniques for restoration.

- **Reconstruct and stabilize stream channels, drainages, and impoundments to exhibit similar hydrologic characteristics found in stable naturally functioning systems.**

  Prior to reclamation of stream channel crossings a site-specific reclamation plan would be submitted to BLM for approval, outlining the techniques for restoration.

- **There shall be no evidence of down cutting or aggradations in drainages adjacent to the reclaimed area as a result of the project.**

  ACEPM W-4 has been developed to address this requirement.

- **Ensure no net loss of riparian habitat.**

  No riparian habitat was recorded during vegetation surveys in the project area.

- **Ensure reclamation objectives are consistent with the Rawlins Resource Management Plan (RMP) goals and objectives for Special Management Designations when projects occur within the boundary of one of these areas (e.g., Wild Horse Management Areas [HMAs], Special Recreation Management Areas [SRMAs], Wildlife Habitat Management Areas [WHMAs], Areas of Critical Environmental Concern [ACECs], Adobe Town Disperse Recreation Use Area [DRUA], etc.).**

  The project area does not occur within any of the areas with Special Management Designations. Reclamation objectives (and ACEPMs) were designed to comply with the Rawlins RMP (BLM 2008).

- **Potential activities proposed during the life of the disturbance and how these activities will affect interim and final reclamation needs for the future (e.g., workover areas) and/or the need for future re-disturbance.**

  The only disturbance that would occur in reclaimed areas is monitoring and fence removal once vegetation has been established. If revegetation is unsuccessful, re-disturbance may be necessary for re-seeding/reclamation efforts.

3.0 Site Preparation and Seeding

Prepare site for re-vegetation (Reclamation Requirement #6 From IM WY-2009-022):

- **Re-distribute soil materials in a manner similar to the original vertical profile.**

  Topsoil will be collected and stockpiled separate from subsoil except in areas of shallow and very shallow rocky soils. During reclamation, the subsoil will be redistributed and then covered with the appropriate depth of topsoil.

- **Reduce compaction to an appropriate depth (generally below the root zone, 18 to 24 inches per the conditions of approval prior to re-distribution of topsoil, to accommodate desired plant species.**

  ACEPM S-6 addresses this requirement and state, areas of deep soils that receive repeated heavy traffic would be ripped to the depth of compaction by ripping with a tool that has at least three shanks to a depth of at least 14 inches. This would help to prepare the seedbed, encourage infiltration, and help to prevent accelerated runoff and erosion. Scarification would be used on areas of shallow soils.

- **Provide suitable surface and subsurface physical, chemical, and biological properties to support the long-term establishment and viability of the desired plant community.**

  By segregating topsoil and subsoil, the topsoil suitability and biological activity will be maintained. In addition, the native seed bank will be available for regeneration.

- **Protect seed and seedling establishment (e.g., erosion control matting, mulching, hydro-seeding, surface roughening, furrow placement, fencing, targeted fertilization, netting, geotextiles, and watering as appropriate).**

  Refer to the ACEPMs and the Mine Permit Application (Mine Plan and the Reclamation Plan) for a description of measures that will be used to protect seedling establishment. Measures may include, but not be limited to, erosion control matting, hydro-seeding, surface roughening, fencing, North American Weed Free Forage Program certified weed-free straw mulch, and native mulch materials.

Establish a desired self-perpetuating native plant community (Reclamation Requirement #7 From IM WY-2009-022):

- **Soil re-testing, amendments as necessary.**

  Soil re-testing would be completed, as necessary, for revegetation efforts.

- **Establish species composition, diversity, structure, and total ground cover appropriate for the desired plant community.**

  Refer to the seed mixes (**Attachment 1**), Weed Management Plan (**Attachment 2**), WY DEQ Land Quality Division Guideline 2, Vegetation (WDEQ 1997), and ACEPMs V-1 to V-4, V-6, V-9 to V-11.

- **Enhance critical resource values (e.g., wildlife, range, recreation, etc.), where appropriate, by augmenting plant community composition, diversity, and/or structure.**

  Refer to the limber pine replanting and mountain mahogany seed collection ACEPMs V-1 to V-4, and V-6, V-9 to V-11.

- **Select genetically appropriate and locally adapted native plant materials based on the site characteristics and ecological setting.**

  Refer to seed mixes (**Attachment 1**) and ACEPMs V-1, V-4, V-9, and V-10.

- **Select non-native plants only as an approved short term and non-persistent alternative to native plant materials. Ensure the non-natives will not hybridize, displace, or offer long-term competition to the endemic plants and are designed to aid in the reestablishment of native plant communities.**

  No non-native plants are planned for use in revegetation, at this time.

4.0 Manage Invasive Species (Reclamation Requirement #9 From IM WY-2009-022)

Refer to the Weed Management Plan (**Attachment 2**) for additional information.

5.0 Monitoring Plan (Reclamation Requirement #10 from IM WY-2009-022)

Conduct compliance and effectiveness monitoring in accordance with the BLM (or other surface management agency) approved monitoring protocol and with the following in mind:

- Soil erosion/movement;
- Compliance with reclamation plan;
- Documenting/monitoring protocols;
- Timing of monitoring during the year;
- Identification of sites needing additional work or more reclamation activities outlining a site-specific prescription for actions to be implemented, including:
  - Re-seeding of areas not attaining reclamation success
  - Soil stabilization
  - Weed control
  - Mulching/fertilization or other cultural practices; and
- Geospatial file(s) identifying surface disturbance activities, ecological sites, reclamation, areas needing additional reclamation (e.g., workover areas, areas' with unsuccessful reclamation) and weed infestations.

Monitoring reports are due to the BLM by March 1 of the year following monitoring. Refer to **Attachment 3** of this document for further details on monitoring that will be performed.

PLS would restore the land to a condition equal to or greater than the “highest previous use” in accordance with Wyoming DEQ guidelines (**Attachment 4**) and in accordance with the RMP. The Wyoming DEQ guidelines outline specific vegetation parameters, which are used to compare reclaimed areas against control areas or reference areas that were identified during baseline vegetation surveys. The control areas or reference areas would be used to determine revegetation success goals when reclaimed lands are considered for full bond release. The vegetation parameters to be used to compare reclaimed areas against the control or reference areas include:

- Percent vegetation cover (absolute value);
- Percent total ground cover (absolute value);
- Total production for herbaceous species (absolute value);
- Density of full shrub and subshrub species (post-mining shrub habitat);
- Areal extent of dense shrub mosaics;
- Density of trees;
- Species diversity and species composition;
- Ability to withstand grazing pressure; and
- Attainment of these parameters for the last 2 consecutive years of the bonding period.

The results of the baseline vegetation inventory, the identification of control and reference areas, and more detail on the quantitative and qualitative vegetation success goals are provided in Mine Plan,

Appendix D-8. PLS would follow the applicable regulatory methods for evaluating attainment of these goals as outlined in the Wyoming DEQ guidelines and BLM Rawlins RMP.

6.0 References

Bureau of Land Management (BLM). 2008. Proposed Resource Management Plan and Final Environmental Impact Statement for Public Lands Administered by the Bureau of Land Management Rawlins Field Office Rawlins, Wyoming. Prepared by United States Department of the Interior Bureau of Land Management Rawlins Field Office. Available online: http://www.blm.gov/rmp/wy/rawlins/documents.html. Accessed on May 8, 2011.

Wyoming Department Of Environmental Quality (WDEQ), Land Quality Division. 1997. Guideline Number 2, Vegetation. Available online: http://deq.state.wy.us/lqd/guidelns/Guideline2.pdf. Accessed on November 28, 2010.

Attachment 1

Seed Mixes

Seed Mixes for the Pete Lien Jonathon Project

Upper Elevation Seed Mix (7,600 to 8,600 ft)

Common Name	Scientific Name	lbs PLS[1] / ac
Grasses		
Western wheatgrass[2]	*Elymus smithii*	1.00
Bluebunch wheatgrass[2]	*Elymus spicatus*	2.00
Sheep fescue[3]	*Festuca ovina (saximontana* if possible*)*	1.00
Prairie junegrass	*Koeleria macrantha*	0.50
Needle and thread	*Stipa comata*	0.50
Green needlegrass[2]	*Stipa viridula*	1.00
	Subtotal	**6.00**
Forbs		
Western yarrow	*Achillea millefolium*	0.10
Lewis flax	*Linum lewisii*	0.50
Rocky Mtn. penstemon	*Penstemon strictus*	0.45
Sulpher buckwheat	*Eriogonum umbellatum*	0.50
Silky lupine	*Lupinus sericeus*	0.50
Scarlet globemallow	*Sphaeralcea coccinea*	0.25
	Subtotal	**2.3**
Shrubs / Trees		
Mountain big sagebrush	*Artemisia tridentata* var. *vaseyana*	0.20
Fourwing saltbush	*Atriplex canescens*	0.50
Mountain mahogany	*Cercocarpus montanus*	1.00
Winterfat	*Krascheninnikovia lanata*	1.50
Antelope bitterbrush	*Purshia tridentata*	1.25
	Subtotal	**4.45**
	Total	**12.75** [4]

[1] PLS - Pure Live Seed.

[2] Primary Species - Should not be substituted for another species.

[3] Secondary Species - Should be in mix unless unavailable, or an alternate is more desirable for a given area.

[4] When drill seeding grasses and broadcasting forbs and shrubs use the 11.5 lb/ac mix; when broadcasting grasses or hydroseeding methods are used for all lifeforms, the rate for grasses should be increased 1.5 times and the seed must be placed prior to mulching.

Alternative Species for Upper Elevation Seed Mix

Common Name	Scientific Name	lbs PLS[1]/ ac
Grasses		
Mountain brome	*Bromus carinatus (marginatus)*	0.50
Thickspike wheatgrass	*Elymus lanceolatus*	0.50
Big bluegrass	*Poa ampla*	0.25
Forbs		
Fringed sage	*Artemisia frigida*	0.10
Blueleaf aster	*Aster glaucodes*	0.25
Hairbell	*Campanula rotundifolia*	0.25
Palmer penstemon	*Penstemon palmeri*	0.20
Small burnet	*Sanguisorba minor*	0.50
Shrubs / Trees		
Black sagebrush	*Artemisia nova*	0.10
Rubber rabbitbrush	*Chrysothamnus naseousus*	0.25
Ponderosa pine	*Pinus ponderosa*	0.15

[1] PLS - Pure Live Seed.

Lower Elevation Seed Mix (7,100 to 7,600 ft)

Common Name	Scientific Name	lbs PLS[1]/ ac
Grasses		
Blue grama	*Bouteloua gracilis*	1.00
Thickspike wheatgrass	*Elymus lanceolatus*	1.50
Western wheatgrass	*Elymus smithii*	1.50
Bluebunch wheatgrass	*Elymus spicatus*	1.00
Sheep fescue	*Festuca ovina (saximontana if possible)*	1.00
Kentucky bluegrass	*Poa pratensis*	0.25
Sandberg bluegrass	*Poa secunda*	0.50
Green needlegrass	*Stipa viridula*	1.50
	Subtotal	**8.25**
Forbs		
Western yarrow	*Achillea millefolium*	0.10
Lewis flax	*Linum lewisii*	0.50
Rocky Mtn. penstemon	*Penstemon strictus*	0.40
Silky lupine	*Lupinus sericeus*	0.25
	Subtotal	**1.25**
Shrubs / Trees		
Fourwing saltbush	*Atriplex canescens*	0.50
Winterfat	*Krascheninnikovia lanata*	1.50
	Subtotal	**2.0**
	Total	11.5

[1] PLS - Pure Live Seed.

[2] Primary Species - Should not be substituted for another species.

[3] Secondary Species - Should be in mix unless unavailable, or an alternate is more desirable for a given area.

[4] When drill seeding grasses and broadcasting forbs and shrubs use the 11.5 lb/ac mix; when broadcasting grasses or hydroseeding methods are used for all lifeforms, the rate for grasses should be increased 1.5 times and the seed must be placed prior to mulching.

Alternative Species for Lower Elevation Seed Mix

Common Name	Scientific Name	lbs PLS[1]/ ac
Grasses		
Mountain brome	*Bromus carinatus (marginatus)*	0.50
Prairie junegrass	*Koeleria macrantha*	0.25
Big bluegrass	*Poa ampla*	0.25
Needle and thread	*Stipa comata*	0.20
Forbs		
Fringed sage	*Artemisia frigida*	0.10
Blueleaf aster	*Aster glaucodes*	0.25
Sulpher buckwheat	*Eriogonum umbellatum*	0.50
Palmer penstemon	*Penstemon palmeri*	0.20
Small burnet	*Sanguisorba minor*	0.50
Scarlet globemallow	*Sphaeralcea coccinea*	0.25

[1] PLS - Pure Live Seed.

Constructed Rock Outcrop/Shallow Soil Seed Mix

Common Name	Scientific Name	lbs PLS[1]/ ac
Graminoids		
Bluebunch wheatgrass	*Elymus spicatus*	0.25
Sandberg bluegrass	*Poa secunda*	0.125
Threadleaf sedge	*Carex filifolia*	0.9
Western wheatgrass	*Elymus smithii*	0.75
	Subtotal	**2.02**
Forbs		
Native forb species observed on site during vegetation surveys (Mine Plan Appendix D-8) and approved by the BLM.		2.0
	Subtotal	**2.0**
	Total	**4.02**

[1] PLS - Pure Live Seed.

Attachment 2

Weed Management Plan

4.0 Weed Management Plan

4.1 Overview

Noxious and invasive weeds are a threat to native ecosystems and biological diversity, contribute to the loss of rangeland productivity, reduce native species diversity, and wildlife habitat, and can cause increased soil erosion. The Rawlins BLM Field Office requires the control and management of the noxious weeds of concern identified by the State of Wyoming (BLM 2008), and additionally, the control of invasive species (e.g., halogeton, henbane, and cheatgrass) that can impede successful reclamation and impact management of livestock, wildlife, and human activities. The State of Wyoming list of Designated Noxious Weeds .S. 11-5-102 (a)(xi) and Prohibited Noxious Weeds W.S. 11-12-104 is on the Wyoming Weed and Pest Council website (http://www.wyoweed.org/statelist.html).

To successfully control and prevent the spread of noxious weed species, an integrated approach is necessary. Integrated weed management techniques may include biological controls, mechanical (such as covering with growth preventing materials [e.g., black plastic tarps], bagging of seed heads, mowing, or grazing),and herbicide use.

4.2 Purpose

The purpose of the Weed Management Plan (WMP) is to describe a weed management program that will be implemented over the lifetime of the project. The WMP prescribes methods to prevent and control the spread of noxious weeds and invasive species, including herbicide application (i.e., spraying) during and following construction and operation activities associated with the Jonathon Project. The WMP objective is first, to prevent the introduction of any new noxious weed species into the project area and second, to prevent any increases in the cover and number of existing noxious and invasive weed species already identified on site.

4.3 Scope

Pete Lien & Sons, Inc.(PLS) and its contractors will be responsible for implementing the WMP. The WMP is applicable to the construction and operation of the proposed quarry, processing facility, haul road, access road, mine facility area, and any other areas disturbed during the construction and operation of the proposed project.

4.4 Definitions and Acronyms

Invasive plants - Non-native plants “whose introduction does or is likely to cause economic or environmental harm or harm to human health” *(Executive Order 13112, Invasive Species)*

Noxious weeds - Weeds, seeds, or other plant parts that are considered detrimental, destructive, injurious or poisonous, either by virtue of their direct effect or as carriers of diseases or parasites that exist within the state (*State of Wyoming -Wyoming Statutes (Title 11, Chapter 5, Section 102.a.xi).*

Control - To suppress or reduce the species to a level below the threshold of damage (i.e., the level of unacceptable damage or threat that an infestation poses).

Acronyms

BLM Bureau of Land Management

FEIS 2007 BLM ROD and Programmatic Environmental Impact Statement for Vegetation Treatments Using Herbicides on BLM Lands (BLM 2007)

PLS Pete Lien & Sons, Inc.

RFO Bureau of Land Management Rawlins Field Office

RMP Resource Management Plan

WMP Weed Management Plan

4.5 Noxious Weed and Invasive Species Pre-Construction Inventory

Vegetation surveys to identify noxious and invasive plant species were conducted in 2007 (Cedar Creek and Associates) and 2009 (AECOM) in the project area. Canada thistle was observed in small patches within the project area in the big sagebrush steppe, aspen woodland, and mixed-grass prairie vegetation communities. No other species found on the State of Wyoming list of Designated Noxious Weeds and Prohibited Noxious Weeds were observed within the project area. Five weedy or invasive species that are of concern to the BLM due to their potential to impede reclamation were observed in the project area. These five species include German-madwort (*Asperugo procumbens*), Japanese brome *(Bromus japonicus*), cheatgrass (*Bromus tectorum)*, bull thistle (*Cirsium vulgare*), and curlycup gumweed (*Grindelia squarrosa*).

4.6 Noxious Weed and Invasive Species Management

The key elements of the WMP are prevention, control, and monitoring. In addition to the WMP, noxious weeds and invasive species will be controlled through the implementation of the construction mitigation and reclamation procedures (**Section 2.0)**, the Applicant-Committed Environmental Protection Measures (**Appendix A**) and this Reclamation Plan.

4.6.1 Prevention

The following measures will be implemented to prevent the spread of noxious weeds.

- Areas of existing Canada thistle populations will be pre-treated with herbicide spraying;
- Any other observed weeds found in small patches will treated before they spread;
- Seed mixes and mulching materials utilized for revegetation will be certified weed-free and obtained from approved certified sources as recommended by County Weed and Pest Districts, Weed Control Supervisors, the State of Wyoming, or the RFO; and
- After mining has been completed, interim and final reclamation of disturbed areas will occur to assist in preventing the spread and establishment of invasive species, which may be present in nearby areas.

4.6.2 Control Methods

Canada thistle

Canada thistle is an introduced creeping perennial species that is difficult to control due to its extensive root system. It grows in a variety of soils, but is most competitive in deep, well-aerated, productive, cool soils (CSU Extension 2011). To control Canada thistle, it is useful to combine control methods, and to be persistent in applying them. The RFO recommends the use of chemical or biological weed management methods for the control of Canada thistle (BLM 2011).

Chemical

Several herbicides are recommended by the RFO for the control of Canada thistle – picloram, 2,4-D, triclopyr, and clopyralid. Herbicide spraying will follow the guidelines described below.

Table 1 RFO Approved Herbicides for the Treatment of Canada Thistle

Herbicide	Recommended Time of Use
Picloram	Fall, but can be applied anytime when weeds are rapidly growing (CSU Extension 2011).
Clopyralid	Spring after all shoots have emerged (pre-bud to early bud growth stages), or in the fall (CSU Extension 2011).
2,4-D	Spring (pre-bud to early bud growth stages) (CSU Extension 2011).
Triclopyr	Spring (pre-bud to early bud growth stages) or fall.

Biological

Biological controls for Canda thistle include Canada thistle stem weevil (*Ceutorhynchus litura),* Canada thistle bud weevil (*Larinus planus*), and thistle stem gall fly (*Urophora cardui*). Canada thistle stem weevil will not control Canada thistle on its own, and must be combine with other control methods (CSU Extension 2011).

Other Weedy or Invasive Species

Other weed or invasive species on site include German-madwort, Japanese brome, cheatgrass, bull thistle, and curlycup gumweed. Control methods for these species will include chemical and mechanical controls and will be determined in conjunction with the BLM and county weed extension officer.

Chemical

- The appropriate herbicides for individual species will be used as determined in conjunction with the BLM and county weed extension officer.
- The herbicide Imazapic is recommended for cheatgrass.
- Herbicide spraying for curlycup gumweed may not be effective, as the species does not respond consistently to herbicide spraying.

Mechanical

- In newly reseeded areas, mowing will be considered during the first season of establishment, prior to seed formation of weeds of concern.
- Hand pulling of weeds will be considered for small or new infestations.
- Appropriate grazing management will be employed to prevent over-grazing of reclaimed areas.

4.7 Herbicide Application, Handling, Spills, and Cleanup

Herbicide application will be conducted in accordance with BLM guidelines and documents. This includes a 2007 BLM ROD and Programmatic Environmental Impact Statement for Vegetation Treatments Using Herbicides on BLM Lands (FEIS) and the RFO RMP. The ROD contains Standard Operating Procedures, Prevention Measures, and Mitigation Measures for the use of herbicides. The FEIS lists herbicide treatment standard operation procedures, mitigation measures, monitoring, and

herbicide active ingredients allowed on BLM lands in Wyoming. In addition, the RFO maintains a list of approved herbicides for use in the lands managed by the RFO.

In general, the following standard operation procedures will be implemented for herbicide spraying in the project area.

- PLS will use locally certified applicators and develop specific herbicide application, handling, and cleanup guidelines.
- Application, and storage of herbicides will follow EPA label guidelines and be performed in accordance with federal, state, and local laws and regulations.
- Disposal of empty containers will also follow label guidelines.
- Prior to spraying on BLM-managed lands, PLS or its contractors will submit to the BLM a Pesticide Use Proposal (PUP) showing the type and quantity of material(s) to be used, pest(s) to be controlled, method of application, etc. The PUP must be approved by the BLM prior to the spraying and be tiered to the approved Reclamation Plan and WMP.
- Copies of daily Pesticide Application Records (required by the State of Wyoming) and Summary Herbicide Use Reports are due monthly to the BLM Weed Coordinator.

4.8 Monitoring and Maintenance

Post-mine inspections of the vegetative cover and soil will occur quarterly for the first 2 years, and then semi-annually in coordination with storm water management inspections. Monitoring of noxious weeds and invasive species will be conducted as part of the post-mine inspection. Monitoring data collected will include: the noxious weed and invasive species, their location, the extent of infestation, and results of previous control measures implemented. These results will be compared with the pre-construction survey data to determine the success of the noxious weed and invasive species control measures.

If new and existing noxious weed and invasive species' populations are observed in the project area, PLS will treat them with various control methods. Control methods will incorporate a variety of techniques including mechanical, chemical, and biological techniques such as application of herbicides, hand pulling, seed bagging, mowing, and grazing that will be focused on the type of weed species identified. PLS will consult with local weed districts and the BLM to determine the most appropriate control measures. All methods will be approved by the RFO and incorporated into a revised WMP for the JPA. Control measures will be implemented before seed development and maturation.

4.9 References

AECOM. 2009. Addendum to Appendix D-8 Baseline Vegetation Survey for Access Road Pete Lien & Sons Jonathon Project. Pete Lien Jonathon Project Mine Permit Application. December, 2009.

Bureau of Land Management (BLM). 2011. Environmental Assessment Noxious and Invasive Weed Control and Commercial Site Vegetation Control Programs. BLM Rawlins Field Office. March 2011.

BLM 2007. Final Programmatic Environmental Impact Statement Vegetation Treatments Using Herbicides on Bureau of Land Management Lands in 17 Western States. BLM Nevada State Office. June 29, 2007.

Cedar Creek and Associates. 2007. Appendix D-8 Baseline Vegetation Survey. Pete Lien Jonathon Project Mine Permit Application. November, 2007.

Colorado State University Extension (CSU Extension). 2011. Canada Thistle Fact Sheet. http://www.ext.colostate.edu/pubs/natres/03108.html. Accessed June 2, 2011.

Attachment 3

Required Annual Report Information for Non-Coal Large Mining Operations

REQUIRED ANNUAL REPORT INFORMATION FOR NON-COAL LARGE MINING OPERATIONS

Land Quality Division, Districts I, II & III

RE: Wyoming Environmental Quality as Amended §35-11-411, Annual Report

1. (a) Name of Permittee.
   (b) Address and Phone Number.
   (c) Mining Permit Number.
   (d) Date of Permit Issuance (and any Amendment).
   (e) Mineral(s) Mined.
   (f) State and Federal Mineral Lease Numbers.

2. Time period covered by the report.

3. Mining:
   (a) Tabulate acreage disturbed (by pits, roads, facilities, etc.) during the report period and illustrate on map.
   (b) Tabulate acreage affected to date by years and illustrate on map.
   (c) Tabulate all topsoil stockpile volumes, date of stockpiling and illustrate on map.
   (d) Tabulate all out-of-pit spoil volumes, dates of placement and illustrate on map.
   (e) Tabulate quantity of commodity mined by years.
   (f) Describe any new construction during the report period and illustrate on map; include:
      1. Shop facilities, erection sites.
      2. Roads.
      3. Culverts.
      4. Diversion ditches, collector ditches, interceptor ditches, etc.
      5. Sediment ponds, containment ponds.
      6. Monitoring sites.

   (g) Describe any environmental problem areas, the proposed plan for mitigating them and illustrate areas on map; including:
      1. Pit stability problems.
      2. Subsidence.
      3. Accidental water discharge, dam failure, etc.

4. Slumping or sliding.
5. Revegetation problem areas.

4. Reclamation

(a) Tabulate the acreage completed during the report period and illustrate on map. Distinguish between:

1. Backfilled, graded, and contoured. Including date of approval for coal permits.
2. Topsoiled.
3. Seeded.
4. Reseeded.
5. Indicate where special construction or reclamation practices were used such as for sand bodies or alluvial material.

(b) Submit a map showing the reconstructed contours. The map must be the same scale and contour interval as the PMT map in the approved permit.

(c) Tabulate acreage reclaimed (seeded with permanent seed mix) to date by years and illustrate on map.

(d) Describe reclamation procedures used during the report period:

1. Depth of topsoil applied. Indicate whether from stockpile or directly applied.
2. Type of seed used for seeding during the report period.
3. Dates of seeding during the report period.
4. Seeding procedures used.
5. Rate of seed application.
6. Type and rate of any fertilizer applied.
7. Type and rate of mulch applied.
8. Rate of irrigation water applied.
9. Any deviations to the approved reclamation plan including, in addition to the items above, changes to the contour or location of post mining features.

(e) Describe results of previous revegetation efforts; include:

1. Types of seed that have germinated and are growing.
2. Types of seed that are not growing successfully.
3. Areas experiencing problems with weeds and weed types.

4. Significant erosional problems.
5. Areas of unsuitable overburden on the surface.
6. Procedures used or proposed to correct these problems.

(f) Summarize the actual reclamation costs incurred during the report period. Costs should be itemized for each operation (i.e. grading, topsoil replacement, seeding, etc.) and for each type of disturbance (i.e. spoil, haul roads, facilities removal, etc.) on a per-acre basis.

5. Describe in detail mining plans for the coming year including revised time schedules and all proposed deviations from previously approved plans. Acreages should be tabulated and illustrated on a map.

6. Describe in detail reclamation plans for the coming year including revised time schedules and deviations from previously approved plans. Acreages should be tabulated and illustrated on a map.

NOTE: On Items 5 and 6 above, any proposed deviation from the approved mine and reclamation plan must be described in detail. The proposed mining and reclamation plans will be reviewed and the operator will be notified if further information is required. "Significant" deviations will require permit revision application (Form 11) and public notice pursuant to Chapter 7, Section 2 of Land Quality Division Noncoal Regulations.

7. Describe in detail all monitoring activities during the report period, summarize the data, and describe procedures to correct any noted problems and deviations from previously approved methods, including:

(a) Groundwater analyses.

(b) Surface water analyses and discharge data.

(c) Precipitation data.

(d) Subsidence monitoring.

(e) Overburden analyses.

(f) Topsoil quantities - compare calculated and actual.

(g) Vegetation data.

(h) Wildlife data.

(i) A map showing and identifying monitoring locations.

8. Operator's Reclamation Performance Bond Estimate as required by Wyoming Statute §35-11-417. Reclamation cost estimates should be itemized in detail to reflect the actual estimated costs of reclaiming all lands which have been affected to date and those lands to be affected during the next report period. Costs must reflect procedures as specified in the

approved mine and reclamation plan. The estimated cost of dismantling and disposal of all facilities and structures must be included. Salvage value will not be used to offset bonding requirements. Reclamation projected for the coming year will not be used to offset bonding requirements. Pit backfill costs must reflect actual yardages to be moved. Actual yardages to be moved will reflect the removal or placement of additional material to correct any deviations between the PMT map and the map submitted for part 4.(b).

9. Supply any additional information as requested by the Division related to:

   (a) Notices of violation

   (b) Orders

   (c) Permit stipulations; and

   (d) Other special conditions.

10. All drill holes used for immediate developmental expansion of the advancing pit(s) shall be tabulated by location and depth and shown on the mining plan map. Pursuant to W.S. §35-11-404(e), all drill holes used for exploration shall be reported to the LQD Abandoned Drill Hole Program Supervisor and the State Engineer.

ANNUAL REPORT MAPS

1. Maps must be clear and legible contour maps or recent aerial photos. The preferred scale is 1" = 500'.

2. Map sheets should be of a reasonable size, generally not to exceed 48" on a side.

3. Maps must have a title block with:
   - (a) Map title.
   - (b) Name and address of permittee.
   - (c) Permit and amendment numbers.
   - (d) Annual report period.
   - (e) Scale, north arrow, contour interval, date of photography, etc.

4. All maps must show:
   - (a) Legal subdivisions -- section, township, and range lines clearly labeled.
   - (b) Permit area boundary clearly shown and labeled.
   - (c) Amendment areas clearly shown and labeled.

5. The following features should all be clearly identified:
   - (a) Topsoil stockpiles (numbered).
   - (b) Settling ponds and sediment control structures.
   - (c) Haul roads.
   - (d) Pits identified by location, name, number, etc.
   - (e) Ramps (numbered).
   - (f) Out-of-pit spoil dumps including date of initial placement of material (if permanent, give approval date).
   - (g) All waste disposal sites including, but not limited to:
     1. Carbonaceous waste dumps.
     2. Partings dumps.
     3. Fly ash disposal sites, etc.
     4. Landfill sites.
   - (h) Diversion ditches
   - (i) Monitoring sites
   - (j) Facilities location (silos, labs, crushers, washbays, etc.)

6. History of mining and reclamation should be documents for all areas. The preferred method

is to outline separate areas on the map and assign each a number. Then a summary should be presented listing the following information for each separate area:

(a) Acreage.

(b) Initial date of disturbance.

(c) Date of regrading.

(d) Date of approval of grading.

(e) Date of topsoiling and approximate depth, source of topsoil.

(f) Date of mulching and type of mulch.

(g) Date of seeding.

(h) Seed mix.

(i) Date and mix of reseeding.

(j) Any reworking such as repair of gullies, etc.

(k) Bond status of areas (type of bond, date of any release and percent released).

7. All areas to be affected by mining and reclamation activities in the coming year should be outlined and labeled.

Annual Report Attachment

A. Please indicate any change in company name or business organization.

_____

_____

B. List the names, addresses and phone numbers for the following:

1. General Manager:_____

_____

_____

2. Party to Receive Notice _____

_____

_____

C. List the names, addresses and phone numbers of all officers, owners and/or controllers. Include titles/positions and beginning and ending dates.

_____

_____

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Attachment 4

Department of Environmental Quality Land Quality Division Guideline No. 2 Vegetation

DEPARTMENT OF ENVIRONMENTAL QUALITY
LAND QUALITY DIVISION

GUIDELINE NO. 2

VEGETATION

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INTRODUCTION

This document is a guideline only for all non-coal surface mining operators. Its contents are not to be interpreted by applicants or DEQ staff as mandatory. This guideline is strictly a document available to assist the applicant. Its preparation is the result of numerous requests from applicants who have expressed a need for a check-list to assist them in the preparation of a comprehensive application containing all required information. If an applicant feels that this guideline is receiving improper use by the Department or he wishes to pursue other alternatives, they are encouraged to contact the Administrator or his designee.

This document outlines acceptable procedures for generation, analysis and presentation of vegetation data and revegetation practices to assist a permit applicant with respect to the permit application requirements of W.S. § 35-11-406(a)(vii), (b)(i) and (b)(iii), Sections 2. (a)(i)(A), 2(a)(i)(B), and 2(b)(iii)(C) of Chapter II of LQD Rules and Regulations and Sections 2(a)(i), 2(a)(ii), 2(d)(i) through (ix) of Chapter III of LQD Rules and Regulations. The description of lands not previously permitted shall be in accordance with methods specified in this document. Renewal applications may utilize vegetation baseline data collected using earlier approved methods if the results are part of the currently approved mine permit.

This document outlines acceptable procedures for:

A. Designing and executing premining baseline vegetation inventories.

B. Documenting the premining land uses and the capability of the existing plant communities to support those uses.

C. Establishing and evaluating appropriate postmining land uses.

D. Formulating a sound revegetation plan by choosing appropriate plant species and plant community types which will support the postmining land uses.

E. Establishing quantitative and qualitative vegetation parameters which serve as reclamation success standards for purposes of final bond release.

F. Preparing sections of Appendices D-1, D-8, and D-11 and the Reclamation Plan.

G. Evaluating the success of revegetation efforts and for eventual request of full bond release.

The methods and format outlined in this guideline are suggested for all regular mining permit applications. Applications for Small Mining Permits and Limited Exemption Mining Permits (ten-acre exemptions) have different requirements. Applicants for these types of permits should contact LQD District Offices for further information.

The type and amount of vegetation information required for mining permit applications may be modified depending upon:

a. The mineral to be mined and the type of mining proposed.
b. The type of land disturbed and/or the type and acreage of disturbance.
c. The size of the permit area.

I. GENERAL INVENTORY PROCEDURES

These procedures constitute an acceptable premining vegetation inventory. Other methods and types of inventories may be acceptable if they meet or exceed the objectives of this guideline. Any alternative study plans or alternative sampling methods should be discussed with and approved by WDEQ/LQD prior to the use of such procedures. Failure to receive prior approval for alternative procedures may cause significant delays during permit review, and rejection of the sampling methods and procedures if it does not result in an equivalent data base. WDEQ/LQD strongly encourages cooperative interactions among the regulatory authority, prospective applicants and consultants to prospective applicants during the design and execution of baseline inventories and preparation of permit applications.

A. Mapping of Plant Communities

The plant communities or vegetation types of the entire permit area should be delineated on an aerial mosaic photograph or topographic base map. The mapping should be extended to adjacent areas (0.8 km) on all sides of the permit area boundary or study area boundary. This suggested extension beyond the permit area applies only to mapping of community types. This suggestion does not refer to sampling of areas outside the permit area.

The LQD does not recommend the use of SCS range sites for the mapping of premining plant communities. The range site concept does not facilitate practical units for reclamation purposes.

The map should be at a scale of 1" equals 1000 feet or greater (e.g., 1" = 500'). The map scale selected should be the same as used in other sections of the permit application or an even multiple thereof. For example, if a scale of 1" = 1000' is used for the premine topography map, the vegetation map should also be at a scale of 1" = 1000', alternately a scale of 1" = 500'.

The vegetation map should clearly and accurately show all appropriate legend information outlined under the heading "Maps" in WDEQ/LQD guidelines No. 6 or 6A. In addition, the vegetation map should identify all sample locations, accurately locate all Control Areas (CONA) (See Glossary), identify and describe the type and extent of all existing disturbances and identify all areas to be affected by mining and associated activities, including access roads, railroad spurs, etc.

B. Sampling of Plant Communities

Each defined plant community of the permit area and all CONAs should be sampled for the following parameters:

1. % vegetation cover by species
2. % total vegetation cover (= sum of all species)
3. % total ground cover (= vegetation + litter + rock)
4. % bare ground
5. herbaceous production by species
6. total herbaceous production
7. density and distribution of full shrubs (and subshrubs when appropriate)
8. density of trees
9. species diversity and species composition

The LQD prefers that these vegetation parameters be estimated by vegetation type, considering the entire permit area as a single unit, i.e. without a distinction between affected and non-affected areas. The LQD feels that sampling the entire permit area will:

1. facilitate the derivation of more accurate quantitative and qualitative revegetation success standards;
2. provide the operator greater flexibility in planning the location and progression of pits and the location of mining facilities.

However, the applicant should also consider their chosen method of evaluating revegetation success (Sections III.B and VIII.B) when deciding whether to distinguish between affected and non-affected areas for sampling purposes.

Both absolute and relative values for % species cover, % vegetation cover, % total ground cover, herbaceous production by species and total herbaceous production should be provided. The absolute values of % vegetation cover, % total cover and total herbaceous production constitute the quantitative revegetation success goals, as per Chapter III, Section 2(d)(vi), for evaluation of full bond release. The relative values of cover and production are used to evaluate the representative nature of the CONAs and may be used in evaluating postmining species diversity and species composition as per Chapter III, Section 2(d)(vi).

Please see the Glossary for definitional distinctions between absolute (pg. 41) and relative (pg. 45) values.

C. Establishing and Sampling Control Areas or Reference Areas

The applicant should establish a Control Area (CONA) or Reference Area (REFA) for each vegetation type, in excess of 10 acres, which will be disturbed (or a greater area approved by the Division) unless the Division has agreed that reestablishment of the vegetation type will not be required. For the sake of brevity, this guideline will generally

use only the term CONA. However, all applicants should clearly understand that either the CONA or REFA concept is an acceptable procedure for the evaluation of revegetation success under provisions of Chapter III, Section 2(d)(vi).

Sections III.B and VIII.B describe the conceptual distinctions between the use of CONAs and REFAs. Applicants may develop, propose and request approval for alternatives to CONAs or REFAs for the evaluation of revegetation success.

Each CONA should be marked on the vegetation map, should be permanently marked in the field, and should be managed in a fashion equivalent to all other non-affected lands within the permit area. By definition the land units chosen as CONAs shall remain unaffected by mining and associated activities over the life of the mine, and they cannot be moved without resampling the entire type they represent.

The applicant should present vegetation data on each community type and each CONA in a fashion which facilitates evaluation of the representative nature of each CONA. A tabular summary might best achieve this comparison (see Appendix V, Table 3).

D. Describing the Plant Communities

Each plant community and the representative CONA should be verbally described. The description should include the general vegetation composition, the dominant plant species, characteristic topography, soil types, average slope, aspect and interspersion with or relationship to other community types. The quantitative and qualitative vegetation information may be best presented in a tabular format (Appendix V, Table 2).

If noxious (designated) or declared weeds (see Appendix I) comprise more than 25% of the vegetation cover on three (3) or more contiguous acres, these areas should be mapped as distinct vegetation types and identified on the vegetation map. These weedy species should be noted in the species list; their presence in any of the mapped community types should also be noted. Quantitative sampling should not be performed on noxious weed mapping units.

The presence of selenium indicators (Appendix III) should also be noted and their distribution discussed.

The applicant should present the following information in a tabular format (see Appendix V, Table 1):

1. Total acreage of each vegetation type on the permit area.
2. Total acreage of each vegetation type sampled on the study area, if the study area is larger than the permit area.
3. Total acreage of each vegetation type affected by mining and associated activities.
4. % of each vegetation type affected by mining and associated activities.
5. Total acreage of each CONA.

6. Total acreage of all other mapping units, e.g. reservoirs, cropland, pastureland, hayland, existing disturbed areas.

A 3 1/2" x 5" (or larger) photograph or a 2-3 frame panoramic sequence showing the general features of each community type and its representative CONA should be provided in the vegetation report. Photocopies of photographs are not acceptable. The location of all photographs should be noted on the vegetation map.

E. Compiling a Plant Species List

The applicant should compile a list of the vascular plants of the permit area, including plant species observed but not actually recorded during sampling. The species list should be field checked and updated at least once a month from April through September during the field season when baseline sampling is performed. Regional and seasonal phenological processes should determine the actual compilation time period.

The plant species should be listed by scientific binomial and common name under life-form categories. Suggested categories include annual grasses, perennial grasses, grass-like species, forbs, succulents, full shrubs, subshrubs and trees.

The applicant should list the literature and/or personnel contacted for identification of plant species and note the location of any herbarium samples collected during the baseline inventory. A specimen of the following may be requested to confirm its occurrence:

1. any plant of special concern (appendix IV).
2. any species which is similar to a plant of special concern.
3. any species not previously recorded in Wyoming.
4. any species out of its known range.

The applicant should specifically note any plants of special concern (appendix IV) which occur on or adjacent to the permit area.

F. Sample Adequacy

The applicant should attain formula-based sample adequacy or achieve the maximum sample size for each of the following vegetation parameters in each vegetation type and each CONA:

1. % vegetation cover (absolute value only).
2. % total ground cover (absolute value only).
3. Total herbaceous production (absolute value only).

Section IV of this guideline outlines procedures for calculating sample adequacy and lists maximum and minimum sample sizes.

II. DETAILED QUALITATIVE AND QUANTITATIVE SAMPLING PROCEDURES

A. Choice of Sample Locations

All sample locations must be chosen by random or systematic procedures. Random procedures are discussed in most standard statistical texts. The selection of sample locations must be done objectively in the lab or office, not in the field. Grid line intervals (when used) should be no more than 65 meters on the ground. After the sample locations are selected, pacing from easily identifiable land marks is sufficiently accurate to locate them in the field.

Systematic sampling is described in Cochran (1977), Chapter 8. Systematic samples are acceptable only if each vegetation type is entirely covered. Calculations for systematic samples may be done by assuming the sample is random.

Sample locations must not be discarded because they are located on areas which are barren or otherwise seem atypical. However, sample locations which fall within recognizable and distinct inclusions within a given vegetation type, on obvious ecotones between types or on areas obviously disturbed by human activities or for land management practices, may be excluded during actual sampling. The applicant should carefully note and report in the text of Appendix D-8 all such occurrences.

The same procedures should be used for choosing sample locations in CONAs as in the permit areas as a whole. These procedures should be clearly described in the text of Appendix D-8.

B. Choosing Sampling Methods

The quantitative vegetation data requested in this guideline can be gathered using the basic methods of quadrats and/or transects. The choice of methods lies with the applicant. The choice should be based upon:

1. The specific parameter being measured.
2. The degree of statistical accuracy desired.
3. Operator knowledge of the permit area and its plant communities.
4. Operator experience in using a given technique.

The methods discussed in this guideline have been widely used in plant communities of Wyoming. In general, they have provided sufficiently detailed and accurate information to meet the permit application requirements of W.S. § 35-11-406 and Chapter II and III of LQD Rules and Regulations. In particular, the methods discussed in this guideline have consistently provided the type, quantity and quality of data necessary to:

1. document the highest previous use of the land within a permit area.

2. document that the regional plant communities can or cannot support the prevailing land uses.
3. develop sound reclamation and revegetation methods.
4. establish sound quantitative and qualitative revegetation success goals.

Investigators have devised numerous study designs, sampling regimes and sampling methods for vegetation analysis. Some of these procedures variously known as two-stage sampling, double sampling, cluster sampling, stratified sampling, etc., have been used for baseline vegetation inventories in Wyoming. However, in general these methods have not proven satisfactory for attaining adequate baseline information. Operationally, the large variance terms associated with these sampling methods have caused serious difficulties in attaining the sample adequacy tests of this guideline. The LQD does not recommend use of these procedures.

The references listed in Appendix VI may provide useful information regarding sampling methods.

1. Use of Quadrats

All of the required vegetation parameters can be estimated using quadrats. However, a single quadrat size and shape may not be appropriate for all parameters. Furthermore, there is no absolute, universal method for determining quadrat size or shape. Quadrat size and shape should be selected to reduce variance and thereby reduce the number of samples needed. The quadrat should be sufficiently large so that:

a. Separation, counting and measurement of the individual plants can be performed with relative ease.
b. Sampling efficiency is as high as possible.
c. The largest plant within the quadrat does not fill the quadrat.
d. All quadrats enclose some vegetation.

2. Use of Line Transects

All transects should be at least 50 meters in length. If a transect runs out of a given vegetation community, select a new random orientation, at the point where the transect leaves the vegetation type, which will return the transect to the same vegetation type.

If quadrats are spaced along a transect, no fewer than five (5) quadrats should be placed along each transect. If point-intercept methods are employed along a 50-meter transect, no fewer than fifty (50) sample points should be evenly spaced along each transect.

Independent of the method, each transect comprises a sample size (N) of one (1).

C. Suggested Sampling Procedures for Specific Vegetation Parameters

1. Cover Parameters

Chapter I of LQD Rules and Regulations defines "cover" as vegetation, litter and rock over the soil which intercept rainfall. This definition describes % total ground cover. Operationally, vegetation cover is the vertical projection of the general outline of plants (ignoring minor gaps between branches and holes in the canopy) to the ground surface expressed as a percent as a surface reference unit.

The applicant should collect data for the following categories:

1. % vegetation cover by species
2. % total vegetation cover (= sum of all species)
3. % total ground cover (= vegetation + litter + rock)
4. % bare ground

The original absolute cover values for individual species should be manipulated to provide relative cover values.

For sampling purposes rock may be considered any stone or mineral matter at least one (1) square centimeter in size. Litter is any plant part, lying on the ground surface, whose structural integrity remains recognizable.

a. Quadrat Methods

Species cover, vegetation cover and total ground cover can be determined from appropriately sized quadrats by ocular estimation. The considerations for determining quadrat size and shape discussed earlier clearly apply to cover sampling.

b. Line Transect Methods

Species cover, vegetation cover and total cover can be determined from procedures based on line transects. The point intercept method has been frequently and successfully applied in Wyoming plant communities. Point samples may be determined using the following tools: sharpened rod or pin or an ocular siting device projected vertically downward to the sample location on the transect.

When estimating % cover by species, only the first hit on each species should be recorded and used in the calculations. If one projection intercepts the same species more than once, record only the "first hit" on that species. If one projection intercepts more than one species, separate hits should be recorded for each "hit" on each species.

When estimating % total vegetation cover, the first "hits" per projection should be used.

In general, the line transect should be at least fifty (50) meters long; Point samples should be collected at one (1) meter intervals. Each transect constitutes a sample size (N) of one (1).

2. Total Herbaceous Production

In this guideline, the term production will describe an estimate of the total herbaceous standing crop biomass which is measured at or near the expected peak of the standing crop. Herbaceous production by species and total herbaceous production should be estimated for each community type and its representative CONA.

a. Grazing Exclosures

All production estimates should be taken from within grazing exclosures. Random sample points (exclosure locations) should be established before the growing season. The exclosures should be placed in the field on or before April 15th or as soon after snowmelt as field conditions permit. Cages should be placed at this time to avoid possible data complications from snow accumulation through the winter.

The number of cages needed can be estimated from preliminary sampling, from results of previous vegetation sampling on-site or from other vegetation surveys in similar vegetation types in the area. All permit applications and approved permits for mining in Wyoming are public documents and open to review. Analysis of existing data from applicable documents should be an integral part of all study designs for a baseline vegetation inventory. Applicants should establish several extra exclosures in each vegetation type and CONA to accommodate possible loss of some exclosures due to destruction by cattle, inaccessible locations, placement in an inclusion, etc.

The cage size and quadrat size must be chosen with each other in mind. The exclosure must be sufficiently large to accommodate the sample

quadrat and to provide a buffer area which reduces the potential for serious edge effects.

All exclosures should be removed when the inventory is complete.

b. Field Methods

The standing crop biomass of all herbaceous species should be harvested in each quadrat. Full shrubs, succulents, annual grasses, annual forbs, Yucca spp., noxious weeds, cushion plants and trees should not be harvested. The seasonal growth of subshrubs should be harvested (see Appendix II) when accurate density data are unattainable. If annual grasses and/or annual forbs are major community components, these life forms should be clipped.

The vegetation should be clipped by species in each vegetation type and each CONA. The minor or remaining species can be harvested by life form category (Section I.E.).

All biomass should be carefully dried in an oven to a constant weight and recorded to the nearest 0.1 gram. Data should be reported in grams per square meter.

c. Data on Cropland, Hayland or Pastureland

Land units which have experienced special management such as cropland or pastureland (see definitions under "cropland and pastureland", respectively) should be delineated and identified on the vegetation map. Best available information on the current and historical management of these lands and their production must be provided. The applicant should consult appropriate land owners or managers for these data. All sources for this information should be identified in the text. Harvest data should be presented in units of grams per square meter, if possible. Cropland need not be sampled for any of the vegetation parameters outlined in Section I.B. However, some vegetation sampling of pasturelands and haylands may be appropriate. It is strongly recommended that the applicant contact LQD during the initial planning stages of the proposed vegetation inventories to discuss appropriate sampling procedures relative to these land units.

In general, CONAs or REFAs need not be established for these land use units. The premining production data, similar undisturbed management units or average area agricultural statistics information may serve as reclamation success standards per Chapter III, Section 2(d)(vi)(F).

However, given site specific conditions it may be appropriate to establish CONAs or REFAs for haylands and pasturelands. The need to establish CONAs or REFAs should be discussed with the LQD during the initial planning stages of the vegetation inventory.

3. Shrub Habitat Characteristics and Tree Distribution

Chapter III, Section 2(a)(ii) requires that wildlife habitat be restored on affected land in a manner commensurate with or superior to habitat conditions which existed before the land became affected. Therefore, the presence of shrubs and trees on a permit area should be documented during baseline sampling. The type, quantity and quality of premining shrub and tree distribution data should be tied to the operator's chosen methods for the restoration of postmining wildlife habitat.

When shrub and tree density data are estimated, they should be gathered from each community, but not from CONAs. In general, the generic category of "shrubs" should be divided into woody species (full shrubs) and suffrutescent species (subshrubs) for sampling purposes (see Appendix II). The general locations or concentrations of trees should be illustrated on the vegetation map.

The sample points for estimation of full shrub and subshrub density, should be randomly or systematically chosen. Quadrats, belt transects and plotless distance methods have been used to estimate shrub density in Wyoming plant communities. The belt transect appears to be the most efficient and accurate method for estimation of this parameter. The 50 meter transect used for cover parameters is easily converted to a 50 square meter belt transect by counting all full shrubs and subshrubs to a distance of 50cm on both sides of the line transect. Data should be recorded by species and then manipulated to formulate full shrub and subshrub density values for each community type. The data should be reported as number per square meter and number per acre. The growth characteristics of certain subshrub species under various environmental conditions may prohibit accurate density counts. Under these circumstances, consultation with LQD may provide for the collection of seasonal growth biomass as a substitute method of characterizing these plant species.

Shrub density data are not subject to sample adequacy tests. However, in general, the number of shrub density sample points should correspond to the number of cover samples in each community type.

The line intercept method may provide an efficient, cost-effective methodology to estimate shrub cover for the purposes of characterizing wildlife habitat.

Plotless distance methods and direct counts have been used to estimate tree densities in Wyoming plant communities. Because of the patterns of distribution

and general paucity of tree species on lands affected by mining in Wyoming, direct count methods may be the most accurate and efficient. Depending upon community characteristics, plant distribution, plant size and availability of source materials, direct counts may be made by field reconnaissance or from aerial photographs. If plotless methods are used, 15-20 randomly chosen sample points should be sampled. Some estimate of height and/or age distribution should also be provided. Tree density data are not subject to sample adequacy tests.

4. Species Composition and Species Diversity

Chapter I of LQD Rules and Regulations defines species composition as the "...number, kinds, amount and quality of species" and species diversity as the "...number of species per unit area". Chapter III, Section 2(d)(vi) establishes suitable postmining species diversity and composition as revegetation success goals for all operators.

The concept of species diversity is complex. Some researchers suggest that species diversity can be measured by indices of diversity. Though numerous indices of diversity have been developed, no standard index exists and no single index is necessarily better than another.

The applicant should collect premining data which can be manipulated to document the species composition and species diversity of premining plant communities.

D. Recording of Sample Methodology

All sampling procedures must be presented clearly in the text of Appendix D-8. The applicant should use the same procedures for sampling vegetation types and CONAs.

III. ESTABLISHING REVEGETATION SUCCESS GOALS

A. Quantitative and Qualitative Vegetation Standards

Chapter III, Section 2(a)(i) requires that reclamation restore the land to a condition equal to or greater than the "highest previous use". Chapter III, Section 2(d)(vi) outlines specific vegetation parameters which constitute revegetation success goals when reclaimed lands are considered for full bond release.

These qualitative and quantitative vegetation parameters which constitute revegetation success goals include:

1. % vegetation cover (absolute value).
2. % total ground cover (absolute value).

3. Total production for herbaceous species (absolute value).
4. Density of full shrub and subshrub species (postmining shrub habitat).
5. Areal extent of dense shrub mosaics.
6. Density of trees.
7. Species diversity and species composition.
8. Ability to withstand grazing pressure.
9. Attainment of these parameters for the last (2) consecutive years of the bonding period.

The premining values of these parameters, estimated from the vegetation types actually affected by mining and/or from other undisturbed portions of the same type which are representative of the affected vegetation types, are used to generate the postmining revegetation success goals.

The baseline vegetation inventory should generate a single quantitative or qualitative value for parameters 1, 2, 3, 5 and 6 from each vegetation type and its representative CONA. Each quantitative and qualitative goal should be clearly presented in Appendix D-8 and at least referenced in the Reclamation Plan.

B. Establishing Land Units for Use in Evaluating Revegetation Success for Full Bond Release

As noted above, Chapter III specifies the vegetation parameters which constitute revegetation success goals for full bond release and requires the LQD administrator to specify methods for evaluating attainment of these goals. at this time, all approved success evaluation methods must be based upon analysis of an undisturbed land unit, i.e. a control area or reference area. As discussed more fully in section VIII, several methods of evaluating revegetation success exist. Each of the methods conceptually share several common features:

1. During the baseline inventory, the applicant delineates portions of vegetation types which will remain undisturbed and which are biotically and abiotically representative of vegetation types affected by mining activities.
2. During the baseline inventory, standard sampling methods are used to estimate the premining values of the vegetation parameters (outlined above in Section III.A) on each affected vegetation type and an undisturbed portion of the same vegetation type. These premining data are used to document the representative nature of the undisturbed unit.
3. At least two (2) years prior to the desire for full bond release, the revegetation success parameters are again estimated on the revegetated areas and the undisturbed units.

The applicant should choose which conceptual framework is appropriate for the evaluation of revegetation success under the conditions expected to exist on the mine site. Alternate success standards for evaluating reclamation success may be submitted for approval by the

Administrator. The applicant must establish at least one land unit, within an undisturbed portion of a vegetation type, which is representative of each vegetation type that will experience ten (10) acres or more of disturbance (or a greater area if approved by the Division).

The following types of undisturbed land units may be established for use in evaluating revegetation success. The land units themselves and the conceptual framework within which they are used are not interchangeable. The applicant should consistently establish one type of land unit from the following:

Control Area means a land unit which is representative, in terms of physiography, soils, vegetation and land use history, of a plant community affected by mining activities. The representative nature of the Control Area is verified by subjective (non-statistical) comparison of its qualitative and quantitative characteristics to similar information from the plan community it typifies.

Quantitative premining and postmining vegetation data from the Control Area are used to mathematically adjust premining affect area data for climatic change. These adjusted data are directly compared by statistical procedures (confidence level of 80%, " = 0.2) to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. Qualitative data are compared by standard procedures agreed to by the applicant or permittee and LQD.

Reference Area means a land unit which is representative, in terms of physiography, soils, vegetation and land use history, of a plant community affected by mining activities. The representative nature of the Reference Area is verified by statistical comparison (confidence level of 90%, " = 0.1) of its absolute values of % vegetation cover, % total ground cover and total herbaceous production to similar data from the plant community it typifies. Species composition and species diversity are subjectively (non-statistically) evaluated.

Quantitative postmining vegetation data from the Reference Area are directly compared, by standard statistical procedures (confidence level of 80%, " = 0.2), to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical climatic adjustment is made. Qualitative data are compared by standard procedures agreed to by the applicant or permittee and LQD.

Note: The following is a special kind of reference area that can be utilized by the operator.

Extended Reference Area means all the undisturbed portions of a vegetation type which has experienced disturbance by mining activities. The representative nature of the Extended Reference Area is verified by evaluation of vegetation mapping procedures, the

adequacy of premining vegetation data, soils data, physiography and land use history information.

Postmining quantitative vegetation data from the Extended Reference Area are directly compared by standard statistical procedures (confidence level of 80%, " = 0.2), to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical adjustment for climatic change is made. Qualitative data are compared by standard procedures agreed to by the applicant or permittee and LQD.

A Control Area (CONA) or Reference Area (REFA) should be at least two (2) acres in size. Larger land units are preferred, whenever possible, for the following reasons: 1) to reduce the variability (in terms of the abiotic and biotic characteristics) between the CONAs or REFAs and the communities they typify; and 2) to reduce the potential adverse impacts to the CONAs or REFAs due to intensive sampling at the time of bond release, which becomes more critical when successive units of reclaimed lands are being evaluated for revegetation success.

All CONAs or REFAs should remain undisturbed by mining activities and should be managed in a fashion which will not cause significant, management-related changes in the vegetation parameters used to evaluate revegetation success. Permittees should contact LQD if they perceive the need to relocate a previously established CONA or REFA.

Section VIII.B further outlines operational differences among the CONA and REFA concepts when evaluating the success of revegetation.

For existing mining operations where vegetation data were not collected prior to disturbance, another type of land unit may be established for purposes of evaluating revegetation success.

<u>Comparison Area</u> means a land unit which is representative, in terms of physiography, soils, vegetation and land use history, of a premining plant community from which no vegetation data were collected prior to disturbance. The representative nature of the Comparison Area may be validated by a subjective field reconnaissance of the site or by subjective evaluation of vegetation data generated by a sampling program. The establishment procedures should be agreed to by the permittee or applicant and the LQD prior to establishment.

Postmining quantitative data from the comparison area are directly compared, by standard statistical procedure (confidence level of 80%, " = 0.2), to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical adjustment for climatic change is made. Qualitative data are compared by standard procedure agreed to by the permittee or applicant and LQD.

A Comparison Area should be at least two (2) acres in size and should be managed in a fashion which will not cause significant changes in the vegetation parameters used to evaluate revegetation success. The permittee or applicant should establish and request approval of the Comparison Area at least two (2) years prior to an anticipated request for full bond release.

IV. ESTIMATING ADEQUATE SAMPLE SIZE

A. General Considerations

The applicant must achieve sample adequacy or execute the maximum sample size for each CONA and for each vegetation type.

The applicant must achieve sample adequacy for each of the following parameters independently in each CONA and each vegetation type.

1. % vegetation cover (absolute cover).
2. % total ground cover (absolute cover).
3. Total herbaceous production.

B. Procedures

The applicant should sample at least the minimum number of sample locations as outlined by Table 2. below. The following formula should then be used in an incremental and iterative fashion to estimate sample adequacy:

$$nmin = \frac{2(sz)^2}{(d\bar{x})^2}$$

where:

nmin = the number of sample points needed in a given vegetation type

sample standard deviation = S

$$S = \sqrt{\frac{(\sum x_i^2 - [(\sum x_i)^2/n])}{n-1}}$$

z = the z statistic
d = acceptable amount of inherent variability to be identified between the sample mean and the true population mean; See Table 1 below for d and z values.

$\bar{x}$ = sample mean for cover or production

If sample adequacy is not met in an incremental fashion, the sample adequacy test should be applied until the maximum number of samples, as outlined by Table 2, is reached. Alternatively, the applicant may simply establish and sample the maximum number of samples presented in Table 2.

The applicant should always present analyses of sample adequacy using the nmin formula. These analyses are best presented in a tabular format (see Appendix V, Table 4). In order that LQD personnel may check these data, all parameters of the formula must be clearly presented.

If the calculated nmin exceeds the maximum sample size of Table 2, the applicant should indicate the confidence level (d value) achieved by solving for z (assuming n actual = nmin). The applicant should also present a brief explanation of why the sample was unusually variable and thus formula adequacy was not achieved.

C. Determining d and z values

The community composition determines the d and z values for assessment of sample adequacy for total herbaceous production. Two arbitrary community types are defined as follows:

1. A grassland community is a vegetation type where the contribution of the cover of full shrubs and subshrubs comprises less than 20% of the total cover of all species.

2. A shrubland community is a vegetation type where the contribution of the cover of full shrubs and subshrubs comprises more than 20% of the total cover of all species.

   These definitions are based upon analyses of existing premining vegetation data. Their derivation is available from LQD upon request.

   After making this operational distinction based upon sampling data, choose the appropriate parameters from Table 1 below. The parameters used for evaluation of % vegetation cover and % total ground cover do not vary with community type. Consult Table 1 for appropriate parameters.

Table 1. z and d values for use in the sample adequacy formula

Vegetation parameter	z	d
% vegetation cover, grassland & shrubland	1.28	0.1

% total ground cover, grassland & shrubland	1.28	0.1
total herbaceous production, grassland	1.28	0.1
total herbaceous production, shrubland	0.84	0.2

D. Determining Minimum and Maximum Sample Sizes

Table 2. Minimum and maximum sample sizes for various sampling methods

Sampling Method	sample size minimum	sample size maximum
1. In Control or Reference Areas		
quadrats	10	30
transects with quadrats	5	30
intercept transects	15	30
belt transect	15	30
2. In Vegetation Types		
quadrats	15	50
transects with quadrats	7	30
intercept transects	20	50
belt transect	20	50

The maximum and minimum sample sizes for CONAs also apply to vegetation types which cover fewer than 30 ha (80 acres) or vegetation types which will experience fewer than 4 ha (10 acres) of disturbance. The applicant should consult LQD for direction in such situations.

The maximum and minimum sample sizes were constructed with the following qualifications:

1. cover, production and density are being estimated using appropriately sized quadrats.
2. line transects are 50m long with 50 evenly-spaced estimation points.
3. all sample points are randomly or systematically chosen.
4. vegetation types are accurately and professionally delineated, mapped and sampled.
5. a permit area no larger than 10,000 acres. If a permit area exceeds 10,000 acres it may require a larger sample size. The applicant should consult LQD for direction in such situations.

Compromise of any of these criteria may result in serious difficulties with sample adequacy requirements and may compromise acceptability of the baseline vegetation inventory.

V. SUGGESTED TIMETABLE FOR COMPONENTS OF THE VEGETATION INVENTORY

Design vegetation study	Any time - discuss with DEQ/LQD well in advance of field sampling season.
Map vegetation types of entire permit area	Any time - field check during growing season, prior to baseline sampling.
Describe each vegetation type	Any time - confirm dominant species during and after field sampling.
Construct species list	Field check at least once a month from April through September (actual period is determined by regional and seasonal phenology).
Place grazing exclosures in field	Before April 15 or following snowmelt.
Sample for vegetation parameters including tree and full shrub period density. CONAs or REFAs and vegetation types should be sampled at the same time to permit valid comparisons of data.	Mid-June through mid-August. Sampling times outside this period must receive prior approval from the LQD.

VI. GENERAL FORMAT FOR APPENDIX D-8

The following is a suggested outline for organization of Appendix D-8.

A. Table of Contents - A summary of the major entries, including lists of figures, tables, and maps.

B. Introduction - A description of the location and general features of the permit area and the personnel (or firm) conducting the baseline inventory.

C. Methods - A description of <u>all</u> procedures used in the baseline inventory, which includes:

1. delineation and mapping of vegetation types and other land units.
2. general sampling design for the permit area.

a. selection of sample points
b. plot size and shape, transect characteristics, etc.
c. specific calendar dates of all sampling.

3. general sampling design for the Control or Reference Areas.
4. establishment, marking and management of CONAs or REFAs.
5. evaluation of sample adequacy.
6. compilation of species list.

D. Results and Discussion - A presentation and interpretation of the vegetation data, to include:

1. description of the Vegetation Map and each vegetation type or other land unit.
2. description of each CONA or REFA and discussion of its representative nature.
3. tabular summary of the areal extent of each mapping unit and acreage affected by mining (see Table 1, Appendix V).
4. summarized vegetation parameters for the permit area (see Tables 2 and 5, Appendix V).
5. summarized vegetation parameters for the CONAs (see Tables 3 and 5, Appendix V).
6. comparison of vegetation data between each vegetation type and its representative CONA (see Table 3, Appendix V).
7. evaluation of sample adequacy for each vegetation type and its representative CONA (see Table 4, Appendix V).
8. species list, selenium indicators, species of special concern and noxious (designated) or declared weeds (see Appendices I, III and IV).

E. Literature Cited.

F. Raw Data

VII. DEVELOPING A REVEGETATION PLAN

A. General Considerations

A postmining revegetation plan should incorporate information from the premining baseline vegetation inventory, to include:

1. Input and concurrence from the "resident or agricultural landowner" regarding the applicant's proposed reclamation plan (as per W.S. § 35-11406(b)(xi)).
2. The premining land uses and the plan species which supported those land uses.
3. The type, number, size and distribution of premining plant communities, croplands or pasturelands.

4. The major plant species from each premining plant community, cropland or pastureland.
5. The growth form (bunch or sod-forming) and seasonal variety (cool or warm season) of the dominant grass species.
6. Type and distribution of full shrubs, subshrubs and trees.

The applicant should consider returning the major vegetation types, major plant species and growth forms in numbers and configurations which will support the postmining land uses (see definitions).

B. Seed Mixtures

After choosing the postmining land uses and considering the dominant postmining topographic features and landowner desires, the applicant should develop different seed mixes which will accommodate the postmining land uses and differences in soils, moisture conditions, exposures etc. on the postmining landscape. Also, considering seed availability, growth form, seasonal variety and prevailing dominant species, each proposed seed mixture should:

1. contain no fewer than four (4) herbaceous species, unless a proposed land use (e.g. managed hayland or pastureland) requires fewer species;
2. contain the native dominant herbaceous species which support the postmining land uses;
3. if needed, contain additional species native to the region which support the postmining land uses;
4. contain naturalized, introduced species only if additional herbaceous species are needed, or if suitable, native species are unavailable or if naturalized species are superior for a specialized land use (e.g. managed hayland or pastureland);
5. contain full shrub and/or subshrub species when these species will support the postmining land uses. If appropriate, to increase postmining species diversity, shrub mixtures may be developed and seeded separately from the herbaceous mixtures (see Coenenberg, 1982);
6. contain native forb species if natural reinvasion of forbs will be limited by site-specific conditions.

Seed mixtures for all postmining communities which will be jointly used by livestock and wildlife should include full shrub and/or subshrub species.

The proposed postmining location of each seed mixture should be illustrated on a postmining contour map.

Seed mixtures for temporary stabilization of sites, stockpiles or other special uses should also be developed considering site-specific characteristics. The LQD strongly discourages

the use of aggressive introduced plant species, particularly crested wheatgrass, on topsoil stockpiles. The concern lies in the possible carry over of such species to postmine lands during the replacement of stockpiled topsoil, which could ultimately result in problems (on the applicant's part) in meeting species diversity requirements at the time of bond release due to the predominance of the above mentioned introduced species. The LQD feels that other vigorous, rhizomatous species are readily available for such uses.

C. Seeding Practices

In general, all seed mixtures should total at least 14 lbs. PLS (Pure Live Seed) per acre when drill seeded. Seeding depth should be 1/4 to 1/2 inch when drilled. However, small seeded species (e.g. big sagebrush, blue grama, etc.) establish best when the seed is broadcast and lightly covered. Drill seeding should occur on the contour or across the prevailing wind direction. If seed mixtures are broadcast, the rate of application should be doubled and the seed should be lightly covered.

The LQD strongly recommends that the applicant consider staggered seeding methods to facilitate the establishment of warm season grasses and shrubs and/or to revegetate areas with poor quality substrates (e.g. see Coenenberg, 1982; De Puit, 1982). Similarly, direct backhaul of live topsoil have proven very beneficial to establishment of diverse postmining plant communities (DePuit, 1984).

In general, the most appropriate seeding times are after October 15th or before April 15th. The soil should not be frozen or snow-covered. An extension to May 15th entails minimal risk of failure in most years. The actual choice of seeding time should be based on regional climatic conditions, site-specific environmental conditions, operator preference and operator experience.

Chapter II, Section 2(b)(iii)(C) requires the use of mulch on all reclaimed lands, unless specific permission is granted for not using mulch. The LQD considers a seeded cover crop/stubble mulch as an acceptable alternative to crimped (hay or straw) mulch. In fact, research (Schuman, et al. 1980) has shown that cover crop/stubble mulch have several advantages over the use of crimped hay or straw mulch including:

1. decreased operation and application costs.
2. better wind and water erosion control.
3. increased water infiltration.
4. increased weed control.
5. less temperature fluctuation at shallow soil depths.

In the event that a crimped mulch is utilized, weed free native hay is preferred over the use of domestic hay or straw mulch. This reduces the changes of introducing noxious weeds onto the reclaimed area and can promote the introduction of desirable native species.

In general, the LQD does not recommend hydromulching as a permanent revegetation practice. Hydromulching has proven useful only for temporary reclamation activities.

D. Husbandry Practices

The applicant should clearly discuss the postmining husbandry practices it expects to use on revegetated communities. The bonding period usually begins after the permittee has completed fertilizing, seeding, irrigation or other work to ensure revegetation (W.S. § 35-11-423(a)).

Chapter III, Section 2(d)(viii) requires that newly seeded areas must be protected from livestock grazing for a minimum of two (2) years or until the plant community is capable of renewing itself under proper management practices. The newly seeded areas may be protected by fencing or other management practices which meet the intent of this statutory provision.

E. Postmining Grazing Practices

Chapter III, Section 2(d)(viii) states that the LQD, the permittee and the landowner or land managing agency will mutually determine when domestic livestock grazing will be introduced on revegetated areas. Secondly, as per Chapter III, Section 2(d)(vi) the capability of revegetated areas to withstand livestock grazing pressure is a distinct criterion for full bond release.

The Reclamation Plan should include some discussion of both the above points. Due to the temporal lag between permit preparation and permanent reclamation activities, the LQD believes that a full, detailed postmining grazing program is not necessary at the permitting stage. However, the applicant should, at a minimum, commit to providing a grazing plan prior to the introduction of grazing on reclaimed lands.

F. Restoration of Wildlife Habitat

For non-coal operators, Chapter III, Section 2(a)(ii) requires the restoration of wildlife habitat at least equal to that of the premining lands. LQD has historically interpreted this requirement to include restoration of a suitable quantity and quality of woody species (full shrubs, trees) when those species existed in the premining community. This requirement can only be waived on private lands upon inclusion of a specific statement from the surface owner (resident or agricultural) and only if the proposed land use is for residential or agricultural purposes which may preclude its use as wildlife habitat.

For areas containing designated critical or important habitat, the Wyoming Game and Fish Department shall be consulted for recommended reclamation standards for shrub density, cover, distribution and species composition.

G. Literature

Literature in Appendix VI may provide additional information for construction of revegetation plans. Specific acceptable revegetation practices may be found in permits approved by DEQ/LQD; additional proposed practices occur in pending permit applications. Both these sources are public documents. Applicants are encouraged to consult these sources and/or DEQ/LQD for further information.

VIII. TESTING ADEQUACY OF RECLAMATION

The Reclamation Plan should contain a discussion of the applicant's proposed methods for evaluation of revegetation success. The discussion should address all qualitative and quantitative success standards.

A. Reclamation Success Standards

Chapter II, Section 2(b)(iii) requires that each application for a mining permit shall contain a plan describing how the operator will reclaim the affected lands to the proposed postmining land use. Livestock grazing and wildlife habitat are the most commonly proposed postmining land uses. Chapter III Section 2(d)(vi) defines the following success goals for all operators:

1. postmining cover equal to premining cover;
2. postmining production equal to premining production;
3. species composition and species diversity capable of supporting the postmining land uses;
4. ability of the reclaimed community to sustain grazing pressure at least equal to premining grazing pressure;
5. attainment of all of the above for two (2) consecutive years immediately prior to full bond release.

B. Land Units Used for Evaluating Revegetation Success

The vegetation parameters which are compared between the Control Area (CONA) or Reference Area (REFA) or Extended Reference Area (EXREFA) and the reclaimed area (RECA) are identical. However, the methods used to compare the vegetation parameters differ intrinsically among the methods. These intrinsic differences are explained in Sections 1, 2 and 3 below.

1. Procedures Using a Control Area

The CONA concept involves the use of a mathematical adjustment for climatic changes which may have occurred between the dates that the premining and postmining data were collected.

The CONA concept is used to test the attainment of the success goals of % vegetation cover, % total ground cover and total herbaceous production. The operator should use the same methods in premining and postmining sampling to generate the following parameters:

Premining

Affected Area	Control Area
$\bar{x}_1$ = percent cover or production	$\bar{y}_1$ = percent cover or production
$S\bar{x}_1^2$ = variance of mean	$S\bar{y}_1^2$ = variance of mean

Postmining

Reclaimed Area	Control Area
$\bar{x}_2$ = percent cover or production	$\bar{y}_2$ = percent cover or production
$S\bar{x}_2^2$ = variance of mean	$S\bar{y}_2^2$ = variance of mean

Where: $S\bar{x}_2^2$ & $S\bar{y}_2^2$ = variance of mean =

$$\frac{\sum x_i^2 - [(\sum x_i)^2/n]}{n(n-1)} = \frac{(S)^2}{n}$$

If the value of $\bar{y}_1$ is statistically equal (confidence level = 90%, " = 0.1) to $\bar{y}_2$, $\bar{x}_1$ should be directly compared (confidence level = 80%, " = 0.2) to $\bar{x}_2$.

If $\bar{y}_1$ is not statistically equal to $\bar{y}_2$, an additional parameter, $\hat{\bar{x}}$, is generated in the following fashion:

$\hat{\bar{x}}$ = the cover or production goal adjusted for climatic change

$$\hat{\bar{x}} = (\bar{y}_2/\bar{y}_1) \bullet \bar{x}_1$$

Reclamation will be considered adequate for % total ground cover, % vegetation

cover and total production when the following inequality has been satisfied for two (2) consecutive growing seasons:

$$\bar{x}_2 - \hat{\bar{x}} + z_{0.8}\sqrt{S\bar{x}_2^2 + S\hat{\bar{x}}^2} \geq 0$$

where $S\hat{\bar{x}}^2$ = the estimated variance of $\bar{x}$ calculated by

$$\left(\frac{\bar{x}_1^2}{\bar{y}_1^2} \bullet S\bar{y}_2^2\right) + \bar{y}_2^2 \bullet Sr^2) + (S\bar{y}_2^2 \bullet Sr^2)$$

where:

$$Sr^2 = \left(\frac{\bar{x}_1^2}{\bar{y}_1^2}\right)\left(\frac{S\bar{x}_1^2}{\bar{x}_1^2} + \frac{S\bar{y}_1^2}{\bar{y}_1^2}\right)$$

If $\bar{x}_2 > \hat{\bar{x}}$, the above inequality is met and the lengthy variance calculations are unnecessary.

An example calculation is available upon request for the entire bond release comparison outlined above.

2. <u>Procedures Using a Reference Area</u>

The REFA concept does not incorporate the use of a mathematical adjustment for climatic change. If climatic change has influenced the vegetation, it is assumed that the individual species and species assemblages of the REFA and RECA will have responded similarly.

The REFA concept is used to test the attainment of the success goals of % vegetation cover, % total ground cover and total herbaceous production. The operator should use the same methods to sample the REFA and RECA for the last two (2) consecutive years after the minimum bonding period and after the operator considers revegetation successful.

For each year's data set, the data from the REFA are directly compared, by standard statistical procedure (confidence level = 80%, " = 0.2), to the RECA data. The goals of equal cover and production must be achieved for each quantitative parameter for the last two (2) consecutive years of the bonding period.

3. Procedures Using an Extended Reference Area

The EXREFA concept is identical to the REFA concept in its statistical comparisons. The intrinsic difference between the EXREFA and REFA concept lies in the postmining sampling of all of the undisturbed area of a given vegetation type, versus the sampling of a small, representative unit, the REFA.

C. Evaluation of Species Diversity and Species Composition

The postmining plant communities must have sufficiently diverse species composition (numbers and types of individual species and life forms) and sufficient species diversity (a measure of the variability of the species composition) to support the postmining land uses.

Appendix D-8 should contain a discussion of premining species composition and species diversity. The discussion should include the value (e.g. browse, shelter, grazing, soil protection) of the major species and communities as a whole. A major species is defined as having relative cover equaling or exceeding two (2) percent. This discussion should be documented by applicable literature.

The Reclamation Plan should include a discussion of projected postmining species composition and species diversity, and the ability of the species to support the postmining land uses. The composition of reclamation seed mixes and/or special plantings, known species characteristics and life form distribution should form the basis of this discussion.

The applicant should also include in the Reclamation Plan a conceptual outline of how it proposes to evaluate species diversity and composition when bond release is requested. This outline may include:

1. a discussion of the species of the reclaimed community and their ability to support and maintain the postmining land uses;
2. the role of these species in secondary succession;
3. a direct qualitative comparison of the species composition of the premining and postmining communities;
4. a direct qualitative comparison of the life forms of the premining and postmining communities using an appropriate index of similarity or other assessment method agreeable to the LQD.

An index of similarity (Mueller-Dombois and Ellenberg, 1974) may be used to compare the premining and postmining communities. However, such indices shall not constitute the sole criterion for evaluation of species diversity.

DEQ/LQD has developed a suggested format and procedures for evaluation of species composition and species diversity. These documents are available upon request; alternative methods may be appropriate.

D. Evaluation of Restored Cropland or Pastureland

Unless specifically approved in a Reclamation Plan, the areal extent of specially managed land units, such as croplands, haylands or pasturelands, should not significantly exceed their areal extent on the premining landscape.

As per Chapter III, Section 2(d)(vi)(F), postmining restoration of cropland is deemed complete when their "productive capability" is equivalent, for at least two (2) consecutive crop years, to premining conditions. Premining cropland production data shall be considered in judging restored croplands, whenever said data are available. The equivalency can be assessed by direct comparison of postmining production data to accurate premining production data. Alternatively, the permittee may identify a premining cropland unit whose production capacity will be used as a success standard. Clearly the premining cropland unit must remain unaffected by mining activities, should be managed in an appropriate manner and should accurately represent the disturbed premining croplands. Alternative methods of evaluating cropland may be approved by the Administrator.

The LQD Rules and Regulations do not specifically address procedures for evaluating revegetation success on postmining pasturelands and haylands. The procedures agreed to by the applicant and LQD should be clearly presented in the Reclamation Plan.

E. Evaluation of Shrub and Tree Density

In order to evaluate the success of wildlife habitat restoration techniques used on the affected area, the operator should present a discussion of the following parameters:

1. Areal distribution of shrubs and trees on the postmining landscape.
2. Species occurring and estimated density of each.
3. Methods used to establish shrubs and trees.
4. Assessment of the quantitative and qualitative aspects of the postmining shrub and tree communities in terms of providing wildlife habitat.

F. Summary

The major components of a complete proposal for evaluation of revegetation success should be presented in the Reclamation Plan and should include:

1. A commitment to provide a brief discussion of the reclamation practices used on each reclaimed area, including the seed mix applied, any husbandry practices used (e.g., interseeding, biocide application, etc.) and the land management practices applied.
2. A commitment to describe the procedures used to define the boundaries of each reclaimed area, including any combinations of different age classes of reclaimed areas.

3. Presentation of the methods used to define the vegetational composition of each reclaimed area, such that the proper CONA may be chosen. Two approaches seem apparent:

   a. The composition may be determined by a thorough, qualitative field reconnaissance. Qualitative means the use of methods which do not involve point sampling procedures as discussed in Section II.A.
   b. The composition may be determined by standard, point sampling techniques. These data would subsequently be used in the direct evaluation of revegetation success.

4. Specification of the actual methods employed for each vegetation parameter. The sampling procedures should use standard methods and should be based upon standard procedures for the choice of sample locations. Clearly, the same methods must be used on the reclaimed areas and CONA or REFA.
5. Specification of the number of samples to be taken for each parameter from the reclaimed areas and CONA. Several options are available:

   a. The applicant may employ the sample adequacy procedures of Guideline No. 2, as qualified by maximum and minimum sample numbers.
   b. The applicant may employ other standard, statistical tests for assessing sample adequacy.

6. Specification of the statistical methods proposed for the comparison of quantitative vegetation parameters.
7. Specification of qualitative or quantitative (or a combination thereof) methods to assess the success standard that species diversity and species composition are capable of supporting the postmining land uses.
8. Specification of methods to demonstrate that the reclaimed area is capable of withstanding grazing pressure at least comparable to that sustained prior to mining.
9. Specification of methods to assess the establishment of suitable postmining wildlife habitat, including assessment of the quantitative and qualitative aspects of wildlife habitat.

APPENDIX I
LIST OF PROHIBITED AND RESTRICTED NOXIOUS (DESIGNATED) WEEDS

This list has been compiled from the appropriate laws governing the control of noxious (designated) weeds in the State of Wyoming (i.e. The Weed and Pest control Act of 1973 and The Wyoming Seed Laws). County Weed Control supervisors should be contacted for additional lists of declared weeds.

<u>Prohibited Noxious (Designated) Weeds</u>

Compositae - Sunflower Family

- Arctium minus - common burdock
- Carduus acanthoides - plumeless thistle
- Carduus nutans - musk thistle
- Centaurea masulosa - spotted knapweed
- Centaurea repens - Russian knapweed
- Chrysanthamum leucanthemum - ox-eye daisy
- Cirsium arvense - Canada thistle
- Franseria discolor = Ambrosia tomentosa - skeletonleaf bursage
- Onopordum acanthium - Scotch thistle
- Sonchus arvensis - perennial sowthistle

Convolvulaceae - Morning Glory Family

- Convolvulus arvensis - field bindweed

Cruciferae - Mustard Family

- Cardaria draba - hoarycress
- Cardaria pubescens - hoarycress
- Isatis tinctoria - Dyer's woad
- Lepidium latifolium - perennial pepperweed

Boraginaceae - Borage Family

- Cynoglossum officinale - hound's tongue

Euphorbiaceae - Spurge Family

- Euphorbia esula - leafy spurge

Gramineae - Grass Family

- Agropyron repens - quackgrass

Scrophulariaceae - Figwort Family

- Linaria dalmatica - Dalmation toadflax
- Linaria vulgaris - yellow toadflax

Restricted Noxious (Designated) Weeds

Compositae - Sunflower Family

- Ambrosia psilostachya - perennial ragweed
- Centaurea diffusa - diffuse knapweed

- Centaurea solstitialis - yellow starthistle
- Iva axillaris - poverty weed
- Lactuca pulchella - blue-flowering lettuce
- Tanacetum vulgare -tansy

Convolvulaceae - Morning Glory Family

- Cuscuta species - dodder

Cruciferae - Mustard Family

- Descurainia pinnata - tansymustard
- Chorispora tenella - blue mustard

Gramineae - Grass Family

- Avena fatua - wild oat

Leguminosae

- Glycyrrhiza lepidota - wild licorice
- Sphaerophya salsula - Austrian peaweed

Plantaginaceae - Plantain Family

- Plantago lanceolata - buckhorn plantain

Zygophyllaceae - Caltrop Family

- Tribulus terrestris - Puncture vine

See glossary for definition of the following terms: noxious (designated) weeds, prohibited noxious (designated) weeds, restricted noxious (designated) weeds and declared weeds.

APPENDIX II
LIST OF SUBSHRUBS

This list was prepared from literature sources and permit documents on file with DEQ/LQD. Nomenclature follows Dorn (1977).

Amorpha canescens
Arctostaphylos uva-ursi
Artemisia frigida
Artemisia longifilia
Artemisia ludoviciana
Gutierrezia sarothrae (= Xanthocephalum sarothrae)
Kochia americana
Leptodactylon caespitosum

Artemisia pedatifida
Artemisia spinescens
Atriplex falcata
Atriplex gardneri (= A. nuttallii = A. gordonii)
Brickellia eupatorioides
Ceratoides lanata
Eriogonom brevicaule
Eriogonum effusum
Eriogonum jamesii
Eriogonum microthecum
Eriogonum pauciflorum
Leptodactylon pungens
Mahonia repens (=Berberis repens)
Sphaeromeria argentea
Yucca glauca

APPENDIX III
PRIMARY SELENIUM INDICATOR PLANTS

This list was developed from Beath (1982). Nomenclature follows Dorn (1977).

Astragalus bisulcatus
Astragalus flavus
Astragalus grayi
Astragalus pectinatus
Astragalus racemosus
Haplopappus multicaulis
Haplopappus wardii
Stanleya pinnata
Stanleya tomentosa
Stanleya viridiflora
Xylorhiza glabriuscula

APPENDIX IV
PLANT SPECIES OF SPECIAL CONCERN

The State of Wyoming has never prepared an official list of Rare, Threatened or Endangered Plant Species. No plants known to occur in Wyoming have been formally listed as Threatened or Endangered under the federal Endangered Species Act. However, several species occurring within Wyoming have been or are being considered under formal listing procedures. State and federal agencies have historically afforded these species special consideration until their status is accurately assessed.

This list was compiled from Dorn (1980) as well as Clark and Dorn (1981), and U.S. Fish and Wildlife Service, (1985). Clark and Dorn (1981) contains a list of Wyoming plants by county.

Agrostis rossiae
Antennaria arcuata
Antennaria aromatica
Arabis pusilla
Arabis williamsii
Arnica paniculata
Aster mollis
Astragalus jejunus
Eriogonum visheri
Gaura neomexicana aromatica ssp. coloradensis
Lesquerella macrocarpa
Lomatium attenuatum
Oryzopsis swallenii
Penstemon absorkensis
Penstemon acaulis

Astragalus paysonii
Astragalus proimanthus
Astragalus shultziorum
Claytonia lanceolata var.flava
Cleome multicaulis
Cryptantha subcapitata
Descurainia torulosa
Draba nivalis var. brevicula
Draba pectinipila
Eriogonum lagopus
Penstemon gibbensii
Physaria condensata
Physaria dornii
Rorippa calycina
Shoshonea pulvinata
Sphaeromeria simplex
Stanleya pinnata
var. gibberosa
Thelesperma pubescens
Trifolium barnebyi

APPENDIX V
SUGGESTED TABULAR FORMAT FOR DATA PRESENTATION

Table 1. Areal extent and percent of total area for each of the vegetation types and other mapping units

	Affected Area		Unaffected Area		Entire Permit Area		Control Areas
Mapping Units	Total Acres	% of Area	Total Acres	% of Area	Total Acres	% of Area	Total Acres
1. Upland grassland	1697.8	51.9	580.8	44.2	2278.6	49.7	2.5
2. Streamside meadow	31.4	0.9	58.4	4.4	89.8	1.9	3.0
•							
•							
•							
8.Agricultural areas	424.9	12.9	60.0	4.5	484.9	10.6	--
9.Disturbed areas	102.7	3.1	5.9	0.4	108.6	2.4	--
10.Reservoirs	1.3	0.1	0.1	0.1	1.4	0.1	--
TOTAL	3271.3		1315.6		4586.9		15.5

Table 2. Summary of life form vegetation sampling data for the Control Area for the Streamside Meadow Grassland Community. All values are means.

	Vegetation Cover (%)		Herbaceous Prod. (g/m^2)	
	Absolute	Relative	Absolute	Relative
PERENNIAL GRASSES & GRASS-LIKE SPECIES				
Agropyron smithii	44.7	85.6	180.0	90.9
Agropyron trachycaulum	0.4	0.8	0.2	0.1
Bouteloua gracilis	1.1	2.1	3.1	1.6
Stipa comata	0.1	0.2	0.4	0.8
Stipa viridula	3.0	5.7	10.5	5.3
Subtotal*	49.3	94.4	194.2	98.0
ANNUAL GRASSES				
Bromus japonicus	0.1	0.2	0.2	0.1
FORBS				
Achillea lanulosa	0.3	0.6	0.5	0.3
Aster adscendens	0.1	0.2	0.2	0.1
Taraxacum officinale	0.8	1.5	1.1	0.5
Unknown Rosette	0.1	0.2	0.1	0.1
Subtotal*	1.3	2.5	1.9	1.0
SUBSHRUBS AND SUCCULENTS				
Artemisia ludoviciana	0.7	1.3	1.8	0.9
Ceratoides lanata	0.1	0.2	--	--
Gutierrezia sarothrae	0.4	0.8	--	--
Subtotal*	1.2	2.3	1.8	0.9
FULL SHRUBS				
Artemisia tridentata	0.1	0.2	--	--
Atriplex canescens	0.2	0.4	--	--
Subtotal*	0.3	0.6	--	--
TOTALS	52.2	100.0	198.1	100.0

* Subtotal across all species within a given life form category

NOTE: A similar table should summarize data for each community type and each control area or reference area.

Table 3. Quantitative Comparison of major species in the Control Area and Affected Area for the Streamside Meadow Grassland Community. All values are means.

	Affected Area		Control Area	
	Absolute Cover (%)	HerbaceousProduction (g/sq m)	Absolute Cover %	Herbaceous Production (g/sq m)
PERENNIAL GRASSES AND GRASS-LIKE SPECIES				
Agropyron smithii	9.0	66.6	44.7	180.1
Poa pratensis	6.7	16.6	1.2	4.9
Bouteloua gracilis	5.7	8.5	1.1	3.1
Distichlis stricta	5.1	13.7	42.3	--
Stipa comata	3.0	4.7	0.1	0.5
Carex spp.	4.9	18.4	0.1	1.2
Subtotal*	45.5	160.8	51.6	208.1
FORBS				
Taraxacum officinale	4.5	--	0.8	--
Aster falcatus	2.4	--	--	--
Aster adscendens	1.8	--	0.1	--
Achillea lanulosa	0.7	--	0.3	--
Subtotal*	13.6	41.3	2.2	7.4
SUB-SHRUBS				
Artemisia ludoviciana	5.5	--	0.7	--
Artemisia frigida	1.0	3.5	--	--
Subtotal*	6.7	3.6	1.1	1.1
SHRUBS				
Artemisia tridentata	0.1	--	0.1	--
Rosa woodsii	0.5	--	--	--
Atriplex canescens	--	--	0.2	--
Subtotal*	0.6	--	0.3	--
TOTALS	66.4	206.4	55.3	217.4

* Subtotal across all species within a life form category

NOTE: A similar table should summarize data for each community type and each control area or reference area.

Table 4. Summary of sample adequacy calculations for % vegetation cover using the formula of Appendix A

	Vegetation Cover (%) x+1 S.D.	Actual Sample Size	Computed Adequate Sample Size	Computed* z-value	Confidence Level Achieved
AFFECTED AREA					
Grasslands					
1. Streamside Meadow	66.4 ± 7.3	26	4	N/A	N/A
2. Upland Grassland	20.4 ± 8.6	29	58	0.90	81.6
C					
C					
C					
5. Scoria Grassland	51.0 ±13.5	33	23	N/A	N/A
Shrublands					
1. Big Sagebrush	28.1 ± 6.9	25	20	N/A	N/A
2. Silver Sagebrush	63.4 ±19.8	21	32	1.04	85.1
CONTROL AREA					
Grasslands					
1. Streamside Meadow	55.3 ±11.1	15	14	N/A	N/A
2. Upland Grassland	33.8 ±19.3	20	107	0.55	70.9
5. Scoria Grassland	52.7 ±14.9	29	27	N/A	N/A
Shrublands					
1. Big Sagebrush	21.6 ± 3.5	15	9	N/A	N/A
2. Silver Sagebrush	53.3 ±15.6	15	29	0.94	82.6

* These values should be calculated only if the computed sample size exceeds the actual sample size and the actual sample size is less than the maximum required sample size.

NOTE: A similar table should summarize data for % total cover and herbaceous production.

Table 5. Summary cover and production data from Affected Area and Control Area sampling. All values are means ± one standard deviation. These data constitute the premining values for use in the Control Area concept for the evaluation of revegetation success

	Affected Area			Control Area		
	Absolute Vegetation Cover	Absolute Total Cover %	Herbaceous Vegetation Cover (g/sq m)	Absolute Vegetation Cover (%)	Absolute Total Cover (%)	Herbaceous Production (g/sq m)
Grasslands* 1. Streamside Meadow	66.4± 7.3	95.7±18.1	206.4±81.9	55.3±11.1	74.0±16.1	217.4±78.6
2. Upland Grassland	20.4± 8.6	78.4±13.2	60.4± 6.3	33.8±19.3	80.3±11.0	83.3±23.4
C						
C						
C						
5. Scoria Grassland	51.0±13.5	95.0± 9.0	70.5±20.9	52.7±14.0	91.7± 9.2	66.9±17.4
Shrublands* 1. Big Sagebrush	28.1± 6.9	81.1±20.1	34.7±14.9	21.6± 3.5	78.9±15.1	26.9±12.0
2. Silver Sagebrush	63.4±19.8	84.1±19.3	116.0±50.7	53.3±15.6	75.8±11.6	117.5±52.8

* As defined by Appendix A

APPENDIX VI
REFERENCES

GENERAL

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APPENDIX VII
GLOSSARY

"Absolute Cover" is the determination of % cover of a given cover category in a fashion which is operationally independent of the other categories. Thus the sum of absolute cover categories (e.g. vegetation and litter/rock and bare ground) may be less than, equal to or greater than 100% (see Relative Cover).

"Affected Land" (Affected Area) means the area of land from which overburden is removed, or upon which overburden, development waste rock or refuse is deposited, or both, access roads, haul roads, mineral stockpiles, mill tailings, impoundment basins, and all other lands whose natural state has been or will be disturbed as a result of the operations.

"Adjacent Areas" means land located outside the permit area upon which air, surface water, groundwater, fish, wildlife, or other resources protected by the Act may reasonably be expected to be adversely impacted by mining or reclamation operations. Unless otherwise specified by the Administrator, this area shall presumptively be limited to lands within one-half mile of the proposed permit area.

"Baseline Vegetation Inventory" is a vegetation sampling program executed prior to any significant surface disturbance caused by proposed mining activities. The inventory will provide a verbal and mental picture of the prevailing plant communities and will quantitatively and qualitatively classify the different plant communities to the specifications of Wyoming State Law.

"Comparison Area" means a land unit which is representative, in terms of physiography, soils, vegetation and land use history, of a premining plant community from which no vegetation data were collected prior to disturbance. The representative nature of the Comparison Area may be validated by a subjective field reconnaissance of the site or by subjective evaluation of vegetation data generated by a sampling program. The establishment procedures should be agreed to by the permittee or applicant and LQD prior to establishment.

Postmining quantitative data from the Comparison Area are directly compared, by standard statistical procedures (confidence level of 80%, " = 0.2), to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical adjustment for climatic change is made. Qualitative data are compared by standard procedures agreed to by the applicant or permittee and LQD.

A Comparison Area should be at least two (2) acres in size and should be managed in a fashion which will not cause significant changes in vegetation parameters used to evaluate revegetation success.

"Control Area" means a land unit which is representative in terms of physiography, soils, vegetation and land use history, of a plant community affected by mining activities. The representative nature of the Control Area is verified by subjective (non-statistical) comparison of its quantitative and qualitative characteristics to similar information from the plant community it typifies.

Quantitative premining and postmining vegetation data from the Control Area are used to

mathematically adjust premining affected area data for climatic change. These adjusted data are directly compared by statistical procedures (confidence level = 80%, "= 0.2) to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. Qualitative data are compared by standard procedures agreed to by the applicant or permittee and LQD.

A Control Area should be at least two (2) acres in size and should be managed in a fashion which will not cause significant changes in the vegetation parameters used to evaluate revegetation success.

"Cool-Season Plant" is a species which grows and flowers during the spring. Its growth usually slows or becomes dormant during the hotter, drier portions of the summer, but the species may resume growth in the fall with the advent of cooler temperatures and available soil moisture.

"Cover" is the proportion of the ground surface cloaked by a vertical projection of objects on or above that ground surface. Cover is expressed as a percentage of a surface reference unit. The following cover categories are of interest to LQD:

1. % litter and rock cover is the proportion of the ground surface overlain by dead plant material and rock (defined as any stone or mineral matter at least one (1) square centimeter in size).

2. % vegetation cover is the vertical projection of the general outline of plants (ignoring minor gaps between branches and holes in the canopy) to the ground surface.

3. % total ground cover is the sum of the cover values for % vegetation, % litter and % rock.

4. % bare ground is the proportion of the ground surface occupied by unvegetated mineral soil.

"Cropland" means land used for the production of adapted crops for harvest, along or in a rotation with grasses and legumes, and includes row crops, small grain crops, hay crops, nursery crops, orchard crops, and other similar specialty crops.

"Density" is the number of individuals per unit area.

"Dominance" refers to the collective size or bulk of individual plant species or life forms and their relative influence on other components of the ecosystem.

"Extended Reference Area" means all the undisturbed portion of a vegetation type which has experienced disturbance by mining activities. The representative nature of the Extended Reference Area is verified by evaluation of vegetation mapping procedures, the adequacy of premining quantitative and qualitative vegetation data, soils data, physiography and land use history information.

Postmining quantitative vegetation data from the Extended Reference Area are directly compared by standard statistical procedures (confidence level of 80%, "= 0.2) to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical

adjustment for climatic change is made. Qualitative data are compared by standard procedures agreed to between the permittee and LQD.

An Extended Reference Area should be managed in a fashion which will not cause significant changes in vegetation parameters used to evaluate revegetation success.

"Forestry" means land used or managed for the long-term production of wood, wood fiber, or wood derived products.

"Full Shrub" is a perennial woody plant which differs from a tree by normally being shorter in height and by often having several stems arising near the base.

"Grazing Exclosure" is a fence or other device utilized to prevent grazing by large herbivores in order to more accurately estimate production of a land unit.

"Grazingland" includes rangelands and forest lands where the indigenous native vegetation is actively managed for grazing, browsing, or may occasionally be cut for hay production.

"Land Use" refers to the specific uses or management-related activities which a given unit of land experiences. Land use is directly supported by, but not directly defined by the existing plant communities. See definitions of cropland, pastureland, grazingland, forestry, or appropriate discussion in LQD Rules and Regulations, Chapter I, under "land use".

"Life Form" is a category of growth morphology which appears to have some adaptive significance. Examples of life forms include trees, full shrubs, sub-shrubs, perennial grasses, annual forbs, succulents, cushion plants, etc.

"Line Intercept" is a cover estimation method based upon the measurement of the proportion of a line transect intercepted by the vertical projection of plant parts. Absolute cover, when using the line intercept method, is defined by the formula

$$\% \text{ cover of A} = \frac{\text{sum of all segments intercepted by A}}{\text{total length of the line transect}} \times 100$$

"Litter" means any recognizable plant parts or structures which are lying on the ground surface. Decomposing organic matter which has lost its structural integrity or which is no longer a recognizable plant part is not litter.

"Noxious Weeds" are agriculturally unuseful or troublesome plants whose seeds are totally prohibited from or severely limited in any amounts in commercial crop seed offered for sale. These designations are made by State law.

"Prohibited noxious" (designated) weeds are those species whose seed is not allowed in the seed of crops under any amounts. Restricted noxious (designated) weeds are those species whose seed is tolerated in the seed of crops only under small amounts. Declared weeds are those species

which are of a particular concern to a specific county which may or may not be considered noxious (designated) under State law.

"Pastureland" is land used primarily for the long-term production of adapted, domesticated forage plants to be grazed by livestock or occasionally cut and cured for livestock feed.

"Permit Area" means the area of land and water within the boundaries of the approved permit or permits during the entire life of the operation and includes all affected lands and water.

"Plant Community" (Vegetation Type) is a relatively homogeneous combination of individual plants existing under common environmental conditions.

"Plotless Sampling" means estimation of vegetation parameters without the use of two-dimensional areal reference units.

"Point Intercept" is a cover estimation method based upon the lowering of a "pin" through the vegetation at objectively established sampling points. The "pin" may be an ocular siting device (e.g. crosshairs), a sharpened rod or a series of sharpened rods. Absolute cover, when using the point intercept method, is defined by the formula:

$$\% \text{ cover of A} = \frac{\text{number of hits on A}}{\text{total number of hits}} \times 100$$

"Production" is an estimate of the total standing crop biomass of herbaceous species (grass, grass-like, forb and some subshrub species). The estimate is made at a time near the expected peak of the current year's growth and is reported on a per unit area basis.

"Quadrat" is a two-dimensional areal unit which is superimposed on the ground surface for the purposes of estimating one or more vegetation parameters.

"Reference Area" means a land unit which is representative, in terms of physiography, soils, vegetation and land use history, of a plant community affected by mining activities. The representative nature of the Reference Area is verified by statistical comparison (confidence level of 90%, " = 0.1) of its absolute values of % vegetation cover, % total ground cover and total herbaceous production to similar data from the plant community it typifies. Species composition and species diversity are also subjectively (non-statistically) evaluated.

Postmining quantitative vegetation data from the Reference Area are directly compared by standard statistical procedures (confidence level of 80%, " = 0.2), to data from a reclaimed vegetation type when evaluating revegetation success for full bond release. No mathematical adjustment for climatic change is made. Qualitative data are compared by standard procedures agreed to between the permittee and LQD.

A Reference Area should be at least two (2) acres in size and should be managed in a fashion which will not cause significant changes in the vegetation parameters used to evaluate revegetation success.

"Relative Cover" is the expression of any number of cover categories e.g. vegetation + litter/rock + bare ground) in relation to each other, such that the sum of the relative cover values for those categories totals 100%. Relative Cover is calculated by the formula:

$$\% \text{ Relative Cover of A} = \frac{\text{Absolute Cover of A}}{\text{Sum of the Absolute Cover of categories A + B + ...n}} \times 100$$

"Selenium Indicator Plants" are plant species which may selectively concentrate selenium in their tissue and/or be tolerant of high selenium concentrations in the soil. These species, when grazed by cattle or sheep, may produce toxic reactions known as selenium poisoning.

"Shrub Mosaic" is a pattern of shrub patches designed to achieve maximum habitat interspersion and edge effect. The boundary of a mosaic encompasses the areal extent of shrub patches and other vegetation types occupying the area between the patches.

"Shrub Patch" refers to a continuous surface of varying shape and size (no less than 0.05 acres) that is intensively managed to support a high density of shrubs.

"Species Composition" means number, kinds, amount, and quality of species.

"Species Diversity" means number of species per unit area.

"Study Area" means the full extent of the surface area which was sampled during the baseline vegetation inventory. The study area may coincide with or exceed the permit area.

"Subshrub" is a perennial plant which is partly woody, usually at the base, but also partly herbaceous. The individual plant generally dies back to the woody tissue after each year's growth.

"Transect" is a sampling method which involves the establishment of a long, continuous line or strip. The starting point and orientation of the line should be randomly established.

"Warm-Season Plant" is a species which produces most or all of its growth during the late spring and summer, subsequently flowering in the late summer or autumn.

Appendix C

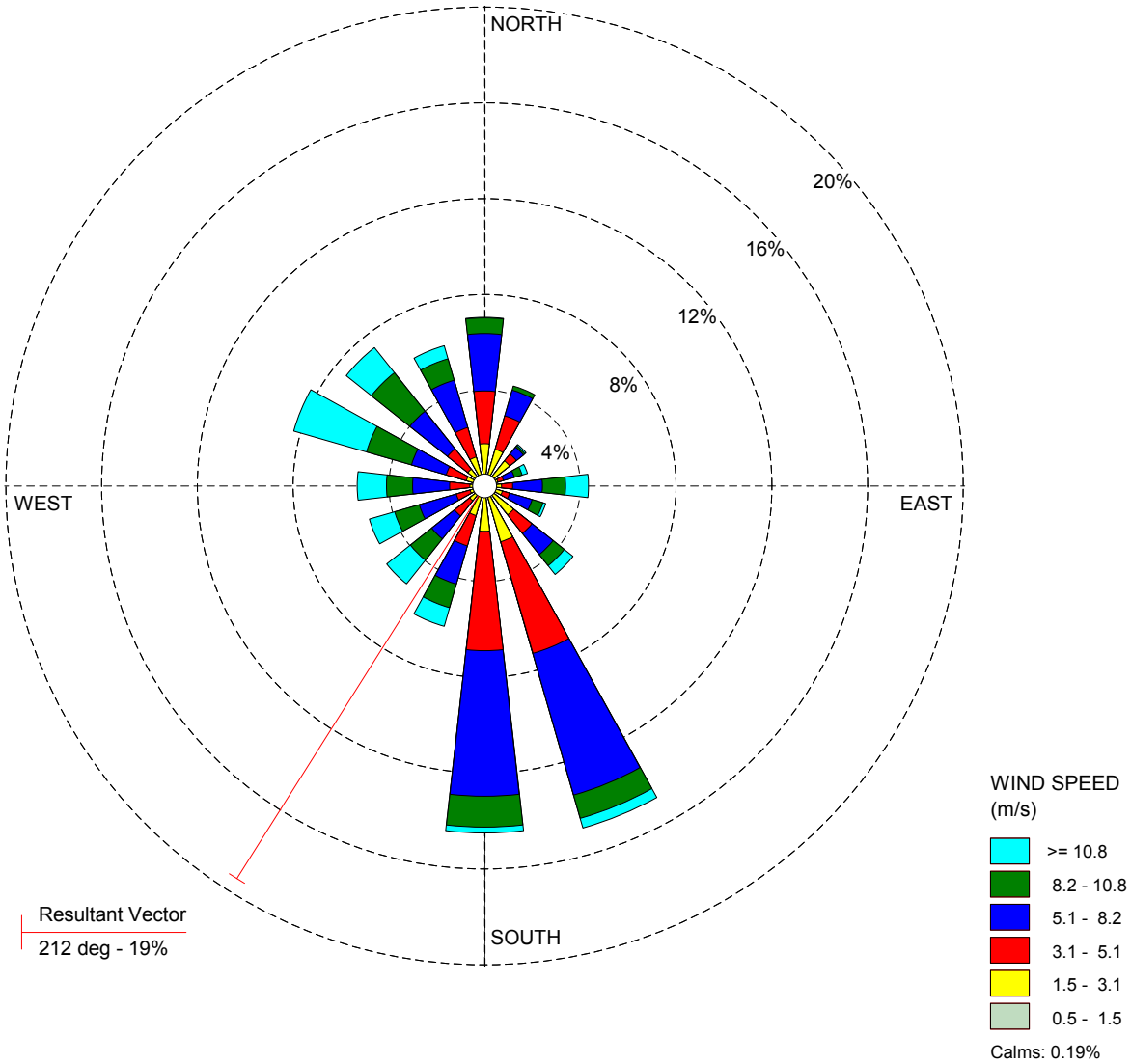
Climate Monitoring Results

WIND ROSE PLOT:

Laramie, Wyoming Monitoring Station

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

30-meter level
Nov 10, 2006 through
Oct 31, 2007

CALM WINDS:
0.19%

AVG. WIND SPEED:
6.31 m/s

TOTAL COUNT:
8284 hrs.

Figure C-1
On-site Wind Rose
(30-meter Level)

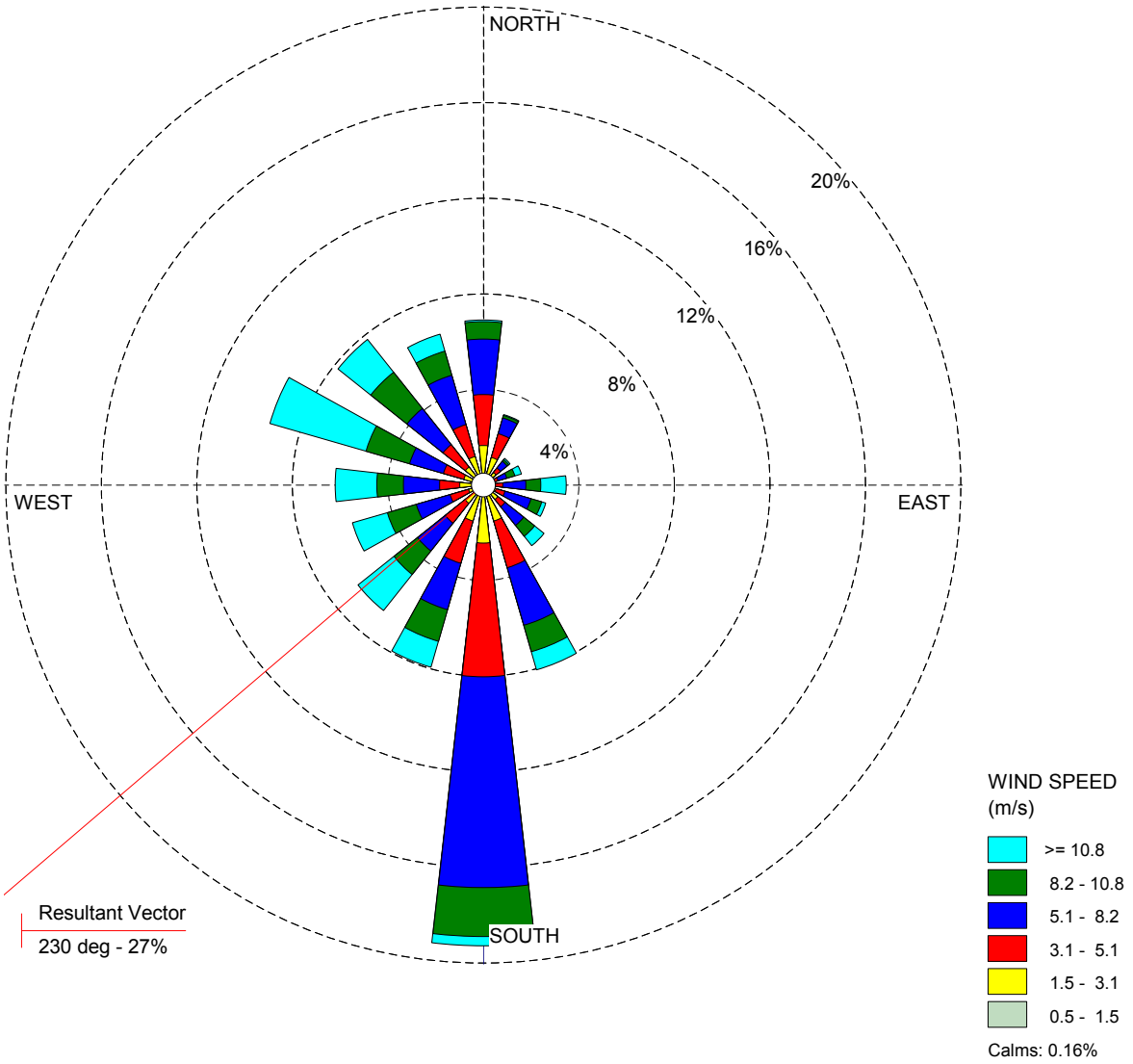
WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:

Laramie, Wyoming Monitoring Station

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

60-meter level
Nov 10, 2006 through
Oct 31, 2007

CALM WINDS:
0.16%

AVG. WIND SPEED:
6.85 m/s

TOTAL COUNT:
8284 hrs.

Figure C-2
On-site Wind Rose
(60-meter Level)

WRPLOT View - Lakes Environmental Software

Appendix D

Species Potentially Occurring On or Near the JPA

Table D-1 Mammal Species Potentially Occurring on or Near the Jonathon Permit Area[1]

Common Name[2]	Scientific Name[2]	Habitat[3]
Merriam's shrew	*Sorex merriami*	All
Dwarf shrew	*Sorex nanus*	All
Western small-footed myotis	*Myotis ciliolabrum*	MMS, LPW, AW
Long-eared myotis	*Myotis evotis*	LPW
Little brown myotis	*Myotis lucifugus*	All
Long-legged myotis	*Myotis volans*	LPW
Hoary bat	*Lasiurus cinereus*	LPW
Big brown bat	*Eptesicus fuscus*	All
Silver-haired bat	*Lasionycteris noctivagans*	LPW, AW
Desert cottontail	*Sylvilagus audubonii*	MMS, MGP, BSS
Mountain cottontail	*Sylvilagus nuttallii*	LPW, AW
White-tailed jackrabbit	*Lepus townsendii*	MGP, BSS, R/CP, DS/G
Least chipmunk*	*Tamias minimus*	All but MGP
Yellow-bellied marmot	*Marmota flaviventris*	Rock Outcrop
Wyoming ground squirrel	*Spermophilus elegans*	MGP, BSS
Thirteen-lined ground squirrel	*Spermophilus tridecemlineatus*	MGP
Pine squirrel*	*Tamiasciurus hudsonicus*	LPW
Northern pocket gopher	*Thomomys talpoides*	MGP, BSS
Olive-backed pocket mouse	*Perognathus fasciatus*	MGP, BSS
Ord's kangaroo rat	*Dipodomys ordii*	MGP, BSS
Deer mouse	*Peromyscus maniculatus*	All
Northern grasshopper mouse	*Onychomys leucogster*	MGP, BSS
Bushy-tailed woodrat	*Neotoma cinerea*	MMS, LPW, AW
Prairie vole	*Microtus ochrogaster*	MGP
Porcupine	*Erethizon dorsatum*	LPW, AW
Coyote*	*Canis latrans*	All
Red fox	*Vulpes vulpes*	All
Swift fox	*Vulpes velox*	MGP, BSS
Black bear*	*Ursus americanus*	LPW, AW, MMS
Long-tailed weasel	*Mustela frenata*	All
Badger*	*Taxidea taxus*	MGP, BSS, DS/G
Striped skunk	*Mephitus mephitus*	All
Mountain lion	*Felis concolor*	MMS, LPW, AW
Bobcat	*Lynx rufus*	MMS, LPW, AW
Pronghorn*	*Antilocapra americana*	MPG, BSS, DS/G, R/CP
Mule deer*	*Odocoileus hemionus*	MMS, LPW, AW, BSS
American elk*	*Cervus elaphus*	MMS, LPW, AW, DS/G

* Indicates species or definitive sign was observed during field surveys.

[1] Listing is based on Clark (1987) and onsite observations of habitat.

[2] Nomenclature follows Clark (1987).

[3] Habitat in which species may occur within the permit area:

MMS = Mountain Mahogany Shrubland
LPW = Limber Pine Woodland
AW = Aspen Woodland
DS/G = Dwarf Sage/Grassland
R/CP = Rocky/Cushion Plant
MGP = Mixed Grass Prairie
BSS = Big Sage Steppe

Table D-2 Bird Species Potentially Occurring on or Near the Jonathon Permit Area1

Common Name[2]	Scientific Name[2]	Habitat[3]	Season[4]
Turkey vulture	*Cathartes aura*	All	S, M
Northern harrier	*Circus cyaneus*	MGP, BSS, DS/G	Y
Sharp-shinned hawk	*Accipiter striatus*	LPW, AW	Y
Cooper's hawk*	*Accipiter cooperii*	LPW, AW	Y
Swainson's hawk	*Buteo swainsoni*	MGP, BSS, DS/G	S, M
Red-tailed hawk	*Buteo jamaicensis*	All	Y
Ferruginous hawk*	*Buteo regalis*	MGP, BSS	Y
Rough-legged hawk	*Buteo lagopus*	MGP, BSS	W
Golden eagle	*Aquila chrysaetos*	MGP, BSS, DS/G	Y
American kestrel*	*Falco sparverius*	LPW, AW	Y
Prairie falcon	*Falco mexicanus*	MGP, BSS, DS/G	W, M
Killdeer*	*Charadrius vociferus*	MGP, Ephemeral Ponds	S, M
Baird's sandpiper*	*Calidris bairdii*	Ephemeral Ponds	M
Mourning dove*	*Zenaida macroura*	AW	S, M
Great horned owl	*Bubo virginianus*	LPW, AW	Y
Burrowing owl	*Athene cunicularia*	MGP, BSS	S
Long-eared owl	*Asio otus*	LPW, AW	Y
Short-eared owl	*Asio flammeus*	MGP	Y
Common nighthawk	*Chordeiles minor*	All	S, M
Common poorwill	*Phalaenoptilus nuttallii*	All	S, M
Broad-tailed hummingbird	*Selasphorus platycercus*	MMS, LPW, AW	S. M
Downy woodpecker	*Picoides pubescens*	LPW, AW	Y
Hairy woodpecker*	*Picoides villosus*	LPW, AW	Y
Northern flicker	*Colaptes auratus*	LPW, AW	Y
Western wood pewee	*Contopus sordidulus*	LPW, AW	S, M
Dusky flycatcher	*Empidonax oberholseri*	MMS, LPW, AW	S, M
Western kingbird	*Tyrannus verticalis*	MGP, BSS, LPW	S, M
Say;s phoebe	*Sayornis saya*	MGP, BSS	S, M
Horned lark*	*Eremophila alpestris*	MGP, BSS	Y
Tree swallow	*Tachycineta bicolor*	LPW, AW	S, M
Violet-green swallow	*Tachycineta thalassina*	LPW, AW	S, M
Cliff swallow	*Hirundo pyrrhonota*	Rock outcrop	S, M
Barn swallow	*Hirundo rustica*	MGP, buildings	S, M
Steller's jay*	*Cyonocitta stelleri*	LPW	Y
Clark's nutcracker*	*Nucifraga columbiana*	LPW	Y
Black-billed magpie	*Pica pica*	MMS	Y
Common raven*	*Corvus corax*	All	Y
Mountain chickadee*	*Parus gambeli*	LPW	Y
Red-breasted nuthatch	*Sitta canadensis*	LPW	Y
Brown creeper	*Certhia americana*	LPW	Y
Rock wren	*Salpinces obsoletus*	Rock outcrop, MMS	S, M
House wren	*Troglodytes aedon*	AW	S, M
Blue-gray gnatcatcher	*Polioptila caerulea*	MMS	S, M
Townsend's solitaire	*Myadestes townsendi*	LPW	Y
Mountain bluebird*	*Sialia currucoirdes*	LPW	S, M
American robin	*Turdus migratorius*	LPW, AW	Y
Sage thrasher	*Oreoxcoptes*	BSS	S, M

Common Name[2]	Scientific Name[2]	Habitat[3]	Season[4]
	montanus		
Loggerhead shrike	*Lanius ludovicianus*	BSS, MMS	S, M
Solitary vireo	*Vireo solitarius*	LPW, AW	S, M
Warbling vireo	*Vireo gilvus*	AW	S, M
Orange-crowned warbler	*Vermivora celata*	MMS, AW	S, M
Yellow-rumped warbler	*Dendroica coronata*	LPW, AW	S, M
Western tanager	*Piranga ludoviciana*	LPW, AW	S, M
Lazuli bunting	*Passerina amoena*	MMS	S, M
Green-tailed towhee	*Pipilo chlorurus*	BSS, MMS	S, M
American tree sparrow	*Spizella arborea*	MMS	W, M
Chipping sparrow	*Spizella passerina*	LPW, AW	S, M
Brewer's sparrow	*Spizella breweri*	BSS	S, M
Vesper sparrow*	*Pooecetes gramineus*	MGP, BSS	S, M
Lark sparrow	*Chondestes grammacus*	MGP, BSS, MMS	S, M
Sage sparrow	*Amphispiza belli*	BSS	S, M
Lark bunting	*Calamospiza melanocorys*	MGP	S, M
Grasshopper sparrow	*Ammodramus savannarum*	MGP, BSS	S, M
Dark-eyed junco*	*Junco hymelis*	LPW, AW	Y
McCown's longspur	*Calcarius mccownii*	MGP	S, M
Lapland longspur	*Calcarius lapponicus*	MGP	W, M
Chestnut -collared longspur	*Calcarius ornatus*	MGP	S, M
Snow bunting	*Plectrophenax nivalis*	MGP	W, M
Western meadowlark	*Sturnella neglecta*	MGP, BSS	Y
Brewer's blackbird	*Euphagus cyanocephalus*	MGP, buildings	S, M
Brown-headed cowbird	*Molothrus ater*	All	S, M
House finch	*Carpodacus mexicanus*	MMS, LPW	Y
Pine siskin	*Carduelis pinus*	All	M, W

* Indicates species was observed during field surveys.

[1] Listing based on Peterson (1990) and onsite observations of habitat.

[2] Nomenclature follows American Ornithologists' Union (1983).

[3] Season in which species is most likely to occur in the project area:

Y = Yearlong Resident,
S = Summer,
W = Winter,
M = Spring or Fall migrant.

[4] Habitat in which species may occur within the permit area:

MMS = Mountain Mahogany Shrubland
LPW = Limber Pine Woodland
AW = Aspen Woodland
DS/G = Dwarf Sage/Grassland
R/CP = Rocky/Cushion Plant
MGP = Mixed Grass Prairie
BSS = Big Sage Steppe

Table D-3 Amphibians and Reptiles Potentially Occurring on or Near the Jonathon Permit Area[1]

Common Name[2]	Scientific Name[2]	Habitat[3]
Amphibians		
Tiger salamander	*Ambystoma tigrinum*	Ephemeral ponds
Reptiles		
Eastern short-horned lizard	*Phrynosoma douglassi brevirostre*	MGP, BSS
Prairie rattlesnake	*Crotalus viridus viridus*	All

* Indicates species was observed during field surveys.

[1] Listing based on Baxter and Stone (1985) and onsite observations of habitat.

[2] Nomenclature follows Baxter and Stone (1985) for amphibians and reptiles.

[3] Habitat in which species may occur within the permit area:

MMS = Mountain Mahogany Shrubland
LPW = Limber Pine Woodland
AW = Aspen Woodland
DS/G = Dwarf Sage/Grassland
R/CP = Rocky/Cushion Plant
MGP = Mixed Grass Prairie
BSS = Big Sage Steppe

Appendix E

Visual Contrast Rating Forms

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date: 09/26/10
District:
Resource Area:
Activity (program):

SECTION A. PROJECT INFORMATION

1. Project Name: Pete Lien Mine US 287 Northbound/Residential
2. Key Observation Point:
3. VRM Class: IV & III
4. Location: Township ____ Range ____ Section: Multiple
5. Location Sketch: See EA description

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Planar and pyramidal	Irregular spheres and planes	Blocks and narrow rectilinear fences
LINE	Horizontal and curvilinear ~~by~~ - Angular ~~by~~	Angular concave & convex. Parallelograms	Horizontal, vertical, and angular
COLOR	Lt tans to dark greys	Lt to medium olives and beiges	Tans, browns, greys
TEXTURE	Fine foreground Medium ~~background~~	Fine to medium ~~by~~ medium to coarse ~~by~~	Fine to medium

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	NA	Cylindrical stack Planar roofs
LINE	/	/	Vertical and angular
COLOR		/	Tans and greys
TEXTURE	/	/	Fines

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X				X		X		
Line				X				X		X		
Color				X				X			X	
Texture				X				X			X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M PAULSON
Date: 9/26/10

Form 8400-4
(September 1985)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

VISUAL CONTRAST RATING WORKSHEET

Date 09.26.10
District
Resource Area
Activity (program)

SECTION A. PROJECT INFORMATION

1. Project Name: Pete Lein Mine
2. Key Observation Point: US 287 Southbound/Residential
3. VRM Class: III & IV
4. Location: Township ____ Range ____ Section Multiple
5. Location Sketch: See EA description

SECTION B. CHARACTERISTIC LANDSCAPE DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	Planar and pyramidal	Irregular spheres and planes	Rectangular blocks and narrow rect. fencelines
LINE	Angular, ~~and~~ vertical horizontal, curvilinear	~~Ir~~ Irregular angular	Horizontal, vertical and ~~rectangular~~ angular/angular,
COLOR	Tans, greys, ~~brown~~ ~~Sand~~	light to medium olives tans, beiges, & browns	Lt to medium tans, greys, and browns
TEXTURE	Fine to very fine	Fine to medium	Fine to medium

SECTION C. PROPOSED ACTIVITY DESCRIPTION

	1. LANDWATER	2. VEGETATION	3. STRUCTURES
FORM	NA	NA	Cylindrical stack and planar roads.
LINE		Edges are angular	Vertical and angular
COLOR		Clearings are revegetated.	Tans and greys
TEXTURE		NA	Fines

SECTION D. CONTRAST RATING ☐ SHORT TERM ☐ LONG TERM

1. DEGREE OF CONSTRAST

ELEMENTS	FEATURES: LANDWATER BODY (1) Strong	Moderate	Weak	None	VEGETATION (2) Strong	Moderate	Weak	None	STRUCTURES (3) Strong	Moderate	Weak	None
Form				X				X		X		
Line				X			X	~~X~~		X		
Color				X			X	~~X~~			X	
Texture				X				X			X	

2. Does project design meet visual resource management objectives? ☒ Yes ☐ No (Explain on reverse side)

3. Additional mitigating measures recommended? ☐ Yes ☒ No (Explain on reverse side)

Evaluator's Names: M PAULSON
Date: 09/26/10

North KOP

South KOP

Appendix F

Sediment Basin Design

Table F-1 Sediment Basin Design (including RUSLE results)

Sediment Basin[1]	Approximate Contributing Area (acres)	R[2]	K[3]	Avg. Slope (ft/ft)	LS[4]	C[5]	P[6]	A[7] (tons/ac/yr)	Vsed[8] (ac-ft/ac/yr)	Vsed[8] (ac-ft/yr)	Rep. Slope Length (ft)	Pre-Mine CN	Post-Mine CN	Post-Mine Vrunoff[9] (ac-ft)	Total Design Volume (ac-ft)	Actual Storage Volume (ac-ft)	Top Radius of Basin (ft)	Depth of Basin (ft)	Peak Discharge into Basin[10] (cfs)	Approx. Trapping Efficiency[11] (%)	Approx. Peak Influent Sediment Conc.[12] (mg/L)	Approx. Peak Effluent Sediment Conc.[13] (mg/L)	Approx. Peak Pre-Mine Sediment Conc.[14] (mg/L)
A1	18	10	0.23	13%	10.90	1.0	0.9	22.56	0.009	0.17	1000	68	46	0.00	0.17	0.18	28	5	0.0	NA	NA	NA	809,000
A2	23	10	0.23	12%	9.57	1.0	0.9	19.81	0.008	0.19	1360	68	66	0.41	0.60	0.61	47	5	5.0	94.0	787,000	33,000	687,000
A3	22	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.13	1860	68	72	0.71	0.84	0.87	55	5	8.7	92.6	566,000	31,000	472,000
A4	39	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.23	1620	68	59	0.28	0.51	0.53	44	5	0.6	96.8	128,000	5,000	491,000
A5	25	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.15	1260	68	61	0.24	0.39	0.40	39	5	1.3	94.9	281,000	11,000	436,000
A6	24	10	0.23	9%	5.97	1.0	0.9	12.36	0.005	0.12	1420	68	59	0.17	0.29	0.31	35	5	0.3	96.6	98,000	4,000	397,000
A7	8	10	0.23	6%	3.30	1.0	0.9	6.83	0.003	0.02	880	68	69	0.19	0.21	0.23	31	5	2.7	93.1	244,000	10,000	192,000
B1	20	10	0.23	17%	17.77	1.0	0.9	36.78	0.015	0.30	1040	68	77	0.93	1.23	1.26	65	5	16.2	93.2	1,049,000	68,000	971,000
B2	29	10	0.23	13%	10.90	1.0	0.9	22.56	0.009	0.27	1760	68	79	1.58	1.85	1.88	78	5	23.0	92.1	984,000	76,000	838,000
B3	47	10	0.23	8%	4.91	1.0	0.9	10.16	0.004	0.20	2310	68	82	3.08	3.28	3.33	102	5	41.1	91.0	522,000	38,000	366,000
B4	24	10	0.23	11%	8.30	1.0	0.9	17.18	0.007	0.17	2180	68	72	0.76	0.93	0.94	57	5	9.1	91.5	838,000	55,000	701,000
C1	38	10	0.23	15%	13.60	1.0	0.9	28.15	0.012	0.44	1270	68	74	1.42	1.86	1.88	78	5	24.5	93.5	1,096,000	64,000	986,000
C2	35	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.21	1990	68	53	0.06	0.27	0.29	34	5	0.1	99.2	96,000	2,000	505,000
C3	26	10	0.23	9%	5.97	1.0	0.9	12.36	0.005	0.13	2050	68	56	0.10	0.23	0.25	32	5	0.1	97.6	74,000	3,000	410,000
C4	22	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.13	1870	68	64	0.32	0.45	0.47	42	5	2.1	92.9	377,000	19,000	472,000
C5	25	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.15	1860	68	51	0.02	0.17	0.18	28	5	0.0	99.8	109,000	1,000	478,000
C6	8	10	0.23	10%	7.02	1.0	0.9	14.53	0.006	0.05	1390	68	56	0.03	0.08	0.09	21	5	0.1	98.0	71,000	3,000	703,000

Notes:

1) Sediment Basins as shown on Map 2-3

2) Rainfall-Runoff Erosivity Factor from Figure 2-2 of Agriculture Handbook Number 703 (AH-703)

3) Soil Erodibility Factor from the National Resourse Conservation Service Soil Survey of Albany County (predominant soil is Cheadle-Passcreek cobbly subsoil Rock Outcrop complex and Nathale-Passcreek cobbly subsoil Rock Outcrop complex)

4) Slope Length and Steepness Factor from Table 4-3 (high ratio of rill to interrill erosion) of AH-703 (values were estimated using a worst-case maximum estimated slope length of 1000 ft prior to concentrated flow and an average slope)

5) Cover Management Factor from Table 4-4 of *Designing for Effective Sediment and Erosion Control on Construction Sites,* Jerald S. Fifield, PhD, CPESC, 2001 (assuming worst case of no cover/bare soil)

6) Support Practice Factor from Table 4-4 of *Designing for Effective Sediment and Erosion Control on Construction Sites*, Jerald S. Fifield, PhD, CPESC, 2001

7) Average annual soil loss

8) Calculated unit volume using 80 pounds per cubic foot for deposited sediment

9) Anticipated volume of runoff from the 10-year, 24-hour storm as calculated with SEDCAD.

10) The anticipated peak flow of runoff from the 10-year, 24-hour storm as calculated with SEDCAD

11) The percentage of sediment that will be trapped within the sediment basin. This assumes that existing soil consists of approximately 80% sand (>0.075 mm), 13% silt (0.075 to 0.002 mm), and 7% clay (<0.002 mm).

12) Approximate peak sediment concentration entering the sediment basin during a 10-year, 24-hour storm as calculated with SEDCAD.

13) Approximate peak sediment concentration exiting the sediment basin during a 10-year, 24-hour storm as calculated with SEDCAD.

14) Approximate peak sediment concentration during pre-mine conditions during a 10-year, 24-hour storm as calculated with SEDCAD.