MINING AND REHABILITATION PLAN
LIBERTY GRAVEL MINE SITE

NORTH SLOPE, ALASKA

BP Exploration (Alaska) Inc.
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INTRODUCTION

A gravel mine site is required to supply an estimated 1,000,000 cubic yards of gravel for the Liberty Development Project consisting primarily of an expansion to the existing Endicott satellite drilling island (SDI).

The goal for the mine site preparation, operation, subsequent closure and rehabilitation is to minimize tundra disturbance.

The following figures provide additional information regarding the mine site development and rehabilitation:

- Figure 1 shows the vicinity of the proposed mine site.
- Figure 2 shows the location of the proposed mine site and overburden storage areas.
- Figure 3 shows the proposed mine site cross sections.
- Figure 4 shows the mine site grading after excavation and features of the rehabilitation plan.
- Figure 5 shows typical cross sections through the rehabilitated mine site.
- Figure 6 shows typical cross sections through the rehabilitated mine site.

The proposed Liberty mine site will disturb approximately 50 acres (including ice pads for staging). This includes a staging area for mining activities, overburden storage areas and the anticipated excavation surface area of approximately 21 acres.

EXISTING CONDITIONS

The proposed Liberty mine site will be located in the eastern operating area of the Prudhoe Bay Unit (EOA/PBU), approximately 7.5 miles northeast of the Deadhorse Airport. The proposed mine site is adjacent to the existing Duck Island Mine Site at

South ½ Section 6, North ½ Section 7, Township 10 North, Range 16 East, Umiat Meridian.

This site was chosen after field geotechnical investigations of several alternative mine sites near the Endicott Road to confirm gravel quality and quantity.

The mine site is still in the planning stages as part of the Liberty Development Project SDI island expansion, therefore, at this stage of the development some flexibility is required regarding mining and rehabilitation plans.

A geotechnical characterization of the material source has been conducted but no development has yet occurred at the site. The outer perimeter boundary shown in the figures describe the maximum aerial extent of the mine site for permitting requirements. The revegetation performance standards are listed in Table 2.

Permits authorizing the proposed mining plan are as follows:

- U.S. Army Corps of Engineers (Section 404)
- Alaska Department of Natural Resources (Material Sale Contract)
- North Slope Borough (Development Permit)

MINING PLAN

General

The mine site will provide gravel for the expansion of the existing SDI to accommodate new facilities and the drilling operations. It is anticipated that gravel will be mined from the site over two winter seasons so that any extra gravel required due to settlement at the SDI can be made up prior to the arrival of the drilling equipment.

The excavated gravel area is shown in Figure 2. The tundra and overburden overlaying the excavated area will be moved adjacent to the north and south sides of the excavated area. The mined area is expected to provide approximately 1,000,000 cubic yards of gravel. Approximately 325,000 cubic yards of overburden is expected to overlay the suitable gravel fill material. The site will be accessed directly by a gravel road from the Endicott Road and a seasonal ice road between the SDI and the mine site. The ice road route will be determined after bathymetric surveys and field reconnaissance of the area between the mine site and the SDI are conducted during the summer 2007. The goal will be to utilize the existing river channel to the extent practicable while avoiding over-wintering fish habitat.

Summer Mining Plan

No summer mining activities are planned.

Winter Mining Plan

Mining operations will occur during the winter months and will include the preparation of a gravel access road for equipment access at the east side of the mine, as well as ice pad staging areas on the north and south sides of the pit for temporary spoil storage. The south side of the mine will be offset approximately 300 ft. from the Endicott Road for safety considerations. A water diversion berm, as depicted in Figure 3, will be constructed around the mine site to protect against flooding. The berm will abut the existing Endicott Road just east of the 48-inch diameter culvert that conducts water under the Endicott Road into the ephemeral Duck Island Creek. The berm will wrap around the site to prevent flood water from flowing into the pit during excavation (see Figure 2). It is not anticipated that the seasonal flow from Duck Island Creek would be diverted from the swale.

Examination of the land form surrounding the mine site suggests that the permafrost is uniform with little thermokarst or ice polygon features. There are shallow ponds to the northeast of the mine site. Based on the experience at the nearby Duck Island Mine Site, BPXA does not expect to encounter significant solid ice features that could thaw and erode into the excavated area.

The site will be monitored during overburden stripping to identify any such ice features. If massive ice is encountered, it will be excavated and replaced with spoil prior to spring break-up.

Mining operations will commence with survey and staking followed by overburden stripping. It is anticipated that an average 10 ft. overburden layer will be removed from the excavated area and stock piled. The organic layer (i.e. the top root mass) within the overburden layer will be removed and stockpiled separately from the inorganic material. The depth of the organic layer will be confirmed by visual inspection during overburden stripping. Mining operations will include blasting and mechanical excavation to an overall depth of approximately 50 ft. with respect to the original land elevation. The 300 ft. offset from the Endicott Road and pipeline will ensure they are not adversely affected by blasting. Blasting safety precautions will be in effect during blasting and all traffic will be halted immediately prior to and until after the blast and "all clear."

Road access to the mine will be via the existing gravel pad turn out from the Endicott Road at the east side of the site as depicted in Figure 2. The access road will connect to the protective flood berm on the west side. Road access ramps will be constructed as mining progresses deeper into the excavated area. The road gradient into the excavated area will not exceed a 10% gradient. Mined gravel will be transported from the mine site to the SDI along an ice road routed north of the Endicott Road. The existing river channel will be used for the ice road where practicable.

The pit side walls will be stepped as shown in Figure 3 and as close to vertical as allowed by safe mining practices. Overburden removed from the excavation area will be stockpiled on ice pads adjacent to the north and south sides of the excavated area. This is intended to reduce the impact to underlying vegetation. The spoil and organic material

stockpiles will be used to contour the excavated area and used for mine site rehabilitation after mining is complete.

REHABILITATION PLAN

Introduction

The Liberty Rehabilitation Plan (Rehabilitation Plan) describes methods and procedures proposed for rehabilitating the Liberty mine site and are subject to confirmation based on a biological assessment of the site prior to mining operations. The Rehabilitation Plan may be amended when more site-specific information is available and as the rehabilitation progresses over time. The target revegetation performance standards are listed in Table 1. A proposed treatment, monitoring, and reporting schedule to evaluate progress towards the performance standards is listed in Table 2.

Surrounding Vegetation

The vegetated area surrounding the Liberty mine site lies within the Sagavanirktok River delta, a relatively flat, rolling landscape with minimal topographic relief. The vegetation is wet and moist tundra dominated by *Eriophorum angustifolium* and *Carex aquatilis*. *Arctophila fulva* is present in wetter areas and shallow flooded habitats. *Dupontia fischeri* may be locally prevalent and in drier areas tussock tundra dominated by *Eriophorum vaginatum* may also occur.

Site Preparation

The excavated area will be rehabilitated once mining has been completed. Inorganic spoil will be placed at a nominal 5:1 H:V side slope within the stepped benches on the west side of the pit. The remaining stockpiled inorganic spoil will be placed in the deeper pit excavation to moderate the side slopes. Inorganic overburden will be placed into the pit after mining in the first year. The fill will be placed along the north, west and south faces so as not to encumber vehicle access if required in future. An irregular shoreline will be created along the south side of the pit during backfilling of the overburden material. Scallops to a depth of 1 - 2 ft. and 20 - 40 ft. back will be incorporated along the edge of the future shore line. Excavated material will be used to create small peninsulas and islands near shore. The creation of artificial island or peninsulas will depend on site specific conditions encountered. The exposed land formations will be covered with organic material. The near shore water depth will be at 1 - 2 ft depth.

The stockpiled organic material will be used to cover the disturbed area to encourage natural species revegetation. Excess organic material will be removed from the mine site and relocated to an offsite location (e.g., Duck Island Mine Site disturbed areas) for potential use elsewhere.

The water diversion berm on the west side will be breached as shown in Figures 4 and 5. The breach will be armored with select material to prevent erosion during spring

flooding. Although the mine site is slightly elevated with respect to the surrounding area based on observations from the most recent spring break up (2007), water should periodically flood into the abandoned mine site. The fill rate will depend on the annual snow cover and precipitation. The pit will flood gradually over time from locally occurring run-off waters. Once the pit completely fills it will connect with the ephemeral Duck Island Creek through the weir breach on the west side of the mine site. Detailed plans for creating a channel connecting the creek with the mine site will be developed following complete filling of the mine site.

The portions of the water diversion berm remaining after breaching will be covered with stockpiled organic material.

Goals and Objectives

The water diversion berm around the site is intended to allow the short-term establishment of seeded grasses that will assist in stabilizing the soil surface within the mine site while allowing natural colonizers to establish over time. The objective in utilizing stockpiled organic spoil is to ensure adequate soil nutrients to encourage rejuvenation of existing native plants. The shallow gradient created inside the berm is intended to establish diverse and productive wetland and upland plant communities similar to those in the surrounding area, thereby improving the appearance of the site and improving its suitability for some wildlife species. The shallow gradient will also encourage animals to more readily escape from the area after it is flooded. By creating an ice pad under the stockpile areas it is intended that the underlying vegetation is preserved after the stockpiles are removed. The goal is to restore conditions to those that existed prior to creating the stockpiles (Table 1).

Wetland Functions

In recent years, the evaluation of wetland rehabilitation has attempted to assess functionality as a criterion for successful rehabilitation. However, wetland function and thereby the possibility of restoring wetland functions in arctic ecosystems are poorly understood (Funk and Streever 2003, unpub. manuscript). Hydrogeomorphic models or HGM's are one approach being used to make functional wetland assessments. HGM's evaluate different biological and environmental variables and contrast this information to ecologically comparable, 'normal' functioning wetlands. In order to effectively deliver a functional HGM assessment, a significant amount of baseline or reference site data must be available. HGM's are developed locally or regionally for different environmental gradients. There is no HGM for Alaska's North Slope and it is doubtful that such an approach will work.

In consultation with the U.S. Army Corps of Engineers, BPXA has established a practice of defining clear goals, objectives, and performance standards as part of their current approach to rehabilitation. The quantitative measures associated with BPXA's rehabilitation goals, objectives, and performance standards typically focus on percent vascular cover, species composition, and available soil nutrients. Additional qualitative

measures often include monitoring the site for wildlife activity, and significant areas of subsidence or thermokarst.

It is reasonable to assume that, until adequate HGM data are made available, inference to wetland functionality may be derived from BPXA's current approach to rehabilitation; reasoning that a positive trend in vegetative establishment and species diversity promotes soil stability, develops soil structure, and indicates adequate plant available nutrients; evaluating surface stability indicates maintenance of thermal equilibrium; and observations of wildlife activity support habitat development and food web structuring.

Rehabilitation Treatments

Disturbed areas outside the excavated area will be seeded with *Puccinellia borealis*, a native grass that is short-lived and non-competitive to invasion by indigenous tundra plant species. An application of approximately 3-5 lb/acre of *P. borealis* should provide adequate cover (BP Exploration (Alaska), Inc. et al. 2004). *P. borealis* seed is available in limited quantities, and this seeding plan (either the species or the year of planting) may be revised if enough seed is not available.

Based on past experience, applying phosphorus fertilizer will greatly enhance establishment of seeded grasses and encourage the invasion of the site by indigenous species. An application of 400 lbs/acre 10:20:20 NPK fertilizer is recommended as a balanced application suitable for most soils in this region. Soil samples will be collected and nutrient analysis conducted to finalize the most appropriate fertilizer application.

The first summer following mine site closure, the area will be allowed to settle, soil samples will be collected, and the area will be inspected to determine the extent of rehabilitation treatments required. Rehabilitation treatments will begin during the following growing season; after breakup and before freeze up in autumn when the soil surface has thawed and drained of excess moisture. The seeded grass is expected to reach maturity by the third growing season following seeding and to begin declining after four to five growing seasons, allowing natural colonizers to occupy the site.

Performance Standards

By the tenth year following cultivation treatments, seeded areas will support 10% total live vascular plant cover excluding seeded grass cultivars. At least five species of naturally colonizing plants should be present, with at least 0.2% cover by each. These performance standards are intended to lead to a soil stabilizing plant cover on the site while also promoting eventual replacement of seeded grasses with naturally colonizing species. These standards do not apply to areas that are ponded for more than four weeks during the growing season. Other disturbed areas, primarily the former overburden stockpile area will, by year 10, support a live vascular cover $\geq$15% of that found in the surrounding undisturbed area (Table 1).

Monitoring for Performance Standards

Monitoring will be used to evaluate the progress of vegetation relative to performance standards. The final monitoring will establish whether the revegetation performance standards have been met.

Canopy cover and species composition will be assessed using BPXA's standard method, as described in "BP Revegetation and Compliance Monitoring; Standardized Methods for Documenting Plant Community Development" and according to the schedule in Table 2. If intermediate sampling indicates that vegetation has not established enough to meet the proposed standards, additional remedial actions may be required to increase plant cover.

Reporting

Progress reports following BPXA's standard format will be submitted by 1 February of the year following site visits scheduled in Table 2. Reports will be provided to State of Alaska Department of Natural Resources, U. S. Army Corp of Engineers, and the U. S. Fish and Wildlife Service.

Remedial Action

If monitoring suggests that performance standards may not be met by Year 10, additional seeding, fertilizing, and/or other planting approaches will be considered in consultation with agency representatives.

REFERENCES

BP Exploration (Alaska), Inc, Conoco Phillips Alaska, Inc., ABR, Inc., and Lazy Mountain Research. 2004. North Slope Plant Establishment Guidelines Table May 11, 2004. Prepared by Oasis Environmental, Inc. 10 pp.

Funk, D.F., and B. Streever. 2003. Wetland function on the Arctic Coastal Plain of Alaska. Unpublished manuscript prepared by LGL Alaska Research Associates, Inc., and BP Exploration (Alaska), Inc. Environmental Studies Program. Anchorage, Alaska.

Table 1. Goals, Objectives, Performance Standards, and Monitoring Methods	
Goals	Flood protection berm: Establish diverse and productive wetland and upland plant communities on the site similar to those of the surrounding area, thereby improving the appearance of the site and improving its suitability for some wildlife species. Former stockpile area: Restore natural conditions comparable to those that existed prior to material stockpiling.
Objectives	Flood protection berm: Short-term establishment of seeded grass that will not persist, allowing natural tundra plant species to colonize the site over time. Former stockpile area: Ensure adequate soil nutrients to encourage rejuvenation of native plants.
Performance Standard	Flood protection berm: By year 10, 10% cover by live vascular plants, including seeded grasses, with at least 1% cover of naturally colonizing species. Species composition consisting of at least 5 naturally colonizing species with 0.2% canopy cover each, on the excavated area and the gravel pad removal area. Former stockpile area: Live vascular cover $\geq$15% of that found in the surrounding, undisturbed area.
Monitoring Methods	Use BPXA's standard method for measuring plant vegetation cover. Establish photopoints to qualitatively assess changes in site conditions.

Table 2. Proposed schedule for application of rehabilitation treatments, site monitoring, and reporting.

Year	Treatment & Monitoring	Reporting
First summer following site close out	Sample and test soil for fertility and other features. Inspect site to determine extent of rehabilitation activities required. Establish photopoint markers.	None.
Year 0	Apply fertilizer and seed; quantitatively measure cover in former stockpile area; collect photo records.	Progress report.
Year 2	Measure vegetation cover and species composition, and compile a species list, using BPXA's standard method in seeded areas and former stockpile area. Sample soil where revegetation success appears lacking. Observe surface stability qualitatively and collect photo records.	Progress report.
Year 6	Measure vegetation cover and species composition, and compile a species list, using BPXA's standard method in seeded areas and former stockpile area. Sample soil where revegetation success appears lacking. Observe surface stability qualitatively and collect photo records.	Progress report.
Year 10	Measure vegetation cover and species composition, and compile a species list, using BPXA's standard method in seeded areas and former stockpile area. Sample soil where revegetation success appears lacking. Observe surface stability qualitatively and collect photo records.	Final report.