Alpine Satellite Development Plan
Final Environmental Impact Statement

Appendix O

CLOVER MINE SITE REHABILITATION PLAN

ECOLOGICAL RESTORATION OF THE CLOVER A MINE SITE, ALPINE SATELLITE DEVELOPMENT PROJECT, ALASKA

REHABILITATION PLAN

Prepared for ConocoPhillips Alaska, Inc.

by ABR Inc.—Environmental Research & Services and
P|N|D Incorporated, Consulting Engineers

July 2004

OVERVIEW

The proposed Clover A Mine Site is located in the National Petroleum Reserve Alaska (NPRA), approximately 13.8 km east of the Alpine Oilfield and 13 km south of Harrison Bay (Figure 1). The vegetation consists primarily of Moist Sedge-Shrub Meadow and Moist Tussock Tundra. Small inclusions of Patterned Wet Meadow also occur within the Moist Tussock Tundra (Figure 2) Restoration plans for this mine site call for the creation of high-value waterbird habitat, which is uncommon in this area.

The mine site is still in the planning stages as part of the Alpine Satellite Development Project (ASDP). Some preliminary characterization of the material source has been done, but no development has yet occurred in the area.

REHABILITATION PLAN

BACKGROUND

Gravel resources in the area near the planned ASDP are relatively scarce due to the presence of extensive eolian sand dunes and fine-grained, alluvial-marine deposits. Near surface gravel was first noted in the Clover area when a conductor hole was drilled for the "Clover A" exploration well. After extensive subsurface exploration in April 2001, three boreholes (to depths of 30–40 ft) in the Clover area indicated the site had potential as a gravel source. In April 2002, 12 additional boreholes were drilled to better characterize the

depth, particle size distribution, moisture content, and salinity of the deposit (Miller and Phillips 2002). The boreholes found an organic-rich, silty sand, layer 6–20 ft in depth overlying a dune sand layer from 10 to 20 ft, and a gravely sand layer varying in depth from 10 to 35 ft. Massive ice was common in the upper 10 ft and ice content in the lower gravelly sand generally ranged from 10 to 20%. The boreholes confirmed the presence of suitable sand and gravel materials within the proposed mine site limits. The gravel encountered was fine grained with a maximum dimension of less than three quarters of an inch (<0.75”). Additional geotechnical exploration performed to the north and east of the proposed site in the winter of 2004 indicated that the deposits of suitable sand and gravel material are localized and the proposed site appears to offer greatest concentration of these deposits in the local vicinity.

The salinity of the overlying silts and sands generally was low (<2 ppt, 3,000 µS/cm), although the salinity of the underlying gravelly sand was substantially higher (mostly 2–5 ppt; 3,000–7,000 µS/cm). The average salt content is 3 ppt.

The gravelly sand and dune sand, with relatively low moisture (ice) contents of 10–20%, are considered to be suitable materials for the construction of roads and pads. ConocoPhillips Alaska, Inc. intends to utilize the suitable gravel fill material excavated from the Clover A Mine Site to construct three oil production gravel pads and approximately 21 miles of access road as part of the ASDP. Unsuitable materials will be further identified and delineated within the material source limits by additional geotechnical investigation at the site and by soils testing incorporated into the mining process.

Materials unsuitable for road or pad construction will remain within the proposed material source boundaries and will be used in rehabilitating the mine site once mining is complete. Construction activities are currently scheduled for two winter construction seasons, not necessarily concurrent (Appendix Figures 1 and 2). An exposed working face will remain open after the first year’s mining efforts. The site will be accessed using seasonal ice roads.

Mining activities will include blasting the frozen material in-situ, stockpiling unsuitable material along the margins of the mine pit, and loading suitable source material into equipment to be used in pad and road construction for the ASDP. To support rehabilitation of

the mine site at closure, the organic overburden (generally the top twelve inches of tundra) will be stockpiled separately from the bulk of the overburden, which consists primarily of silty sand and ice-rich soils (combined volume estimated at approximately 1.8 million yds^3). Overburden waste from year-one mining activities would be stockpiled within the mine site limits immediately adjacent to the excavation. (Appendix Drawing 1). This material would then be shifted into the excavated area once that year's mining activities cease. Although the tundra supporting the overburden stockpile would be disturbed by the placement and removal of the overburden waste, care will be taken to ensure that this disturbance is minimized and does not extend beyond the proposed year-two excavation footprint. Overburden waste from year-two mining activities would be stockpiled in the year-one excavation area (Appendix Drawing 2). After the overburden is stockpiled (during each year of excavation), it will be contoured to the final rehabilitation configuration to the extent possible. The excavation area perimeter will be shaped to produce an irregular, scalloped cut slope of varying steepness.

The total quantity of soil enclosed within the mine site limits, to a depth of sixty feet and with a maximum 1½:1 cut slope, is estimated at 5.6 million cubic yards, this quantity would be the maximum possible excavation. Mining plan features such as excavation set-backs at the perimeter of the site, isolated areas of unsuitable material within the mine site limits, reduced side slopes, irregular side slopes, and berms left between excavation cells can be expected and would reduce this total quantity. 1.8 million cubic yards of this volume is expected to consist of the unsuitable overburden materials. An unknown fraction of the remaining material will consist of unsuitable materials such as silt or massive ice. Excavation will proceed in a manner intended to minimize the surface impact of this mine site. Efforts will be made to excavate vertically, in order to maximize the volume of suitable gravel taken from each square yard of disturbed area, and limit the lateral disturbance ahead of the excavation as much as possible. Lateral disturbance ahead of the excavation could include stripping of overburden or equipment ramps. Currently, preliminary gravel requirements for the ASDP are projected at 1.1 million cubic yards of excavated suitable fill material.

Restoration of the site to pre-mining conditions will not be possible, however, this rehabilitation plan proposes to create high-value waterbird habitats that are uncommon in the

local area. Specifically, the plan proposes to create a mosaic of shallow-water habitat, aquatic grass marsh, and vegetated islands within the shallow-water area for waterfowl nesting.

This rehabilitation plan assumes that the Clover A Mine Site will not be expanded beyond the currently permitted boundaries and that the most appropriate use of the mine site at closure is wildlife habitat. The plan presents approaches that may be used to rehabilitate the site based on current, existing information, but should be considered preliminary due to uncertainty about the final conditions that will exist at abandonment. A final survey of topography and water levels at the mine site will be performed prior to implementation, to ensure that the proposed rehabilitation plan is still feasible. If it becomes desirable to expand this site or to use the site in an alternative manner, a revised rehabilitation plan will be submitted to the regulatory agencies. The monitoring methods, water-surface level and revegetation goals and preliminary performance standards will be finalized through a consultation process involving CPAI and agency representatives.

REHABILITATION FEATURES

The area of the flooded mine pit is expected to be approximately 60 acres (Appendix Drawing 3). The maximum depth of the lake will be approximately 50 feet, with over 50 percent of the area greater than 30 feet in depth. Depending on the volume of material available, littoral (water depth > 1.5 ft to < 6 ft) and shallow littoral (water depth approximately 1.5 ft) habitats will be created over approximately 20% of the area of the pit, using overburden stockpiled during excavation of the mine pit. In addition, islands will be constructed within the shallow littoral zone. Shallow littoral areas provide the appropriate growing environment for aquatic plants, which in turn improve habitat quality for waterbirds. Littoral areas are also necessary in order to make construction of the islands feasible. If additional segregated topsoil is available following the topdressing of the islands, this material will be used as the final cover for portions of the shallow littoral zone.

Nesting islands for waterfowl (ducks and geese) will be constructed by placing additional fill at selected locations in the shallow-water zone (Appendix Drawing 3). Construction of the islands will follow the criteria outlined in Appendix 1 of the Alaska North Slope Gravel Pit Performance Guidelines (McLean 1993). The islands will be approximately 0.1 acre in size, to accommodate several nests. The number and locations of

nesting islands will be determined by the final configuration of the site and the volume of fill available, but they will be constructed at least 30 ft. from the edge of the former pit to minimize the risk of nest predation by foxes. The shallow-water zones will be characterized by shallow side slopes of about 10:1. Islands will be constructed to be from 0.5 to 1.0 meters above the water surface at full water depth. Some of the topsoil that is segregated from the overburden will be used as a final topdressing on the islands to improve the soil characteristics for supporting plant growth.

Those portions of the mine pit margins adjacent to the deeper water areas will have a steeply sloped shoreline that is unchanged from the configuration present at the termination of mining. The large volume of water that will eventually be impounded in the pit is expected to alter the thermal regime of the permafrost beneath and adjacent to the waterbody. The most conspicuous response to the thawing of the frozen materials surrounding the site is expected to occur along the steep side slopes. Settlement of the thawed materials may result in: 1) a natural flattening of the side slopes and 2) subsidence at the surface. The amount of subsidence can be estimated and will be taken into consideration when constructing the shallow water and island habitats. Differential settlement could introduce shoreline and water depth irregularities that improve habitat diversity. Thus, the cumulative results of thawing are not expected to adversely impact the use of this site for waterfowl habitat.

WATER LEVEL MAINTENANCE

Maintaining a stable water level within the excavated area, once mining activities cease, will be critical to the success of this rehabilitation effort. It is expected that the main source of water recharge to this site will be through the capture of snow, through drifting, though recharge from the Ublutuoch River during spring flooding or an existing ephemeral drainage is possible.

REVEGETATION TREATMENTS

The overall goal of the revegetation effort at the Clover A Mine Site is to establish a variety of productive, diverse, and self-sustaining plant communities that provide habitat value for wildlife. After rehabilitation, the site will include several different habitats,

including nesting islands, shallow littoral areas, and an upland area along the margin of the pit. Each of these habitat types will require a different suite of revegetation techniques, as described below. A more detailed revegetation plan, including preliminary performance standards and monitoring methods, will be finalized in consultation with CPAI and pertinent agencies once construction of the rehabilitation features is at least partly completed. We detail below examples of performance standards that have been used at other mine sites on the North Slope and that may be applicable to the Clover site.

NESTING ISLANDS

Once water levels in the various zones have stabilized and reached final design depths, indigenous grasses and sedges will be introduced to the islands by transplanting 1) tundra plugs on the tops of the islands at a density of 0.5 plug/m^2 and 2) sprigs of the aquatic grass *Arctophila fulva* at a density of 1 stem/m^2 just below the water line along the island margins. In addition, cuttings of native willows (*Salix* spp.) will be planted at a density of 5 stems/m^2, primarily to provide cover for nesting birds. Fertilizer (20-20-20 N-P-K) will be applied at a rate of 200–400 kg/ha, depending on the quality of the substrate.

SHALLOW LITTORAL AREAS

Initial revegetation treatments for shallow littoral areas will include applying fertilizer and seed of native wetland sedges, to promote the development of a plant community dominated by indigenous species. Fertilizer (20-20-20 N-P-K) will be applied at a rate of 200–400 kg/ha, depending on the quality of the substrate. Plant species may include *Carex aquatilis*, *Eriophorum* spp., and *Dupontia fisheri*. These treatments will be applied following the placement and final contouring of the overburden. If the volume of remaining topdressing in sufficient for topdressing only portions of the shallow littoral zone, then revegetation efforts will be focused in these areas. Additional treatments will be applied once the water surface elevation in the pit approaches the final elevation and the soil moisture regime along the shoreline of the pit is suitable for the establishment of wetland plant species. At that time, tundra plugs (consisting mostly of sedges) and sprigs of the emergent aquatic grass *Arctophila fulva* will be planted along the planned final shoreline of the shallow littoral areas.

REHABILITATION MONITORING

A CPAI representative with knowledge of the intent of the rehabilitation plan will monitor the construction of the rehabilitation features. This individual will participate in the initial project planning stages to communicate the rehabilitation plan's goals and objectives to the project team and will monitor the rehabilitation efforts. In addition, a CPAI representative will monitor the rehabilitated site for two years after the site has filled with water. Monitoring will include inspecting the pit margin for erosion and instability. Corrective action will be taken as necessary to meet the intent of the rehabilitation plan.

Revegetated areas will be monitored periodically over a 10-year period, to determine whether productive, diverse, and self-sustaining plant communities are developing within the rehabilitated mine site. Monitoring will be conducted by CPAI representatives with knowledge of the goals and objectives of the revegetation effort.

PERFORMANCE STANDARDS

Performance standards will be developed in consultation with the Corps of Engineers based on performance standards used at other mine sites and review of vegetation performance at older mine sites. For example, the performance standards for a similar rehabilitation plan for the mine site on the Colville Delta may be applicable. For the Colville mine site, the recommended performance standard for *Arctophila* transplants was 50 stems/m^2 after 10 years, based on an initial planting of 1 stem/m^2. For shallow littoral areas seeded with indigenous hydrophytic grasses and sedges, the recommend performance standard was 10% cover after 10 years. For transplanting willow cuttings, a performance standard at the Alpine oilfield was 30% survival after 2 years, but good performance indicates a standard of 50% survival after 2 years may be reasonable. For transplanted tundra plugs, the performance standard would be set to ensure that the plugs were planted at the density specified.

REHABILITATION SCHEDULE

Current plans call for gravel extraction at the Clover A Mine Site to be completed by May 2009. A final rehabilitation plan and schedule will be developed in consultation with state, local, and federal agency representatives and submitted at that time.

REFERENCES

McLean, R. F. 1993. North Slope Gravel Pit Performance Guidelines. Tech. Report 93-9, Habitat and Restoration Division, Alaska Dept. of Fish and Game.

Miller, D. L., and W. Phillips. 2002. Geotechnical exploration NPRA Clover Material Site, NPRA, Alaska. Unpublished report prepared for ConocoPhillips Alaska, Inc., Anchorage, AK by Duane Miller & Associates, Anchorage, AK.

APPENDIX
CLOVER A MINE SITE
PRELIMINARY DRAWINGS

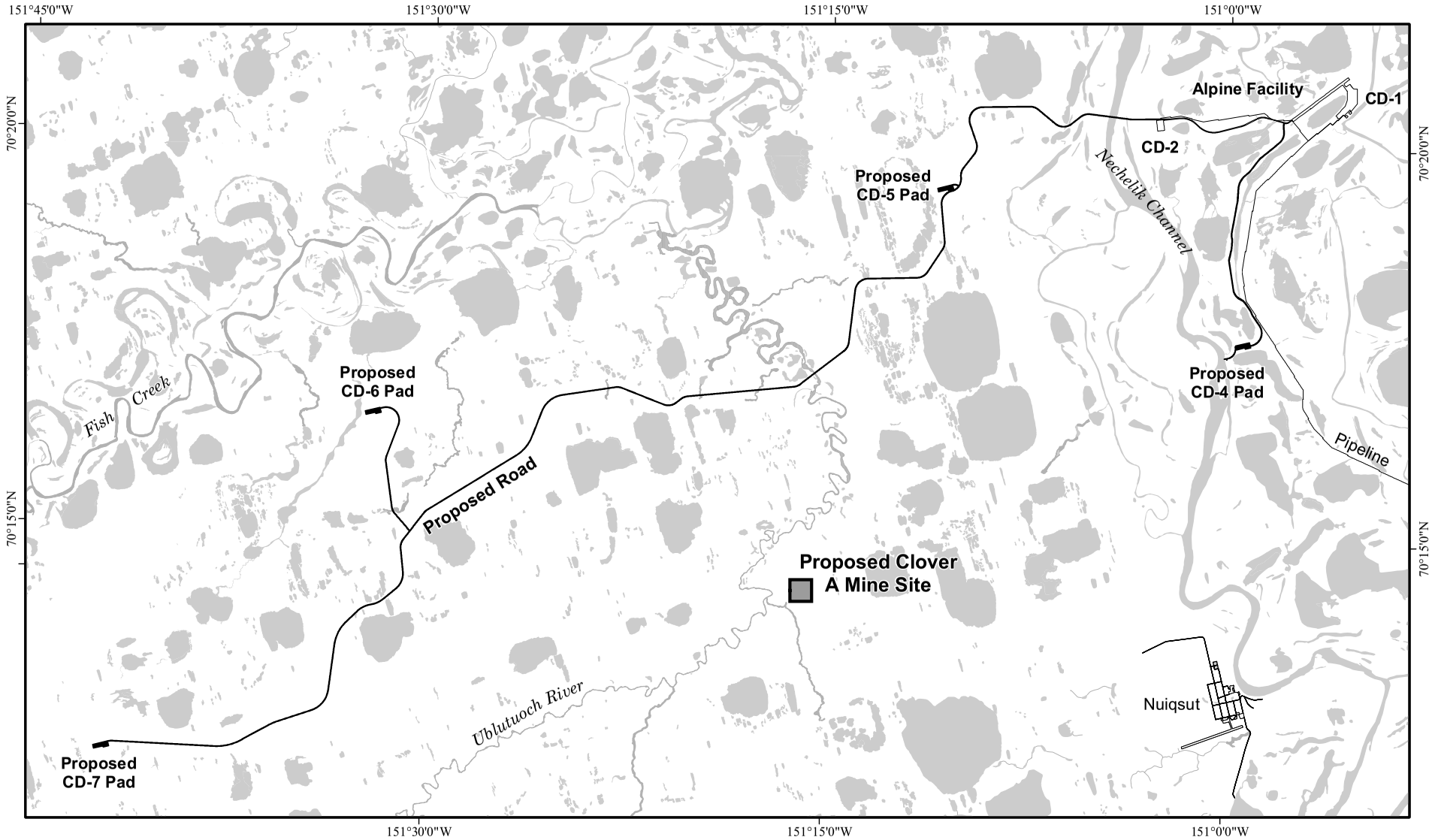


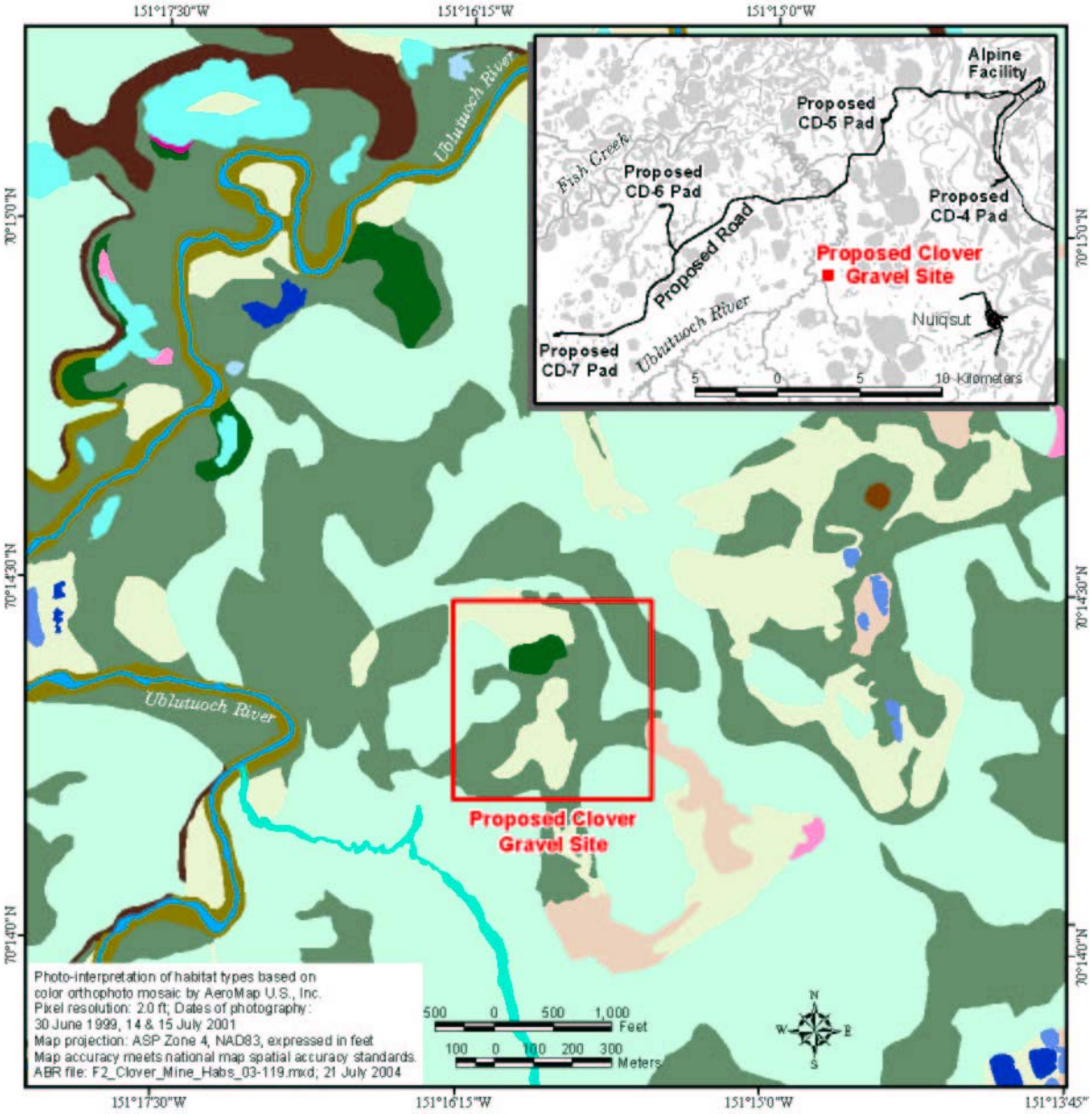
Figure 1.
Location of Proposed Clover A Mine Site, Alpine Satellite Development Project Area, Northern Alaska, 2004.

N W E S

1 0 1 2 Miles

1 0 1 2 3 Kilometers

Photo-interpretation of waterbodies based on color orthophoto mosaic by AeroMap U.S., Inc.; Pixel resolution: 2.0 ft;
Dates of photography: 30 June 1999 and 14 & 15 July 2001
Map accuracy meets national map spatial accuracy standards.
Projection: Alaska State Plane Zone 4 (units feet); Datum: NAD 83.
ABR file: F1_CloverA_Rehab_Loc_03-119.mxd; 9 June 2004



Wildlife Habitat Type

- Deep Open Water without Islands
- Deep Open Water with Islands or Polygonized Margins
- Shallow Open Water without Islands
- Shallow Open Water with Islands or Polygonized Margins
- River or Stream
- Aquatic Sedge Marsh
- Aquatic Grass Marsh
- Old Basin Wetland Complex
- Riverine Complex
- Nonpatterned Wet Meadow
- Patterned Wet Meadow
- Moist Sedge–Shrub Meadow
- Moist Tussock Tundra
- Riverine Low and Tall Shrub
- Upland and Riverine Dwarf Shrub
- Upland Low and Tall Shrub

Figure 2. Wildlife Habitats near the Proposed Clover Gravel Site, ASDP Area, Northern Alaska, 2004.

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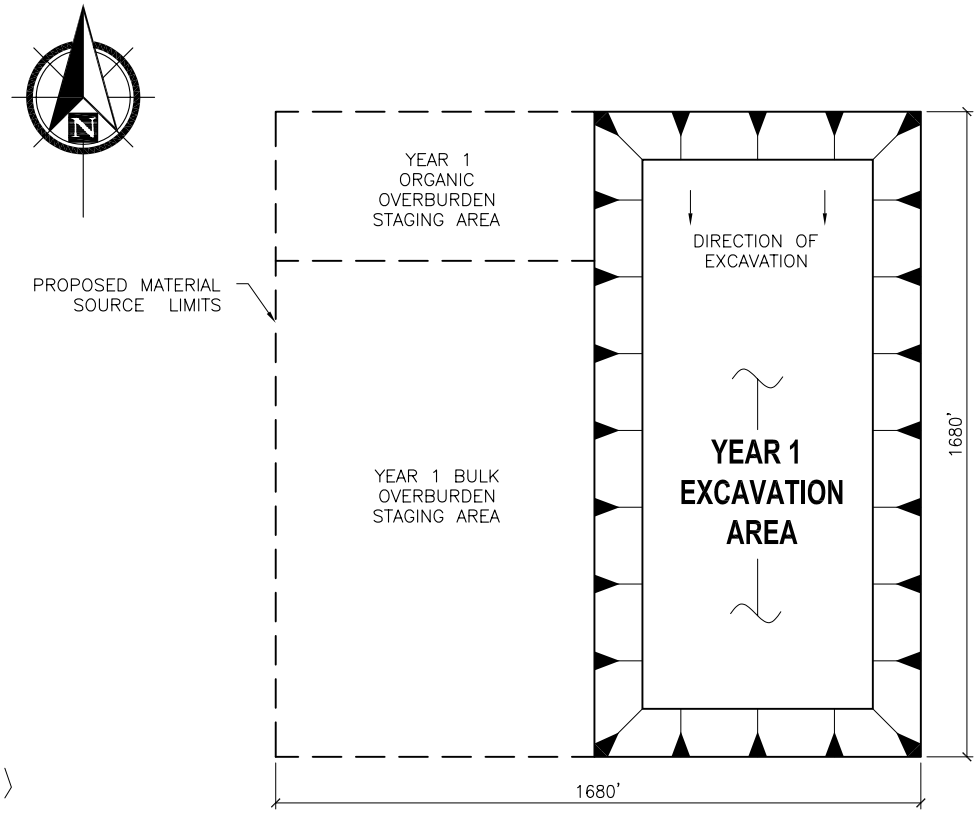
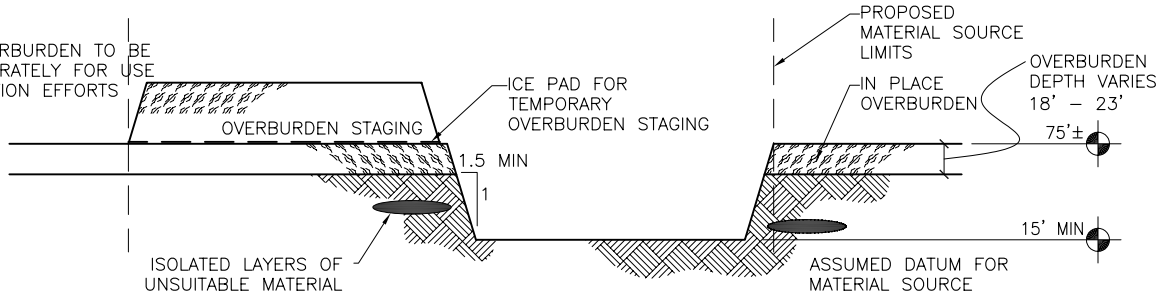


NOTES:
1. OVERBURDEN TO BE STAGED WITHIN MATERIAL SOURCE LIMITS FOR USE IN REMEDIATION OF MATERIAL SOURCE AREA UPON YEAR'S CLOSE OUT OF MATERIAL SOURCE.
2. ORGANIC OVERBURDEN TO BE STAGED SEPARATELY FOR USE IN REVEGETATION EFFORTS

PLAN



SECTION

PRELIMINARY
07-08-04

SCALE IN FEET
250 0 250 500 750

P N D Incorporated CONSULTING ENGINEERS

ConocoPhillips Alaska, Inc.

AREA: 00 MODULE: XXXX UNIT: R1

ALPINE SATELLITE DEVELOPMENT PROGRAM
CLOVER A GRAVEL SOURCE, DRAWING 1 OF 3
YEAR 1

CADD FILE NO.	DRAWING NO:	SHEET:	REV:
	CEA–R1XX–XXXX	062B OF 71	0

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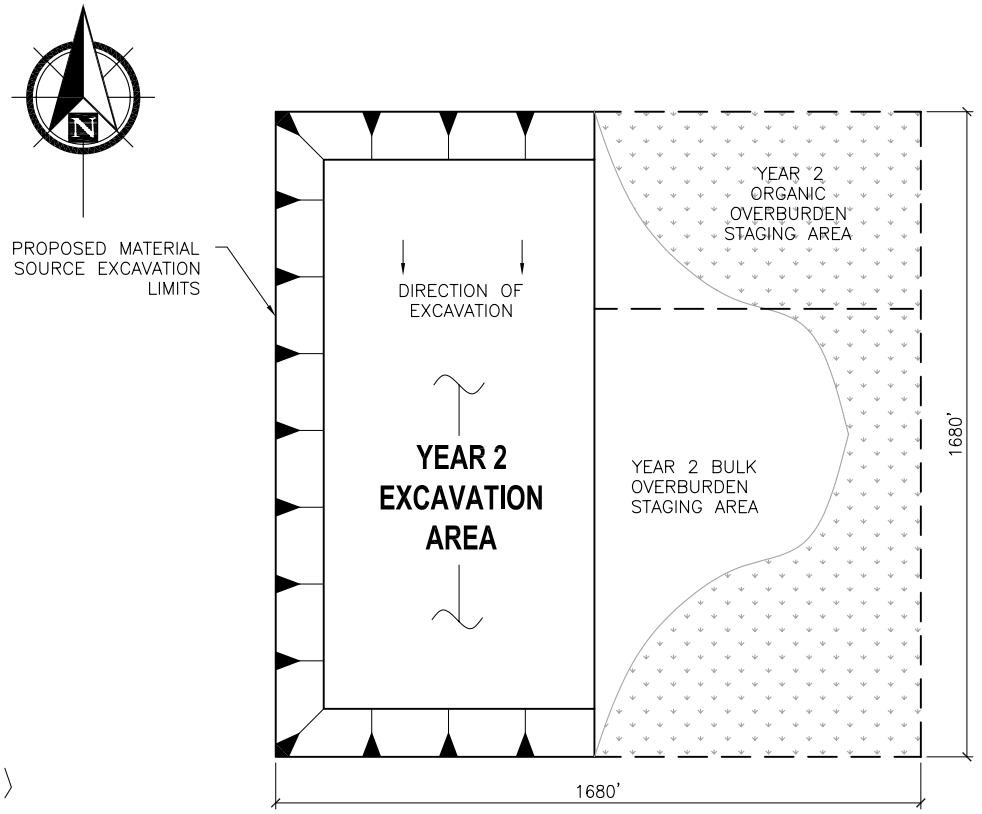
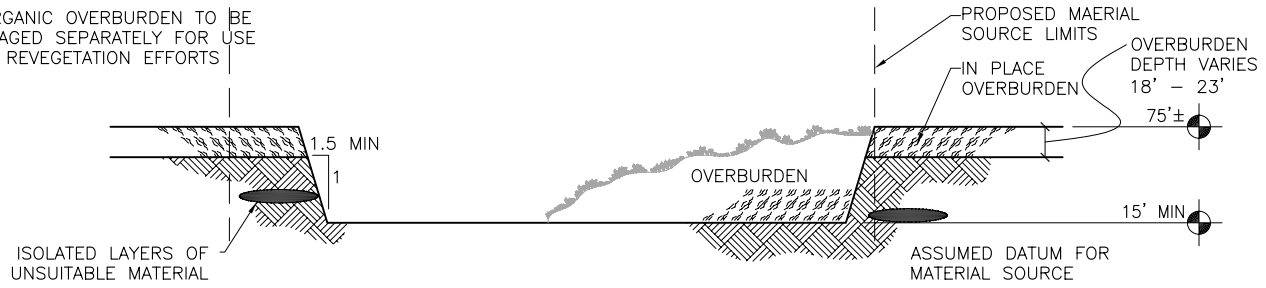


PLAN

NOTES:
1. OVERBURDEN TO BE PLACED IN REMEDIATION AREA UPON YEAR'S CLOSE OUT OF MATERIAL SOURCE.
2. ORGANIC OVERBURDEN TO BE STAGED SEPARATELY FOR USE IN REVEGETATION EFFORTS



SECTION

PRELIMINARY
07-08-04

SCALE IN FEET
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PND Incorporated CONSULTING ENGINEERS

ConocoPhillips Alaska, Inc.

AREA: 00 MODULE: XXXX UNIT: R1

ALPINE SATELLITE DEVELOPMENT PROGRAM
CLOVER A GRAVEL SOURCE, DRAWING 2 OF 3
YEAR 2

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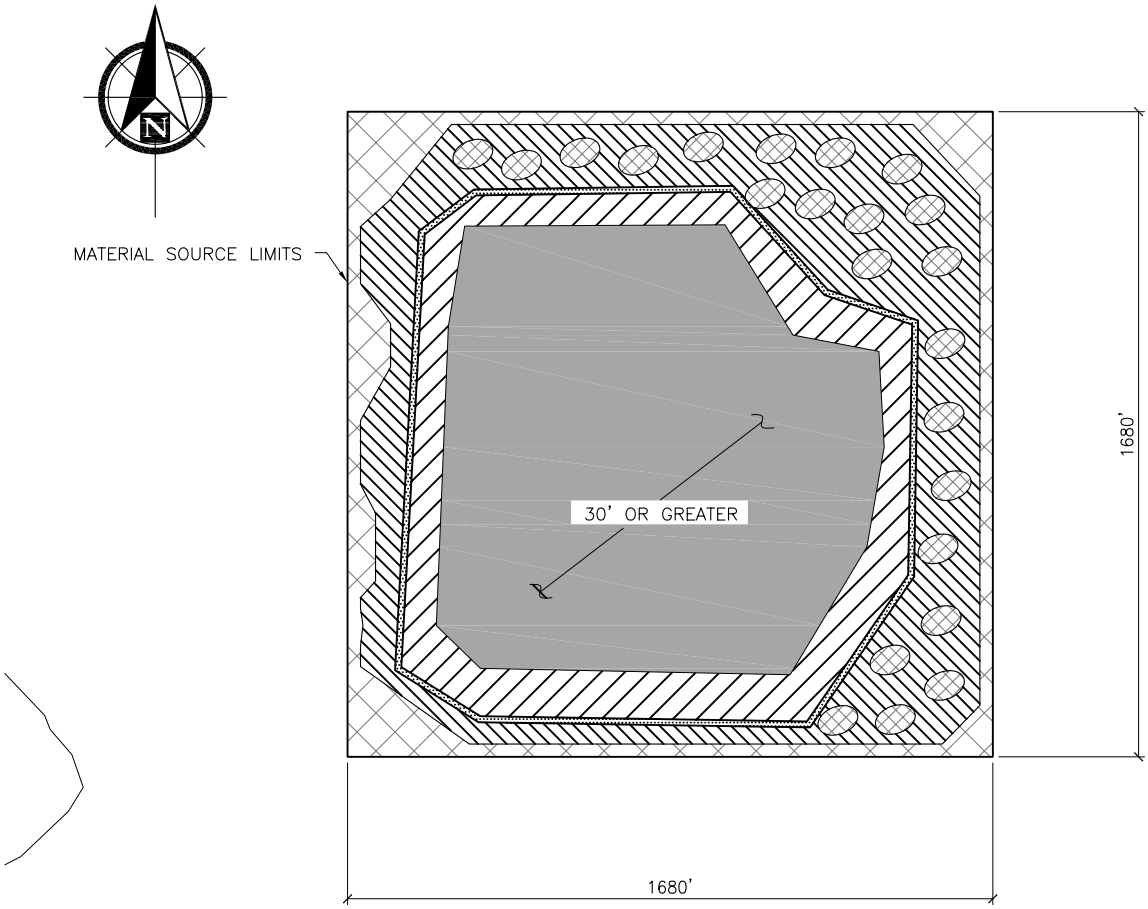

PLAN

LEGEND:

PROPOSED

- GROUND LEVEL 1–3' ABOVE TUNDRA
- 1' ABOVE TUNDRA TO WATERLINE
- WATERLINE TO 1.5' DEEP
- 1.5' TO 6' DEEP
- 6' DEEP TO 30' DEEP
- GREATER THAN 30' DEEP

REHABILITATION EFFORT IS INTENDED TO PROVIDE NESTING, FEEDING, AND RESTING HABITAT FOR WATER BIRDS.

ESTIMATED QUANTITIES

± 5% ISLAND HABITAT BY AREA
> 20% LITTORIAL HABITAT BY AREA

PRELIMINARY 7-8-04
TO BE FINALIZED UPON CLOSURE OF MATERIAL SOURCE

SCALE IN FEET
250 0 250 500 750

P N D Incorporated CONSULTING ENGINEERS

ConocoPhillips Alaska, Inc.

AREA: 00 MODULE: XXXX UNIT: R1

ALPINE SATELLITE DEVELOPMENT PROGRAM
CLOVER A GRAVEL SOURCE, DRAWING 3 OF 3
PRELIMINARY REHABILITATION PLAN

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