SPY HILL
AGGREGATE OPERATION

Application for Conservation and Reclamation Approval

Prepared for
Alberta Transportation
& Alberta Infrastructure

Prepared by
Brown and Associates Planning Group
& Russ Gerrish Consulting

December 2003

CONTENTS

ATTACHMENTS

PLAN DRAWINGS

1.0 Introduction

This document provides supporting information for Conservation and Reclamation Approval for an aggregate operation on lands located in the City of Calgary and legally described as Section 28 and Section 33, Township 25, Range 2, W5M. The titled area of the subject site includes 1,255 acres owned by the Province of Alberta and located adjacent to the northwest boundaries of the City. All lands within Sections 28 and 33 are owned by the Province with the exception of 14.4 acres owned by the City of Calgary for the Top Hill Water Reservoir.

Map 1: Existing Site Context describes existing site conditions, adjacent land uses and the total site area proposed for long-term, phased aggregate operations. The "long-term aggregate area" includes approximately 960 acres or six quarter sections located in Section 33 and the north half of Section 28.

Aggregates at the site will be used by Alberta Transportation and its contractors for public highway construction and rehabilitation projects throughout the Calgary region. In order to expedite depletion of the long-term aggregate resources within a timeframe of 40 to 50 years it is anticipated that Alberta Transportation will enter into short and long-term agreements from time to time with private and/or public contractors and partners that will recover aggregates for local industry and the general public.

A full package of background information and a description of the proposed Concept Plan for this aggregate operation is contained in the report entitled "Spy Hill Lands Development Project – Phase 1 Report", by Brown and Associates Planning Group and Russ Gerrish Consulting, February 2003.

2.0 Existing Site Conditions

2.1 Existing Land Use and Site Features

There are no permanent buildings within the application area. The University of Calgary historically leased these lands for extensive agricultural purposes associated with the University Research Centre located on the SE quarter of Section 28. These leases will expire in 2004 and are being renewed at the discretion of the Province of Alberta as interim uses within the aggregate application area or south of the aggregate application area.

The topography of the long-term site consists of rolling and undulating plains separated by a large ravine that drains to the northeast toward West Nose Creek. The majority of the rolling plains have been heavily grazed by cattle and

incorporate gentle slopes. The large ravine system contains sideslopes of 20 to 30 percent. The ravine is not permanently wet, but surface water and groundwater collects into ponds at the base of the ravine after significant precipitation events.

The two most ecologically significant habitats on long-term site are tall willows maintained by low volume groundwater on the north-facing slopes of the large ravine; and the willow-fescue groveland that occur in two relatively large patches in the eastern and northern portion of the property[1].

2.2 Aggregate Resources

The depth of overburden within the proposed mining area varies between 9.9 metres and 14.6 metres, with an average 13.2 metres of overburden. The depth of gravel extends an additional 16.1 to 22.7 metres below the overburden. The average depth of gravel is approximately 19.3 metres. The gravel to overburden ratio on the property ranges from 1.16:1 to 1.82:1, with an average of 1.46:1.

Extraction operations on the site will be quite deep, averaging 32 metres deep at the bottom of the gravel. Operations will need to stockpile or strip-and-place an average of 13 metres of overburden. A final grading plan and reclamation phasing plan will be used to minimize the expense of "double-handling" overburden during extraction and reclamation operations.

3.0 Aggregate Operations

3.1 Extraction Area and Setbacks

Map 2: Extraction Phasing illustrates the proposed limits of extraction and setbacks from the legal boundaries of the application area. Proposed extraction limits and setback areas for the long-term site include the following:

North
- 50 metre setback includes 20 metre high pressure gas line right-of-way, 20 metres for construction of an earth berm, and an existing poplar hedgerow. Construction of this berm should occur once the operation is ready to move into Phase 5 (see Map 2).

West
- A 60-100 metre setback will include an allowance for future road widening, and land for a 3 to 4 metre visual screening berm along the west side of the

[1] Biophysical Impact Assessment – Ecological Component Baseline, Spy Hill Lands. Prepared for Alberta Transportation by URSUS Ecosystem Management Ltd., October 2002.

operation. A meandering berm will be located along the west edge of the extraction area to provide visual screening, dust mitigation and noise mitigation. The berm will be planted with a mix of deciduous and evergreen material to provide a natural appearance when viewed from 101st Street. In response to input from nearby residents the berm will be extended through a low valley area located near the southwest corner of the application area. Drainage will be maintained by installing two culverts at the base of the berm.

East
- A 40-metre extraction setback at the corner of 85th Street and 144th Avenue NW will accommodate major road widening requirements and retention of an existing poplar hedgerow. A 25-metre setback adjacent to 85th Street NW will accommodate sufficient land for future road widening, a 2-3 metre berm and landscaping treatments such as driveway entry features.

South
- A 6 metre setback is proposed at the south limit of the application area. There is no public roadway at the south boundary and adjacent land uses are anticipated to be compatible with the aggregate operation. The 6 metre setback would contain a small ditch to intercept minor stormwater flows from the south.

3.2 Access Road

Truck traffic from the Spy Hill operation will access 85th Street at a location opposite the existing Provincial Young Offender's Centre driveway. This location provides good sight-lines and convenient access to operations in Phase 1 and 2 operations. This location meets City of Calgary intersection guidelines and is centrally located with respect to operations on the site during Phases 1 to 3.

A separate report by Finn Transportation Consultants[2] provides details of existing and future traffic levels on 85th Street. Alberta Transportation intends to provide a safe driveway intersection at 85th Street in accordance with the

[2] Spy Hill Lands Development Project Traffic Impact Study. Prepared for Alberta Transportation by Finn Transportation Consultants, August 7, 2003.

recommendations of the Finn report. Future aggregate and traffic volumes anticipated from the site will warrant construction of new acceleration and deceleration lanes to minimize conflict with through traffic on the roadway and provide safe truck turning movements.

3.3 Extraction Phasing and Timeframe

The following are key features of the Extraction and Phasing Plan as illustrated in Map 2.

- Scalehouse and plant areas will be established immediately south of the power transmission line and proposed driveway access. Phase 1 extraction will cover the northeast quarter of Section 28. Phase 2 extraction operations proceed west to incorporate the majority of the mining area in the northwest of Section 28, south of the existing drainage ravine. Together, Phase 1 and 2 extraction operations can proceed without needing to breach the power transmission line or the existing drainage ravine system.
- Longer term Phase 3 extraction operations will be located north of the Phase 1 area and north of the power line. This phase includes lands between the power transmission line and the existing ravine system. Phase 2 and Phase 3 are planned to extract gravel up to the south side of an existing drainage ravine system, while leaving a 20-metre undisturbed natural buffer area along the top of the drainage channel. This will prevent run-off from operations from entering the drainage course and will allow the existing natural drainage ravine to remain functional as long as possible.
- Phase 4 will occur on the west side of the property. Phase 4 will be the first phase to breach a natural drainage channel. Prior to mining through the channel, off-site drainage will be routed through a new channel on the Phase 1 and 2 reclaimed pit areas. Note that Phase 3 and Phase 4 could be interchanged if required to accommodate lowering of the power transmission line at an early date.
- Operations can proceed north of the power line and be connected to the initial driveway and operating areas via a deep cut driveway through the power transmission line easement. The easement can remain un-excavated until such time as relocation of the transmission towers is economical. Interim treatment of the power line easement will require some backsloping for safety reasons. Therefore temporary backsloping at the power line location at a slope of 2:1 will be appropriate. Once the ultimate urban development plan for Section 28 has been approved, the power transmission lines should be lowered to final grade level and aggregates extracted from the former easement.

- Final phases of the extraction operation will proceed from east to west within the northern portion of Section 33.

3.4 On-Site Equipment and Activities

The following activities are planned for the mining operation:

- Stripping will be carried out with conventional motor scrapers. Owing to the large volumes and long haul distances, the use of larger equipment will be most likely. The first phases of stripping will create all the berms along 101st Street and those along 85th Street south of the main ravine. Graders and dozers will also be used to grade the berms prior to landscaping. Once the desired berms have been constructed, additional topsoil and overburden from stripping operations will be placed into stockpile at a location that need not be disturbed for a number of years. The surfaces of these stockpiles will be rough graded to reduce the possibility of dust problems. The area around the stockpiles will be graded to direct surface runoff toward the gravel excavation.
- Crushers will first be set up on top of the stripped gravel, an average of 13 metres below the existing terrain. Aggregate stockpiles will initially be placed on top of the in situ gravel as well. Once an area of sufficient size (approximately 15 acres) has been depleted of gravel, crushing and stockpiling will move to the pit bottom, a further 19 metres lower in elevation. Crushing will typically follow the mining face as it travels in a generally east-to-west direction. Because of the depths involved, gravel will have to be mined in a series of three terraces. However, in so doing, this will facilitate material selection for the production of different aggregate products. With the high proportion of conglomerate in the pre-glacial gravel formation in this area, additional effort will be needed to excavate the gravel from the bank. Other operators in the area are employing methods ranging from large front-loading hydraulic shovels to blasting.
- Stockpiles and loading areas will generally be adjacent to the crushing operations. During the first few years, this will be toward the west side of the first area stripped. Once mining has progressed westward to the initial stockpile area, further stockpiling will take place on the pit bottom.
- Washing is not anticipated at this location unless a concrete plant is erected on site. If washing is undertaken, it will either use piped water from the city water system or a separate application for groundwater would be made. There is an existing city water supply line on 85th Street that currently serves the Provincial Jail property. Alberta Transportation intends to build a connection to this water supply line as a source of water for water trucks used in dust suppression operations on the site.

- The scalehouse and staging area for trucks will be near the main entrance off 85th Street. There will very likely be two truck scales, one either side of the scalehouse. This will give flexibility in using one scale for establishing tare weights for inbound trucks early in the day, and then switching traffic flow to act as an outbound scale to help handle the high volumes anticipated on occasion from this site. The other scale would probably be dedicated to outbound traffic. These scales will handle aggregate shipments only. A truck staging yard is anticipated to be built near the main entrance. This will be necessary to get the trucks off 85th Street and avoid interference with traffic on 84th Street should the scaling operations experience delays.
- An asphalt plant will be erected on the site from time to time. There may even be two plants on site occasionally. A concrete plant is likely to occupy the site periodically as well, as projects require it. The plants will first occupy areas prepared especially for them south of the main entrance adjacent to 85th Street. Stockpiles of aggregates for these plants will be hauled in from the main part of the operation by trucks and conveyors as appropriate. Once again, the sites will be graded and the surface drainage will be directed toward the gravel excavation. Approximately 10 years after operations have commenced, the plants will likely be moved to a site on the pit bottom.

3.5 Utility Servicing

Utility servicing will be provided initially that is flexible to accommodate mobile equipment of different contractors operating on the site. At such time as semi-permanent plant facilities are constructed at the site then more permanent servicing connections can be constructed.

- Sanitary sewer services for site employees will be collected in a holding tank or tanks near the central plant and scalehouse buildings. Sewage will be trucked out until such time as volumes or cost warrants installation of a tank and pump to connect to the existing private (Provincial) sewer line in 85th Street.
- Connection to local power lines on 85th Street will provide power for site buildings and on-site lighting. Power for industrial equipment may be provided by on-site power generating equipment. Where equipment can be established on a semi-permanent basis, then connection to the local power lines on 85th Street will be considered.
- Potable water for employee consumption will be provided by connection to an existing City of Calgary water line in 85th Street. This water supply

would also be used to supplement on-site ponding for purposes of dust control.

3.6 Hours of Operation

Market demand and typical operating practices will tend to limit night-time operations. Site operations will respect City of Calgary day-time and night-time noise bylaw requirements.

3.7 Noise Mitigation

Noise analysis undertaken by Patching Associates Acoustical Engineering Ltd.[3] identified conceptual worst-case (unmitigated) noise levels associated with simultaneous operation of a portable crusher plant, electrical power plant, a conveyor, front-end loaders, scrapers, haul truck traffic, an engine/water pump, an asphalt plant and a concrete plant. By using a range of appropriate noise control methods, the noise levels associated with a gravel operation are predicted to be maintained within City of Calgary noise bylaw requirements. Noise mitigation measures to be considered for use in the operation include the following:

- Enclosure or acoustical blanket on the crusher plant
- Explore the potential for using rubber liners at various transfer points to reduce impact noise
- Installing a berm
- Installing noise reducing accessories for equipment where available
- Placement of gravel stockpiles in strategic locations to provide a barrier effect to the receiver locations, and thereby also reducing noise levels
- Orientation of the equipment to direct noise away from the receptor location, thereby also reducing the noise level
- Locating noise sources at lower depths (bottom of excavation)
- Adding additional noise control to the electrical power plant enclosure
- Operator awareness when operating mobile equipment
- Limiting the duration of an activity in a particular location
- Keeping equipment maintained for peak efficiency and overall reduction of noise.

In addition, excavation operations will move from east to west toward the residences located west of 101st Street/Rocky Ridge Road. The excavation face itself will serve as an effective obstacle to noise transmission.

[3] Conceptual Noise Assessment for the Spy Hill Lands Development Project, Phase 1. Patching Associates Acoustical Engineering Ltd., February 24, 2003.

3.8 Dust Control and Dust Monitoring Program

Alberta Transportation is committed to maintaining good air quality and meeting environmental and regulatory guidelines with respect to acceptable ambient particulate concentrations (products of incomplete combustion and dust). The most significant source of dust to be controlled is from trucks traveling within the pit. Other sources of dust such as stockpiles and crushers tend to be of less importance due to encrustation, the inherent moisture of the material and blanketing effects.

The dust control program for the site will include the following priority initiatives:

- Paved driveways from 85th Street entry to plant circulation areas;
- Regular application of dust suppressants (water, petroleum resin) to unpaved site driveways;
- Watering and sweeping of paved driveway;
- Enclosure (blanketing or housing) around crushing operations.

Issues related to the cumulative impact of a number of different gravel operations throughout the Spy Hill area will need to be addressed through accurate monitoring of actual dust levels. As annual levels of extraction activity grow over time at the Alberta Transportation site, it is possible that overall levels of activity in the Spy Hill area will decrease as other sites become depleted. Since it is difficult to predict future operating levels for private operations throughout the area, Alberta Transportation intends to design and implement a monitoring program, in co-operation with regulatory agencies, to measure ambient air quality levels adjacent to its aggregate operation. Monitored data will be continuously evaluated to determine if the dust control program needs to be modified to ensure acceptable air quality is maintained in the near vicinity of the operation. Results of the air monitoring will be made available to the public and regulatory agencies, in a timely fashion throughout the life of the operation.

An “Air Quality Assessment” study for the proposed Spy Hill operation assessed particulate emissions related to a “peak conditions” operating scenario in 2022. Please refer to Section 5.4 (page 16) of this report for the executive summary of findings from the Air Quality Assessment.

3.9 Erosion and Sedimentation Control Plan

Topsoil of approximately 150 mm thick will be stripped from the area of the first operating phase and used to top dress the perimeter berms. Approximately 9 to 15 m of overburden will then be removed from the initial area of the pit to be mined and used to construct the perimeter berms. The volume of overburden,

including topsoil and browns in the initial mining area of Phase 1 is estimated at 750,000 m3. The surplus overburden material not required for berm construction will be stockpiled in the area shown on Map 2 and Map 3 as overburden storage. This area will also be used to separately stockpile topsoil and subsoils as well as overburden. Sufficient separation will be provided between the stockpiles to prevent mixing.

The berms will be constructed, landscaped with trees and seeded to grass prior to mining of gravel from the pit. When the gravel mining operation has advanced to a stage so that reclamation will not interfere with the mining operation, the overburden will be replaced in the mined area along with the topsoil. To complete restoration of the mined areas in the pit the topsoil will then be seeded with grass.

In keeping with Alberta Environment guidelines, three types of stockpiles for each area of the site will be created to ensure that material from each area is not mixed. One pile is for the first few centimeters of pure topsoil, the second pile is for subsoils (topsoil mixed with clay) and the third pile is for overburden. Once the gravel is removed from the pit area and the overburden replaced, subsoils will be replaced in each area, followed by the topsoil.

All sediment laden flows from Phase 1 and Phase 2 stockpiles will be directed into the pit where the runoff will collect in a pond at the northeast corner of Phase 1. Sediment laden flow within the pit will be collected in the operating pond at the northeast corner of Phase 1, contained within the pit, re-used as appropriate as a source of water within the operation, and ultimately filtered down into the base of the pit.

In Phase 2 the extraction operations will extend westward to within 20 m of the top of the slope of the drainage course that crosses Section 28. The 20 m undisturbed buffer strip will ensure sediment-laden flows are contained in the pit.

Sediment laden flows from the berms adjacent to public roadways will be controlled by silt fencing as shown in Map 3. A space of at least 2 metres should be left between the silt fence/property line and the toe of the berm. Along 85th Street the distance between the toe of the berm and the property line will be 6 metres due to the existing gas line easement. Where the berm ends in the vicinity of a drainage course, ravine silt fence will be installed as shown on Map 3 to prevent any sediment from flowing into the drainage course.

Wherever possible, all erosion and sediment control measures, such as silt fencing to define and protect natural drainage ravines, will be installed prior to

proceeding with any stripping and excavation. The silt fencing for the berms will be maintained until the grass on the berms is established

3.10 Site Security and Fencing

Permanent fencing will be provided around the south, west and east sides of the Phase 1 and 2 application area. Additional temporary fencing will be provided along the north boundary of the Phase 1 and Phase 2 area. This temporary fencing will help define the 20-metre setback from the top of the drainage channel and the power transmission line easement in order to prevent any intrusions into these areas during operations. Temporary fencing will ultimately be relocated or replaced to allow operations to proceed into Phase 3 and Phase 4.

4.0 Reclamation Plan

4.1 End Land Use

The Calgary Plan Municipal Development Plan identifies the subject lands as appropriate for future, urban "Industrial" land uses. In addition,
The Employment Centres Strategy, approved by Calgary Council in 1999, recommends future development of an "Employment Area" on the subject land.

Aggregate extraction and reclamation plans have been designed with the intent of accommodating and facilitating ultimate urban surface development of the subject site. These plans are described in detail in the Phase 1 report[4]. Once extraction and reclamation operations are completed in the north half of Section 28 and the Phase 3 portion of Section 33, it would be appropriate to commence urban development on these reclaimed lands where appropriate infrastructure connections are available. The Phase 3 lands north of the power transmission line will create the "site low" grades for future urban sewer connections. Urban development on the north half of Section 28 may occur while aggregate operations are ongoing in Section 33 north of the power transmission line. In this case, appropriate arrangements for construction of the realigned 85th Street and driveway access to this new 85th Street alignment would need to be determined.

4.2 Final Grades

Final site grades are illustrated in Map 3: Cross Sections and Map 4: Final Grade Plan. The final grade plan has been designed to reconstruct the existing pre-extraction drainage catchment areas and channel alignments.

[4] Spy Hill Lands Development Project – Phase 1 Report", by Brown and Associates Planning Group and Russ Gerrish Consulting, February 2003.

The final grade plan for the site will drain the property toward a location adjacent to the existing natural low area at the existing ravine and 85th Street. The entire mining area will be graded to drain toward this low area adjacent to 85th Street. The final grading plan will allow ultimate urban storm water runoff to be routed to the low point of the site and then through the natural ravine on the east side of 85th Street (Lafarge property). Ultimate urban sanitary storm trunks will be extended to connect to the future trunk system located to the east of the site.

All permanent backslopes will be provided with 3:1 grades. The base of the pit will be graded toward the existing site low area where the major ravine crosses 85th Street.

Reclamation of the Phase 4 and Phase 5 areas will provide a final constructed drainage channel in approximately the same location and alignment as the existing ravine.

4.3 Planting Plan

Map 4 illustrates the proposed Reclamation Planting Concept Plan. The majority of the subject site's reclaimed base and backslopes will be planted with an appropriate grass seed mix such as slender and/or awned wheatgrass pending future urban development. In addition certain environmentally significant features associated with the existing site will be replaced. Permanent natural areas to be created through the reclamation process include:

a) A Constructed Wetland Drainage System, and
b) Revegetated North-Facing Backslopes.

Constructed Wetland Drainage System

The final grade plan will result in a natural low point near the ravine crossing at 85th Street. In this vicinity (and upstream) a constructed drainage course with pockets of wetland will be located along an alignment similar to the existing, pre-extraction drainage course alignment. The purpose of this wetland/drainage feature would be to replace existing drainage channels and wildlife habitat. Wetlands provide habitat for a disproportionately high number of wildlife species (including species at risk) and are in short supply in the Calgary region.

Wetland habitat in the existing ravine is limited to wet [graminoid] meadow dominated by hairgrass, sedges and rushes. An attempt should be made to restore aspects of this plant community around the fringe of constructed marshes. Wet meadows are dominated by low to intermediate grasses, sedges and herbs. Characteristic species suitable for planting include *Poa palustris, Calamagrostis Canadensis, Hordeum jubatum, Carex spp., Juncus balticus,*

Rumex maratimus, Salix petiolaris and *Mentha arvensis*. Surface water in wet meadows should persist temporarily in spring and early summer or after heavy rains. Potential marsh plant species include *Scirpus lacustris, Scirpus maritimus, Typha latifolia, Phragmites australis, Potamogeton pusillus, Drepanocladus spp., and Ceratophyllum demersum.* Consideration may also be given to the planting of woody riparian trees (balsam poplar) and shrubs (Bebb's willow, red osier dogwood) around the fringes of the wetland on sloped areas. This would provide additional vertical structure for perching birds and would enhance wildlife species diversity.

Revegetated North-Facing Backslopes.

Environmental specialists retained by Alberta Transportation have recommended replacement of vegetation currently associated with the existing north-facing ravine slopes. This approach to reclamation planting has also been supported by the City of Calgary Parks Department. Therefore, the 3:1 north-facing backslopes at the south end of the property will be planted with a moist tall willow community. Environmental specialists have recommended the following species as appropriate for this area. The plantings will therefore include selection of the following plants. Shrub species could include Scouler's willow (*Salix scouleriana*), smooth/beaked Willow (*Salix glauca/bebbiana*), and shrubby cinquefoil (*Potentilla fruticosa*). Forb species that should be considered are northern bedstraw (Galium boreale), veiny meadow rue (*Thalictrum venulosum*), western Canada violet (*Viola canadensis*), bunchberry (*Cornus canadensis*), smooth aster (*Aster laevis*), smooth fleabane (*Erigeron glabellus*), Canada goldenrod (*Solidago canadensis*), common yarrow (*Achillea millifolium*) and leafy arnica (*Arnica chamissonis*). Suitable graminoid species for planting include hairy wild rye (*Elymus innovatus*), bluejoint (*Calamagrostis canadensis*), fringed brome (*Bromus ciliatus*), and Kentucky bluegrass (*Poa pratensis*).

5.0 Other Supporting Information

5.1 Historical Resources Impact Assessment

A Historical Resource Impact Assessment (HRIA) was undertaken by Lifeways of Canada Limited in July 2003 to assess the potential for items of historical interest within the proposed Phase 1 and Phase 2 areas of the gravel operation (north half of Section 28).

Field studies of the area were carried out over a two day period in the spring of 2003. Subsequently an extensive backhoe testing program was carried out to

test high potential areas and to identify and examine deeper sediments. No archaeological sites were noted during the course of this HRIA. Lifeways recommended that no further archaeological studies be undertaken for these lands and that Alberta Community Development issue development clearance for Phases 1 and 2 of the proposed development. The report is currently being reviewed by Alberta Culture.

5.2 Species at Risk Baseline Study

Purpose and Method

Ursus Ecosystem Management Ltd. (URSUS) undertook the following surveys during the spring, summer and fall of 2003 to verify the presence/absence and abundance of potential wildlife and plant species at risk on the Spy Hill lands[5].

- Songbird call survey – June 2003
- Rare plant survey – June and July 2003
- Transect survey for badger – August 2003
- Nocturnal amphibian survey – May and June 2003

Findings and Conclusions

- No COSEWIC[6] (2003) listed plant or vertebrate species were found in the study area.
- Overall, there is a scarcity of plant "species at risk"[7]** and their habitats within the study area. One provincially rare species (stiff yellow paintbrush) has been identified. While a number of stiff yellow paintbrush (*Castilleja lutescens*) populations will be removed by gravel operations, the largest concentration of these plants is located outside the proposed mining limits in SW 28 and will not be affected by gravel operations.
- A rare high quality fescue grassland community is located in the southwest corner of the study area (SW 28). This grassland is not located within the proposed extraction development area and will not be affected by the proposed operation. The grassland can be

[5] This section paraphrased from "Species At Risk Survey – Spy Hill Lands", prepared for Alberta Transportation by URSUS Ecosystems Ltd., September 2003.

[6] COSEWIC (2003) – Committee on the Status of Endangered Wildlife in Canada.

[7] "Species at risk" in this context refers to any species listed either federally (COSEWIC 2003) or provincially (AEP 2000 & 2001). COSEWIC designates federally listed species as Endangered, Threatened, Special Concern, Not at Risk, or Indeterminate. Alberta Environmental Protection (AEP) designates provincially listed species as At Risk, May Be At Risk, and Sensitive. Swainson's Hawk is designated Sensitive (AEP) and not listed (COSEWIC). Badgers are designated Sensitive (AEP) and Not At Risk (COSEWIC).

protected by leaving the area ungrazed and not removing the native prairie cover.

- Two vertebrate "species at risk" were detected during field surveys: Swainson's Hawk and Badger. Their occurrence can be maintained after reclamation if grassland habitat and ground squirrel populations persist. Swainson's Hawk also requires trees or tall shrubs as nesting substrate.
- Although not detected during the surveys, there are two additional "species at risk" that are likely to occur within the study area: long-tailed weasel and garter snakes. The presence of these "species at risk" can be maintained after reclamation if sufficient habitat with a mixture of hiding cover and moist grasslands are fostered. Any garter snake hibernacula encountered during excavation should be reported to the regulatory authority for assessment and appropriate mitigation.

5.3 Groundwater Study

Purpose and Method

EBA Engineering Consultants Ltd. (EBA) conducted a hydrogeological assessment[8] of the proposed gravel mining operation to determine whether the project could present any risk to the existing water wells in the vicinity of the mining operation, and to determine if the mining could affect the surface water bodies west of the site.

EBA reviewed available hydrogeologic reports and water well databases, conducted site visits to existing gravel operations in the area and prepared a "water balance" for the site under pre-development and development conditions to identify possible changes to groundwater recharge attributable to the gravel operation.

Findings and Conclusions

- Two distinct water-bearing units (i.e., aquifers) have been identified using information in the water well database, and various literary sources. They consist of a Tertiary gravel unit and the bedrock Paskapoo formation. The proposed Spy Hill aggregate operation will extract gravels from the Tertiary gravel unit.
- The Tertiary gravels at the Spy Hill subject site appear to be unsaturated. Therefore, the extraction of the gravel should have a minimal impact on

[8] Spy Hill Provincial Aggregate Operation Hydrogeological Assessment. Prepared for Alberta Transportation by EBA Engineering Consultants Ltd., October 2003.

portions of the gravel unit that do contain water. Within the local watershed, the Tertiary gravel unit makes up an intermittent and largely unused aquifer. Only 10 of 722 water wells in the watershed were completed in the gravel. Therefore, the extraction of the gravel should have a minimal impact on portions of the gravel unit that do contain water.

- Extraction of the gravel is anticipated to minimally increase recharge to the underlying Paskapoo Aquifer.
- Surface water bodies to the west of the subject site are ponded on low permeability surface soils and therefore, should not be affected by the gravel extraction operation.
- To the northeast, groundwater discharge to West Nose Creek should not be reduced as a result of the gravel extraction. Recharge to any saturated (wet) portions of the gravel (and hence potential discharge to West Nose Creek) should not be affected. Recharge to the deeper bedrock (Paskapoo) aquifer should increase (i.e., there should be no negative impact on that aquifer).
- There is no apparent potential for an impact on domestic groundwater supplies resulting from the gravel extraction.

5.4 Air Quality Assessment

DM Leahey & Associates Limited and Jacques Whitford prepared an Air Quality Assessment study[9] for the proposed aggregate operation. The following text is taken directly from the Executive Summary of this study.

"Operations involved in the excavation, processing and marketing of the sand and gravel will result in emissions of particulate matter. Dust comprised of fine particles with diameters of less then 2.5 µm ($PM_{2.5}$), particles with diameters of less than 10 µm (PM_{10}), and total suspended particulates (TSP) will be generated through the removal/ replacement of soil and overburden, stockpiling, material handling, and truck traffic on paved and unpaved roads. Operations of diesel engines and diesel trucks associated with excavation and processing operations will also result in emissions of $PM_{2.5}$. Asphalt plant stack emissions will be an additional source of $PM_{2.5}$.

Maximum acceptable ambient ground-level concentrations of TSP are governed by Alberta's Ambient Air Quality Guidelines. There is a Canadian Wide Standard (CWS) pertaining to the 98th percentile daily average concentration of $PM_{2.5}$.

[9] An Air Quality Assessment of Alberta Transportation's Proposed Spy Hill Sand and Gravel Operations. Prepared for Alberta Transportation by DM Leahey & Associates Limited and Jacques Whitford, October 8, 2003.

There are no ambient air quality Canadian or provincial guidelines relating to PM_{10}. The United States however has ambient air quality standards for this air pollutant.

Particulate emissions relating to the 2022 operating scenario were assessed in this report to determine the acceptability of air quality impacts from the proposed sand and gravel operations. This annual operating scenario was selected for evaluation because it includes the highest anticipated annual emissions for about the next 20 years and also includes the closest anticipated location of the gravel pit to residential areas.

AT is proposing a program of applying dust suppressants (i.e. water, oil) to the unpaved roads and of watering and sweeping for the paved roads associated with its operations. Moisture levels of excavated materials will be maintained at minimum levels of 3 percent. Dust emissions from the paved and unpaved roads and other potential sources (e.g. topsoil/overburden removal and replacement, stock pile handling, conveyors) were estimated from equations obtained from studies conducted in the United States. All other potential sources of dust (*e.g.* crushers, screens, wind erosion) should be negligible because of the nature of the excavated material (i.e. wetness, size, encrustation) and blanketing effects. Emission estimates for the $PM_{2.5}$ associated with diesel engines (*e.g.* pumps, generators, loaders, scrapers, trucks) and Asphalt Plant operations were obtained either from data supplied by manufacturers or from the United States Environmental Protection Agency (USEPA).

Calculations were performed to assess the air quality impact of particulate matter emissions ($PM_{2.5}$, PM_{10}, and TSP) from all potential sources associated with AT's proposed sand and gravel operations through the use of the ISCPRIME dispersion model. This model, developed by the USEPA and accepted by Alberta Environment, allows for the air quality assessment of air emissions from pit and road sources associated with the proposed gravel mine. Meteorological data relating to wind, cloud and temperature, as obtained from the nearby Calgary International Airport were used for plume dispersion calculations. Wind information was modified to allow for effects on air flows of local terrain. Data relating to atmospheric mixing depths was derived from an Environment Canada upper air station at Stony Plain which is located about 260 km north of the proposed gravel pit.

Results of plume dispersion calculations showed that maximum ground-level particulate concentrations were not sensitive to assumed wind rose information. The highest predicted particulate concentrations occurred during the summer production period. All 98 percentile daily average values for fine particulate matter, $PM_{2.5,}$ predicted for areas outside the Gravel Pit, were much less than the

Canadian Wide Standard. This was especially true for the residential communities of Royal Oak and Rocky Ridge. All daily and annual average concentrations of PM_{10}, as predicted for the environs of the Gravel Pit, were also less than relevant USEPA standards.

Maximum daily average ground-level concentrations of TSP were predicted to exceed Alberta Environment Guidelines in the near vicinity of the proposed gravel pit. Predicted exceedances usually occurred with an annual frequency of only about once or twice a year. This is a small level of exceedances compared to the fact that these guidelines are exceeded in all major urban areas of Canada about 10 percent of the time. All predicted concentrations of TSP were also much less than Canada's acceptable National Air Quality Objective of 400 μgm^{-3}. They should therefore not have adverse environmental implications.

It was concluded that particulate air emissions associated with dust generation and diesel exhausts from activities at AT's proposed sand and gravel operations should have no adverse effects on the environment. This conclusion with respect to fine particulates ($PM_{2.5}$) is consistent with results of observational studies conducted at a typical stone crushing plant in the United States."

5.5 Public Consultation and Communication

This conservation and reclamation application has been prepared in consultation with industry stakeholders, the general public, and residents of communities adjacent to the subject site. Consultation and communication has occurred continuously throughout the planning and design stages of this project to date. Results of the Phase 1 stakeholder consultation program have been summarized in the "Spy Hill Lands Development Project – Phase 1 Report", by Brown and Associates Planning Group and Russ Gerrish Consulting, February 2003. During the early stages of conceptual planning Brown and Associates consulted directly with stakeholders including

- Existing Spy Hill area aggregate operators
- Major corporate aggregate consumers
- The City of Calgary and the MD of Rocky View
- The University of Calgary (leaseholder)
- Nearby landowners and residents via open house meetings and community meetings.

Through these initial interviews, Brown and Associates compiled a mailing list of stakeholders that has been updated continuously.

The Brown and Associates/Russ Gerrish Consulting team has hosted three open house meetings.

1. A preliminary public open house meeting was held at the Rocky Ridge Community Centre on December 3rd 2002. The purpose of this open house was to advise the general public, neighbours and industry stakeholders about the land use concept and obtain input about specific concerns to be addressed in the design stages.

2. A second public open house meeting was held at the Rocky Ridge Community Centre on May 22, 2003. The purpose of this meeting was to display a draft aggregate plan for discussion, comments and feedback. In response to feedback obtained at this open house, additional meetings were held with specific residents and additional technical studies were commissioned. A number of changes were also incorporated into the final plan.

3. A third public open house meeting was held at the Rocky Ridge Community Centre on October 21, 2003. The purpose of this open house was to display the results of technical studies, to display the final development plans, and to identify any remaining concerns prior to filing an application with Alberta Environment.

Input received from stakeholder interviews is summarized in the Phase 1 report.

Displays from each open house have been posted on the Alberta Transportation web-site for review by the public.

Details about each open house meeting, advertising for each meeting, comments received, and questions/answers from discussion sessions at the public meetings are summarized in a separate report by Brown and Associates Planning Group (November 2003).

ATTACHMENT 1:

LIST OF TECHNICAL AND SUPPORTING INFORMATION REPORTS

DM Leahey and Associates Limited and Jacques Whitford Environment Limited, October 2003. An Air Quality Assessment of Alberta Transportation's Proposed Spy Hill Sand and Gravel Operation.

Ursus Ecosystem Management Ltd, October 2002. Biophysical Impact Assessment Ecological Component Baseline – Spy Hill Lands.

Ursus Ecosystem Management Ltd., October 2003. Species at Risk Survey - Spy Hill Lands.

Brown and Associates Planning Group and Russ Gerrish Consulting, February 2003. Spy Hill Lands Development Project: Phase 1 Report.

Brown and Associates Planning Group, November 2003. Summary of Public Meetings: Spy Hill Lands Development Project.

EBA Engineering Consultants Ltd., October 2003. Spy Hill Provincial Aggregate Operation Hydrogeological Assessment 33-025-2 W5M.

Lifeways of Canada Limited, July 2003. Historical Resource Impact Assessment - Alberta Transportation/Alberta Infrastructure Spy Hill Aggregate Mine (Sections 28 and 33-25-2-W5M).

D.A. Watt Consulting Group Ltd., October 2002. Spy Hill Lands Development Project Servicing Study.

D.A. Watt Consulting Group Ltd., March 2003. Erosion and Sediment Control Report for Spy Hill Aggregate Operations.

Finn Transportation Consultants, August 7, 2003. Spy Hill Lands Development Project Traffic Impact Study.

Patching Associates Acoustical Engineering Ltd., February 2003. Conceptual Noise Assessment for the Spy Hill Lands Development Project Phase 1.

ATTACHMENT 2:
DRILL HOLE DATA

ALBERTA TRANSPORTATION GRAVEL PIT - TEST HOLES

SECTIONS 28 & 33 in 25 - 2 - W5th

STRIPPING LOSS = 0 m

PIT FLOOR LOSS = 0 m

TH #	NORTH	EAST	Topsoil GROSS (m)	SiC GROSS (m)	GSiC GROSS (m)	Total OB GROSS (m)	Gravel GROSS (m)	BOTTOM	COMMENTS	TOG ELEV (m)	BOG ELEV (m)	GND ELEV (m)	IF H_20 ELEV (m)
28NW05	5670109	-16334	0.2	2.8	10.7	**13.7**	15.8	SiC	B	**1259.5**	-1243.7	1273.2	**1245.8**
28NE01	5670227	-14865	0.1	15.1	0.0	**15.2**	29.6	BR	Bottom	**1252.5**	1222.9	1267.7	
28NE10	5669926	-14873	0.1	9.0	2.5	**11.6**	31.7	BR	Bottom	**1253.6**	1221.9	1265.2	
28NE11	5669904	-15174	0.1	9.0	1.3	**10.4**	27.3	C	Bottom	**1253.7**	1226.4	1264.1	
28NE12	5669861	-15537	0.1	9.0	5.5	**14.6**	26.8	C	Bottom	**1256.3**	1229.5	1270.9	
28NE17	5669613	-14867	0.1	9.0	4.6	**13.7**	26.5	C	Bottom	**1250.9**	1224.4	1264.6	
28NE19	5669603	-15175	0.1	9.0	5.2	**14.3**	23.5	C	Bottom	**1253.7**	1230.2	1268.0	
28NE21	5669615	-15482	0.1	0.0	12.7	**12.8**	30.8	BR	Bottom	**1255.9**	1225.1	1268.7	
28NW01	5670230	-15670	0.1	1.3	7.4	**8.8**	28.2	BR	Bottom	**1257.4**	1229.2	1266.2	
28NW11	5669907	-15978	0.2	0.0	13.3	**13.5**	25.2	BR	Bottom	**1257.7**	1232.5	1271.2	
33NE01	5671814	-14872	0.1	5.3	0.0	**5.4**	18.1	BR	Bottom	**1248.8**	1230.7	1254.2	
33NE03	5671814	-15068	0.1	6.9	0.0	**7.0**	19.5	**BR & W**	Bottom	**1250.8**	1231.3	1257.8	**1231.3**
33NE15	5671612	-14880	0.1	2.3	0.0	**2.4**	20.1	BR	Bottom	**1250.3**	1230.2	1252.7	
33NE17	5671613	-15068	0.1	7.2	0.0	**7.3**	20.7	BR	Bottom	**1250.2**	1229.5	1257.5	
33NE29	5671411	-14873	0.1	6.2	0.0	**6.3**	15.7	BR	Bottom	**1245.4**	1229.7	1251.7	
33NE31	5671423	-15076	0.8	8.4	0.0	**9.2**	12.8	BR	Bottom	**1244.3**	1231.5	1253.5	
33SE01	5671009	-14903	0.0	9.7	1.9	**11.6**	13.4	BR	Bottom	**1240.8**	1227.4	1252.4	
33SW03	5671013	-15967	0.3	13.1	2.4	**15.8**	17.7	SS	Bottom	**1246.5**	1228.8	1262.3	
33SW05	5671036	-16268	0.3	5.8	2.7	**8.8**	29.7	**C & W**	Bottom	**1257.3**	1227.6	1266.1	**1227.6**
33SW10	5670733	-15673	0.1	10.8	1.8	**12.7**	26.3	C	Bottom	**1252.1**	1225.8	1264.8	
28NE02	5670216	-15068	0.2	10.5	4.5	**15.2**		G	More G below	**1253.2**		1268.4	
28NE03	5670261	-15172	0.3	8.8	4.6	**13.7**	18.3	G	More G below	**1254.2**	-1235.9	1267.9	
28NE04	5670195	-15270	0.3	8.8	4.6	**13.7**		G	More G below	**1254.5**		1268.2	
28NE05	5670106	-15529	0.2	12.0	2.4	**14.6**	20.8	G	More G below	**1255.0**	-1234.2	1269.6	
28NE06	5669972	-15523	0.3	11.9	7.3	**19.5**		G	More G below	**1250.8**		1270.3	
28NE07	5670005	-15271	0.2	8.9	4.9	**14.0**		G	More G below	**1252.3**		1266.3	
28NE08	5670004	-15075	0.1	12.1	2.4	**14.6**		G	More G below	**1250.0**		1264.6	
28NE09	5670026	-14873	0.1	9.0	5.2	**14.3**		G	More G below	**1251.7**		1266.0	
28NE13	5669760	-15489	0.1	12.1	3.0	**15.2**		G	More G below	**1256.3**		1271.5	
28NE14	5669827	-15272	0.1	9.0	3.1	**12.2**		G	More G below	**1254.8**		1267.0	
28NE15	5669826	-15076	0.6	11.6	3.0	**15.2**		G	More G below	**1250.8**		1266.0	
28NE16	5669825	-14880	0.1	12.1	3.6	**15.8**		G	More G below	**1248.2**		1264.0	

ALBERTA TRANSPORTATION GRAVEL PIT - TEST HOLES

SECTIONS 28 & 33 in 25 - 2 - W5th

STRIPPING LOSS = 0 m

PIT FLOOR LOSS = 0 m

TH #	NORTH	EAST	Topsoil GROSS (m)	SiC GROSS (m)	GSiC GROSS (m)	Total OB GROSS (m)	Gravel GROSS (m)	BOTTOM	COMMENTS	TOG ELEV (m)	BOG ELEV (m)	GND ELEV (m)	IF H_20 ELEV (m)
28NE18	5669603	-15077	0.1	12.1	2.4	**14.6**		G	More G below	**1254.0**		1268.6	
28NE20	5669615	-15279	0.1	16.7	0.0	**16.8**		G	More G below	**1252.0**		1268.8	
28NW02	5670219	-15872	0.1	9.7	2.7	**12.5**		G	More G below	**1246.0**		1258.5	
28NW03	5670264	-15977	0.1	8.7	1.6	**10.4**	20.6	G	More G below	**1253.9**	-1233.3	1264.3	
28NW04	5670198	-16075	0.1	0.0	14.5	**14.6**		G	More G below	**1243.1**		1257.7	
28NW06	5669975	-16327	0.1	3.9	9.6	**13.6**		G	More G below	**1257.7**		1271.3	
28NW07	5670008	-16076	0.1	9.0	2.8	**11.9**		G	More G below	**1257.4**		1269.3	
28NW08	5670007	-15880	1.5	9.2	2.1	**12.8**		G	More G below	**1253.2**		1266.0	
28NW09	5670029	-15677	0.1	10.9	2.8	**13.8**		G	More G below	**1254.6**		1268.4	
28NW10	5669928	-15678	0.1	0.0	13.4	**13.5**	18.0	G	More G below	**1256.0**	-1238.0	1269.5	
28NW12	5669864	-16342	0.1	0.0	15.1	**15.2**		G	More G below	**1256.7**		1271.9	
28NW13	5669763	-16293	0.1	3.0	12.8	**15.9**		G	More G below	**1260.6**		1276.5	
28NW14	5669829	-16076	0.1	13.7	2.1	**15.9**		G	More G below	**1259.1**		1275.0	
28NW15	5669829	-15881	0.1	16.7	0.0	**16.8**		G	More G below	**1257.2**		1274.0	
28NW16	5669828	-15685	0.1	15.1	4.0	**19.2**		G	More G below	**1255.6**		1274.8	
28NW17	5669616	-15672	0.1	6.4	9.0	**15.5**	13.2	G	More G below	**1257.2**	-1244.0	1272.7	
28NW18	5669606	-15882	0.1	0.0	11.2	**11.3**		G	More G below	**1259.9**		1271.2	
28NW19	5669606	-15979	0.1	0.0	12.7	**12.8**	22.4	G	More G below	**1259.2**	-1236.8	1272.0	
28NW20	5669617	-16084	0.1	8.5	3.0	**11.6**		G	More G below	**1262.9**		1274.5	
28NW21	5669618	-16287	0.1	0.0	16.7	**16.8**	8.8	G	More G below	**1258.7**	-1249.9	1275.5	
28NW22	5670208	-15977	0.1	16.1	0.0	**16.2**		G	More G below	**1240.8**		1257.0	
33NE04	5671815	-15173	0.2	8.6	0.0	**8.8**		G	More G below	**1251.0**		1259.8	
33NE05	5671826	-15270	0.3	9.5	0.0	**9.8**	12.7	G	More G below	**1251.7**	-1239.0	1261.5	
33NE06	5671827	-15368	0.2	11.0	0.0	**11.2**		G	More G below	**1252.6**		1263.8	
33NE07	5671827	-15473	0.2	10.7	0.0	**10.9**	26.6	G	More G below	**1253.8**	-1227.2	1264.7	
33NE08	5671726	-15473	0.1	10.8	0.0	**10.9**		G	More G below	**1254.6**		1265.5	
33NE09	5671726	-15369	0.1	10.6	0.0	**10.7**		G	More G below	**1253.3**		1264.0	
33NE10	5671726	-15271	0.1	9.9	0.0	**10.0**		G	More G below	**1251.3**		1261.3	
33NE11	5671725	-15173	0.1	9.9	0.0	**10.0**		G	More G below	**1250.1**		1260.1	
33NE12	5671725	-15068	0.1	6.9	0.0	**7.0**		G	More G below	**1251.4**		1258.4	
33NE13	5671713	-14970	0.1	5.1	0.0	**5.2**		G	More G below	**1249.9**		1255.1	
33NE14	5671724	-14872	0.1	3.9	0.0	**4.0**		G	More G below	**1249.7**		1253.7	

ALBERTA TRANSPORTATION GRAVEL PIT - TEST HOLES

SECTIONS 28 & 33 in 25 - 2 - W5th

STRIPPING LOSS = 0 m

PIT FLOOR LOSS = 0 m

TH #	NORTH	EAST	Topsoil GROSS (m)	SiC GROSS (m)	GSiC GROSS (m)	Total OB GROSS (m)	Gravel GROSS (m)	BOTTOM	COMMENTS	TOG ELEV (m)	BOG ELEV (m)	GND ELEV (m)	IF H_20 ELEV (m)
33NE16	5671613	-14971	0.1	5.7	0.0	5.8		G	More G below	1249.6		1255.4	
33NE18	5671614	-15173	0.1	9.3	0.0	9.4		G	More G below	1251.6		1261.0	
33NE19	5671614	-15271	0.1	10.9	0.0	11.0	16.0	G	More G below	1252.0	-1236.0	1263.0	
33NE20	5671614	-15369	0.2	11.0	0.0	11.2		G	More G below	1252.6		1263.8	
33NE21	5671615	-15467	0.3	10.9	0.0	11.2	18.0	G	More G below	1254.1	-1236.1	1265.3	
33NE22	5671525	-15474	0.3	12.5	0.0	12.8		G	More G below	1253.7		1266.5	
33NE23	5671525	-15369	0.2	9.9	0.0	10.1		G	More G below	1252.8		1262.9	
33NE24	5671525	-15271	0.3	8.5	0.0	8.8		G	More G below	1252.4		1261.2	
33NE25	5671524	-15174	0.5	9.9	0.0	10.4		G	More G below	1249.0		1259.4	
33NE26	5671524	-15069	0.4	7.5	0.0	7.9		G	More G below	1248.8		1256.7	
33NE27	5671523	-14971	0.2	5.4	0.0	5.6		G	More G below	1248.7		1254.3	
33NE28	5671512	-14873	0.1	4.1	0.0	4.2		G	More G below	1248.7		1252.9	
33NE30	5671412	-14971	0.1	6.8	0.0	6.9		G	More G below	1248.4		1255.3	
33NE32	5671412	-15174	0.3	7.0	0.0	7.3		G	More G below	1251.1		1258.4	
33NE33	5671424	-15272	0.3	9.4	0.0	9.7	15.3	G	More G below	1252.2	-1236.9	1261.9	
33NE34	5671424	-15370	0.2	10.7	0.0	10.9		G	More G below	1252.8		1263.7	
33NE35	5671402	-15447	0.3	10.6	0.0	10.9	23.1	G	More G below	1252.8	-1229.7	1263.7	
33NE36	5671268	-15503	0.2	12.1	0.0	12.3		G	More G below	1252.6		1264.9	
33NE37	5671313	-15370	0.2	11.8	0.0	12.0		G	More G below	1249.6		1261.6	
33NE38	5671323	-15272	0.2	11.8	0.0	12.0		G	More G below	1247.1		1259.1	
33NE39	5671323	-15174	0.3	9.4	0.0	9.7		G	More G below	1249.6		1259.3	
33NE40	5671311	-15077	0.2	9.6	0.0	9.8		G	More G below	1247.1		1256.9	
33NE41	5671311	-14972	0.2	8.7	0.0	8.9		G	More G below	1241.1		1250.0	
33NE42	5671300	-14867	0.2	15.4	0.0	15.6		G	More G below	1225.2		1240.8	
33NE43	5671221	-14867	0.6	17.0	0.0	17.6		G	More G below	1219.9		1237.5	
33NE45	5671222	-15070	0.1	16.6	0.0	16.7		G	More G below	1233.1		1249.8	
33NE46	5671211	-15182	0.6	17.4	0.0	18.0		G	More G below	1233.5		1251.5	
33NE47	5671234	-15273	0.3	11.6	0.0	11.9	13.6	G	More G below	1249.8	-1236.2	1261.7	
33NE48	5671212	-15391	0.2	12.0	0.0	12.2		G	More G below	1251.9		1264.1	
33NE49	5671168	-15503	0.3	11.6	0.0	11.9	22.6	G	More G below	1251.9	-1229.3	1263.8	
33NE50	5671111	-15267	0.2	13.5	0.0	13.7		G	More G below	1246.0		1259.7	
33NE51	5671166	-15078	0.1	12.1	0.0	12.2		G	More G below	1244.5		1256.7	

ALBERTA TRANSPORTATION GRAVEL PIT - TEST HOLES

SECTIONS 28 & 33 in 25 - 2 - W5th

STRIPPING LOSS = 0 m

PIT FLOOR LOSS = 0 m

TH #	NORTH	EAST	Topsoil GROSS (m)	SiC GROSS (m)	GSiC GROSS (m)	Total OB GROSS (m)	Gravel GROSS (m)	BOTTOM	COMMENTS	TOG ELEV (m)	BOG ELEV (m)	GND ELEV (m)	IF H_20 ELEV (m)
33NE52	5671165	-14881	0.2	10.5	0.0	10.7		G	More G below	1239.3		1250.0	
33NW01	5671805	-15662	0.2	12.6	2.4	15.2		G	More G below	1253.8		1269.0	
33NW02	5671817	-15858	0.3	10.4	3.0	13.7		G	More G below	1253.7		1267.4	
33NW03	5671806	-15963	0.2	11.1	1.8	13.1	25.9	G	More G below	1254.6	-1228.7	1267.7	
33NW04	5671818	-16068	0.1	12.1	1.5	13.7		G	More G below	1255.0		1268.7	
33NW05	5671819	-16264	0.2	12.0	2.4	14.6	22.9	FSG	More G below	1254.9	-1232.0	1269.5	
33NW06	5671617	-16271	0.2	12.0	4.6	16.8		G	More G below	1253.4		1270.2	
33NW07	5671617	-16069	0.2	12.0	4.6	16.8		G	More G below	1252.7		1269.5	
33NW08	5671616	-15866	0.1	12.1	4.6	16.8		G	More G below	1252.7		1269.5	
33NW09	5671604	-15670	0.1	12.1	3.6	15.8		G	More G below	1252.9		1268.7	
33NW10	5671504	-15670	0.2	10.5	1.5	12.2	25.3	G	More G below	1253.8	-1228.5	1266.0	
33NW11	5671516	-15964	0.1	12.7	0.7	13.5		G	More G below	1257.3		1270.8	
33NW12	5671539	-16272	0.2	12.3	0.0	12.5	26.5	G	More G below	1256.8	-1230.3	1269.3	
33NW13	5671375	-16256	0.2	11.4	1.8	13.4		G	More G below	1258.6		1272.0	
33NW14	5671393	-15999	0.3	10.4	3.0	13.7		G	More G below	1254.7		1268.4	
33NW15	5671403	-15811	0.2	11.1	2.6	13.9		G	More G below	1254.1		1268.0	
33NW16	5671414	-15650	0.7	7.3	2.7	10.7		G	More G below	1254.0		1264.7	
33NW17	5671202	-15636	0.2	13.2	0.0	13.4	25.1	G	More G below	1254.6	-1229.5	1268.0	
33NW18	5671225	-15860	0.4	10.3	2.1	12.8		G	More G below	1253.2		1266.0	
33NW19	5671214	-15972	0.2	10.8	2.1	13.1	27.9	G	More G below	1255.3	-1227.4	1268.4	
33NW20	5671214	-16070	0.2	9.6	2.1	11.9		G	More G below	1255.3		1267.2	
33NW21	5671204	-16266	0.2	10.2	1.2	11.6	28.4	G	More G below	1256.6	-1228.2	1268.2	
33SE02	5671010	-15071	0.1	12.1	1.5	13.7		G	More G below	1249.7		1263.4	
33SE03	5671010	-15176	0.1	10.6	0.0	10.7	14.8	G	More G below	1252.5	-1237.7	1263.2	
33SE04	5670999	-15274	0.1	10.6	2.1	12.8		G	More G below	1249.8		1262.6	
33SE05	5671000	-15470	0.1	9.0	3.7	12.8	16.2	G	More G below	1252.7	-1236.5	1265.5	
33SE06	5670799	-15471	0.1	9.0	3.7	12.8		G	More G below	1251.4		1264.2	
33SE07	5670798	-15275	0.2	11.7	1.8	13.7		G	More G below	1246.0		1259.7	
33SE08	5670797	-15079	0.8	11.1	1.8	13.7		G	More G below	1236.6		1250.3	
33SE12	5670698	-15471	0.1	9.7	2.1	11.9	15.1	G	More G below	1249.7	-1234.6	1261.6	
33SE13	5670609	-15471	0.2	11.7	3.3	15.2		G	More G below	1241.1		1256.3	
33SE16	5670607	-14877	0.1	10.6	0.0	10.7		G	More G below	1251.9		1262.6	

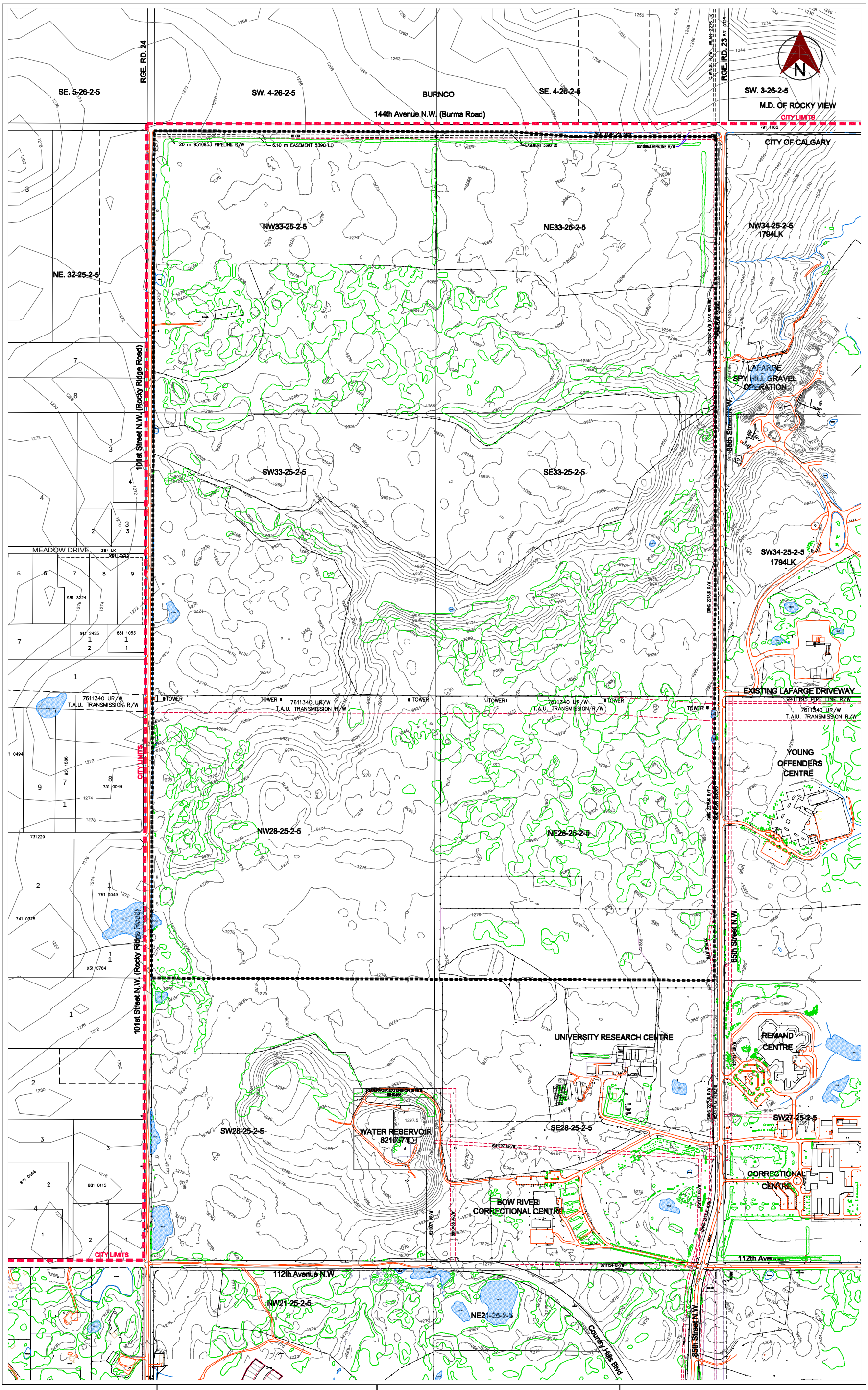
ALBERTA TRANSPORTATION GRAVEL PIT - TEST HOLES

SECTIONS 28 & 33 in 25 - 2 - W5th

STRIPPING LOSS = 0 m

PIT FLOOR LOSS = 0 m

TH #	NORTH	EAST	Topsoil GROSS (m)	SiC GROSS (m)	GSiC GROSS (m)	Total OB GROSS (m)	Gravel GROSS (m)	BOTTOM	COMMENTS	TOG ELEV (m)	BOG ELEV (m)	GND ELEV (m)	IF H_20 ELEV (m)
33SE17	5670417	-14878	0.2	12.0	0.0	**12.2**	17.8	G	More G below	**1254.9**	-1237.1	1267.1	
33SE18	5670417	-15073	0.2	10.5	0.0	**10.7**		G	More G below	**1255.3**		1266.0	
33SE19	5670418	-15171	0.2	12.0	0.0	**12.2**	16.8	G	More G below	**1254.9**	-1238.1	1267.1	
33SE20	5670418	-15241	0.2	12.0	0.0	**12.2**		G	More G below	**1254.4**		1266.6	
33SE21	5670419	-15465	0.6	14.6	0.0	**15.2**	11.3	G	More G below	**1244.1**	-1232.8	1259.3	
33SE23	5670875	-15016	0.2	13.5	0.0	**13.7**		G	More G below	**1246.4**		1260.1	
33SE26	5670764	-15212	0.3	14.9	0.0	**15.2**		G	More G below	**1239.6**		1254.8	
33SW01	5671012	-15673	0.5	13.7	1.8	**16.0**	13.6	G	More G below	**1249.6**	-1236.0	1265.6	
33SW02	5671013	-15869	0.2	9.0	2.1	**11.3**		G	More G below	**1254.4**		1265.7	
33SW04	5671013	-16072	0.2	8.9	2.4	**11.5**		G	More G below	**1256.0**		1267.5	
33SW06	5670813	-16268	0.2	8.3	2.4	**10.9**		G	More G below	**1257.6**		1268.5	
33SW07	5670823	-16066	0.8	14.1	5.1	**20.0**		G	More G below	**1237.4**		1257.4	
33SW11	5670722	-15968	0.3	4.0	4.6	**8.9**		G	More G below	**1255.5**		1264.4	
33SW12	5670712	-16269	0.2	8.9	2.1	**11.2**	20.3	G	More G below	**1258.2**	-1237.9	1269.4	
33SW13	5670612	-16269	0.1	6.0	3.7	**9.8**		G	More G below	**1261.0**		1270.8	
33SW14	5670611	-16073	0.1	6.0	3.0	**9.1**		G	More G below	**1258.0**		1267.1	
33SW15	5670610	-15878	0.1	3.0	2.4	**5.5**		G	More G below	**1261.0**		1266.5	
33SW16	5670609	-15675	0.3	5.8	1.5	**7.6**		G	More G below	**1239.3**		1246.9	
33SW17	5670408	-15675	0.1	7.8	2.1	**10.0**	15.5	G	More G below	**1255.2**	-1239.7	1265.2	
33SW18	5670409	-15871	0.1	4.8	2.1	**7.0**		G	More G below	**1258.2**		1265.2	
33SW19	5670409	-15976	0.3	4.8	3.7	**8.8**	23.1	G	More G below	**1256.4**	-1233.3	1265.2	
33SW20	5670410	-16074	0.1	7.5	4.0	**11.6**		G	More G below	**1258.5**		1270.1	
33SW21	5670410	-16270	0.2	5.1	8.2	**13.5**	26.5	G	More G below	**1258.7**	-1232.2	1272.2	
33SE09	5670763	-14876	0.2	21.1	0.0	**21.3**		SiC	SiC	**1225.8**		1247.1	
33SE10	5670685	-14842	0.2	11.4	0.0	**11.6**		SiC	SiC	**1248.6**		1260.2	
33SE11	5670719	-15163	1.5	13.7	0.0	**15.2**		SiC	SiC	**1230.6**		1245.8	
33SE14	5670619	-15268	0.4	20.9	0.0	**21.3**		SiC	SiC	**1224.2**		1245.5	
33SE15	5670708	-15072	0.2	21.1	0.0	**21.3**		SiC	SiC	**1220.6**		1241.9	
33SW08	5670800	-15891	0.7	19.1	0.0	**19.8**		SiC	SiC	**1233.0**		1252.8	
	AVERAGES		0.22	9.75	2.41	**12.38**							



prepared by: BROWN AND ASSOCIATES PLANNING GROUP

RUSS GERRISH CONSULTING

OCTOBER 2003

GOVERNMENT OF ALBERTA

BROWN & ASSOCIATES PLANNING GROUP

J/647/DP-1

NOTES

ISSUE	REVISION	DATE
1	FOR TEAM REVIEW	02/28/03
2	FOR SUBMISSION TO AT&U	03/28/03
3	FOR AEPEA SUBMISSION	October 2003

LEGEND

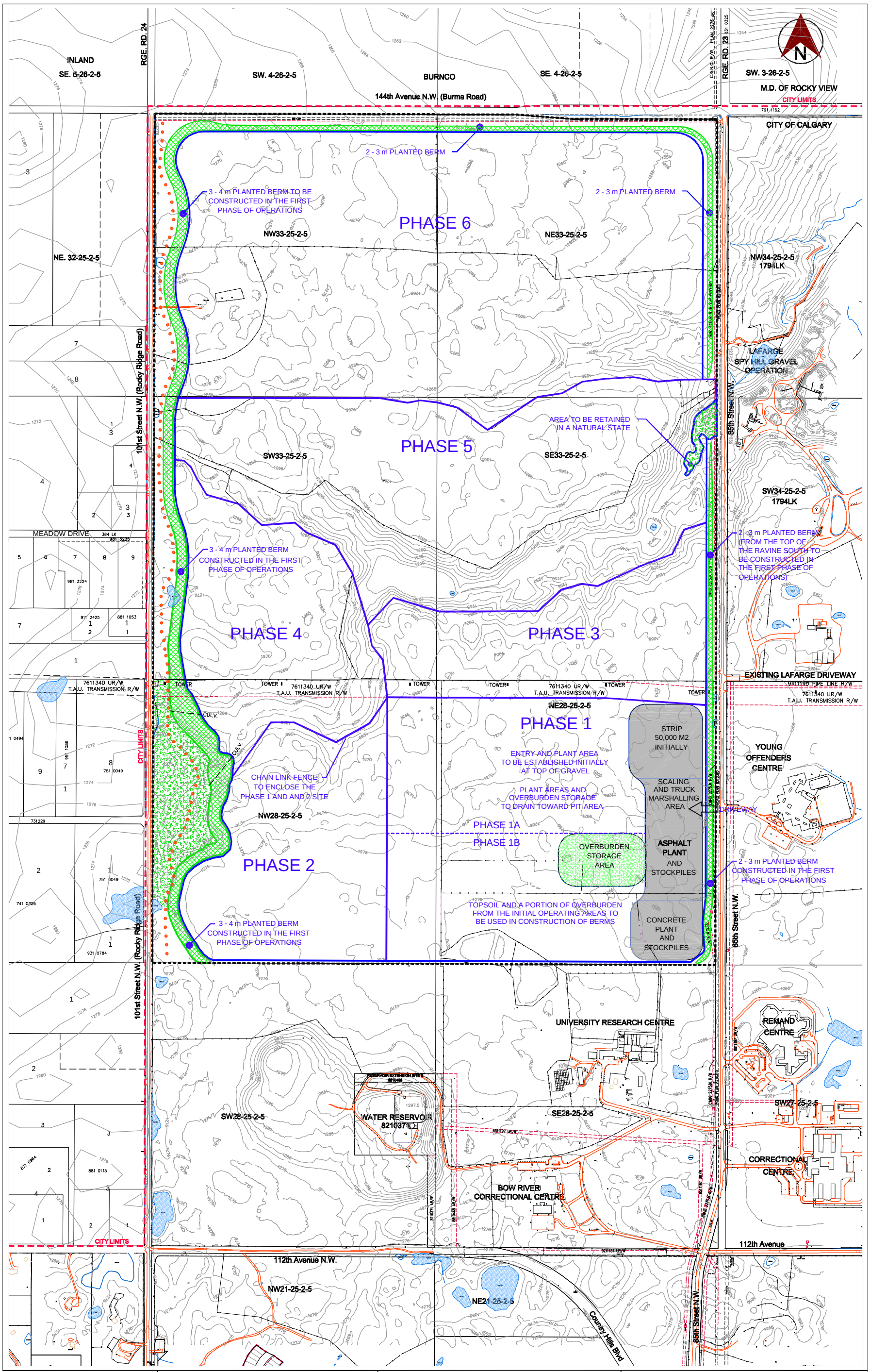
- CITY LIMITS
- SITE BOUNDARY
- FENCE
- EXISTING CONTOUR (2.5 m INTERVAL)
- EXISTING ROADWAY
- EXISTING EASEMENT or R/W
- EXISTING TREES

SCALE 1:5000

SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND
SECTION 28-25-2-W5M

MAP 1

EXISTING SITE CONTEXT



prepared by: BROWN AND ASSOCIATES PLANNING GROUP

RUSS GERRISH CONSULTING

OCTOBER 2003

GOVERNMENT OF ALBERTA

BROWN & ASSOCIATES PLANNING GROUP

J/647/DP-2

NOTES

- EXCAVATION TO PROCEED FROM PHASE 1 TO PHASE 6
- THE INITIAL PHASES OF STAGE 1 ARE SHOWN WITHIN THE SHADED AREA
- ALL BERMS AROUND THE PERIMITER OF THE PROPERTY TO BE CONSTRUCTED DURING PHASE 1
- ALBERTA LEGAL SURVEY CONTROL STATIONS AND MARKERS DISTURBED DURING SURFACE OPERATIONS WILL BE RE-ESTABLISHED TO THE SATISFACTION OF THE CITY LAND SURVEYOR

ISSUE	REVISION	DATE
1	FOR TEAM REVIEW	02/28/03
2	FOR SUBMISSION TO AT&U	03/28/03
3	FOR AEPEA SUBMISSION	OCT, 2003

LEGEND

- CITY LIMITS
- SITE BOUNDARY
- LIMIT OF EXCAVATION (PHASING BOUNDARY)
- EXISTING FENCE
- EXISTING CONTOUR (2.5 m INTERVAL)
- 2.0 m LOCAL PATHWAY
- PLANTED BERM
- AREA TO BE LEFT IN A NATURAL STATE

SCALE 1:5000

SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND
SECTION 28-25-2-W5M

MAP 2

EXTRACTION PHASING

RGE. RD. 24

SW. 4-26-2-5

SE. 4-26-2-5

144th Avenue N.W. (Burma Road)

RGE. RD. 23

CITY LIMITS

N

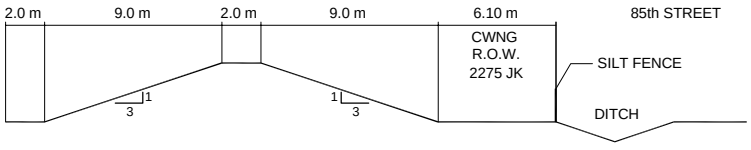
3 - 4 m PLANTED BERM TO BE CONSTRUCTED IN THE FIRST PHASE OF OPERATIONS

NW33-25-2-5

NE33-25-2-5

85th Street N.W.

SECTION A-A



101st Street N.W. (Rocky Ridge Road)

3 - 4 m PLANTED BERM CONSTRUCTED IN THE FIRST PHASE OF OPERATIONS

INSTALL SILT FENCING 2.0 m FROM THE TOE OF BERM AND MAINTAIN UNTIL GRASS IS ESTABLISHED ON THE BERM

SILT FENCE

SW33-25-2-5

SE33-25-2-5

NW28-25-2-5

NE28-25-2-5

A

A

CULVERT

CULVERT

MAINTAIN A 20 m UNDISTURBED BUFFER AREA BETWEEN THE TOP OF SLOPE OF DRAINAGE COURSE AND TOP OF PIT EXCAVATION

PHASE 1

ENTRY AND PLANT AREA TO BE ESTABLISHED INITIALLY AT THE TOP OF GRAVEL

OVERLAND FLOW IN THE PIT WILL BE DIRECTED TO THE NORTH EAST CORNER

TOPSOIL, SUBSOILS, AND OVERBURDEN STOCKPILES IN THE OVERBURDEN STORAGE AREA TO BE SEPARATED TO PREVENT MIXING

STRIP 50,000 M2 INITIALLY

INSTALL AND MAINTAIN SILT FENCING UNTIL GRASS IS ESTABLISHED ON THE BERM

SCALING AND TRUCK MARSHALLING AREA

DRIVEWAY

PHASE 2

PHASE 1A

PHASE 1B

OVERBURDEN STORAGE AREA

ASPHALT PLANT AND STOCKPILES

2 - 3 m PLANTED BERM CONSTRUCTED IN THE FIRST PHASE OF OPERATIONS

CONSTRUCT A SWALE TO FACILITATE THE OVERLAND FLOW FROM POND

INSTALL SILT FENCING 2.0 m FROM THE TOE OF THE BERM AND MAINTAIN UNTIL GRASS IS ESTABLISHED ON THE BERM

PLANT AREAS AND OVERBURDEN STORAGE TO DRAIN TOWARD PIT AREA

CONCRETE PLANT AND STOCKPILES

SILT FENCING TO BE INSTALLED PRIOR TO THE CONSTRUCTION OF BERMS

3 - 4 m PLANTED BERM CONSTRUCTED IN THE FIRST PHASE OF OPERATIONS

CONSTRUCT A 1 m DEEP DITCH ALONG 1/4 SECTION LINE TO INTERCEPT OVERLAND FLOW FROM THE S 1/2 OF SECTION 28

SW28-25-2-5

SE28-25-2-5

prepared by: D.A. Watt CONSULTING GROUP LTD.
BROWN AND ASSOCIATES PLANNING GROUP

OCTOBER 2003

GOVERNMENT OF ALBERTA

NOTES

- THE INITIAL PHASES OF STAGE 1 ARE SHOWN WITHIN THE SHADED AREA
- ALL BERMS SHOWN TO BE CONSTRUCTED DURING PHASE 1

ISSUE	REVISION	DATE
1	FOR TEAM REVIEW	03/28/03
2	FOR AEPEA SUBMISSION	03/28/03

LEGEND

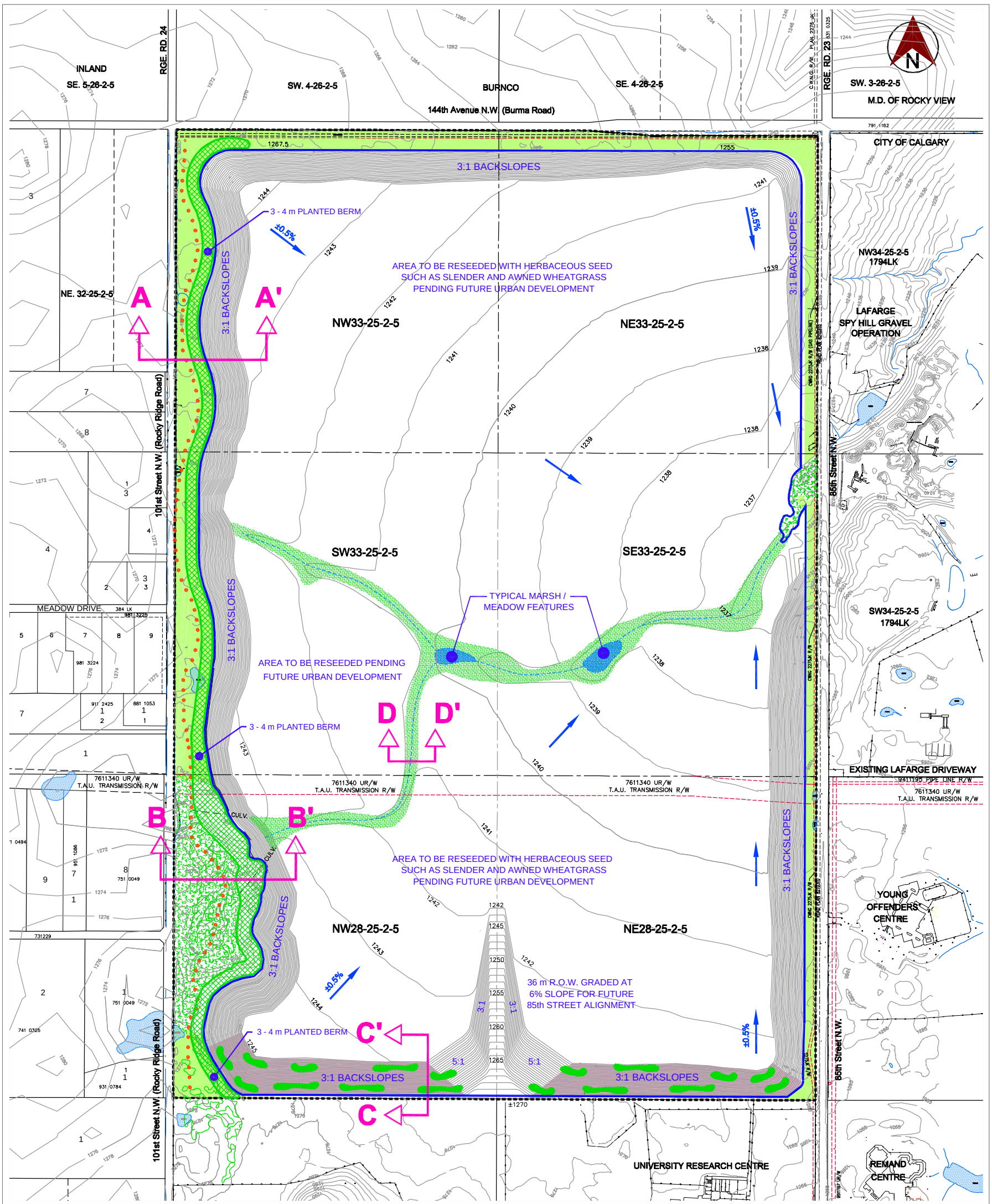
- SILT FENCE
- OVERLAND SWALE
- DIRECTION OF OVERLAND FLOW
- LIMIT OF EXCAVATION (PHASING BOUNDARY)
- EXISTING CONTOUR (2.5 m INTERVAL)
- PLANTED BERM
- AREA TO BE LEFT IN A NATURAL STATE

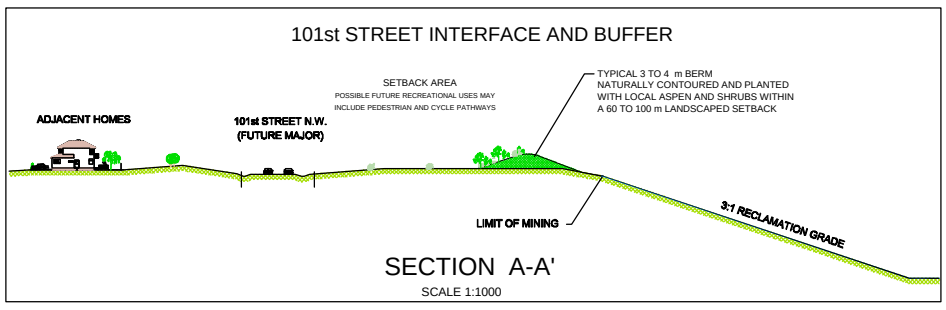
SCALE 1:4000

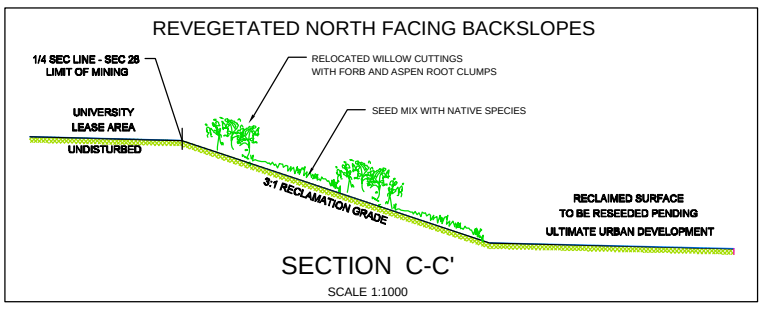
SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND
SECTION 28-25-2-W5M

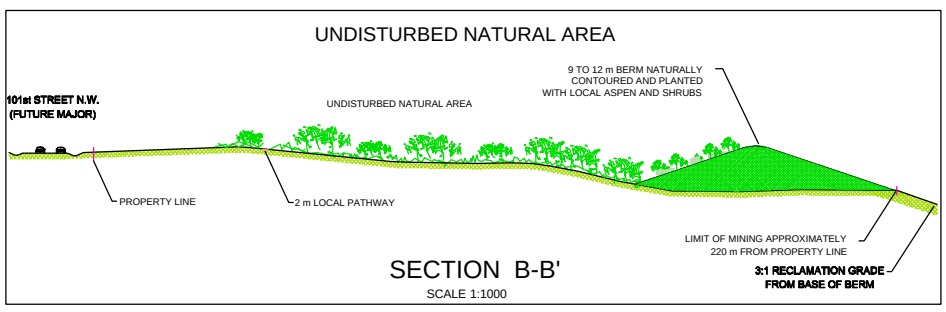
MAP 3

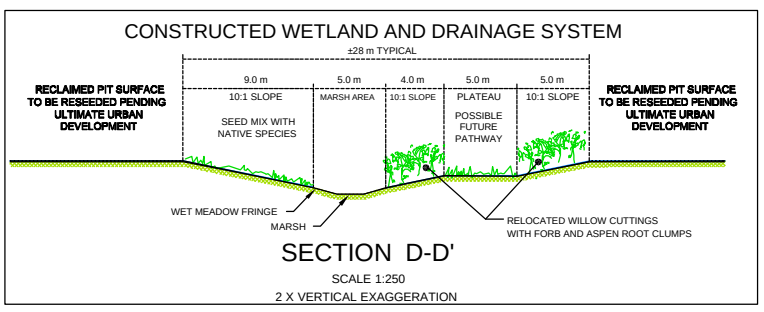
EROSION AND SEDIMENTATION CONTROL PHASE 1 AND 2











prepared by: BROWN AND ASSOCIATES PLANNING GROUP

RUSS GERRISH CONSULTING

OCTOBER, 2003

GOVERNMENT OF ALBERTA

BROWN & ASSOCIATES PLANNING GROUP

J/647/DP-4

LEGEND

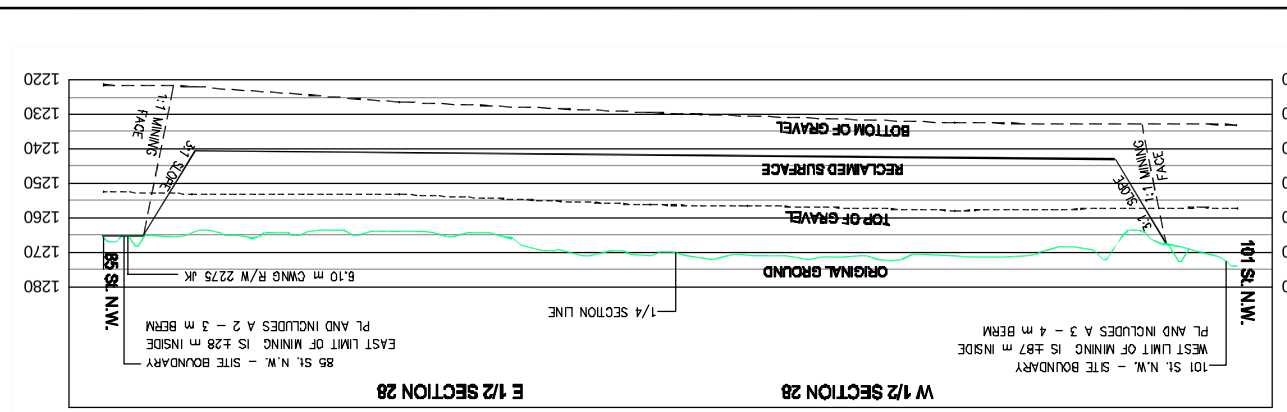
- SITE BOUNDARY
- RECLAIMED CONTOUR ELEVATION (1.0 m INSIDE EXCAVATION BOUNDARY)
- 2.0 m LOCAL PATHWAY
- DIRECTION OF OVERLAND FLOW
- UNDISTURBED NATURAL AREA — SEE DETAILS - SECTION C - C'
- AREA OF SURFACE DISTURBANCE ONLY — TEMPORARY AND PERMANENT BERMING, MINIMAL STRIPPING AND GRADING TO SEPARATE TOPSOIL'S, AND ESTHETIC ENHANCEMENTS
- CONSTRUCTED WETLAND AND DRAINAGE SYSTEM — SEE DETAILS - SECTION D-D'
- RECLAIMED NORTH BACKSLOPES — SEED MIX - GRASS MIX WITH NATIVE SPECIES SUCH AS ROUGH FESCUE, WHEATGRASS, AND NEEDLEGRASS
- PROPOSED PLANT MATERIAL — TOP DRESS WITH COMBINATION OF NEW AND DIRECTLY PLACED LOCAL STRIPPINGS. TO INCLUDE WILLOW CUTTINGS WITH FORB AND ASPEN ROOT CLUMPS.

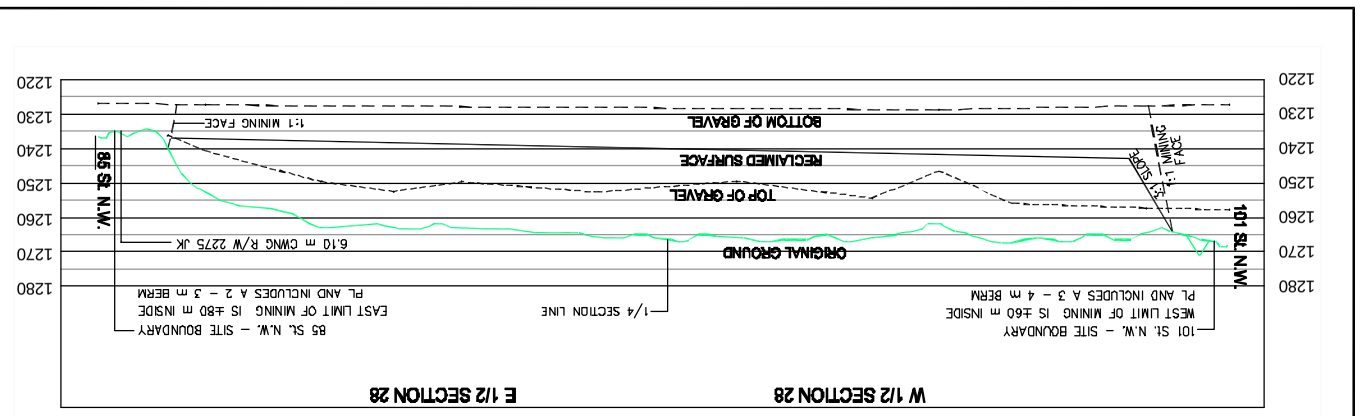
SCALE 1:5000

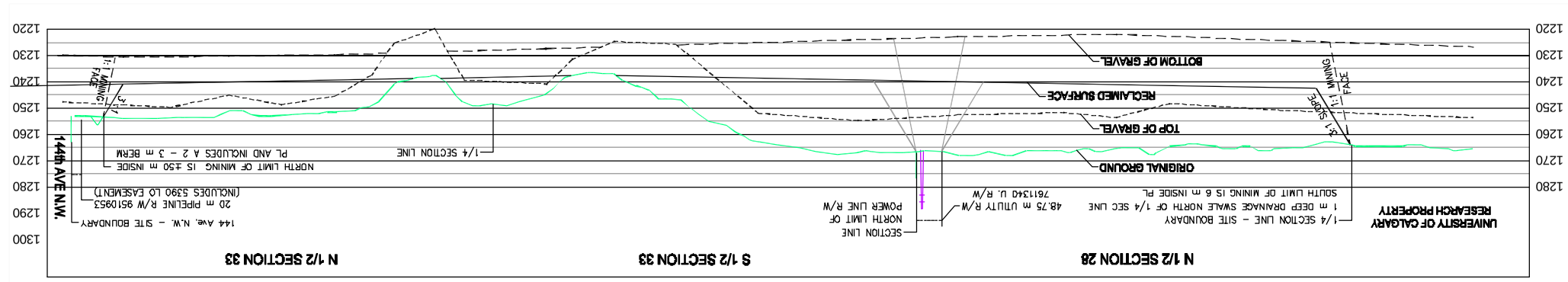
ISSUE	REVISION	DATE
1	FOR TEAM REVIEW	02/28/03
2	FOR SUBMISSION TO AT&U	03/28/03
3	FOR AEPEA SUBMISSION	OCT, 2003

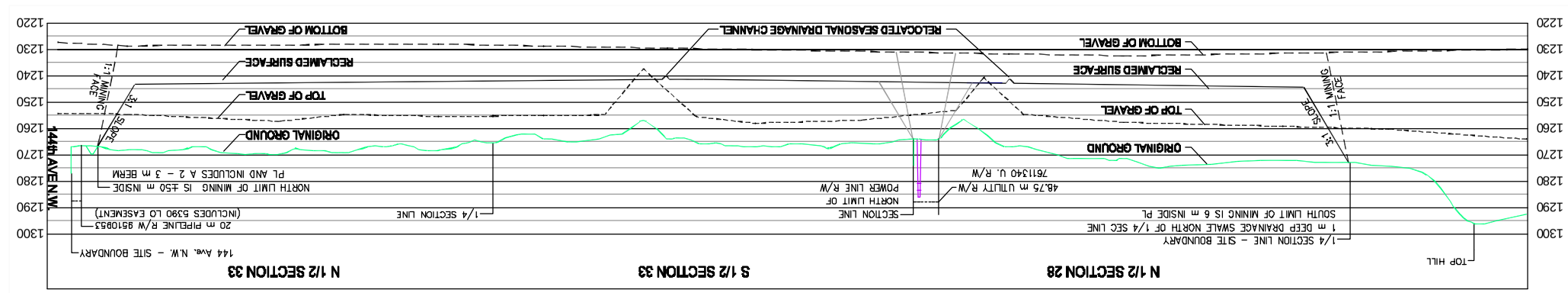
SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND SECTION 28-25-2-W5M

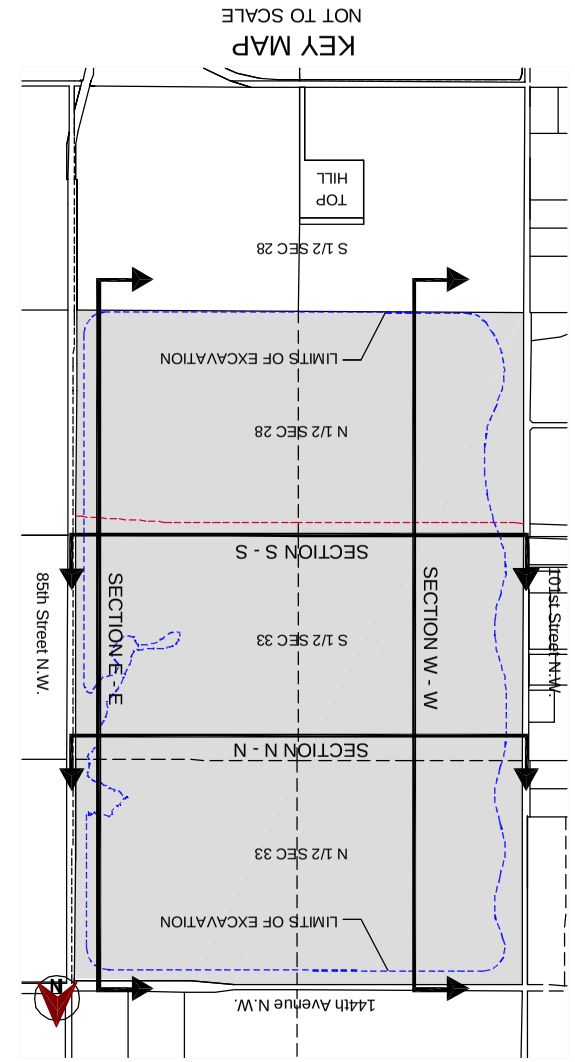
MAP 4
FINAL GRADING, NATURAL AREA RECLAMATION, AND PLANTING PLAN











NOTES

DUE TO THE SCALE OF THE DRAWINGS THE DEPTH OF TOPSOIL HAS NOT BEEN DETAILED

THE AVERAGE TOPSOIL DEPTH IS 0.3 m (1 ft)

ISSUE	REVISION	DATE
1	FOR TEAM REVIEW	02/28/03
2	FOR SUBMISSION TO ATB(L)	03/28/03
3	FOR AEPEA SUBMISSION	OCT. 2003

MAP 5
CROSS SECTIONS

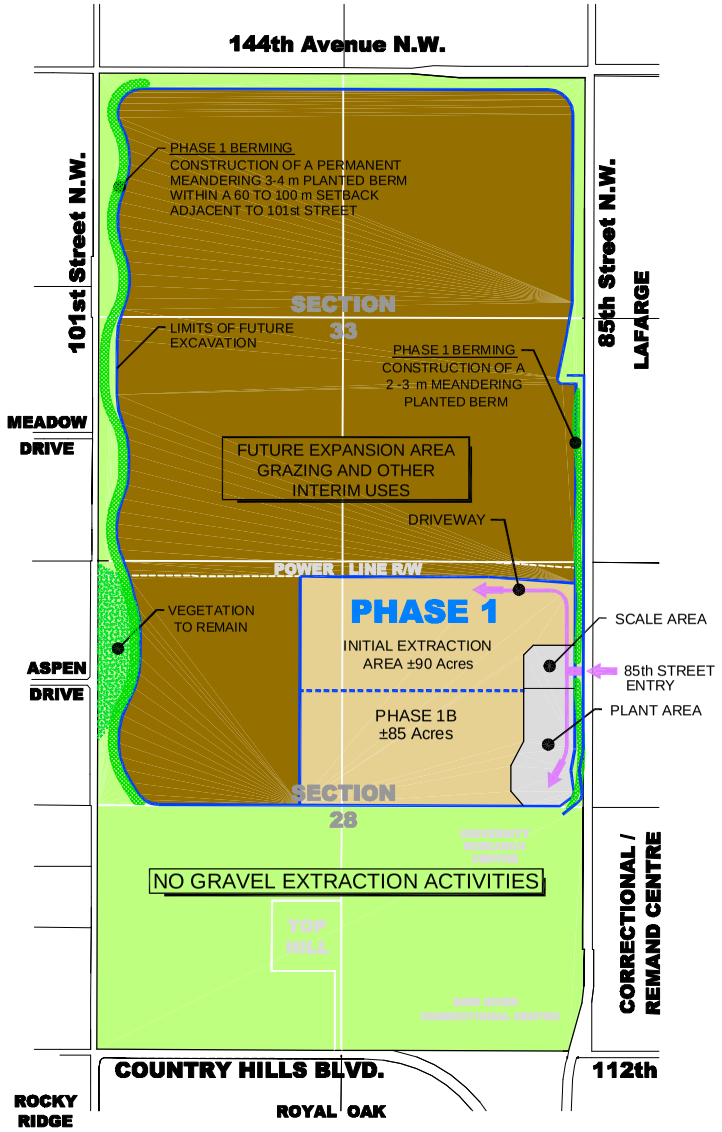
SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND
SECTION 28-25-2-W5M

prepared by: BROWN AND ASSOCIATES PLANNING GROUP
RUSS GERRISH CONSULTING
OCTOBER 2003

Alberta
GOVERNMENT OF ALBERTA

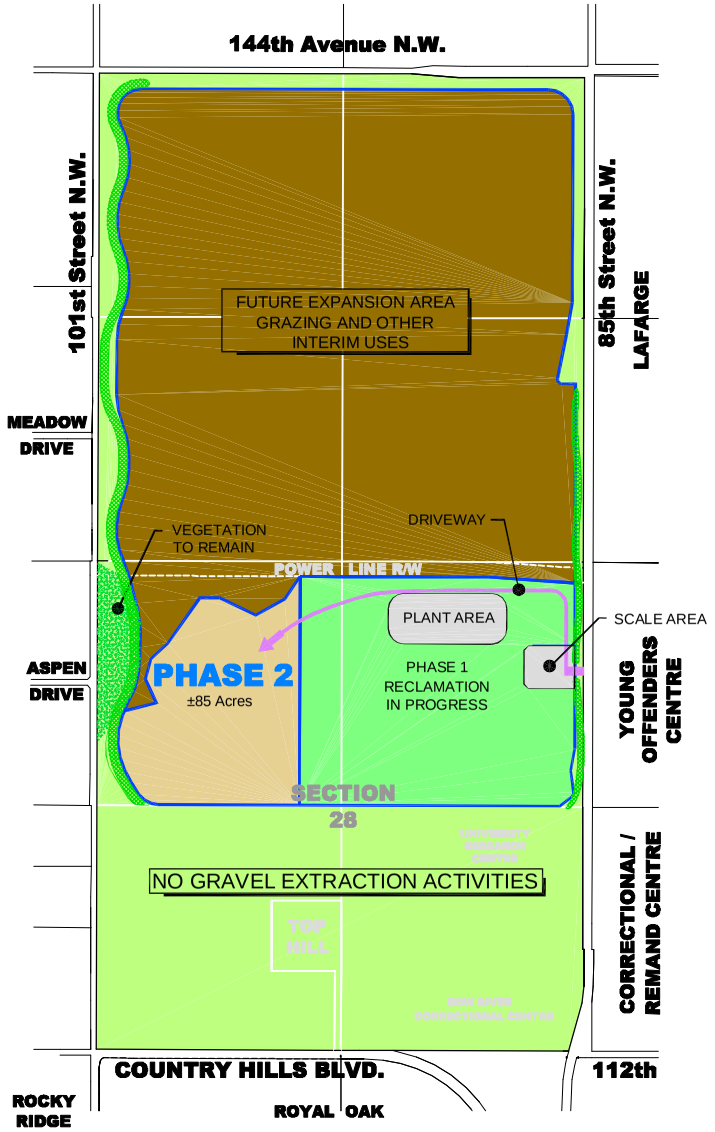
BROWN & ASSOCIATES PLANNING GROUP

JAN/99-5



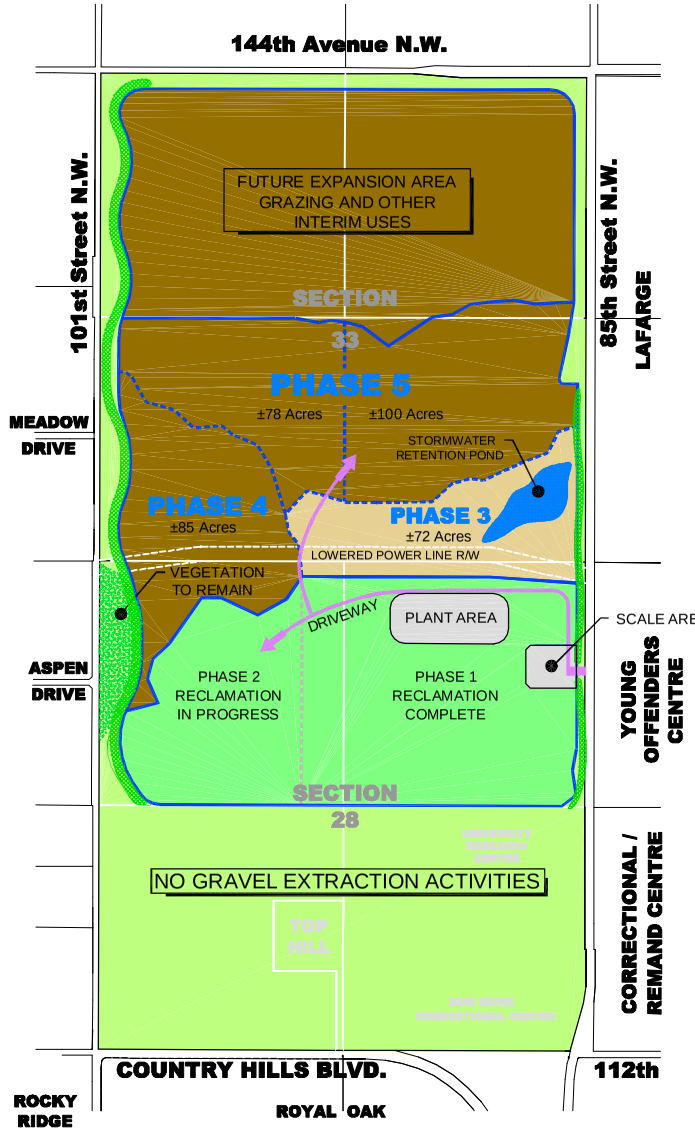
PHASE 1

- CONSTRUCTION OF A PERMANENT BERM ALONG THE WEST SIDE OF THE PROPERTY ADJACENT TO 101st STREET
- ESTABLISH THE SITE ACCESS, SCALING AREA, AND CONCRETE AND ASPHALT PLANT SITES. CONSTRUCT AN UPGRADED DRIVEWAY INTERSECTION ON 85th STREET TO ACCOMMODATE A SEPARATE TRUCK TURNING LANE.
- COMMENCE PHASE 1 INITIAL STRIPPING AND EXTRACTION ACTIVITIES. TOPSOIL, SUBSOILS, AND A PORTION OF THE OVERBURDEN TO BE USED IN BERM CONSTRUCTION. REMAINING OVERBURDEN AND SOME TOPSOIL AND SUBSOIL TO BE STOCKPILED IN PHASE 1B AREA AND THEN USED FOR DIRECT AND SEQUENTIAL RECLAMATION AND BACKFILLING



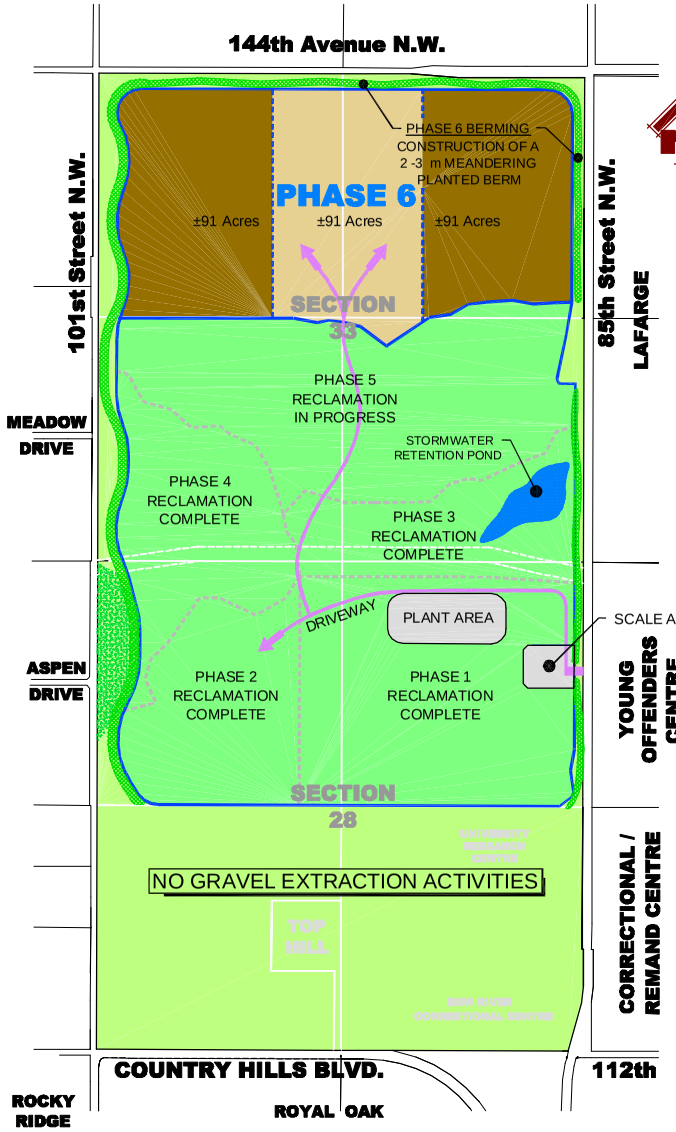
PHASE 2

- ONGOING EXTRACTION WITHIN PHASE 2
- RELOCATION OF CONCRETE AND ASPHALT PLANT SITES TO THE BASE OF PHASE 1A APPROXIMATELY 20 METRES BELOW THE EXISTING GRADE OF THE PROPERTY
- EXTENSION OF WORKING DRIVEWAY TO CURRENT PHASE
- RECLAMATION OF COMPLETED PHASE 1 AREAS AT A LEVEL APPROXIMATELY 20 METRES BELOW EXISTING GRADE. TOPSOIL FROM PHASE 2 WILL BE PLACED IN PHASE 1 RECLAMATION AREAS AND RESEEDED.



PHASES 3 TO 5

- ONGOING EXTRACTION TO PROGRESS FROM PHASE 3 TO 5
- EXISTING POWER LINE TO BE LOWERED TO THE BASE OF THE RECLAIMED AREA
- CONSTRUCTION OF A STORMWATER RETENTION POND WITHIN PHASE 3 TO PREVENT SILTATION OF OFF-SITE DRAINAGE COURSES
- EXISTING ON-SITE DRAINAGE CHANNEL WILL BE RE-ESTABLISHED AT THE BASE OF THE RECLAIMED AREA
- RECLAMATION OF COMPLETED AREAS AT A LEVEL APPROXIMATELY 20 METRES BELOW EXISTING GRADE. DIRECT AND SEQUENTIAL PLACEMENT OF TOPSOIL AND OVERBURDEN IN RECLAMATION AREAS



PHASE 6

- CONSTRUCT NORTH AND NORTHEAST BERMS PRIOR TO COMMENCING PHASE 6 EXTRACTION
- ONGOING EXTRACTION WITHIN PHASE 6
- RECLAMATION OF COMPLETED AREAS AT A LEVEL APPROXIMATELY 20 METRES BELOW EXISTING GRADE.
- CONTINUE DIRECT AND SEQUENTIAL PLACEMENT OF TOPSOIL AND OVERBURDEN IN RECLAMATION OF PREVIOUS EXTRACTION AREA.

GOVERNMENT OF ALBERTA

BROWN & ASSOCIATES PLANNING GROUP
J/647/DP-6

MAXIMUM AREA OF OPEN MINING AT ANY TIME WILL BE 100 ACRES

NOTE: THIS DRAWING IS FOR ILLUSTRATIVE PURPOSES ONLY, AND SHOULD NOT BE SCALED

FOR AEPEA SUBMISSION — OCTOBER, 2003

SPY HILL AGGREGATE OPERATIONS
SECTION 33-25-2-W5M, AND
SECTION 28-25-2-W5M

MAP 6

OPERATIONS AND RECLAMATION PLAN