

Part E - Conceptual Conservation and Reclamation Plan

TABLE OF CONTENTS

E.	CONCEPTUAL CONSERVATION & RECLAMATION PLAN	1
E.1	INTRODUCTION	1
E.2	RECLAMATION GOALS AND OBJECTIVES	2
E.2.1	General Reclamation Procedures	2
E.2.2	Reclamation to Equivalent Capability	3
E.2.2.1	Land Capability for Forestry	3
E.2.2.2	Drainage Systems	4
E.2.2.3	Fisheries	4
E.2.2.4	Wetlands	4
E.2.2.5	Vegetation	4
E.3	SOILS HANDLING	7
E.3.1	Soil Resources	7
E.3.2	Soil Salvage	7
E.3.2.1	Phase 1	9
E.3.2.2	Phase 2	16
E.3.2.3	Phase 3	24
E.3.3	Soil Storage	34
E.4	RECLAMATION	36
E.4.1	Final Site Grading and Re-contouring	36
E.4.2	Soil Replacement	37
E.4.2.1	Plant Site and Camp	38
E.4.2.2	Well Pads	38
E.4.2.3	Utility Corridor	38
E.4.2.4	Borrow Pits	38
E.4.2.5	Laydown Area	39
E.4.2.6	Sumps	39
E.4.3	Reclamation of Compacted Areas	39
E.4.4	Post Reclamation Land Capability	39
E.4.5	Revegetation	41
E.4.5.1	Revegetation Practices	41
E.4.5.2	Woody Species Planting	43
E.4.5.3	Post Reclamation Ecosites	43
E.4.6	Reclamation Timing	44
E.5	RECLAMATION MONITORING PROGRAM	44
E.5.1	Monitoring Objectives	44
E.5.2	Monitoring Schedule	45
E.5.2.1	Revegetation Monitoring	45
E.5.2.2	Terrain and Soils Monitoring	45
E.5.2.3	Wildlife Monitoring	46
E.6	ABANDONMENT AND CLOSURE	46

List of Tables

Table E.1.1	Components of the Project Footprint for Phases 1, 2, and 3	2
Table E.2.1	Pre-disturbance Land Capability for the Project Footprint	3
Table E.2.2	Pre-disturbance Ecosites for the Project Footprint.....	6
Table E.3.1	Soil Materials Available for Salvage for Phase 1	15
Table E.3.2	Soil Materials Available for Salvage for Phase 2	23
Table E.3.3	Soil Materials Available for Salvage for Phase 3	32
Table E.3.4	Reclamation Material Balance for the all Phases of the Project – Includes Preferred Organic Handling	35
Table E.4.1	Predicted Reclaimed Forest Soil Land Capability for the Project.....	40
Table E.4.2	Comparison of the Baseline and Reclaimed Land Capabilities	41
Table E.4.3	Baseline and Estimated Reclaimed Ecosites	43

List of Figures

Figure E.1-1	Project Development Plan
Figure E.2-1	Pre-disturbance Forest Soil Capabilities
Figure E.2-2	Pre-disturbance Ecosites
Figure E.3-1	Upland and Organic Soils
Figure E.3-2	Potential Organic Material Salvage Locations within the Project Footprint (Option A)
Figure E.3-3	Potential Soil Stockpile Locations based on the Preferred Organic Material Options
Figure E.4-1	Reclaimed Forest Soil Capabilities
Figure E.4-2	Reclaimed Ecosites in the Footprint
Figure E.4-3	Phase 1 Development and Reclamation (0 to 8 Years)
Figure E.4-4	Phase 2 Development and Reclamation (9 to 16 Years)
Figure E.4-5	Phase 3 Development and Reclamation (17 to 24 Years)
Figure E.4-6	Final Reclamation (25+ Years)

E. CONCEPTUAL CONSERVATION & RECLAMATION PLAN

E.1 INTRODUCTION

Connacher is currently operating the Great Divide SAGD Project with a design capacity of approximately 1600 m³/day (10,000 barrels/day) of bitumen. Connacher is also in the final stages of construction of the Algar SAGD Facility which is expected to be fully operational in the spring of 2010 with a similar design capacity of 1600 m³/day. Connacher plans to expand the capacity of the lease operations in the Great Divide area, which captures both the Great Divide and Algar Project, by an additional 3,800 m³/day (24,000 barrels/day) of bitumen production. The total production of the Great Divide Lease area will increase to approximately 7,000 m³/day (44,000 barrels/day).

The Great Divide SAGD Expansion Project (the Project) will involve expanding the Algar central processing facility (CPF) by an additional 3,800 m³/day (24,000 barrels/day). The Great Divide CPF will not be altered as part of the expansion. With the increased production capacity of the CPF, there is need for additional bitumen supply for the Project. This application provides the details for the additional bitumen supply over three phases for the life of the Project which is estimated to be 25 years. Connacher has a high level of confidence in developing Phase 1 of the Project as presented in this application. The confidence level in the subsequent phases is less than Phase 1. The total estimated disturbance for all three phases of the Project is 521 ha. While Connacher expects this will evolve and change as development progresses, this is the area that the assessment of the Project impacts was based.

This report presents the Conceptual Conservation and Reclamation (C&R) Plan for the Project. The C&R Plan serves many purposes:

- it provides the regulatory review agencies with the information needed to assess whether, upon completion of the Project, the land can be reclaimed and returned to the equivalent land capability that was present prior to commencement of the Project;
- it provides information about the ongoing reclamation activities that Connacher will carry out during the life of the Project to ensure that environmental impacts are kept to a minimum and end land use objectives and goals are attained;
- it provides conceptual information about the ultimate closure and abandonment plans for the facilities once the Project has ceased operations; and
- after considering landforms, soils, vegetation and the hydrological regime, the C&R Plan identifies the reclamation practices and mechanisms that will be carried out to ensure that a sustainable post-Project landscape meets the equivalent land capability of the pre-Project landscape.

The Project will include three phases of development including road and utility corridors (i.e. surface pipelines, power lines), a laydown area, sumps, well pads and borrow pits, which will disturb approximately 520.8 ha (Figure E.1-1 and Table E.1.1).

Table E.1.1 Components of the Project Footprint for Phases 1, 2, and 3						
Project Component	Phases of Development					
	Phase 1		Phase 2		Phase 3	
	Number Required	Component Area (ha)	Number Required	Component Area (ha)	Number Required	Component Area (ha)
Road/utility corridor	1	47.0	1	91.4	1	84.6
Laydown area	1	9.9	-	-	-	-
Sump(s)	2	19.3	1	4.0	1	4.0
Well pads	9	41.9	11	53.1	19	69.0
Borrow pit(s)	5	27.4	7	40.6	4	28.7
TOTALS	-	145.5	-	189.1	-	186.3

To supplement this C&R Plan, once the Project is operational, Connacher will prepare an Annual C&R Report that will outline development work, including modifications to the plan, that were completed in the previous year and activities that are planned for the following year. In compliance with the Alberta Environmental Protection and Enhancement Act (EPEA) approval, an abandonment and reclamation plan will be submitted to Alberta Environment (AENV) six months before decommissioning the surface facilities.

E.2 RECLAMATION GOALS AND OBJECTIVES

The reclaimed landscape of the Project is predicted to be a mosaic of forest, wetlands and pond habitats that will be compatible with the surrounding landscape.

The reclamation goal for the Project is to reclaim developed lands to achieve equivalent capability similar to pre-disturbance conditions resulting in reclaimed landscapes that are compatible with the surrounding landscape, including forested areas, organic landscapes, wetlands, and streams. The reclaimed lands will provide a range of end land uses including forestry, wildlife habitat, traditional use and recreation. SAGD is a linear activity that can be contoured to blend easily into the natural landscape.

The reclaimed landscape will have a land capability equivalent to that of the pre-disturbance landscape to allow for:

- re-establishment of merchantable forests; and
- establishment of diverse wildlife habitats that are compatible with the surrounding ecosites.

Equivalent land capability is the ability of the land to support various land uses after reclamation is similar to the ability that existed prior to any activity being conducted on the land, but the ability to support individual land uses will not necessarily be equal after reclamation (Powter 1994).

E.2.1 General Reclamation Procedures

The Project reclamation plan will include implementation of the following procedures to reclaim the disturbed lands to a capability equivalent to pre-disturbance conditions:

- determination of pre-disturbance land capability;
- meeting with local reclamation inspector prior to commencing reclamation activities, to confirm the land use and reclamation procedures that are planned;

- removal of facilities;
- remediation of contaminated areas;
- completion of appropriate reclamation of peat lands as per the end land use objectives;
- ripping well pads, roadways, and facility pad areas, as required, to alleviate surface compaction;
- re-contouring and re-establishment of natural drainage patterns;
- placing salvaged topsoil (i.e. litter and mineral A horizons) and peat materials over re-contoured disturbed areas;
- promoting natural recovery as the primary means of ground cover re-establishment. Where necessary, specific sites will be seeded with either a nurse crop or longer-lived, non-invasive vegetation cover and planted with tree species consistent with the revegetation plan;
- undertaking regular monitoring and maintenance activities following reclamation in order to assess reclamation success and identify areas of concern; and
- undertaking a post-reclamation site assessment to determine the status of the site prior to applying for a reclamation certificate.

E.2.2 Reclamation to Equivalent Capability

E.2.2.1 Land Capability for Forestry

The presence of the different forest communities in the Project footprint is determined by parent material, soil, topography and drainage. The potential for commercial forestry in the development area has been assessed using the Alberta Vegetation Inventory (AVI).

Forest communities that develop on the reclaimed sites will be determined by the existing forest communities within the Project footprint, the degree of disturbance to the original site, and by the success of the revegetation efforts. The pre-disturbance forest soil capabilities within the Project footprint are provided in [Table E.2.1](#) and are shown on [Figure E.2-1](#).

Table E.2.1 Pre-disturbance Land Capability for the Project Footprint					
Component	Forest Soil Capability Rating				Total Area (ha)
	Class 3	Class 4	Class 5	NR	
Phase 1					
Road/UC	28.6	-	18.4	-	47.0
Laydown	5.9	-	4.0	-	9.9
Sump(s)	14.1	-	5.2	-	19.3
Borrow Pit(s)	22.0	-	5.4	-	27.4
Well Pad(s)	28.8	-	12.9	0.2	41.9
Sub-total	99.3	-	46.0	0.2	145.5
Phase 2					
Road/UC	55.32	1.3	34.8	-	91.4
Sump	4.0	-	-	-	4.0
Borrow Pit(s)	37.2	-	3.4	-	40.6
Well Pad(s)	35.4	-	17.6	-	53.0
Sub-total	132.0	1.3	55.8	0.0	189.1
Phase 3					

Table E.2.1 Pre-disturbance Land Capability for the Project Footprint					
Component	Forest Soil Capability Rating				
	Class 3	Class 4	Class 5	NR	Total Area
Road/UC	40.6	4.3	39.6	0.2	84.6
Sump	<0.1	-	4.0	-	4.0
Borrow Pit(s)	26.5	0.03	2.2	-	28.7
Well Pad(s)	32.6	3.3	33.0	0.2	69.0
Sub-total	99.6	7.5	78.8	0.3	186.3
Total Area*	330.8	8.8	180.6	0.6	520.8
% of Project Area	63.5	1.7	34.7	0.1	100.0

The land capability of the Project footprint is covered by predominantly Class 3 (330.8 ha) and Class 5 soils (180.6 ha). Class 4 soils represent transitional areas between the uplands and are comprised of peaty Gleysolic soils which have limitations mainly due to poor drainage and poor nutrient regime. Appropriate soils salvage, storage, and replacement coupled with effective revegetation will ensure lands suitable for commercial forests (i.e. Class 3 and 4) achieve similar capability post disturbance.

E.2.2.2 Drainage Systems

The Project has been designed to minimize impacts to surface waters by developing site drainage patterns during operations that minimize the impact to the area's drainage patterns. Integral to the development of a sustainable reclaimed landscape is the re-establishment of drainage systems that serve to channel surface runoff waters to wetlands.

E.2.2.3 Fisheries

A 50 m buffer will be maintained between project activities any watercourses with defined channels. In addition, sediment control techniques, prompt revegetation and proper surface drainage in and around the footprint will ensure minimal impact on the water quality and fisheries resource.

E.2.2.4 Wetlands

Wetland classification has been conducted within the proposed Project footprint and adjacent lands (GDC 2010). A total of 19.5 ha of wetland habitat exists within the proposed Project footprint. Development of the Project is not expected to have any impacts on wetland distribution within the study area. Wetlands in the Project area will have drainage patterns maintained to minimize the impact on surface water drainage. The use of geotextile materials and drainage control measures will minimize the effect on wetlands during operations. The removal of drainage structures at closure will ensure drainage is maintained and impact to wetlands will be minimized.

E.2.2.5 Vegetation

An assessment of vegetation for the Project has been conducted ([Consultant Report # 10](#) (CR #10)). Delineation of vegetation communities was based on AVI map units that were classified using *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996). The pre-disturbance ecosites for the Project footprint are provided in [Table E.2.2](#) shown on [Figure E.2-2](#).

The sites will be cleared, likely by mulching or dozing, as there was very little merchantable timber within the Project Area. The large forest fires that burned most of the Project area have had a major effect on the site

vegetation. Connacher will incorporate some of the coarse woody debris into the salvaged soil and will use the majority to spread across the surface as a measure to improve wildlife habitat.

Table E.2.2 Pre-disturbance Ecosites for the Project Footprint														
Ecosite	B	C	D	G	H	I	J	K	L	All	AIH	CIP	CIW	Total
Phase 1														
Road/UC	-	16.7	-	11.1	-	11.7	4.0	3.5	-	-	-	-	-	47.0
Laydown	-	5.8	-	-	-	4.1	<0.1	-	-	-	-	-	-	9.9
Sump(s)	-	9.2	-	-	-	10.1	<0.1	-	-	-	-	-	-	19.3
Borrow Pit(s)	-	15.7	-	6.3	-	5.3	-	<0.1	-	<0.1	-	-	-	27.4
Well Pad(s)	-	20.6	-	5.8	-	11.4	2.3	1.7	-	<0.1	-	0.2	-	41.9
Sub-total	0.0	68.0	0.0	23.3	0.0	42.6	6.3	5.1	0.0	0.0	0.0	0.2	0.0	145.5
Phase 2														
Road/UC	1.12	39.6	0.8	17.8	-	19.4	6.7	5.7	-	0.3	-	-	<0.1	91.39
Sump	-	-	-	4.0	-	-	-	-	-	-	-	-	-	4.00
Borrow Pit(s)	-	18.8	-	14.2	-	7.0	0.6	-	-	-	-	-	-	40.65
Well Pad(s)	5.90	18.0	-	9.0	-	11.6	0.3	3.8	0.1	3.5	-	-	0.7	53.02
Sub-total	7.0	76.4	0.8	45.0	0.0	38.0	7.6	9.5	0.1	3.8	0.0	0.0	0.7	189.06
Phase 3														
Road/UC	13.2	14.9	1.3	25.6	2.0	8.4	10.8	7.5	-	0.4	0.2	-	0.3	84.6
Sump	-	-	-	<0.1	4.0	-	-	0.01	-	-	-	-	-	4.0
Borrow Pit(s)	4.7	4.7	4.6	11.5	0.1	1.5	1.7	-	-	-	-	-	-	28.7
Well Pad(s)	8.5	20.7	0.1	18.5	0.7	7.6	9.8	2.8	-	-	0.2	-	-	69.0
Sub-total	26.4	40.3	6.1	55.6	6.7	17.5	22.3	10.3	0.0	0.4	0.3	0.0	0.3	186.3
Total Area	33.4	184.7	6.9	123.9	6.7	98.1	36.2	25.0	0.1	4.2	0.3	0.2	1.0	520.8
% of Project Area	6.4	35.5	1.3	23.8	1.3	18.8	7.0	4.8	0.0	0.8	0.1	0.0	0.2	100.0

Drier landscapes include ecosites “c” and “d” which account for a total of 191.6 ha of the Project footprint. Other large proportions of the Project area include transitional communities, ecosite classification “g” (123.9 ha) and bogs, ecosite classification “i” (98.1 ha). Appropriate soils handling and revegetation post disturbance will ensure that vegetation community’s post disturbance can evolve to community types similar to pre-disturbance conditions.

E.3 SOILS HANDLING

Connacher will use the following objectives as the basis for operational and reclamation program design:

- facility development, well pads, roadways, pipelines, and other landscape alterations will be constructed to be geotechnically stable;
- all construction and operational activities will be designed with final reclamation objectives in mind to ensure that the necessary natural resources are conserved to allow for end land use objectives to be met;
- reclamation is designed to create a landscape that is self-sustaining and capable of supporting soils and vegetation processes similar to the adjacent undeveloped areas with no subsequent management input required;
- following soil placement or de-compaction, vegetation communities will establish and will be capable of ecological succession processes similar to those found within the region;
- on those localized sites that are sensitive to erosion (i.e. steeper erodable slopes, coarse textured soils) soil stabilization/conservation will take priority over vegetation objectives;
- on disturbances immediately adjacent to watercourses, watershed protection will take priority over other vegetation objectives;
- water discharges during development and following reclamation will be managed to ensure an acceptable level of input into the streams adjacent the Project disturbance areas; and
- reclaimed lands will meet the criteria for certification.

The areas disturbed by construction activities will be progressively reclaimed to minimize post-construction impacts such as soil erosion. Final reclamation will be undertaken when components of the Project are complete.

E.3.1 Soil Resources

An assessment of soil resources for the Project has been conducted in the *Baseline Soil Survey and Environmental Effects Assessment Report for the Connacher Great Divide SAGD Expansion Project* (Consultant Report # 9 (CR #9)).

E.3.2 Soil Salvage

Topsoil is defined by AENV in various operating approvals as the undisturbed soil profile comprised of the following (if present):

- all organic horizons as defined in the Canadian System of Soil Classification, 3rd Edition (SCWG 1998); and
- all mineral A horizons (upland soils) rated as good, fair or poor, as described in the Quality Criteria Relative to Disturbance and Reclamation (SQWG1987).

Shallow organic soil is defined by AENV as a surface organic horizon that is <40 cm in depth and deep organic soil as having a surface organic horizon >40 cm in depth.

All required topsoil (upland) and shallow organic materials (<40 cm of surface organics) will be salvaged and replaced at reclamation to ensure that the reclaimed areas will support revegetation activities, allow ecological succession and achieve equivalent land capability. Details with respect to assessing baseline soil conditions, soil mapping, and determining suitable soil salvage depths for the Project are provided in the baseline soil report (CR #9). The upland and organic soils that are found within the Project footprint (Phases 1 to 3) are shown on [Figure E.3-1](#).

AENV requires subsoil material (to a maximum depth of 30 cm) be salvaged from Plant sites as a part of soil conservation for SAGD developments. This material is stockpiled separately from the topsoil material. Since the Plant site was previously constructed for the Algar Project, and additional clearing is not anticipated, additional soil and subsoil salvage is not expected for the expansion.

The prime assumption for all deep organic soils (greater than 40 cm thick) is they will not be salvaged. To allow for operational flexibility when handling organic soils, Connacher has identified three options. These include no salvage (B), completely salvaged (C), or selective organic salvage (A). During construction, modifications to the organic soil handling plan (i.e. no salvage) may be made, where some or all the organic material may be salvaged. These field decisions will be finalized and documented at the field level by a qualified site construction specialist. If organic soils are salvaged, they will be stockpiled in appropriate locations (outside of construction activity), to be used in the reclamation program. Areas of potential organic soil salvage are shown on [Figure E.3-2](#).

This plan presents the preferred and proposed options for each Project component. The three organic material handling options for deep organic soils are defined below:

- **Option A - selective salvage** – portions of the organic material within the footprint will be completely salvaged and the some will be left intact with clay fill placed over top; for reclamation the clay fill over organic material will be removed exposing the under-lying material and for all other areas, the site will be decompacted/conditioned and will have soil material (either upland or organic) placed over top;
- **Option B - no salvage** – all organic material will be left intact, and padded over with clay fill material; for reclamation the clay fill over organic material will be removed exposing the under-lying material; and
- **Option C - complete salvage** – all organic materials will be completely salvaged; for reclamation the site will be decompacted/conditioned and will have soil material (either upland or organic) placed over top.

There are three phases (Phase 1, 2 and 3) and five distinct Project components that will have unique soil salvage requirements, which are described further in this section:

- roads and utility corridor;
- laydown;
- sumps;
- well pads; and
- borrow pits.

Each Phase of the Project is broken down into components a description of upland and organic soil salvage activities are provided below. All upland soils materials will be salvaged. Connacher will incorporate some of the coarse woody debris into the salvaged soil and will use the majority to spread across the surface as a measure to improve wildlife habitat. Connacher will ensure that the clearing operations comply with the mulching directive. A summary for each of the applicable organic salvage options (A, B, C) is provided, and the preferred method of handling is shown on [Table E.3.1](#).

E.3.2.1 Phase 1

Approximately 100.7 ha of the total 145.5 ha of the Phase 1 is considered upland and will have topsoil material salvaged and stockpiled for replacement at reclamation. The following sections detail the topsoil and organic material salvage options and associated volumes per component. A summary of the soils materials available for Phase 1 of the Project is provided in [Table E.3.1](#).

Road / Utility Corridor

Approximately 29.8 ha of the 47.0 ha of the road / utility corridor is considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the right of way, out of the way of construction activities. Some of this topsoil material will be spread along the ditches after construction is complete and some will be stored along the right of way, seeded to establish a vegetative cover and used during final reclamation of the utility corridor.

While it is anticipated that organic soils will not be salvaged along the utility corridor (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the utility corridor:

Planned Salvage:

- upland (29.8 ha) = **68,325 m³**;
- organic = **0 m³**

Available Organics

- organics (17.2 ha) - total available = 216,288 m³;
 - Option A (2.9 ha) = 17,507 m³;
 - **Option B = none salvaged (preferred);** and
 - Option C = 216,288 m³.

Laydown

Approximately 5.9 ha of the 9.9 ha of the laydown is considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the component area, out of the way of construction activities. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the laydown area.

While it is anticipated that organic soils will not be salvaged within the laydown area (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the laydown area:

Planned Salvage:

- upland (5.9 ha) = **14,636 m³**;
- organic = **0 m³**

Available Organics

- organics (4.0 ha) - total available = 32,094 m³;
 - Option A (3.5 ha) = 21,144 m³;

- **Option B = none salvaged (preferred); and**
- Option C = 32,094 m³.

Sump(s)

Approximately 14.0 ha of the 19.3 ha of the sump areas are considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the component areas, out of the way of construction activities. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the sump areas.

It is anticipated that all organic soils will be salvaged within the sump area (Option C is preferred). The following is a summary of the soil material planned for salvage and the amount available within the sump area:

Planned Salvage:

- upland (14.0 ha) = **33,393 m³**;
- organic (5.3 ha) = **31,439 m³**

Available Organics

- organics (5.2 ha) - total available = 31,439 m³;
 - Option A (5.2 ha) = 31,439 m³;
 - Option B = not an option; and
 - **Option C = 31,439 m³ (preferred).**

Well Pad(s)

Approximately 29.0 ha of the total 41.9 ha of the well pad(s) are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the well pads.

While it is anticipated that organic soils will not be salvaged within the well pads (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the well pad areas:

Well Pad 104 (4.0 ha)

Planned Salvage:

- upland (4.0 ha) = **10,028 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 110 (3.9 ha)

Planned Salvage:

- upland (0.6 ha) = **1,421 m³**;
- organic = **0 m³**

Available Organics

- organics (3.3 ha) - total available = 38,301 m³;
 - Option A = 6,236 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 38,301 m³.

Well Pad 111 (4.5 ha)*Planned Salvage:*

- upland (3.4 ha) = **6,812 m³**;
- organic = **0 m³**

Available Organics

- organics (1.1 ha) - total available = 6,493 m³;
 - Option A = 6,493 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 6,493 m³.

Well Pad 112 (4.7 ha)*Planned Salvage:*

- upland (3.7 ha) = **9,347 m³**;
- organic = **0 m³**

Available Organics

- organics (0.9 ha) - total available = 5,648 m³;
 - Option A = 5,648 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 5,648 m³.

Well Pad 231 (4.7 ha)*Planned Salvage:*

- upland (3.3 ha) = **6,523 m³**;
- organic = **0 m³**

Available Organics

- organics (1.5 ha) - total available = 13,997 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 13,997 m³.

Well Pad 232 (4.6 ha)

Planned Salvage:

- upland (3.2 ha) = **5,916 m³**;
- organic = **0 m³**

Available Organics

- organics (1.5 ha) - total available = 13,869 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 13,869 m³.

Well Pad 233 (4.5 ha)*Planned Salvage:*

- upland (3.5 ha) = **7,025 m³**;
- organic = **0 m³**

Available Organics

- organics (1.0 ha) - total available = 9,266 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 9,266 m³.

Well Pad 234 (3.6 ha)*Planned Salvage:*

- upland (<0.1 ha) = **10 m³**;
- organic = **0 m³**

Available Organics

- organics (3.6 ha) - total available = 34,677 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 34,677 m³.

Well Pad 235 (7.3 ha)*Planned Salvage:*

- upland (7.3 ha) = **10,840 m³**;
- organic = **197 m³**

Available Organics

- organics (<0.1 ha) - total available = 197 m³;
 - Option A = 0 m³;

- Option B = none salvaged; and
- **Option C = 197 m³(preferred)**

Borrow Pits

Approximately 17.4 ha of the total 21.5 ha of the borrow pits are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. All of the organic material (4.1 ha) will be salvaged (Option C is preferred). The upland and organic material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the borrow pits.

The following is a summary of the soil material planned for salvage and the amount available within the borrow areas:

Borrow Pit 10 (A and B) (6.5 ha)*Planned Salvage:*

- upland (5.0 ha) = **16,187 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 11 (2.6 ha)*Planned Salvage:*

- upland (1.2 ha) = **2,251 m³**;
- organic = **13,693 m³**

Available Organics

- organics (1.4 ha) - total available = 13,693 m³;
 - Option A = 13,693 m³;
 - Option B = 13,693 m³, all organics salvaged for borrow development; and
 - **Option C = 13,693 m³ (preferred).**

Borrow Pit 12 (5.3 ha)*Planned Salvage:*

- upland (5.3 ha) = **10,555 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0) - total available = 0 m³;

Borrow Pit 13 (3.1 ha)*Planned Salvage:*

- upland (0.5 ha) = **1,035 m³**;

- organic = **24,746 m³**

Available Organics

- organics (2.6 ha) - total available = 24,746 m³;
 - Option A = 24,746 m³;
 - Option B = 24,746 m³, all organics salvaged for borrow development; and
 - **Option C = 24,746 m³ (preferred).**

Borrow Pit 14 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = **9,987 m³**;
- organic = **68 m³**

Available Organics

- organics (<0.1 ha) - total available = 68 m³;
 - Option A = 68 m³;
 - Option B = 68 m³, all organics salvaged for borrow development; and
 - **Option C = 68 m³ (preferred)**

Borrow Pit Storage Area (Borrow Pit 12S & 14S)

Borrow pit storage areas (total of 6.0 ha in Phase 1) are designated to provide additional soil storage areas for the borrow developments. Topsoil and organic material salvaged from the development of the associated borrows will be stockpiled within the storage areas.

Soil Salvage Summary

A summary of the available volumes for upland and organic soils for Phase 1 are provided in [Table E.3.1](#). The volumes of organic material estimated for each handling option and the preferred option are shown for each Project component.

Table E.3.1 Soil Materials Available for Salvage for Phase 1

Project Component	Total Area (ha)	Area of Upland Soils (ha)	Volume of Upland Soil available (m³)	Area of Organic Soils (ha)	Organic Handling Options						Preferred Organic Handling Option
					Option A – Selective Salvage		Option B – No Salvage		Option C – Complete Salvage		
					Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	
Road/UC	47.0	29.8	68,325	17.2	2.9	17,507	-	-	17.2	216,288	B
Laydown	9.9	5.9	14,636	4.0	3.5	21,144	-	-	4.0	32,094	B
Sump 1	13.1	8.6	21,396	4.5	4.5	26,746	-	-	4.5	26,746	C
Sump 2	6.2	5.4	12,397	0.8	0.8	4,693	-	-	0.8	4,693	C
Well Pad 104	4.0	4.0	10,028	-	-	-	-	-	-	-	-
Well Pad 110	3.9	0.6	1,421	3.3	1.0	6,236	-	-	3.3	38,301	B
Well Pad 111	4.5	3.4	6,812	1.1	1.1	6,493	-	-	1.1	6,493	B
Well Pad 112	4.7	3.7	9,347	0.9	0.9	5,648	-	-	0.9	5,648	B
Well Pad 231	4.7	3.3	6,523	1.5	-	-	-	-	1.5	13,997	B
Well Pad 232	4.6	3.2	5,916	1.5	-	-	-	-	1.5	13,869	B
Well Pad 233	4.5	3.5	7,025	1.0	-	-	-	-	1.0	9,266	B
Well Pad 234	3.6	0.0	0	3.6	-	-	-	-	3.6	34,677	B
Well Pad 235	7.3	7.3	14,650	<0.1	<0.1	197	-	-	<0.1	197	C
Borrow Pit 10A	4.3	4.3	10,840	-	-	-	-	-	-	-	-
Borrow Pit 10B	1.5	1.5	3,639	-	-	-	-	-	-	-	-
Borrow Pit 10RW	0.7	0.7	1,708	-	-	-	-	-	-	-	-
Borrow Pit 11	2.6	1.1	2,251	1.4	1.4	13,693	1.4	13,693	1.4	13,693	C
Borrow Pit 12	5.3	5.3	10,555	-	-	-	-	-	-	-	-
Borrow Pit 12S	2.5	2.1	4,205	0.4	-	-	-	-	0.4	3,399	B
Borrow Pit 13	3.1	0.5	1,035	2.6	2.6	24,746	2.6	24,746	2.6	24,746	C
Borrow Pit 14	4.0	4.0	9,987	<0.1	<0.1	68	<0.1	68	<0.1	68	C
Borrow Pit 14S	3.5	2.5	6,269	1.0	-	-	-	-	1.0	13,935	B
TOTALS ^I	145.5	100.7	228,965	44.8	18.8	127,171	4.0	38,507	44.8	458,110	

¹ Due to rounding of values total areas presented in this table are approximate.

E.3.2.2 Phase 2

Approximately 141.5 ha of the total 189.1 ha of the Phase 2 is considered upland and will have topsoil material salvaged and stockpiled for replacement at reclamation. The following sections detail the topsoil and organic material salvage options and associated volumes per component. A summary of the soil materials available for Phase 2 of the Project are provided in [Table E.3.2](#).

Road / Utility Corridor

Approximately 60.8 ha of the 91.3 ha of the road / utility corridor is considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the right of way, out of the way of construction activities. Some of this topsoil material will be spread along the ditches after construction is complete and some will be stored along the right of way, seeded to establish a vegetative cover and used during final reclamation of the utility corridor.

While it is anticipated that organic soils will not be salvaged along the utility corridor (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the utility corridor:

Planned Salvage:

- upland (60.8 ha) = **137,943 m³**;
- organic = **0 m³**

Available Organics

- organics (30.6 ha) - total available = 339,623 m³;
 - Option A = 59,797 m³;
 - **Option B = none salvaged (preferred);and**
 - Option C = 339,623 m³.

Sump

All 4.0 ha of the sump area are considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the component areas, out of the way of construction activities. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the sump area. There are no organic materials on the proposed sump location, so none is planned for salvage.

Planned Salvage:

- upland (4.0 ha) = **8,000 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pads

Approximately 39.4 ha of the total 53.0 ha of the well pads are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the well pads.

While it is anticipated that organic soils will not be salvaged for a majority of the well pads (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the well pad areas:

Well Pad 105 (4.0 ha)*Planned Salvage:*

- upland (0.0 ha) = **0 m³**;
- organic = **0 m³**

Available Organics

- organics (4.0 ha) - total available = 24,523 m³;
 - Option A = 569 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 24,523 m³.

Well Pad 114 (3.3 ha)*Planned Salvage:*

- upland (2.6 ha) = **5,094 m³**;
- organic = **0 m³**

Available Organics

- organics (0.7 ha) - total available = 4,017 m³;
 - Option A = 4,017 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 4,017 m³.

Well Pad 204 (5.5 ha)*Planned Salvage:*

- upland (5.1 ha) = **10,291 m³**;
- organic = **0 m³**

Available Organics

- organics (0.4 ha) - total available = 7,792 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 7,792 m³.

Well Pad 205 (6.4 ha)*Planned Salvage:*

- upland (5.3 ha) = **10,532 m³**;

- organic = 0 m³

Available Organics

- organics (1.1 ha) - total available = 16,364 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 16,364 m³.

Well Pad 206 (6.3 ha)*Planned Salvage:*

- upland (6.0 ha) = 12,069 m³;
- organic = 0 m³

Available Organics

- organics (0.3 ha) - total available = 5,446 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 5,446 m³.

Well Pad 401 (4.1 ha)*Planned Salvage:*

- upland (4.1 ha) = 8,160 m³;
- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 402 (3.7 ha)*Planned Salvage:*

- upland (2.3 ha) = 8,324 m³;
- organic = 0 m³

Available Organics

- organics (1.4 ha) - total available = 8,041 m³;
 - Option A = 8,041 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 8,041 m³.

Well Pad 403 (3.7 ha)*Planned Salvage:*

- upland (3.7 ha) = **7,360 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 404 (3.7 ha)*Planned Salvage:*

- upland (0 ha) = **0 m³**;
- organic = **0 m³**

Available Organics

- organics (3.7 ha) - total available = 49,711 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 49,711 m³.

Well Pad 501 (5.5 ha)*Planned Salvage:*

- upland (4.6 ha) = **11,567 m³**;
- organic = **0 m³**

Available Organics

- organics (0.9 ha) - total available = 12,924 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 12,924 m³.

Well Pad 502 (3.2 ha)*Planned Salvage:*

- upland (2.1 ha) = **6,026 m³**;
- organic = **0 m³**

Available Organics

- organics (1.1 ha) - total available = 16,293 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 16,293 m³.

Well Pad 503 (3.7 ha)

Planned Salvage:

- upland (3.5 ha) = **11,372 m³**;
- organic = **0 m³**

Available Organics

- organics (0.2 ha) - total available = 809 m³;
 - Option A = 809 m³;
 - Option B = none salvaged; and
 - **Option C = 809 m³(preferred).**

Borrow Pits

Approximately 26.9 ha of the total 27.8 ha of the borrow pits are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. All of the organic material (0.9 ha) will be salvaged (Option C is preferred). The upland and organic material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the borrow pits. The following is a summary of the soil material planned for salvage and the amount available within the borrow areas:

Borrow Pit 15 (3.4 ha)*Planned Salvage:*

- upland (3.4 ha) = **6,711 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 16 (4.4 ha)*Planned Salvage:*

- upland (4.1 ha) = **8,204 m³**;
- organic = **6,499 m³**

Available Organics

- organics (0.3 ha) - total available = 6,499 m³;
 - Option A = 6,499 m³;
 - Option B = 6,499 m³, all organics salvaged for borrow development; and
 - **Option C = 6,499 m³ (preferred)**

Borrow Pit 17 (2.4 ha)*Planned Salvage:*

- upland (2.4 ha) = **4,739 m³**;

- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 18 (5.6 ha)*Planned Salvage:*

- upland (5.6 ha) = 11,237 m³;
- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 19 (4.0 ha)*Planned Salvage:*

- upland (3.4 ha) = 8,375 m³;
- organic = 3,644 m³

Available Organics

- organics (0.6 ha) - total available = 3,644 m³;
 - Option A = 3,644 m³;
 - Option B = 3,644 m³, all organics salvaged for borrow development; and
 - **Option C = 3,644 m³ (preferred).**

Borrow Pit 20 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = 7,908 m³;
- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 21 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = 8,000 m³;
- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit Storage Areas (includes Borrow Pit 15S, 19S, 20S, and 21S)

Borrow pit storage areas (totalling 12.9 ha) are designated to provide additional soil storage areas for the borrow developments. Topsoil and organic material salvaged from the development of the associated borrows will be stockpiled within the storage areas.

Soil Salvage Summary

A summary of the available volumes for upland and organic soils are provided in [Table E.3.2](#). The volumes of organic material estimated for each handling option and the preferred option are shown for each Project component.

Project Component	Total Area (ha)	Area of Upland Soils (ha)	Volume of Upland Soil available (m³)	Area of Organic Soils (ha)	Organic Handling Options						Preferred Organic Handling Option
					Option A – Selective Salvage		Option B – No Salvage		Option C – Complete Salvage		
					Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	
Road/UC	91.3	60.8	137,943	30.5	10.0	59,797	-	-	30.6	339,623	B
Sump	4.0	4.0	8,000	0.0	-	-	-	-	-	-	-
Well Pad 105	4.0	0.0	0	4.0	<0.1	569	-	-	4.0	24,523	B
Well Pad 114	3.3	2.6	5,094	0.7	0.7	4,017	-	-	0.7	4,017	B
Well Pad 204	5.5	5.1	10,291	0.4	-	-	-	-	0.4	7,792	B
Well Pad 205	6.4	5.3	10,532	1.1	-	-	-	-	1.1	16,364	B
Well Pad 206	6.3	6.0	12,069	0.3	-	-	-	-	0.3	5,446	B
Well Pad 401	4.1	4.1	8,160	0.0	-	-	-	-	-	-	-
Well Pad 402	3.7	2.3	8,324	1.3	1.3	8,041	-	-	1.3	8,041	B
Well Pad 403	3.7	3.7	7,360	0.0	-	-	-	-	-	-	-
Well Pad 404	3.7	0.0	0	3.7	-	-	-	-	3.7	49,711	B
Well Pad 501	5.5	4.6	11,567	0.9	-	-	-	-	0.9	12,924	B
Well Pad 502	3.2	2.1	6,026	1.2	-	-	-	-	1.2	16,293	B
Well Pad 503	3.7	3.5	11,372	0.2	0.2	809	-	-	0.2	809	A
Borrow Pit 15	3.4	3.4	6,711	0.0	-	-	-	-	-	-	-
Borrow Pit 15S	2.6	1.1	2,185	1.5	-	-	-	-	1.5	20,868	B
Borrow Pit 16	4.4	4.1	8,204	0.3	0.3*	6,449*	0.3*	6,449*	0.3	6,449	C
Borrow Pit 17	2.4	2.4	4,739	0.0	-	-	-	-	-	-	-
Borrow Pit 18	5.6	5.6	11,237	0.0	-	-	-	-	-	-	-
Borrow Pit 19	4.0	3.4	8,375	0.6	0.6*	3,644*	0.6*	3,644*	0.6	3,644	C
Borrow Pit 19S	3.5	2.5	6,093	1.0	1.0	5,918	-	-	1.0	5,918	B
Borrow Pit 20	4.0	4.0	7,908	-	-	-	-	-	-	-	-
Borrow Pit 20S	3.3	3.3	6,115	-	-	-	-	-	-	-	-
Borrow Pit 21	4.0	4.0	8,000	0.0	-	-	-	-	-	-	-
Borrow Pit 21S	3.5	3.5	6,985	-	-	-	-	-	-	-	-
TOTALS	189.1	141.5	313,290	47.6	14.1	89,244	0.9	10,093	47.6	522,422	

E.3.2.3 Phase 3

Approximately 114.7 ha of the total 186.3 ha of the Phase 3 is considered upland and will have topsoil material salvaged and stockpiled for replacement at reclamation. The following sections detail the topsoil and organic material salvage options and associated volumes per component. A summary of the soil materials available for Phase 3 of the Project are provided in [Table E.3.3](#).

Road / Utility Corridor

Approximately 47.0 ha of the 84.6 ha of the road / utility corridor is considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the right of way, out of the way of construction activities. Some of this topsoil material will be spread along the ditches after construction is complete and some will be stored along the right of way, seeded to establish a vegetative cover and use at final reclamation of the utility corridor.

While it is anticipated that organic soils will not be salvaged along the utility corridor (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the utility corridor:

Planned Salvage:

- upland (47.0 ha) = **108,596 m³**;
- organic = **0 m³**

Available Organics

- organics (37.6 ha) - total available = 292,892 m³;
 - Option A (21.2 ha) = 130,513 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 292,892 m³.

Sump

Approximately 2.7 ha of the 4.0 ha of the sump areas are considered upland and will have the topsoil layer salvaged by blading the soil material to the edge of the component areas, out of the way of construction activities. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the sump areas.

It is anticipated that all organic soils will be salvaged within the sump area (Option C is preferred). The following is a summary of the soil material planned for salvage and the amount available within the sump area:

Planned Salvage:

- upland (2.7 ha) = **11,938 m³**;
- organic = **9,403 m³**

Available Organics

- organics (1.3 ha) - total available = 9,403 m³;
 - Option A (1.3 ha) = 9,403 m³;
 - Option B = not an option; and

- **Option C = 9,403 m³ (preferred).**

Well Pads

Approximately 35.8 ha of the total 69.0 ha of the well pads are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. This topsoil material will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the well pads.

While it is anticipated that organic soils will not be salvaged for a majority of the well pads (Option B is preferred), there may be portions of organic landscapes that will be salvaged and stockpiled. The following is a summary of the soil material planned for salvage and the amount available within the well pad areas:

Well Pad 106 (3.7 ha)

Planned Salvage:

- upland (2.9 ha) = **8,644 m³**;
- organic = **0 m³**

Available Organics

- organics (0.8 ha) - total available = 5,112 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 5,112 m³.

Well Pad 107 (4.1 ha)

Planned Salvage:

- upland (3.0 ha) = **5,931 m³**;
- organic = **0 m³**

Available Organics

- organics (1.1 ha) - total available = 7,800 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 7,800 m³.

Well Pad 108 (3.5 ha)

Planned Salvage:

- upland (0.0 ha) = **0 m³**;
- organic = **0 m³**

Available Organics

- organics (3.5 ha) - total available = 22,009 m³;
 - Option A = 20,201 m³;

- **Option B = none salvaged (preferred); and**
- Option C = 22,009 m³.

Well Pad 109 (3.7 ha)*Planned Salvage:*

- upland (<0.1 ha) = **80 m³**;
- organic = **0 m³**

Available Organics

- organics (3.6 ha) - total available = 18,803 m³;
 - Option A = 13,781 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 18,803 m³.

Well Pad 110 (2.9 ha)*Planned Salvage:*

- upland (2.9 ha) = **5,888 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 115 (3.3 ha)*Planned Salvage:*

- upland (0 ha) = **0 m³**;
- organic = **0 m³**

Available Organics

- organics (3.3 ha) - total available = 18,962 m³;
 - Option A = 18,962 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 18,962 m³.

Well Pad 116 (3.3 ha)*Planned Salvage:*

- upland (0.0 ha) = **0 m³**;
- organic = **0 m³**

Available Organics

- organics (3.3 ha) - total available = 48,024 m³;

- Option A = 0 m³;
- **Option B = none salvaged (preferred); and**
- Option C = 48,024 m³.

Well Pad 207 (3.7 ha)*Planned Salvage:*

- upland (3.3 ha) = **6,658 m³**;
- organic = **0 m³**

Available Organics

- organics (0.4 ha) - total available = 4,598 m³;
 - Option A = 297 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 4,598 m³.

Well Pad 208 (3.1 ha)*Planned Salvage:*

- upland (0.4 ha) = **875 m³**;
- organic = **0 m³**

Available Organics

- organics (2.7 ha) - total available = 57,831 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 57,831 m³.

Well Pad 209 (5.3 ha)*Planned Salvage:*

- upland (4.4 ha) = **8,856 m³**;
- organic = **0 m³**

Available Organics

- organics (0.9 ha) - total available = 13,469 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 13,469 m³.

Well Pad 405 (3.7 ha)*Planned Salvage:*

- upland (0.3 ha) = **781 m³**;
- organic = **0 m³**

Available Organics

- organics (3.4 ha) - total available = 47,147 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 47,147 m³.

Well Pad 406 (3.3 ha)*Planned Salvage:*

- upland (3.3 ha) = **6,538 m³**;
- organic = **301 m³**

Available Organics

- organics (<0.1 ha) - total available = 301 m³;
 - Option A = 301 m³;
 - Option B = none salvaged; and
 - **Option C = 301 m³ (preferred).**

Well Pad 407 (3.7 ha)*Planned Salvage:*

- upland (3.0 ha) = **7,484 m³**;
- organic = **4,118 m³**

Available Organics

- organics (0.7 ha) - total available = 4,118 m³;
 - Option A = 4,118 m³;
 - Option B = none salvaged; and
 - **Option C = 4,118 m³ (preferred).**

Well Pad 408 (3.3 ha)*Planned Salvage:*

- upland (3.3 ha) = **8,280 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 409 (3.1 ha)

Planned Salvage:

- upland (0.0 ha) = **0.0 m³**;
- organic = **0 m³**

Available Organics

- organics (3.1 ha) - total available = 21,897 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 21,896 m³.

Well Pad 504 (4.1 ha)*Planned Salvage:*

- upland (4.1 ha) = **8,160 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 505 (3.8 ha)*Planned Salvage:*

- upland (2.0 ha) = **4,027 m³**;
- organic = **0 m³**

Available Organics

- organics (1.8 ha) - total available = 24,724 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 24,724 m³.

Well Pad 506 (3.7 ha)*Planned Salvage:*

- upland (3.7 ha) = **14,730 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Well Pad 507 (3.7 ha)*Planned Salvage:*

- upland (1.8 ha) = **3,643 m³**;

- organic = 0 m³

Available Organics

- organics (1.9 ha) - total available = 27,879 m³;
 - Option A = 0 m³;
 - **Option B = none salvaged (preferred); and**
 - Option C = 27,879 m³.

Borrow Pits

Approximately 14.8 ha of the total 16.0 ha of the borrow pits are considered upland and will have the topsoil material salvaged and stockpiled for replacement at reclamation. All of the organic material (1.2 ha) will be salvaged (Option C is preferred). The upland and organic materials will be stockpiled, seeded to establish a vegetative cover and used at final reclamation of the borrow pits. The following is a summary of the soil material planned for salvage and the amount available within the borrow areas:

Borrow Pit 22 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = 8,000 m³;
- organic = 0 m³

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit 23 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = 7,964 m³;
- organic = 55 m³

Available Organics

- organics (<0.1 ha) - total available = 55 m³;
 - Option A = 55 m³;
 - Option B = 55 m³, all organics salvaged for borrow development; and
 - **Option C = 55 m³.**

Borrow Pit 24 (4.0 ha)*Planned Salvage:*

- upland (2.8 ha) = 5,831 m³;
- organic = 16,578 m³

Available Organics

- organics (1.2 ha) - total available = 16,578 m³;
 - Option A = 16,578 m³;
 - Option B = 16,578 m³, all organics salvaged for borrow development; and
 - **Option C = 16,578 m³ (preferred).**

Borrow Pit 25 (4.0 ha)*Planned Salvage:*

- upland (4.0 ha) = **10,000 m³**;
- organic = **0 m³**

Available Organics

- organics (0.0 ha) - total available = 0 m³;

Borrow Pit Storage Areas (includes Borrow Pit 22S, 23S, 24S, and 25S)

Borrow pit storage areas (totalling 12.8 ha) are designated to provide additional soil storage areas for the borrow developments. Topsoil and organic material salvaged from the development of the associated borrows will be stockpiled within the storage areas.

Soil Salvage Summary

A summary of the available volumes for upland and organic soils are provided in [Table E.3.3](#). The volumes of organic material estimated for each organic handling option and the preferred option are shown for each Project component.

Project Component	Total Area (ha)	Area of Upland Soils (ha)	Volume of Upland Soil available (m ³)	Area of Organic Soils (ha)	Organic Handling Options						Preferred Organic Handling Option
					Option A – Selective Salvage		Option B – No Salvage		Option C – Complete Salvage		
					Salvage Area (ha)	Volume (m ³)	Salvage Area (ha)	Volume (m ³)	Salvage Area (ha)	Volume (m ³)	
Road/UC	84.6	47.0	108,596	37.6	21.2	130,513	-	-	37.6	292,892	B
Sump	4.0	2.7	11,938	1.3	1.3	9,403	-	-	1.3	9,403	C
Well Pad 106	3.7	2.9	8,644	0.7	-	-	-	-	0.7	5,112	B
Well Pad 107	4.1	3.0	5,931	1.1	-	-	-	-	1.1	7,800	B
Well Pad 108	3.5	0.0	0	3.5	3.4	20,201	-	-	3.5	22,009	B
Well Pad 109	3.7	<0.1	80	3.6	2.3	13,781	-	-	3.6	18,803	B
Well Pad 110	2.9	2.9	5,888	-	-	-	-	-	-	-	-
Well Pad 115	3.3	0.0	0	3.3	3.2	18,962	-	-	3.3	18,962	B
Well Pad 116	3.3	0.0	0	3.3	-	-	-	-	3.3	48,024	B
Well Pad 207	3.7	3.3	6,658	0.4	<0.1	297	-	-	0.4	4,598	B
Well Pad 208	3.1	0.4	875	2.7	-	-	-	-	2.7	57,831	B
Well Pad 209	5.3	4.4	8,856	0.9	-	-	-	-	0.9	13,469	B
Well Pad 405	3.7	0.3	781	3.4	-	-	-	-	3.4	47,147	B
Well Pad 406	3.3	3.3	6,538	<0.1	<0.1	301	-	-	<0.1	301	C
Well Pad 407	3.7	3.0	7,484	0.7	0.7	4,118	-	-	0.7	4,118	C
Well Pad 408	3.3	3.3	8,280	-	-	-	-	-	-	-	-
Well Pad 409	3.1	0.0	0	3.1	-	-	-	-	3.1	21,896	B
Well Pad 504	4.1	4.1	8,160	-	-	-	-	-	-	-	-
Well Pad 505	3.8	2.0	4,027	1.8	-	-	-	-	1.8	24,724	B
Well Pad 506	3.7	3.7	14,730	0.0	-	-	-	-	-	-	-
Well Pad 507	3.7	1.8	3,643	1.9	-	-	-	-	1.9	27,879	B
Borrow Pit 22	4.0	4.0	8,000	-	-	-	-	-	-	-	-
Borrow Pit 22S	3.5	3.5	7,026	-	-	-	-	-	-	-	-
Borrow Pit 23	4.0	4.0	7,964	<0.1	<0.1	55	-	-	<0.1	55	C
Borrow Pit 23S	2.3	2.2	4,390	0.1	0.1	445	0.1	445	0.1	445	C
Borrow Pit 24	4.0	2.8	5,831	1.2	1.2	16,578	1.2	16,578	1.2	16,578	C
Borrow Pit 24S	3.5	2.9	6,013	0.6	-	-	-	-	0.6	9,699	B

Table E.3.3 Soil Materials Available for Salvage for Phase 3											
Project Component	Total Area (ha)	Area of Upland Soils (ha)	Volume of Upland Soil available (m³)	Area of Organic Soils (ha)	Organic Handling Options						Preferred Organic Handling Option
					Option A – Selective Salvage		Option B – No Salvage		Option C – Complete Salvage		
					Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	Salvage Area (ha)	Volume (m³)	
Borrow Pit 25	4.0	4.0	10,000	-	-	-	-	-	-	-	-
Borrow Pit 25S	3.5	3.1	7,866	0.3	-	-	-	-	0.3	2,402	B
TOTALS	186.3	114.7	268,202	71.6	33.4	214,654	1.3	17,023	71.6	654,147	

E.3.3 Soil Storage

All upland and organic materials that are salvaged, as described in [Section E.3.2.1](#) to [E.3.2.3](#), will be placed in designated stockpiles as follows:

- soil material salvaged along the internal access roads (part of utility corridor) will be windrowed along the right-of-way and some of this topsoil material will be spread along the ditches after construction is complete and some will be stored along the right of way, seeded to establish a vegetative cover and used at final reclamation of the utility corridor.
- soil materials salvaged from the well pads will be stockpiled at the respective pad sites until required for reclamation;
- soil materials salvaged from the borrow pit will remain at the borrow location or at the designated soil storage area in stockpile until required for reclamation;
- soil materials (topsoil and upper subsoil) salvaged from the construction of the plant site will be stored on the edge of the plant site in stockpiles.

The stockpiles will be constructed as follows:

- topsoil will be stockpiled separately from salvaged subsoil and other materials;
- stockpile foundations will be stable;
- stockpiles will be stabilized to control water and wind erosion;
- stockpiles will be accessible and retrievable;
- stockpiles will be revegetated and controlled for weeds; and
- stockpiles will include signage that indicates the type of reclamation material.

For all Project footprint components, the location, size, and stockpile contents will vary depending on the organic handling option(s) utilized. [Figure E.3-3](#) displays the estimated stockpile locations and material types of all salvaged materials. The reclamation material balance for the Project is shown in [Table E.3.4](#). The estimated volume of soil material that is expected to be salvaged in the Project footprint is based on the preferred method of organic handling for each Project component (Option A, B, or C) and complete salvage of all upland material. Materials salvaged from the access / utility corridor are not displayed on [Figure E.3-3](#). It is expected that all topsoil and organic material salvaged along the utility / access corridor will be stored along the edge of the right of way and replaced once construction is complete.

Table E.3.4 Reclamation Material Balance for the all Phases of the Project – Includes Preferred Organic Handling

Project Component	Area of Upland Soils (ha)	Volume of Upland Soils (m³)	Area of Organic Soils (ha)	Preferred Organic Handling Option	Organic Material - Preferred Method		Total Planned Soil Salvage (m³)	Max Soil Available for Salvage (m³)
					Salvage Area (ha)	Volume (m³)		
Phase 1								
Road/UC	29.8	68,325	17.2	B	-	-	68,325	284,614
Laydown	5.9	14,636	4.0	B	-	-	14,636	46,730
Sump(s)	14.0	33,793	5.2	C	5.2	31,439	65,233	65,233
Borrow Pit(s)	17.4	40,015	4.1	C	4.1	38,506	78,521	78,521
Borrow Pit Storage Areas	4.6	N/A	1.4	B ¹	-	-	-	27,808
Well Pad(s)	29.0	61,723	12.9	B ²	<0.1 ²	197 ²	61,922	184,169
Sub-total	100.7	218,492	44.8	-	9.3	70,142	288,638	687,075
Phase 2								
Road/UC	60.8	137,943	30.6	B	-	-	137,943	477,567
Sump	4.0	8,000	0.0	C	0.0	0	8,000	8,000
Borrow Pit(s)	26.8	55,174	0.9	C	0.9	10,093	65,267	65,267
Borrow Pit Storage Areas	10.4	N/A	2.5	B ¹	-	-	-	48,165
Well Pad(s)	39.4	90,793	13.6	B ³	0.2 ³	809 ³	91,602	236,714
Sub-total	141.5	291,911	47.6	-	1.1	10,902	302,812	835,713
Phase 3								
Road/UC	47.0	108,596	37.6	B	-	-	108,596	401,488
Sump	2.7	11,938	1.3	C	1.3	9,403	21,341	21,341
Borrow Pit(s)	14.8	31,795	1.2	C	1.2	16,633	48,429	48,429
Borrow Pit Storage Areas	11.7	N/A	1.0	B ¹	-	-	-	37,841
Well Pad(s)	38.6	90,578	30.4	B ⁴	0.7 ⁴	4,419 ⁴	94,997	413,251
Sub-total	114.7	242,907	71.6	-	3.2	30,455	273,363	922,350
TOTALS	356.9	753,310	164.0	-	13.6	111,499	864,813	2,445,138

N/A – Volumes for salvaged topsoil material within the storage locations is not displayed as it is not known how much area (if any) will need to be salvaged for storage of poor construction material (if any).

¹ Portions of soil storage areas do contain organic materials that may be padded over for placement of poor construction material (if any).

² The preferred organic material handling option for well pad 235 is Option C; Option B is preferred for all other well pads in Phase 1.

³ The preferred organic material handling option for well pad 503 is Option C; Option B is preferred for all other well pads in Phase 2.

⁴ The preferred organic material handling option for well pads 406 and 407 is Option C; Option B is preferred for all other well pads in Phase 3.

Approximately 864,813 m³ of soil material is planned to be salvaged over the three phases of the Project (Table E.3.4). This excludes volumes of materials available in the soil storage areas. For comparison purposes, the total volumes of soil materials that would be salvaged if organic handling was carried out using Option A, or B or C are provided below:

Phase 1

- A - upland material (218,492 m³) + selective organic salvage (Option A – 70,142 m³)
= **288,634 m³**;
- B - upland material (218,492 m³) + no organic salvage except from borrow pits (38,506 m³)
= **256,998 m³**; and
- C - upland material (218,492 m³) + complete organic salvage (Option C – 458,110, m³)
= **676,602 m³**.

Phase 2

- A - upland material (291,911 m³) + selective organic salvage (Option A – 89,244 m³)
= **381,156 m³**;
- B - upland material (291,911 m³) + no organic salvage except from borrow pits (10,093 m³)
= **302,005 m³**; and
- C - upland material (291,911 m³) + complete organic salvage (Option C – 522,422 m³)
= **814,334 m³**.

Phase 3

- A - upland material (242,907 m³) + selective organic salvage (Option A – 214,654 m³)
= **457,561 m³**;
- B - upland material (242,907 m³) + no organic salvage except from borrow pits (17,023 m³)
= **259,930 m³**; and
- C - upland material (242,907 m³) + complete organic salvage (Option C – 654,147 m³)
= **897,054 m³**.

E.4 RECLAMATION

E.4.1 Final Site Grading and Re-contouring

Connacher will re-contour disturbed land such that the reclaimed lands approximate the natural landforms in the areas adjacent to the footprint. Connacher will re-establish surface drainage on all reclaimed areas such that it is integrated with the adjacent land.

Connacher will reclaim all access roads by removing culverts and other structures, re-contouring, restoring drainage, decompaction of subsoil, replacement of topsoil and revegetation. All watercourse crossings will be removed as part of the final reclamation.

Final re-contouring will involve the removal of fill material where applicable, ripping/decompaction and contouring to blend with surrounding area. Once the re-contouring is complete, the areas will be ready for soil replacement and revegetation.

The completed borrow pit will have side slopes graded to 3:1. The lowest portion of the borrow area will fill with water and will develop into a wetland. The upper portions of the borrow area are expected to be upland sites with local vegetation being established.

E.4.2 Soil Replacement

Connacher will reclaim land through appropriate conservation and reclamation methods to construct post disturbance landscapes having characteristics (soils, topography, and drainage) that results in a return of land capability equivalent to that which existed prior to disturbance.

Connacher will replace salvaged topsoil materials on re-contoured areas such that the average depth of the replaced topsoil in the reclaimed profile for each reclamation area shall be equivalent to or greater than 80% of the original topsoil depth (this is not a target, it is the minimum).

While it is anticipated that organic soils will not be salvaged for a majority of the site (except for the borrow and sump locations and select well pads), there may be some that will be salvaged and stockpiled (as per Options A, and C described in [Section E.3.2](#)). Soil replacement activities will be determined for each development area, by the type of soil salvage that occurred during site construction which includes:

- **Option A - selective salvage** – for reclamation the clay fill over organic material will be removed exposing the under-lying material and for all other areas, the site will be decompacted/conditioned and will have soil material (either upland or organic) placed over top;
- **Option B - no salvage** – for reclamation the clay fill over organic material will be removed exposing the under-lying material; and
- **Option C - complete salvage** – for reclamation the site will be decompacted/conditioned and will have soil material (either upland or organic) placed over top.

Following construction of surface pipelines and power lines, soil material salvaged for construction purposes will be immediately replaced and revegetated on the right of ways.

With respect to other Project infrastructure, soil will be placed once final re-contouring and de-compaction of the surficial materials is complete. The goal of soil replacement is to establish a soil profile that permits the establishment of an initial vegetation cover, subsequent natural recovery of the plant community and initiation of natural soil processes such that land capability equivalent to that which existed prior to disturbance is achieved. The reclaimed soil profile will provide:

- adequate moisture supply;
- adequate nutrient supply; and
- capability to support a self-sustaining vegetative cover similar to pre-disturbance conditions.

Soil handling practices are designed to follow the guidelines provided in *Land Capability Classification for Forest Ecosystems in the Oil Sands Region, Working Manual* (CEMA 2006). Equivalent forest capability is the primary consideration for reclamation. This focus is not expected to drastically alter soil salvage criteria, but it will assist in managing the placement of better-suited reclamation material.

A range of soil replacement and fill removal is required to meet equivalent capability. Connacher is committed to ensuring that equivalent capability is returned on the reclaimed landscape. Within the Project footprint, depending on the methods employed to handle peat material, the amount of salvaged soil material to be replaced is variable. A description of expected soil replacement activities for each component is summarized below.

E.4.2.1 Plant Site and Camp

The plant site and camp site will remain active for the entire life of the Project. Reclamation can only begin when the Project is decommissioned. At this point, all contamination on the sites will be remediated, facilities will be removed and contouring/grading can begin. A C&R plan was developed and approved for the Algar Project, and will be relied upon for the final reclamation.

E.4.2.2 Well Pads

The well pads will remain active for several years. Reclamation can only begin once the well pads are decommissioned. At this point, all contamination on the pads will be remediated, facilities will be removed and contouring/grading can begin.

A majority of the well pads have a component of organic soils that will have fill material placed over top. To complete the reclamation, fill material will be removed. The underlying organic material may need to be conditioned or decompacted as part of the process, but no additional topsoil will be required. If Connacher decides to leave some fill material in place on any of the well pads, a surplus of topsoil/organic material may exist from the development of the borrow pit that could be used for reclamation purposes.

If Connacher includes selective or complete salvage of the organic materials (Options A or C as described in [Section E.3.2.](#)), portions of fill over organic material may be left in place and reclaimed using the organic soils. These sites would be conditioned and re-contoured to tie into the adjacent lands.

Some areas of the well pads are located on upland terrain, and once appropriate re-contouring is complete the upland areas will first be decompacted, then the upland and salvaged organic material will be replaced.

E.4.2.3 Utility Corridor

The utility corridor (power line, surface pipelines and access road) will be in place for the life the Project. The upland soils will be pushed to the edge of the right of way during construction activities. Once construction is complete, the upland soil material will be spread evenly on the powerline and pipeline portions of the right of way and along the ditches. Excess soil materials will be stockpiled on the edge of the corridor. At the end of the Project, the powerlines and pipelines will be removed, the road grade will be recontoured or will be removed if placed on top of organic materials, soil will be placed/conditioned and the site will be ready for vegetation.

If Connacher includes selective or complete salvage of the organic materials (Options A or C as described in [Section E.3.2.](#)), portions of fill over organic material may be left in place and reclaimed using the organic soils. These sites would be conditioned and re-contoured to tie into the adjacent lands.

If additional soil resources are required at Project completion, a surplus of topsoil/organic material may exist from the borrow pit development that could be used for reclamation purposes.

E.4.2.4 Borrow Pits

All soil material, upland and organic, will be salvaged from the borrow pits. Once a borrow pit has been completed it will be reclaimed by re-contouring the site and ensuring appropriate surface drainage to allow for a wetland to form at the bottom of the borrow area. A portion of the borrow area is expected to fill with water and remain as a wetland.

Connacher plans to submit a Surface Material Licence Application to SRD for approval of the borrow areas. Final conservation and reclamation details will be as agreed upon with SRD.

E.4.2.5 Laydown Area

The laydown area (associated with Phase 1, adjacent the Algar CPF) will remain active for several years. A majority of the laydown area consists of organic materials (4.9 ha) that will have fill material placed over top. To complete the reclamation, fill material will be removed. The underlying organic material may need to be conditioned or decompacted as part of the process, but no additional topsoil will be required. If Connacher decides to leave some fill material in place within the laydown area, a surplus of topsoil/organic material may exist from the development of the borrow pits that could be used for reclamation purposes.

If Connacher includes selective or complete salvage of the organic materials (Options A or C as described in [Section E.3.2.](#)), portions of fill over organic material may be left in place and reclaimed using the organic soils. These sites would be conditioned and re-contoured to tie into the adjacent lands.

A portion of the laydown area is located on upland terrain (1.9 ha). Once appropriate re-contouring is complete the upland areas will first be decompacted, then the upland and salvaged organic material will be replaced.

E.4.2.6 Sumps

All soil material, upland and organic, will be salvaged from the sump development areas. Once a sump area is no longer required and remediated (to comply with ERCB guidelines) it will be reclaimed by re-contouring the site and ensuring appropriate surface drainage. All salvaged soil material will be replaced over the re-contoured areas.

E.4.3 Reclamation of Compacted Areas

Surfaces receiving gravel surface treatment, such as the working surface of access roads, central facilities and well pads, will all be subjected to significant load applications and traffic over their life. These areas will become relatively compacted compared to the density of undisturbed soils.

Connacher will ensure that compacted subgrades along the access roads are deep ripped or “subsoiled” prior to replacement of coversoil. These activities will help ensure that densities of the formerly compacted soils are not significantly different from that of nearby undisturbed lands.

In locations where fill material is to be removed from organic materials the peat surface (once exposed) will be de-compacted to allow for vegetation and water flow throughout the peat landforms.

E.4.4 Post Reclamation Land Capability

Connacher will reclaim the land through appropriate conservation and reclamation methods to construct post disturbance landscapes, which have characteristics (soils, topography and drainage) that result in a return of land capability equivalent to that which existed prior to disturbance.

The post reclamation land capabilities will be similar to the ratings determined for the baseline soil map units. The predicted reclaimed forest soil land capability rating of the reclaimed soils post reclamation are presented in [Table E.4.1](#) and are shown on [Figure E.4-1](#).

Table E.4.1 Predicted Reclaimed Forest Soil Land Capability for the Project						
Component	Class 3	Class 4	Class 5	NR	Water *	Total Area (ha)
Phase 1						
Road/UC	28.6	-	18.4	-	-	47.0
Laydown	5.9	-	4.0	-	-	9.9
Sump(s)	14.1	-	5.2	-	-	19.3
Borrow Pit(s)	11.9	-	6.9	-	8.6	27.4
Well Pad(s)	28.8	-	12.9	0.2	-	41.9
Sub-total	89.2	-	47.5	0.2	8.6	145.5
Phase 2						
Road/UC	55.3	1.3	34.8	-	-	91.4
Sump	4.0	-	-	-	-	4.0
Borrow Pit(s)	19.1	-	9.6	-	12.0	40.6
Well Pad(s)	35.4	-	17.6	-	-	53.0
Sub-total	113.8	1.3	62.0	0.0	12.0	189.1
Phase 3						
Road/UC	40.6	4.3	39.6	0.2	-	84.6
Sump	0.01	-	4.0	-	-	4.0
Borrow Pit(s)	15.9	0.03	5.3	-	7.5	28.7
Well Pad(s)	32.6	3.3	33.0	0.2	-	69.0
Sub-total	89.0	7.5	81.9	0.3	7.5	186.3
Total Area	292.0	8.8	191.3	0.6	28.1	520.8
% of Project Area	56.1	1.7	36.7	0.1	5.4	100.0
* Wetland/pond created as a result of the creation of the Borrow pit.						

Although the shape of the soil polygons will be altered as a result of the development, the reclaimed capability will be similar to pre-existing patterns. The forest soil land capability classification system (LCCS) ratings assigned to the baseline soil map units and reclaimed LCCS ratings are not meant to imply that the identical soil profiles and distribution of soil units exist upon completion of reclamation. The reclaimed LCCS values were calculated using the physical and chemical characteristics of baseline soils using assumptions of reclaimed soil characteristics that are based on the anticipated soil salvage, storage and eventual replacement conditions. The summary of the reclaimed LCCS calculations are provided in the Baseline Soil Survey and Terrain Assessment (CR #9).

The reclaimed LCCS ratings incorporate assumptions of salvaged soil characteristics and the likely composition of expected reclaimed soil profiles. For example, the MNSpt soil contains a thick surface peat layer over medium textured material (B & C horizon), it is expected that the reclaimed profile will contain a similar profile orientation (peat layer over mineral) and contain blended physical and chemical characteristics due the blending of material during material handling. It is possible that the soil capability may be improved as a result of the mixing that will occur at the final reclamation stage, which may create a more favourable growth medium for vegetation.

The reclaimed suitability ratings anticipated for the proposed Project footprint are similar to the baseline ratings calculated. In many instances the ratings of the reclaimed map units varied slightly (3-5 points) from the baseline LCCS ratings, primarily due to using conservative assumptions (decreased organic matter, firmer soil

structure, changes in soil nutrient regimes due to blending of the litter and topsoil materials). Table E.4.2 presents a comparison of the reclaimed and baseline LCCS ratings for soil map units within the proposed footprint.

Table E.4.2 Comparison of the Baseline and Reclaimed Land Capabilities					
Capability Class	Baseline Capabilities		Reclaimed Capabilities		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
Phase 1					
Class 3	99.3	68.2	89.2	61.3	-6.9
Class 4	0.0	0.0	0.0	0.0	0.0
Class 5	46.0	31.6	47.5	32.6	1.0
NR	0.2	0.2	0.2	0.2	0.0
Water	0.0	0.0	8.6	5.9	5.9
Sub-Total	145.5	100.0	145.5	100.0	0.0
Phase 2					
Class 3	132.0	69.8	113.8	60.2	-9.6
Class 4	1.3	0.7	1.3	0.7	0.0
Class 5	55.8	29.5	62.0	32.8	3.3
NR	0.0	0.0	0.0	0.0	0.0
Water	0.0	0.0	12.0	6.3	6.3
Sub-Total	189.1	100.0	189.1	100.0	0.0
Phase 3					
Class 3	99.6	53.5	89.0	47.8	-5.7
Class 4	7.5	4.0	7.5	4.0	0.0
Class 5	78.8	42.3	81.9	44.0	1.7
NR	0.3	0.2	0.3	0.2	0.0
Water	0.0	0.0	7.5	4.0	4.0
Sub-Total	186.3	100.0	186.3	100.0	0.0

E.4.5 Revegetation

Connacher will follow the recommendations provided by the Oil Sands Vegetation Reclamation Committee. The committee's report, *Guidelines for Reclamation of Terrestrial Vegetation in the Alberta Oil Sands Region* (OSVRC 1998), forms the basis for future revegetation activities on reclaimed sites within the Project footprint.

The primary objective of the revegetation program is to provide site conditions suitable to support plant communities capable of developing into self-sustaining forest ecosystems that provide watershed protection, traditional land uses, wildlife habitat and commercial forest production, with possibilities for recreation and other end uses.

E.4.5.1 Revegetation Practices

Revegetation practices are designed to enhance the natural recovery of vegetation communities. On those sites where the level of disturbance is low, natural recovery is expected to occur without additional revegetation activities; however, additional revegetation activities may need to be employed where the degree of disturbance is higher.

On those sites with higher degree of disturbance, site characteristics such as slope, aspect, topography, and slope position become important in determining the most effective methods to encourage natural recovery.

Salvage and direct placement of soil onto reclamation sites normally enhances natural recovery of vegetation communities because of the viable seed, roots and other plant material fragments transferred with the soil. Directly replaced soil requires less revegetation effort to achieve reclamation objectives. The type of soil to be replaced (i.e. texture) is also an important factor in determining a revegetation strategy.

Soil to be used in the reclamation program for this Project will be either organic or upland soil, and most will have been in stockpile or covered by fill material for extensive periods prior to reclamation. This material will have little viable seed or root material remaining, and will need more revegetation effort to achieve objectives. Opportunities for direct replacement, as with most SAGD Projects will be limited to ditches along access corridors and surface pipelines.

Revegetation practices to be employed as part of the reclamation program are discussed in terms of the degree of disturbance experienced:

- **Low degree of disturbance** – seismic lines, corehole sites, above ground pipeline and power line rights-of-way. On these sites, rollback will be completed in areas disturbed (unless it is determined that access is to be maintained to meet other land use objectives). Natural recovery is expected to redevelop native plant communities that are similar in composition to those of adjacent undeveloped areas. No further revegetation activities will be conducted unless site-specific conditions warrant, e.g. a steeper, potentially erodible slope that needs runoff diversion work and/or revegetation;
- **Moderate degree of disturbance** – borrow pits, underground pipeline facilities and corridor sites. When the pipeline or soil stockpile is removed from these sites, the capability of the underlying native soil is expected to recover quickly. On these sites, rollback will be replaced (if available) and a short-lived nurse crop may be seeded. This nurse crop will provide short-term erosion control and leave a protective layer of organic matter that will help to encourage natural recovery of the vegetation communities. On those sites where erosion is not an issue, a nurse crop may not be necessary. Tree planting will be conducted on those upland reclaimed disturbances that had tree cover prior to disturbance. On poorly drained sites, natural recovery will be relied upon for woody species re-establishment. Tree planting will reduce the time needed for these sites to regain a forest cover; otherwise, it is expected that a full range of herbaceous and shrub species will re-establish naturally; and
- **Highest degree of disturbance** - well pads, road grades and the plant site. After the soil profile on these sites has been reclaimed, natural recovery will be encouraged, especially on poorly drained (organic) sites. On upland areas the application of a short-lived nurse crop of barley or other agronomic species and subsequent planting with tree seedlings will be carried out. The nurse crop will provide short-term cover, a protective organic layer, and conditions that will encourage the natural ingress of locally native herbaceous plants, shrubs and trees.

Some areas located in the vicinity of streams or watercourses may be sensitive to soil erosion. In such areas, the value of watershed protection supersedes other vegetation objectives, and special measures are required to stabilize soils including the use of agronomic species that are effective due to their quick establishment. In consultation with SRD, Connacher has been using an approved seed mix that will continue to be used in the reclamation program.

Weed control, by picking or spraying, will be undertaken as required. Revegetation of disturbances will be coordinated with construction / reclamation activities to limit the area of exposed soil at any one time.

As reclamation proceeds, monitoring of reclamation and revegetation performance over time allows land use objectives to be reviewed and adjustments made to site conditions according to natural revegetation processes. The intent of adaptive management is to facilitate and respond to the soil replacement and revegetation process to meet specific objectives and allow for improvements to be made to the reclamation and revegetation process. These are the same practices that have been successfully used at both the Great Divide and Algar projects. The expansion areas will continue to do “more of the same”.

E.4.5.2 Woody Species Planting

Establishment of woody plants in reclamation areas is an important part of revegetation activities. Selection of species and the proportion of each species in the planting mix are based on:

- expected growth of woody-stemmed species from seeds and root fragments in the replaced soil;
- woody-stemmed species common to the adjacent ecosites;
- existing field conditions;
- vegetation type or types desired for development on the site, based on end land use objectives and landscape terrain features; and
- the ability to produce the species at a practical scale.

The planting prescription for establishing woody species on the Project footprint will consider ecological site characteristics, land use objectives for the site, the degree of disturbance, and the likelihood that woody plants will recover naturally. Where feasible, the planting prescription will use those species that are present within the adjacent ecosite. Typically the species that will be planted will include jack pine, white spruce, black spruce and aspen. These species are all relatively easy to collect seed and can be commercially grown in tree nurseries.

E.4.5.3 Post Reclamation Ecosites

A comparison between the predicted post disturbance/reclaimed ecosites and the baseline ecosites are provided in [Table E.4.3](#). The reclaimed ecosites are shown on [Figure E.4-2](#).

Table E.4.3 Baseline and Estimated Reclaimed Ecosites					
Ecosite	Baseline		Reclaimed		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
B - Blueberry - submesic	33.4	6.4	31.3	6.0	-0.4
C - Labrador tea - mesic	184.7	35.5	167.7	32.2	-3.3
D - low bush cranberry	6.9	1.3	4.6	0.9	-0.4
G - Labrador tea - subhygric	123.9	23.8	110.5	21.2	-2.6
H - Labrador tea - horsetail	6.7	1.3	2.8	0.5	-0.8
I - treed bog	98.1	18.7	94.5	18.1	-0.7
J - treed poor fen	36.2	7.0	34.7	6.7	-0.3
K - treed rich fen	25.0	4.8	25.0	4.8	0.0
L - marsh	0.1	0.0	15.9	3.1	3.0
All - industrial sights	4.2	0.8	4.2	0.8	0.0
AIH - permanent RoW	0.3	0.1	0.3	0.1	0.0
CIP - pipelines, transmission lines	0.2	0.0	0.2	0.0	0.0
CIW - Geophysical well sites	1.0	0.2	1.0	0.2	0.0

Table E.4.3 Baseline and Estimated Reclaimed Ecosites					
Ecosite	Baseline		Reclaimed		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
Water *	0.0	0.0	28.1	5.4	5.4
Total	520.8	100.0	520.8	100.0	0.0
* Wetland/pond created as a result of the creation of the Borrow pit.					

E.4.6 Reclamation Timing

Phase 1 development and reclamation are shown on [Figure E.4-3](#). The new development of Phase 1 is shown along with the existing activities for Great Divide and Algar. The reclamation that is proposed during this phase of the Project is limited to borrow areas.

Phase 2 development and reclamation are shown on [Figure E.4-4](#). During this phase of development, the completed areas from Phase 1 will be reclaimed.

Phase 3 development and reclamation are shown on [Figure E.4-5](#). During this phase of development, the completed areas from Phase 2 will be reclaimed. The only active areas will be related to the two CPF's and the Phase 3 development.

Once Phase 3 development has been completed, in 25+ years, the entire project will be reclaimed. This is shown on [Figure E.4-6](#). If additional bitumen reserves are found in the Project Area, then the life of the Project could be extended beyond Phase 3, following similar development and reclamation strategies.

E.5 RECLAMATION MONITORING PROGRAM

Development of the Project will progress in a phased manner, allowing for sequential reclamation of well pads, roads and facilities over the operating period of the Project. This development schedule minimizes the active footprint within the Project area at any one time and will allow for consistency in the reclamation measures to be used in all phases of the Project. Reclamation monitoring will be incorporated into an annual report to document the success of reclamation efforts and, over time, to refine measures according to site-specific conditions.

E.5.1 Monitoring Objectives

The objectives of the reclamation monitoring program are to evaluate the success of reclamation measures and to adjust or modify those measures where necessary to ensure:

- natural recovery of desired plant communities;
- erosion control and slope stability;
- self-sustaining vegetation cover on all disturbed areas;
- noxious weed control;
- establishment of the designated end land uses; and
- reclamation certification.

The objectives will be met through regular site inspections, implementation of additional reclamation measures (if necessary). Connacher will also evaluate the results of monitoring programs on reclaimed areas and update reclamation practices as new information becomes available.

Connacher will continue to produce an annual C&R report for Great Divide and Algar and will add the expansion activities as well. This report will summarize the year's activities in terms of development activities, assessments completed on facility areas to be constructed, reclamation activities, materials balance estimates, reclamation monitoring, and planned activities for the following year. This report will be submitted to Alberta Environment.

E.5.2 Monitoring Schedule

Reclamation monitoring will be consistent with the Project development schedule to ensure that reclaimed sites are fully documented according to the types of reclamation measures employed in the area. Information on each reclamation site will include:

- a description of the type of development (e.g. plant site, well pads, roads);
- a description of the reclamation activities undertaken (e.g., recontouring, soil depths, seeding, tree planting);
- the date when the reclamation activities took place; and
- end land use objectives that were established for each site.

E.5.2.1 Revegetation Monitoring

Each reclaimed area will be inspected after the first growing season following site landscaping as is currently done, soil replacement and revegetation. The inspections will be used to gauge the success of initial revegetation activities and to evaluate conditions designed to encourage natural recovery. The assessments will include information regarding soil stabilization, erosion control and the status of herbaceous vegetation growth, including dominant species composition.

Subsequent annual inspections will be undertaken to monitor the continued establishment of the vegetative cover and progress towards natural recovery of plant communities, as well as to identify requirements for follow-up activities. The annual program will include a routine maintenance component to address any potential erosion repair and control as well as any supplemental seeding and fertilizing needs for the reclaimed sites. Noxious weeds will also be identified and removed in consultation with the local reclamation inspector.

Assessments of older reclaimed areas will be conducted on a less frequent basis if deemed necessary at the time. For example, stocking and growth measurements will be recorded for all commercial tree species, including planted stock and naturally established seedlings.

Information collected from the monitoring program will allow further evaluation of the reclamation techniques and measures used for various sites. The data will be incorporated into the reclamation database for subsequent reference on the status of all reclaimed sites. As a final step, Connacher will apply for a reclamation certificate.

E.5.2.2 Terrain and Soils Monitoring

Soil and slope stability monitoring of all reclaimed sites will be undertaken in conjunction with the revegetation assessment, using a combination of site observations and systematic transects. The performance of reconstructed soils is a key element in erosion control, watershed protection and ecosystem sustainability. Connacher will monitor the reclaimed soil profiles by completing post reclamation profile checks and by

comparing soil physical and chemical parameters on the reclaimed sites with the *Land Capability Classification System for Forest Ecosystems in the Oil Sands* (CEMA, 2006).

E.5.2.3 Wildlife Monitoring

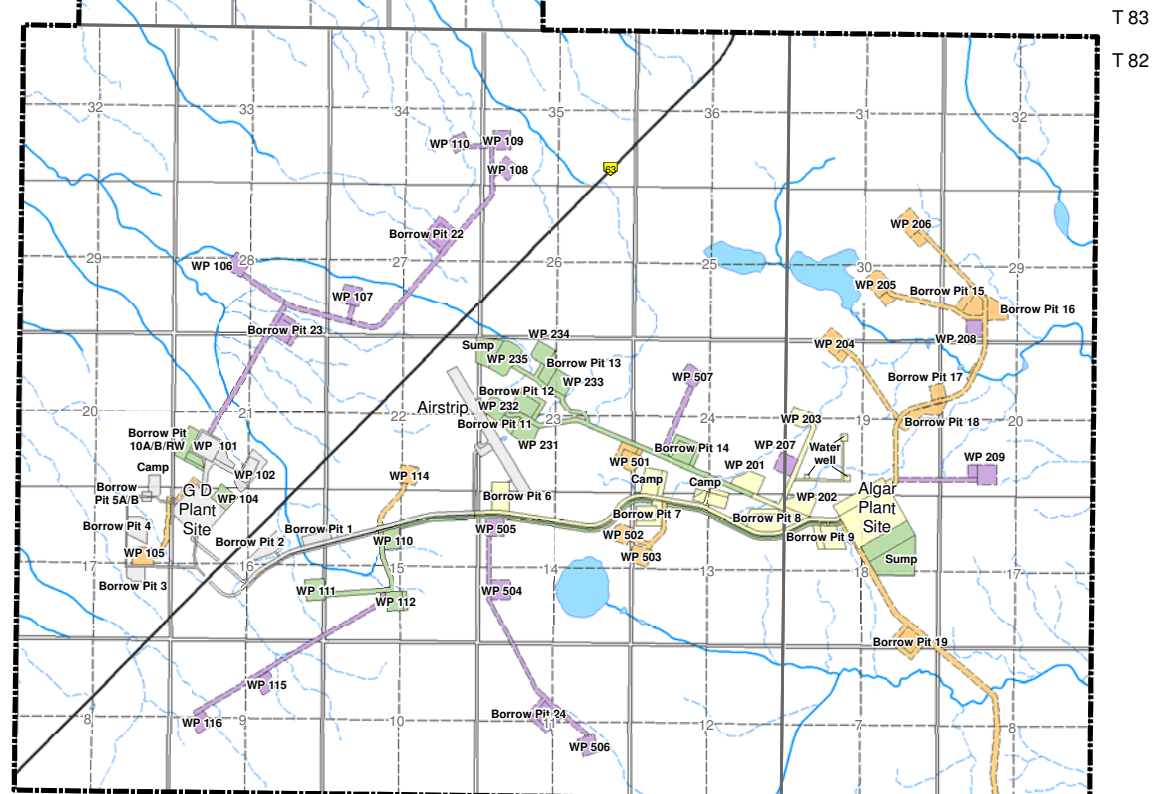
Connacher will build on the Algar wildlife monitoring program to determine the response of wildlife to the Project development and the subsequent reclamation activities. Monitoring wildlife use of both natural and reclaimed areas within the study areas will provide information on the success of re-establishing wildlife habitat. Previous experience from other developments in the region has shown that wildlife will begin using the reclaimed area as soon as the herbaceous vegetation cover has been established. The diversity of wildlife use tends to increase over time as the vegetation cover increases and as shrub and tree species colonize the area.

Connacher plans to participate in the Alberta Biodiversity Monitoring Institute (ABMI) as part of regional biomonitoring and the Alberta Caribou Committee, since the Project is partially located within a caribou management area.

E.6 ABANDONMENT AND CLOSURE

At the end of the life of the Project, project facilities will be decommissioned. In compliance with the EPEA Approval, an abandonment and reclamation plan will be submitted to AENV six months before decommissioning of surface facilities. It is envisioned that abandonment and closure plans will address the following:

- the use of an adaptive management approach that incorporates knowledge learned during the operation of the Project;
- undertaking site assessments on required facilities to characterize and delineate any soil or groundwater contamination present. Remediation will also be undertaken, as required;
- removal of surface structures and equipment. Wells will be cut off 1.2 m below the surface, cemented and blanked off. Steel piping will be cut off 1.2 m below surface;
- abandonment of all production, geotechnical and hydrogeological monitoring wells in accordance with AENV and Energy Resources Conservation Board (ERCB) standards;
- reclamation of mud pits and the oily waste holding facility by relocating all contents of these facilities to an agreed upon location then addressing any remaining soil or groundwater contaminant issues;
- abandonment of access roads and removal of culverts;
- re-contouring all sites to restore natural drainage patterns and topography;
- ripping, as required, to alleviate surface compaction on former disturbed areas;
- removal of fill materials and conditioning of underlying organic materials;
- placement of soil over the disturbed areas followed by revegetation activities;
- reclamation of peat landscapes to ensure reclaimed landscapes are appropriate for successional vegetation to eventually achieve the desired ecosite community;
- promotion of natural recovery of vegetation as the primary means of ground cover re-establishment. Where necessary, specific sites will be seeded with either a nurse crop or longer-lived, non-invasive vegetation cover and planted with tree species consistent with the revegetation plan;
- undertaking regular monitoring and maintenance activities, following reclamation and revegetation, to assess reclamation success and identify areas of concern; and
- undertaking a post-reclamation site assessment to determine the status of the site prior to applying for a reclamation certificate.



T 83

T 82

Legend

	Lease Boundary		EIA Phase 1
	Algar Existing		EIA Phase 2
	Great Divide Existing		EIA Phase 3

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

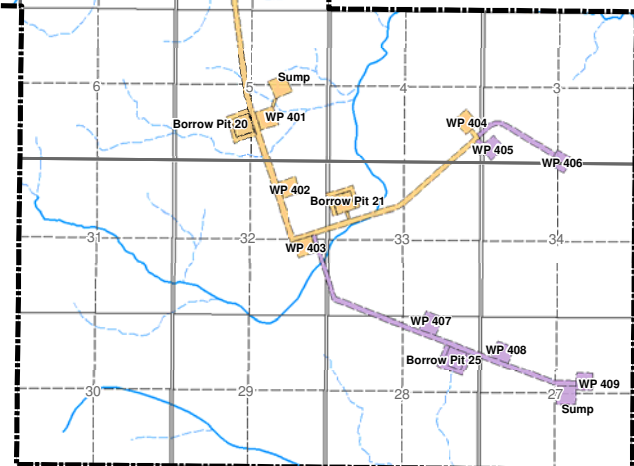
**Great Divide
Expansion Project**

TITLE:

Project Development Plan

DRAWN: SL
CHECKED: GW
DATE: Apr 22/10
PROJECT: 07-104

FIGURE:

E.1-1

T 82

T 81


R 12 R11 W4M




T 83


T 82


Legend


 Lease Boundary

Phase


 Existing Facility


 EIA Phase 1


 EIA Phase 2


 EIA Phase 3


LCCS Rating


 3V


 3VW

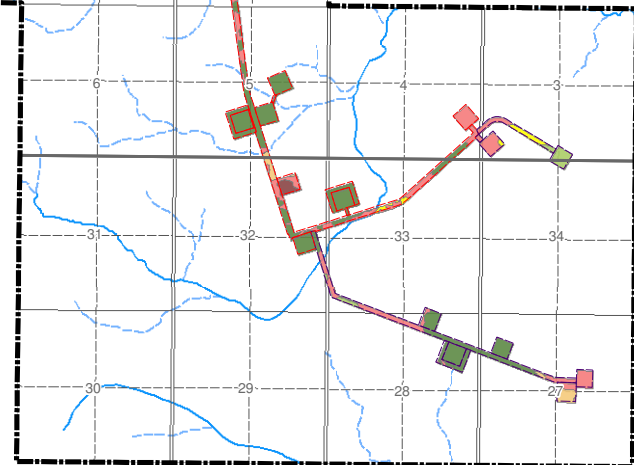
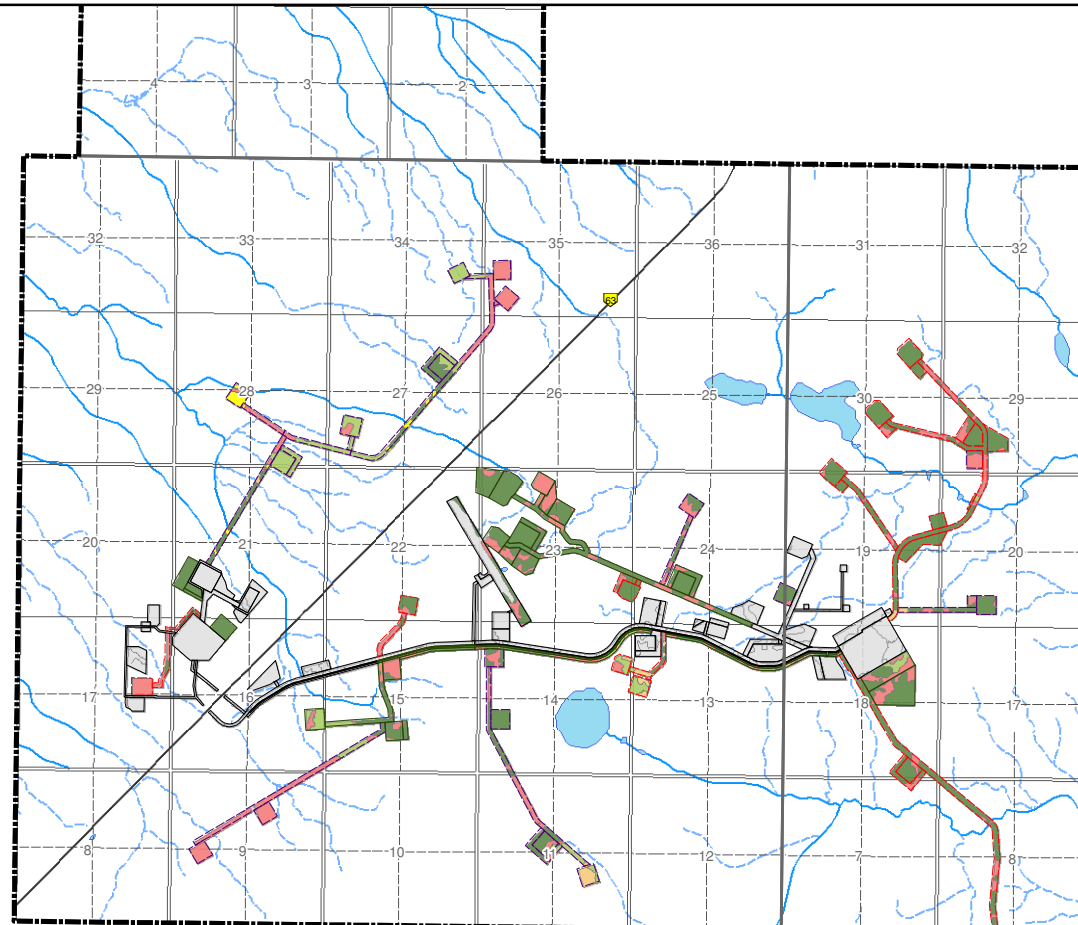
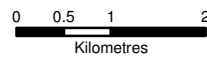
 4WV

 5W

 5WF

 5WV

 NR



T 82

T 81

R 12 R11 W4M

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

Pre-Disturbance Forest Soil Capability



DRAWN: SL
CHECKED: GW
DATE: Apr 22/10
PROJECT: 07-104

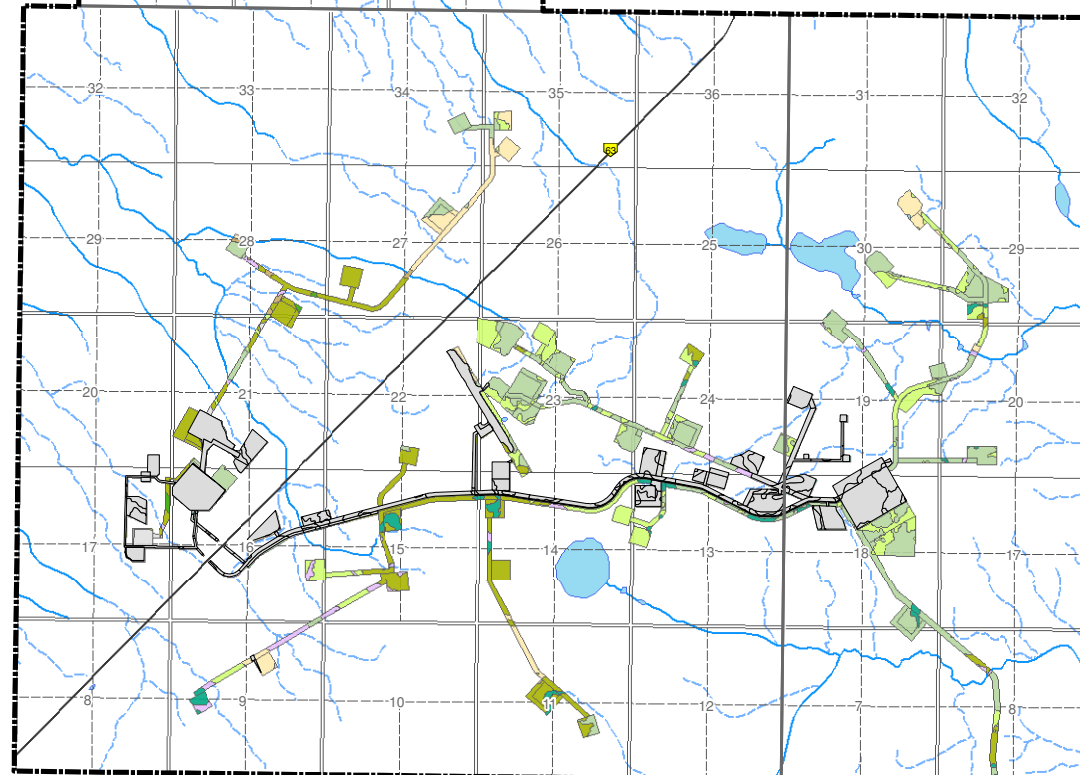
FIGURE:

E.2-1




T 83

T 82



Legend

 Lease Boundary

Ecosite Phase

-  B
-  C
-  D
-  E
-  G
-  H
-  I
-  J
-  K
-  L
-  Disturbed

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

Pre-Disturbance Ecosites



DRAWN: SL

CHECKED: GW

DATE: Apr 22/10

PROJECT: 07-104

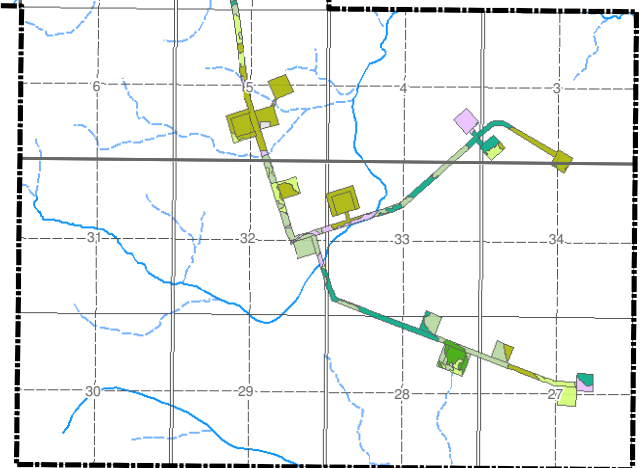
FIGURE:

E.2-2

R 12 R11 W4M

T 82

T 81





T 83

T 82

Legend

Lease Boundary

Mineral

Anzac (ANZ)

Egg Lake/Surmont (EGSR)

Moonshine (MNS)

Moonshine/Surmont (MNSR)

Moonshine/Wanham (MNWH)

Surmont (SRT)

Organic

McClelland (MLD)

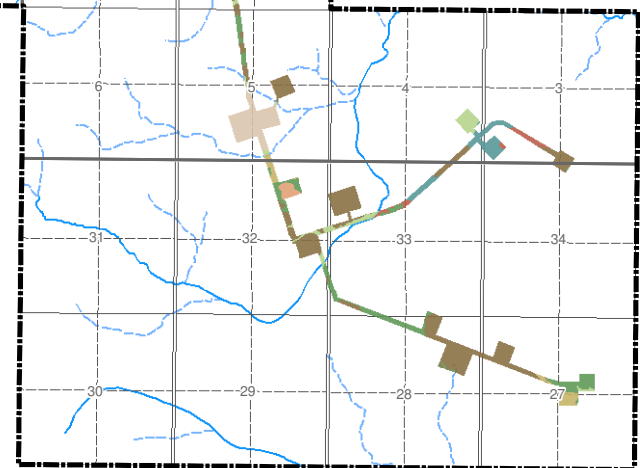
Mariana (MRN)

Muskeg (MUS)

Other

Disturbed (ZDL)

0 0.5 1 2
Kilometres



T 82

T 81

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

Great Divide Expansion Project

TITLE:

Upland and Organic Soils



DRAWN: SL

CHECKED: GW

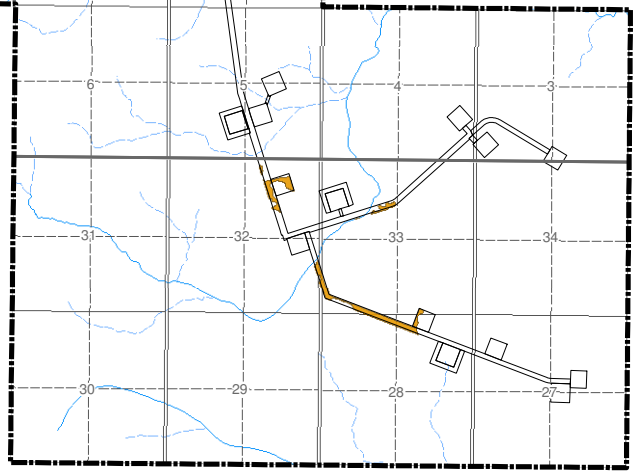
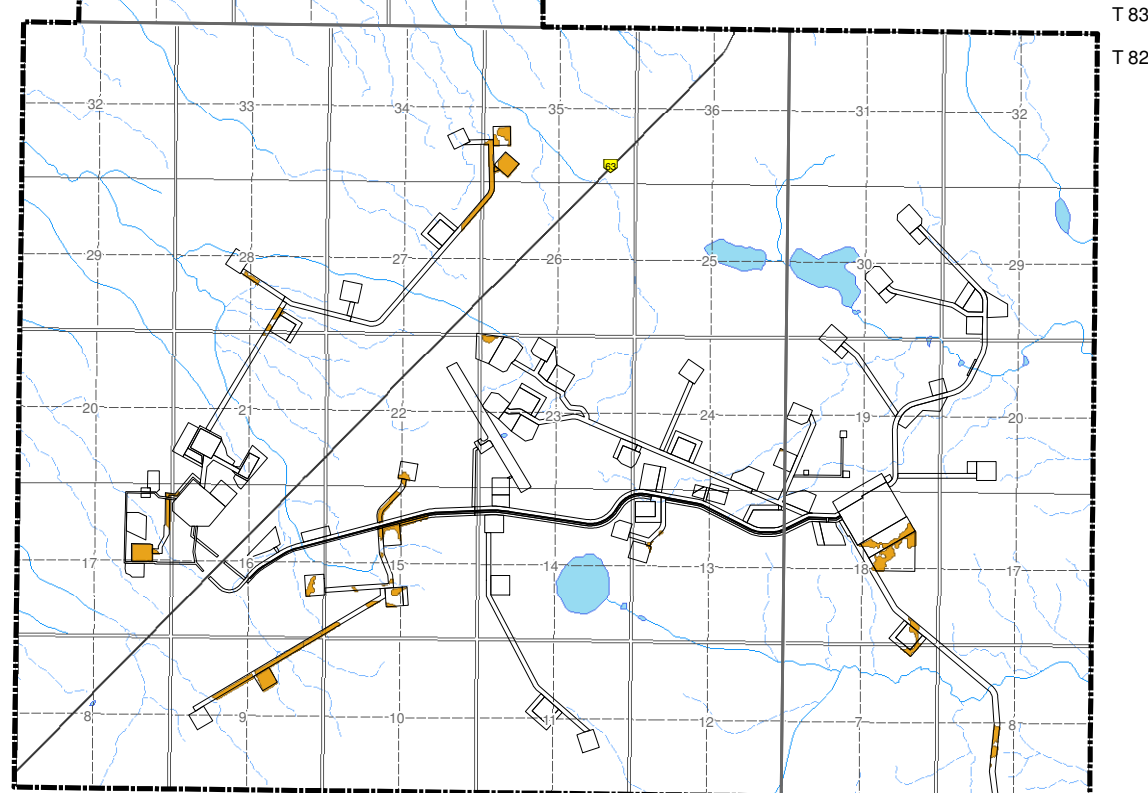
DATE: Apr 22/10

PROJECT: 07-104

FIGURE:

E.3-1

R 12 R11 W4M



Legend

- Lease Boundary
- Project Footprint
- Potential Organic Material Salvage

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

Great Divide Expansion Project

TITLE:

Potential Organic Material Salvage Locations within the Project Footprint (Option A)

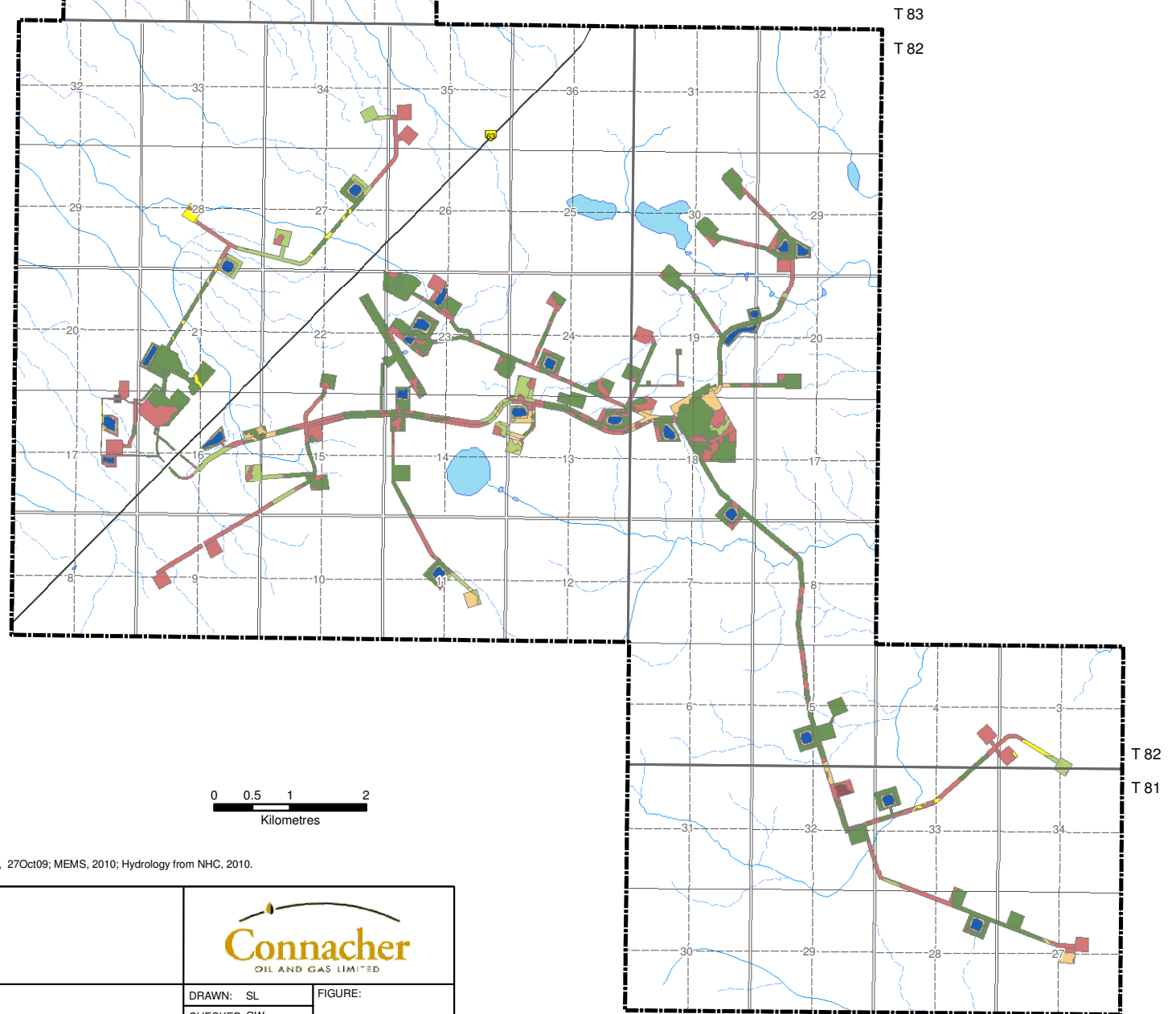


DRAWN: SL
CHECKED: GW
DATE: Apr 22/10
PROJECT: 07-104

FIGURE:

E.3-2

R 12 R 11 W 4M



Legend

- Lease Boundary
- LCCS_Recl_Footprint
- LCCS Rating
 - 3V
 - 3VW
 - 4WV
 - 5W
 - 5WF
 - 5WV
 - Pond

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

Reclaimed Forest Soil Capability



DRAWN: SL

CHECKED: GW

DATE: Apr 22/10

PROJECT: 07-104

FIGURE:

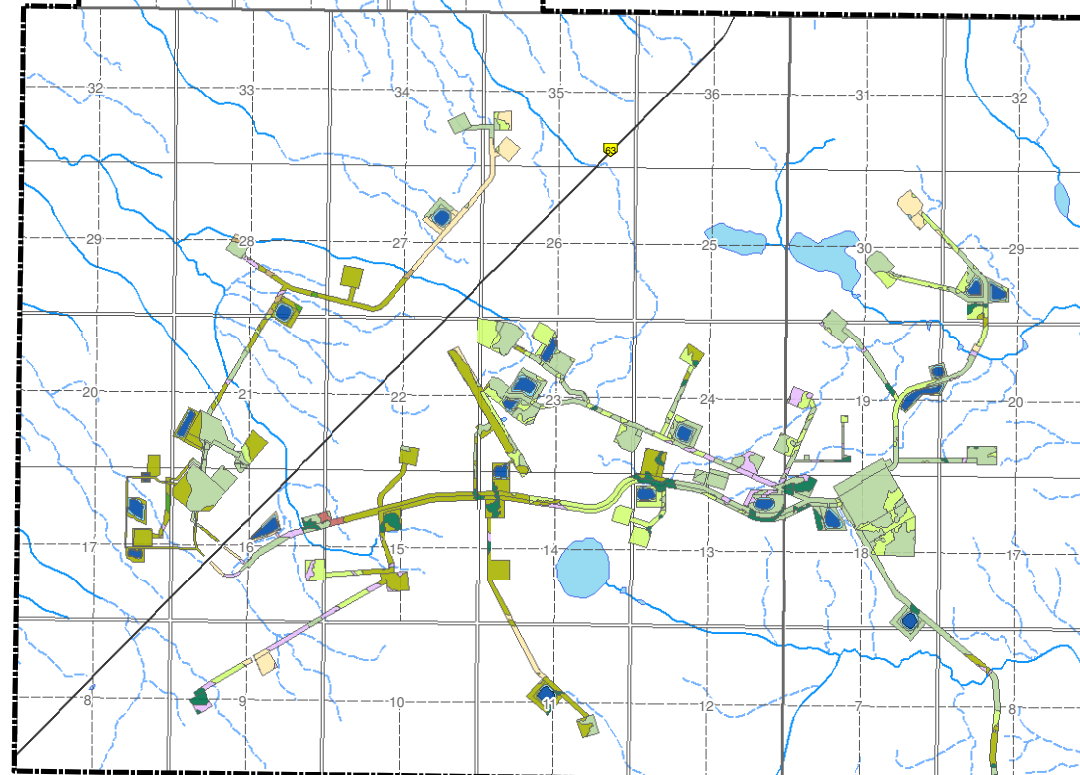
E.4-1

R 12 R 11 W 4M



T 83

T 82



Legend

Lease Boundary

Ecosite Phase

- B
- C
- D
- E
- G
- H
- I
- J
- K
- L
- Pond

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; MEMS, 2010; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

Reclaimed Ecosites



DRAWN: SL

CHECKED: GW

DATE: Apr 22/10

PROJECT: 07-104

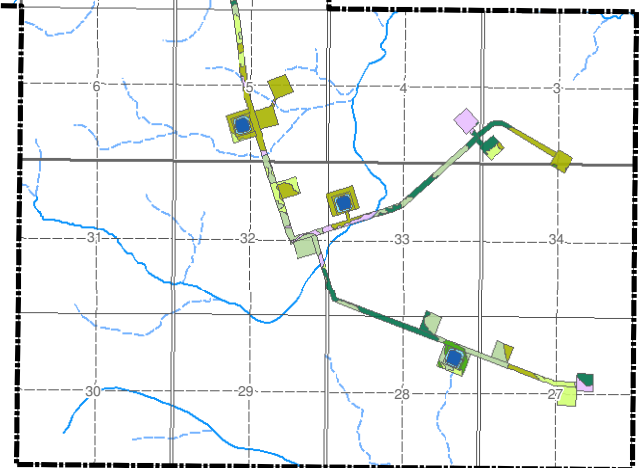
FIGURE:

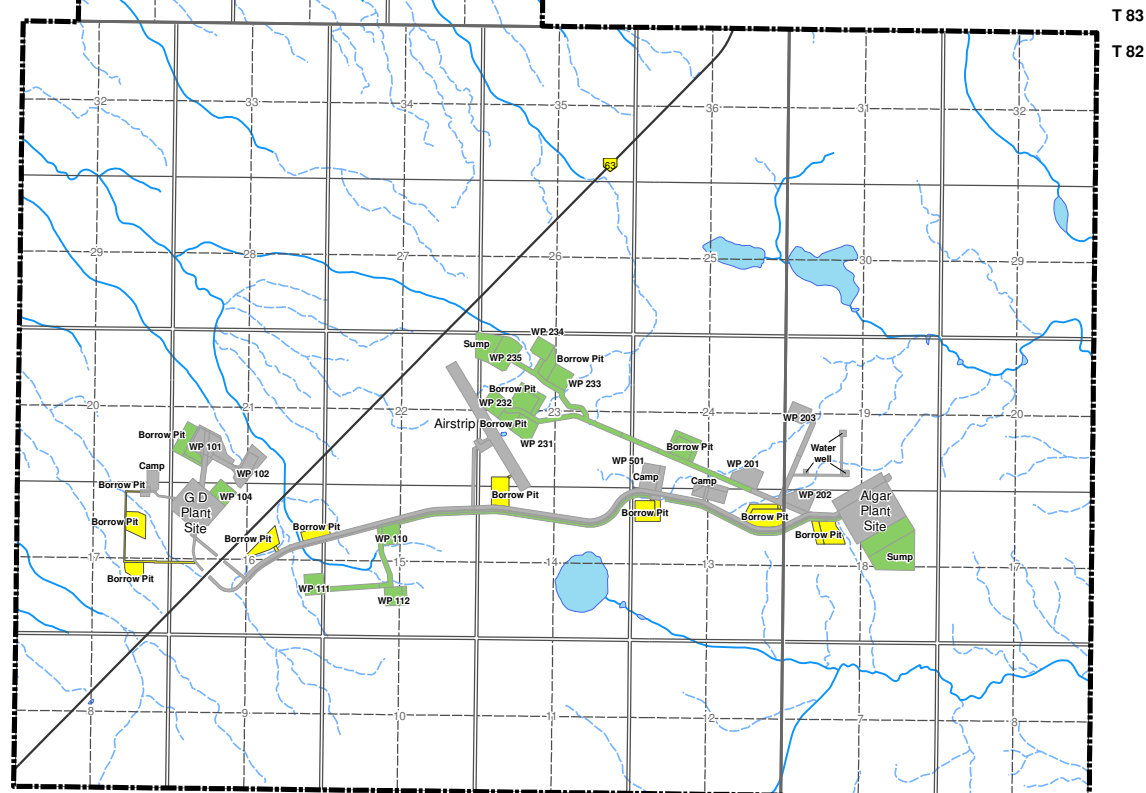
E.4-2

R 12 R11 W4M

T 82

T 81






T 83


T 82


Legend

 Lease Boundary

Year8

 Reclamation

 EIA Phase 1 Development

 Existing Development

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

**Phase 1 Development and Reclamation
(0 - 8 Years)**



DRAWN: SL

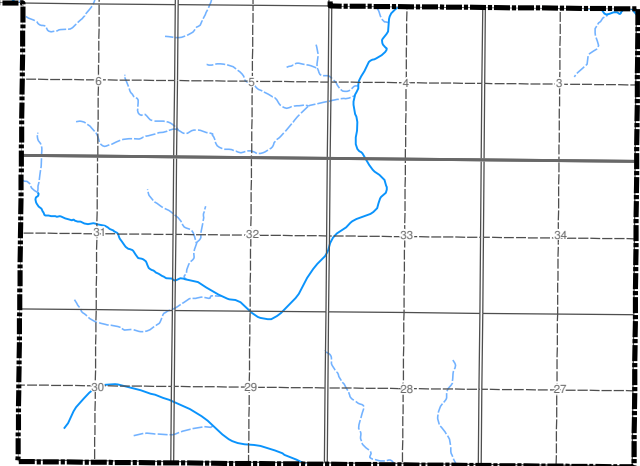
CHECKED: RM

DATE: Apr 26/10

PROJECT: 07-104

FIGURE:

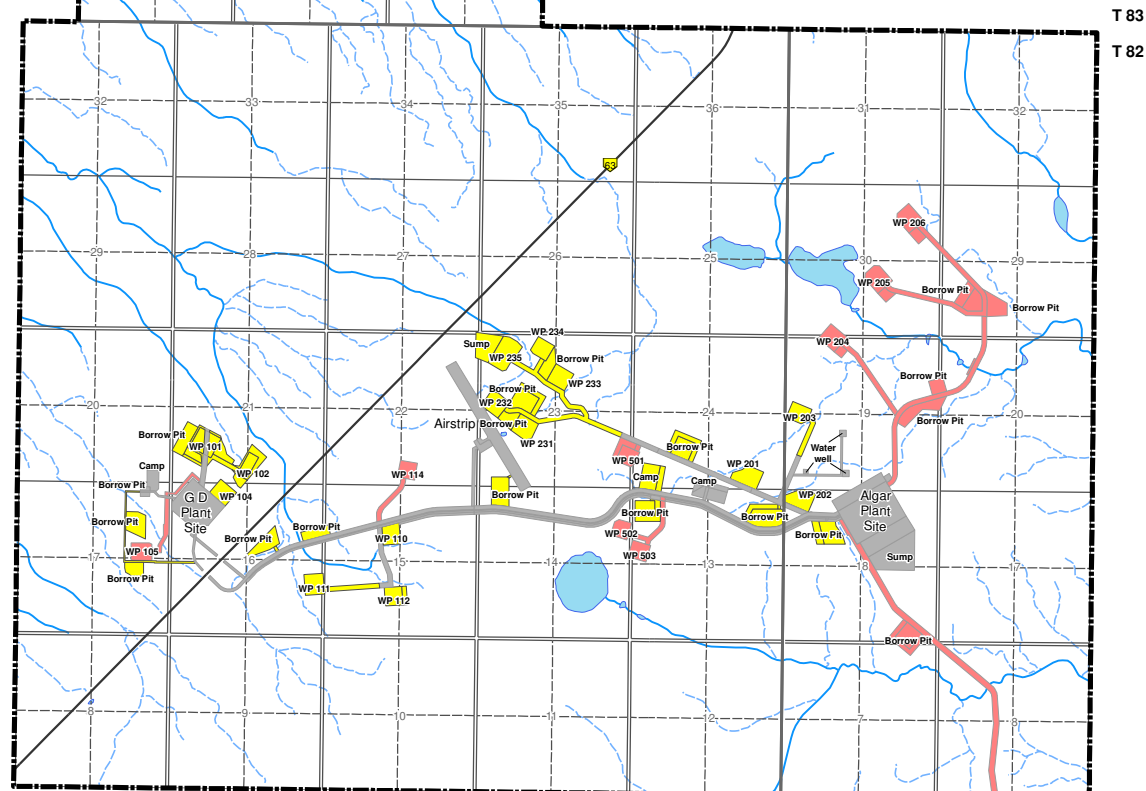
E.4-3



T 82

T 81

R 12 R 11 W4M



T 83
T 82

Legend

- Lease Boundary
- Reclamation
- EIA Phase 2 Development
- Existing Development

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

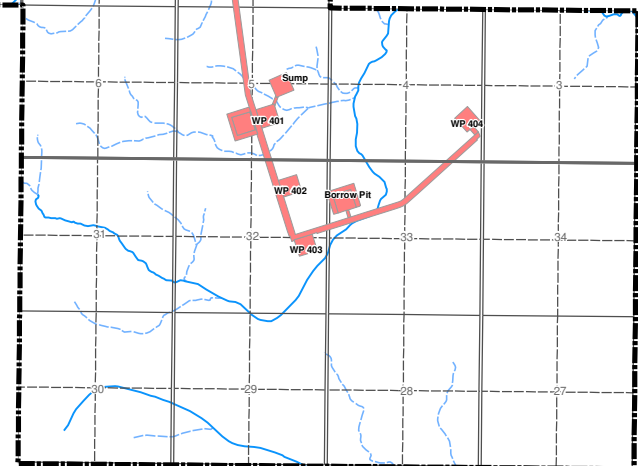
**Phase 2 Development and Reclamation
(9 - 16 Years)**



DRAWN: SL
CHECKED: RM
DATE: Apr 26/10
PROJECT: 07-104

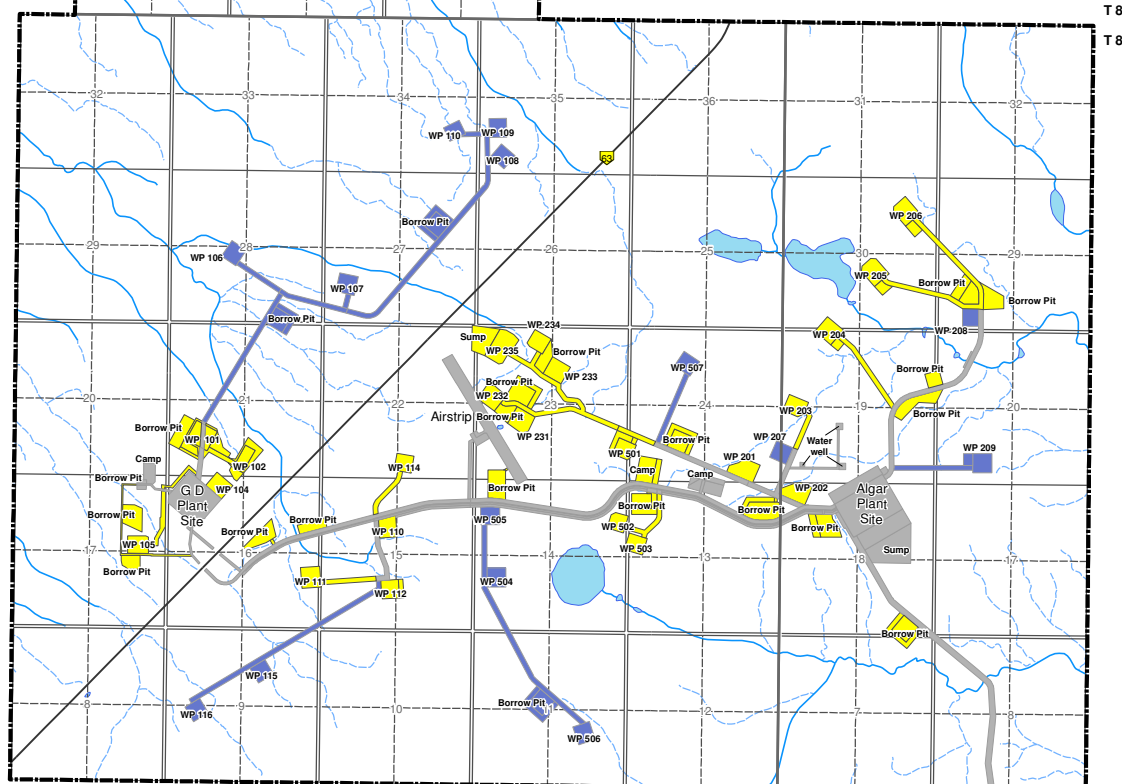
FIGURE:

E.4-4



T 82
T 81

R 12 R 11 W4M



Legend

- Lease Boundary
- Reclamation
- EIA Phase 3 Development
- Existing Development

0 0.5 1 2
Kilometres

REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

**Phase 3 Development and Reclamation
(17 - 24 Years)**



DRAWN: SL

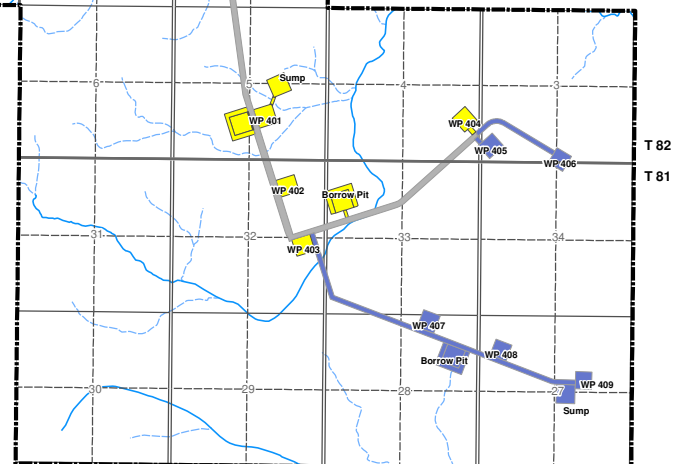
CHECKED: RM

DATE: Apr 26/10

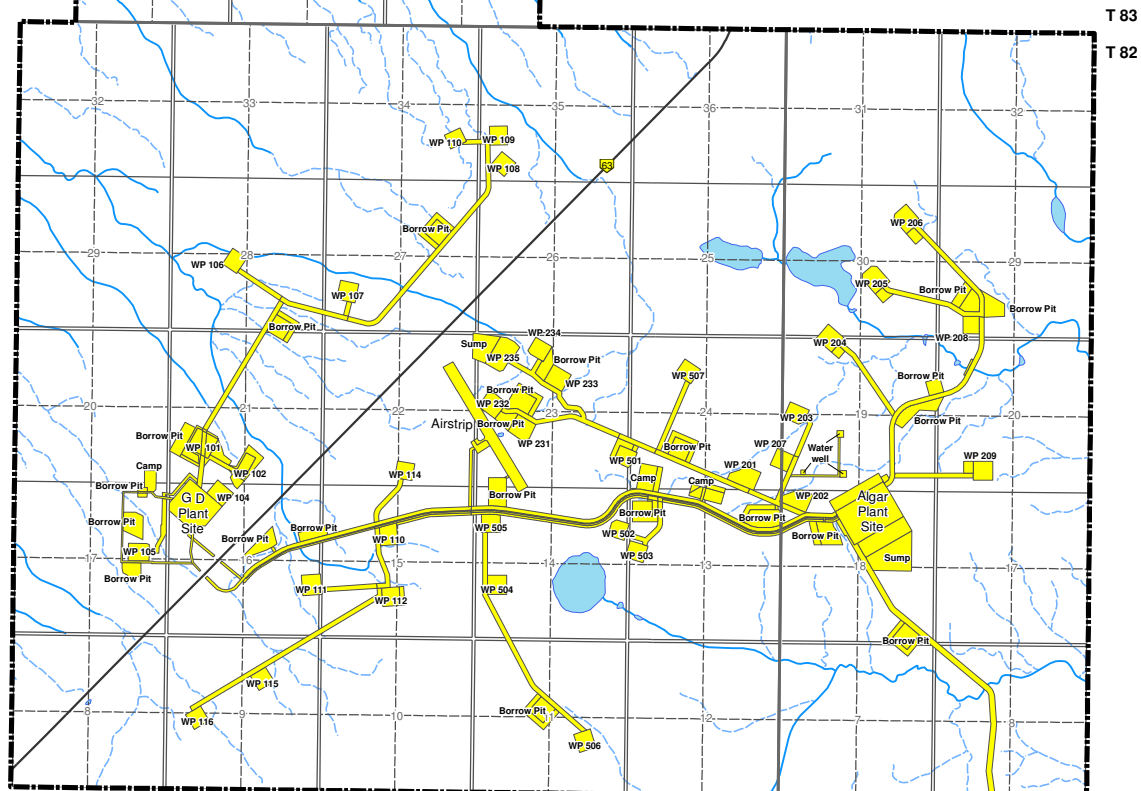
PROJECT: 07-104

FIGURE:

E.4-5

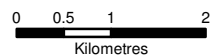


R 12 R 11 W4M



Legend

- Lease Boundary
- Reclamation



REF: D. Loucks Consulting Drifter Projects Ltd. EIA Master Plan Rev 5, 27Oct09; Hydrology from NHC, 2010.

PROJECT:

**Great Divide
Expansion Project**

TITLE:

Final Reclamation (25+ Years)



DRAWN: SL

CHECKED: RM

DATE: Apr 26/10

PROJECT: 07-104

FIGURE:

E.4-6

R 12 R 11 W4M

