Part E

Conceptual Conservation and Reclamation Plan

SOUTHERN PACIFIC
RESOURCE CORP.

TABLE OF CONTENTS

List of Tables

List of Figures

E. CONCEPTUAL CONSERVATION & RECLAMATION PLAN

E.1 INTRODUCTION

STP is currently constructing a Steam Assisted Gravity Drainage (SAGD) project on their McKay oil sands leases located in Township 91, Ranges 14 & 15, West of the 4th Meridian. The Phase 1 Project is expected to commence circulation and subsequent steam injection in the 2nd quarter of 2012. Phase 1 consists of a central processing facility (CPF), four well pads, borrow pits, water source wells, a water treatment plant, access roads and construction and operations camps. It is located on the west side of the MacKay River and was designed to produce 1,908 m^3/d (12,000 bpd) of bitumen.

This application and C&R Plan are for the Phase 2 Project, which will have a CPF on the east side of the MacKay River, and will produce an additional 3,816 m^3/d (24,000 bpd) of bitumen for approximately 25 years. The total combined bitumen production of the McKay project (Phase 1 and Phase 2) will be 5,724 m^3/d (36,000 bpd). Over the life of the Phase 2 Project a number of well pads, borrow pits and access roads will be required to maintain production. The disturbance footprint for Phase 2 will be approximately 488.1 ha. The Phase 2 Project development components have been broken into the Initial Development required to increase production to the facilities design capacity (24,000 bpd) and the Future Development required to sustain production of the entire McKay Project (Phase 1 and Phase 2) at 36,000 bpd.

This section presents the Conservation and Reclamation (C&R) Plan for the Phase 2 Project. This C&R Plan includes the detailed requirements of a pre-disturbance assessment (AENV, 2009) for the Initial Development footprint components and the conceptual details for the Future Development components.

The C&R Plan for Phase 2 serves numerous purposes:

- it provides the regulatory agencies with the information needed to assess whether the land can be reclaimed and returned to the equivalent land capability that was present prior to commencement of Phase 2;
- it provides information about the ongoing reclamation activities that STP will carry out during the life of Phase 2 to ensure that environmental effects 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 Phase 2 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-reclamation landscape meets the equivalent land capability of the pre-disturbance landscape.

The soil salvage, soil handling, soil storage, site construction, operation and progressive reclamation activities proposed for the development, operation, and reclamation of Phase 2 will be similar to those in place for the approved Phase 1 Project. Requirements from other recent SAGD projects and implementation of current reclamation trends in the Oil Sands have been taken into consideration in the development of this C&R Plan. STP will adapt the plan to comply with the regulatory requirements in place at the time of construction and reclamation.

In order to develop a C&R Plan suitable for resources within and adjacent to the proposed disturbance area, information on existing biophysical conditions is required. Information sources utilized to design the C&R Plan include:

- project design and development processes to be utilized by STP;
- C&R Plans for the approved Phase 1 Project;
- the final terms of Reference (FTOR) for Phase 2 (AENV 2011);
- a review of C&R requirements in recent AENV approvals for in-situ projects; and
- applicable regulatory guidance documents relating to development and reclamation.

The Phase 2 Project footprint includes the development of the Phase 2 expansion which is comprised of an Initial Development and Future Development. The Initial Development of Phase 2 includes the following components: a central processing facility (CPF), eight well pads, three borrow pits, an operators camp and a utility corridor that includes internal access and pipeline and power infrastructure. The Future Development of Phase 2 will include; additional borrow pits, well pads and utility corridors. The Future Development will allow STP to continue to add bitumen production to keep Phase 1 and Phase 2 CPF's at capacity. Components of Phase 2 are displayed in Table E.1.1 and on Figure E.1.1.

Table E.1.1 Components of the Phase 2 Footprint for the Initial and Future Developments

Phase 2 Component	Component Area (ha)		Totals (ha)
	Initial Development	Future Development	
Central Processing Facility (CPF)	28.8	-	28.8
Central Processing Facility – Soil Storage Areas	16.2	-	16.2
Well Pads	54.7	156.9	211.6
Borrow Pits	36.0	92.7	128.7
Operators Camp	2.8	-	2.8
Utility Corridor	24.5	75.5	100.0
TOTALS (ha)	163.0	325.1	488.1

Dash (-): a particular component does not contain a value associated with a row and/or column.

To supplement this C&R Plan, once Phase 2 is operational, STP will prepare an Annual C&R Report for submission to AENV. The annual report will summarize the C&R activities of the preceding year along with those planned to be undertaken in the following year.

In compliance with typical *Alberta Environmental Protection and Enhancement Act* (EPEA) approvals, an abandonment and reclamation plan will be submitted to AENV six months prior to final decommissioning of the surface facilities.

E.2 RECLAMATION GOALS AND OBJECTIVES

The reclamation goal for Phase 2 is to reclaim developed lands to equivalent land capability. Equivalent land capability is the ability of the land to support various land uses after reclamation in a manner similar to that which 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 2002).

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

- re-establishment of merchantable forests;
- establishment of diverse wildlife habitats that include a range of vegetation communities and landscapes that are compatible with the surrounding ecosites; and
- vegetation community diversity that will provide traditional land uses similar to pre-disturbance conditions.

Objectives of the C&R plan include:

- development of the Phase 2 Project to mitigate environmental effects to soil, landscapes, vegetation, wetlands and streams within and immediately adjacent to the development footprint;
- soil conservation throughout the life of the Phase 2 Project to provide sufficient soil material of suitable quality at reclamation;
- mitigate potential effects to watercourses throughout the life of the Phase 2 Project through prevention of sedimentation or soil erosion;
- creation of reclaimed landscapes that tie into adjacent undisturbed lands and accommodate appropriate surface drainage patterns across reclaimed lands;
- providing a prescriptive soil replacement plan; and
- creating a re-vegetation plan.

E.2.1 Reclamation to Equivalent Capability

E.2.1.1 Land Capability for Forestry

The distribution of forest communities in the Phase 2 footprint is determined by parent materials, soil types (texture and development), topography, and drainage patterns. The potential for commercial forestry in the development area has been assessed using the *Alberta Vegetation Inventory* (AVI) (Alberta Pacific Forest Industries 2004).

Forest communities that develop on the reclaimed sites will be determined by the forested land capability of the reclaimed lands, degree of disturbance, adjacent undisturbed forest communities and success of the revegetation efforts. The pre-disturbance forest soil capabilities within the Phase 2 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 Phase 2 Footprint

Component (number of components)	Pre-Disturbance Land Capability Rating					
	Class 2	Class 3	Class 4	Class 5	NR	Total %
Phase 2 – Initial Development						
Central Processing Facility (CPF)	22.1	3.6	0.2	2.9	<0.1	28.8
CPF – Soil Storage Areas	12.9	0.1	3.2	-	-	16.2
Well Pads (8)	16.0	-	1.6	37.1	-	54.7
Borrow Pits (3)	33.0	0.9	1.3	0.8	<0.1	36.0
Operators Camp	2.8	<0.1	-	-	-	2.8
Utility Corridor	3.9	0.1	1.6	18.8	<0.1	24.5

Table E.2.1 Pre-Disturbance Land Capability for the Phase 2 Footprint

Component (number of components)	Pre-Disturbance Land Capability Rating					
	Class 2	Class 3	Class 4	Class 5	NR	Total %
Sub-total[1]	90.7	4.8	7.9	59.6	<0.1	163.0
Phase 2 – Future Development						
Well Pads (24)	25.5	30.4	12.2	87.7	1.1	156.9
Borrow Pits (6)	41.3	5.5	8.3	37.6	-	92.7
Utility Corridor	8.2	10.4	1.8	54.1	1.0	75.5
Sub-total[1]	75.0	46.3	22.3	179.4	2.1	325.1
Total Area[1]	165.7	51.1	30.2	239.0	2.1	488.1
% of Phase 2 Area	33.9	10.5	6.2	49.0	0.4	100

[1] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.
Dash (-): a particular component does not contain a value associated with a row and/or column.

The land capability of the proposed Initial Development is covered by predominantly Class 2 (90.7 ha) and Class 5 landscapes (59.6 ha). The land capability of the Future Development is dominated by Class 5 (179.4 ha) and by Class 2 landscapes (75.0 ha).

Class 2 landscapes are upland landscapes and are limited mainly by soil reaction (slightly acidic pH in the upper profiles) and firm consistence in the upper subsoil layers.

Class 3 landscapes are upland landscapes or transitional landscapes with significant upland soils recorded. Limitations to Class 3 landscapes were variable and included moisture limitations (both poor and rapid drainage) as well as consistence limitations in the upper subsoil profiles of various component soils.

Class 4 soils account for 30.2 ha of the Phase 2 Project footprint and represent transitional areas between the uplands and organics and are comprised of peaty Gleysolic soils which have limitations mainly due to poor drainage and poor nutrient regime.

Class 5 lands are limited by poor drainage and are associated with organic landscapes within the Phase 2 footprint.

Appropriate soil and subsoil salvage, storage, and replacement coupled with effective revegetation will ensure lands suitable for commercial forests (*i.e.*, Class 2 and 3) achieve similar capability post disturbance. All other lands (Class 4 and 5) will be reclaimed to provide equivalent capability and provide ecological function similar to pre-disturbance conditions. Details on baseline soil and terrain are provided in CR #9 Baseline Soil & Terrain Assessment.

E.2.1.2 Surface Water Drainage Systems

Phase 2 lies within the watershed of MacKay River which originates to the southwest. A large tributary, the Dunkirk River, originates in the Birch Mountains to the northwest. The MacKay River flows from southwest to northeast through the Phase 2 area. A majority of the area is drained by small tributaries and undefined drainages, however, portions of the watersheds of three larger tributaries including Birchwood Creek are also included within the Phase 2 area.

There are no large permanent lakes in the vicinity of Phase 2. There are small beaver ponds that exist on a number of the tributaries (Section D.6 and CR #6).

No new crossings of the MacKay River are required for development of the Phase 2 Project. The utility corridors for future well pads will cross some streams with defined channels. A total of five watercourse crossings for streams with defined channels are proposed for Phase 2 (Figure E.1.1). A number of crossings of mapped drainages without defined channels will also be crossed. The drainage at these crossings will be maintained with adequately sized culverts. Figure E.2.2 shows the proposed locations of culverts as well as the proposed surface water drainage flow around the Phase 2 components.

Surface water runoff will be directed around various Phase 2 components through use of ditches. Surface water flow will also be maintained across disturbance areas using ditches and culverts where necessary. Surface water run-off from the CPF will be directed to a storm water retention pond located to take advantage of the natural elevation gradient. Surface runoff will be collected in the storm water runoff pond and will either be returned to the CPF which may be used as plant makeup water or (depending upon site and operating conditions) released into the surrounding watershed receiving waters. Prior to discharge, the water will be tested and released in accordance with the terms and conditions of the operating approval. STP will monitor pump off receiving areas for potential erosion and appropriate mitigation implemented if signs of erosion are recorded.

Phase 2 has been designed to mitigate effects to drainage and surface waters. Maintaining site drainage patterns during operations will facilitate return of proper drainage patterns upon closure. Management of the local drainage systems is an integral component of a reclaimed landscape, which is a focus of the operational and closure plans for Phase 2.

E.2.1.3 Fisheries & Aquatics

Watercourses in the Phase 2 area consist of first to fourth, and sixth order streams (MacKay River is the only a sixth order stream within the Project Area). Baseline fish inventories were conducted at ten watercourses. Small-bodied, large-bodied, and sportfish species were recorded; a majority of sportfish were only recorded in the MacKay River. There is a high probability of

first to sixth order streams containing small-bodied fish. The MacKay River can be expected to have a much higher probability of all types of fish and a more diverse range of species than the lower order streams (Section D.2 and CR #2).

Throughout the development, operation, and reclamation of Phase 2 STP will ensure that all activities undertaken are carried out utilizing appropriate mitigation and monitoring activities to minimize impacts to fisheries and aquatic resources. A 50 m buffer will be maintained between Phase 2 activities and any watercourses with defined channels. Sediment control plans will be implemented prior to undertaking earthworks activities, and erosion control undertaken in areas where vegetation has been removed and site grading or contouring has been completed. Instream activities are not contemplated for any of the larger named watercourses. Instream activities for the smaller streams and channels will be completed during periods of low flow and crossing will be compliant with per the *Alberta Code of Practice for Watercourse Crossings* (AENV 2007). In addition, prompt revegetation and proper surface drainage in and around the footprint will ensure minimal impact on the surface water quality and fisheries resource. STP will follow the necessary mitigation and monitoring requirements as detailed in Section D.2.4.

E.2.1.4 Wetlands

Wetland classification has been conducted within the proposed Phase 2 footprint and adjacent lands as detailed in Section D.10. Wetlands were classified using the *Alberta Wetland Inventory Standards* (Halsey et. al. 2004). A total of 244.7 ha of wetland habitat were classified within the proposed Phase 2 footprint. The distribution of the wetlands is as follows:

- 55.8 ha of wooded bog without internal lawns (BTNN);
- 39.9 ha of wooded bog with internal lawns (BTNI);
- 6.0 ha of non-patterned, open, graminoid-dominated fens (FONG);
- 10.1 ha of open shrub fen with internal lawns (FONI);
- 5.3 ha of a non-patterned wooded fen with islands of internal lawns (FTNI);
- 98.8 ha of non-patterned, wooded fens with no internal lawns (FTNN);
- 18.1 ha of non-patterned, open, shrub-dominated fens (FONS);
- 1.8 ha of deciduous swamps (SONS);
- 8.6 ha of wooded coniferous swamps (STNN); and
- 0.3 ha of shallow open water (WONN).

Wetlands in the Phase 2 area will have drainage patterns maintained throughout the life of the Phase 2 Project to minimize the impact on surface water drainage and wetland viability. The use of drainage control measures will minimize the effect on wetlands during operations. The

removal of drainage structures and pad materials and appropriate re-contouring of reclaimed lands (wetlands) at closure will ensure drainage (hydrologic regime) is maintained and impact to wetlands will be minimized. Detailed mitigation information for wetlands is provided in Section D.10.4.

E.2.1.5 Vegetation

An assessment of vegetation for the Phase 2 Project has been conducted (Section D.10). Delineation of vegetation communities was based on AVI map units, and detailed field sampling and were then classified using *The Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996).

Eleven ecosites, three disturbed units and open water were identified within the Phase 2 footprint. The Phase 2 footprint is dominated by ecosite d (low-bush cranberry) in upland areas and poorly drained landscapes are dominated by i (bogs), j (poor fens), and k (rich fens). Ecosites and corresponding ecosite phases recorded within the Phase 2 are include:

- **blueberry (b)**: blueberry / jack pine – aspen (b1); blueberry / white spruce – jack pine (b4);
- **Labrador tea (c)**: Labrador tea -mesic / jack pine – black spruce (c1);
- **low-bush cranberry (d)**: low-bush cranberry / aspen (d1); low-bush cranberry / aspen - white spruce (d2); low-bush cranberry / white spruce (d3);
- **dogwood (e)**: dogwood / balsam poplar - aspen (e1); dogwood / balsam poplar – white spruce (e2); dogwood / white spruce (e3);
- **horsetail (f)**: horsetail / balsam poplar - aspen (f1); horsetail / balsam poplar - white spruce (f2); horsetail / white spruce (f3);
- **labrador tea-subhygric (g)**: Labrador tea-subhygric / black spruce – jack pine (g1);
- **labrador tea-horsetail (h)**: Labrador tea-horsetail / white spruce-black spruce (h1);
- **bog (i)**: treed bog (i1); shrubby bog (i2);
- **poor fen (j)**: treed poor fen (j1); shrubby poor fen (j2);
- **rich fen (k)**: treed rich fen (k1); shrubby rich fen (k2); graminoid rich fen (k3); and
- **marsh (l)**.

The pre-disturbance ecosites for the Phase 2 footprint are in Table E.2.2 and the distribution of the ecosite phases are shown on Figure E.2.3.

Table E.2.2 Pre-Disturbance Ecosites in the Phase 2 Footprint

Ecosite	B	C	D	E	F	G	H	I	J	K	L	AlH1	CIW1	NWL1	Total
Phase 2 - Initial															
Central Processing Facility (CPF)	-	1.4	22.3	-	-	-	-	3.0	1.3	<0.1	-	0.8	-	-	28.8
CPF – Soil Storage Areas	0.3	-	11.5	-	-	-	-	-	3.1	0.9	-	0.4	-	-	16.2
Well Pads (8)	-	-	13.9	0.8	0.8	-	2.5	7.5	9.0	18.1	-	0.4	1.7	-	54.7
Borrow Pits (3)	0.7	-	27.1	0.1	3.4	0.1	-	1.6	-	0.6	-	2.4	-	-	36.0
Operators Camp	-	-	2.8	-	-	-	<0.1	-	-	-	-	-	-	-	2.8
Utility Corridor	-	0.2	3.2	0.5	0.9	-	0.1	5.7	3.8	8.5	-	1.5	0.1	-	24.5
Sub-total[2]	1.0	1.6	80.8	1.4	5.1	0.1	2.6	17.8	17.2	28.1	0	5.5	1.8	0.0	163.0
Phase 2 – Future Development															
Well Pads (24)	0.2	3.2	44.0	1.7	<0.1	8.8	0.9	46.6	25.5	21.9	0.1	1.3	2.5	0.2	156.9
Borrow Pits (6)	-	-	49.2	0.1	1.0	8.6	1.6	8.6	12.4	7.2	-	1.2	2.8	-	92.7
Utility Corridor	0.2	2.8	12.2	1.8	1.0	4.3	0.6	22.6	14.7	13.8	-	1.3	-	0.2	75.5
Sub-total[2]	0.4	6.0	105.4	3.6	2.0	21.7	3.1	77.8	52.6	42.9	0.1	3.8	5.3	0.4	325.1
Total Area[2]	1.4	7.6	186.2	5.0	7.1	21.8	5.7	95.6	69.8	71.0	0.1	9.3	7.1	0.4	488.1
% of Phase 2 Area	0.3	1.6	38.1	1.0	1.5	4.5	1.2	19.6	14.3	14.5	<0.1	1.9	1.5	0.1	100

[1] All – Industrial Sites, plant sites, AIH – permanent right – of ways, CIW – geophysical well sites that have been seeded, NWL – natural wet lake.
[2] Due to rounding of values, totals may not equal the sum of the individual values presented in the table.
Dash (-): a particular component does not contain a value associated with a row and/or column.

Drier landscapes include ecosites b, c, and d which account for a total of 195.2 ha of the Phase 2 footprint. Transitional communities, ecosite classification g and h account for 27.5 ha. Lowland (organic landscapes) includes ecosites i, j, k, and l account for 236.5 ha of the Phase 2 footprint. Vegetation community diversity, post revegetation will be achieved through re-establishing a range of moisture and nutrient regimes on the landscape. Appropriate re-contouring of reclaimed lands will provide a range of moisture regimes by establishing drainage patterns and flora that will be similar to pre-disturbance conditions. Prescriptive replacement of soil material in the reclaimed areas will allow for a range of soil moisture and nutrient regimes to form on the reclaimed landscape that will influence vegetation community diversity, post reclamation and revegetation.

E.2.1.6 Wildlife

STP conducted an assessment of the wildlife resources for the Phase 2 Project (Section D.11 and CR #11). The Phase 2 Project is located within an area of low-lying, mature boreal forest. Treed and shrubby bogs and fens dominate the landscape while upland habitats are relatively uncommon. Wildlife habitat in the study area was classified on the basis of ecosite phases (Beckingham and Archibald 1996) and field observations. Several wildlife species of special concern (sensitive, rare, threatened, or endangered) are associated with the habitat types that occur in the study area, including woodland caribou, northern long-eared bat, and the Cape May warbler.

The reclamation goal is to establish a biologically self-sustaining reclaimed landscape with a land capability equivalent to that of the pre-disturbance landscape. This will allow for establishment of diverse wildlife habitats that are compatible with the surrounding landscape. The reclaimed landscape is predicted to be a mosaic of forest, wetlands, pond and stream habitats. It is expected 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. Monitoring wildlife use of both natural and reclaimed areas within the study areas will provide information on the success of re-establishing wildlife habitat.

E.2.1.7 Traditional Land Use

The Athabasca Oil Sands Region has a long history of use by Aboriginal peoples. First Nations and Métis within the local area include the communities of Fort MacKay and Fort McMurray. Further removed from the Phase 2 area is the community of Fort Chipewyan. Traditional resource use in the region includes hunting, trapping, fishing, berry picking, collecting medicinal plants, and the use of trail networks, cabins and special sites (*e.g.*, sweat lodges). Further information on Traditional Environmental Knowledge (TEK) and use within the region is being gathered as discussed in Part F. STP is also working directly with the local communities to

identify site specific TEK information for the Phase 2 Project. This information will be used to enhance the capability of the C&R process to return these values to the land.

E.3 INITIAL DEVELOPMENT, SOIL SALVAGE, AND STORAGE PROGRAM

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

- all timber harvesting and vegetation clearing will be completed in consultation with the Forest Management Agreement (FMA) holder and in compliance with all regulatory requirements related to removal and harvest/disposal of timber and vegetation;
- all upland topsoil and subsoil material will be salvaged for replacement at reclamation for the proposed CPF, borrow pits, and all associated well pads.
- 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 Phase 2 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 interim reclamation will be undertaken when components of Phase 2 are complete.

E.3.1 Timber and Vegetation Management

In consultation with Alberta Pacific Forest Industries Inc. (Al-Pac) (FMA holder) STP will salvage all merchantable timber in compliance with all regulatory requirements. Harvesting of merchantable timber will occur annually following STP's development plan and harvest planning and timing will be compliant with Al-Pac requirements.

Upon completion of harvesting merchantable timber, clearing of woody debris will commence. Slashing, degrubbing, clearing and any other means of physical woody debris removal will be conducted to preserve the quality of the soil. Care will be taken to remove as much woody debris as possible before soil salvage commences.

Woody debris disposal will be handled in consultation with Alberta Sustainable Resource Development (ASRD). Woody debris will either be mulched or burned depending on site conditions in accordance with regulatory requirements. If some woody debris is mulched it will be spread to a maximum o thickness of 5 cm or less over the ground surface as per ASRD Directive 2009-1 (ASRD 2009).

It is expected that through the process of timber harvest and vegetation removal (via burning or mulching) STP will conserve some coarse woody debris (CWD). STP intends to utilize some CWD for site reclamation as CWD allows for increased vegetation diversity, moisture retention and decreases the risk of erosion of replaced soil materials at reclamation (ASRD 2009). CWD retained (not burned or mulched) for use in reclamation (either final or interim reclamation) will be stored on select sites at the base of stockpiled soil materials that are not immediately adjacent standing timber to act as temporary erosion control. STP's final CWD management plan will be finalized with ASRD and comply with ASRD debris management standards (ASRD 2007 & ASRD 2010).

E.3.2 Interim Reclamation

Interim reclamation will be undertaken where possible to minimize the amount of active surface disturbance. For example, road ditches will have the topsoil replaced and allowing natural revegetation to occur upon completion of road construction. Once a particular component of the site infrastructure is no longer required or the entire disturbance area is no longer required from a construction or operations perspective site decommissioning, abandonment, grading and re-contouring activities will take place.

Interim reclamation will also focus on re-vegetation and erosion control of soil stockpiles, access corridor ditches, edges of well pads and workspaces. Erosion control of these areas will remain a priority until the desired interim vegetation cover has established.

Interim reclamation activities throughout the life of Phase 2 will adhere to the processes and activities listed in this C&R Plan as well as ASRD requirements outlined in the *Public Lands Act* approval.

E.3.3 Erosion and Sediment Control

The risk of erosion to surface soils is greatest during the soil salvage and storage stages of site construction, and during the soil replacement phase of the reclamation process. Erosion of stockpiled soil may occur by wind and water. Salvaged soil material will be stored in stockpiles with slopes graded to a maximum slope of 3H:1V. The topsoil stockpiles will be stabilized, and vegetated immediately after placement. Soil materials replaced during reclamation are at risk of erosion by wind and/or water during soil handling activities and immediately after replacement.

A majority of the terrain slopes within the proposed Project footprint are considered to be nearly level to gently sloped. A total of 79% of the proposed disturbance footprint occur in lands that have slopes from 0-2%. Terrain with 2-5% slopes account for approximately 22% of the proposed disturbance area. Reclaimed landscapes will be re-contoured to achieve similar landscapes and slopes as the pre-disturbance conditions; erosion potential for reclaimed landscapes will be low. Details on erosion ratings for various soil and terrain map units are provided in CR #9 Baseline Soil & Terrain Assessment.

During soil handling, stockpiling, and reclamation activities STP will minimize erosion risk by implementing the following:

- when stockpiling soil material, soil piles will be placed in strategic locations, to minimize exposure to wind or water;
- stockpiles will have relatively gentle slopes less than or equal to 3:1, and will be contoured with small ridges perpendicular to slope direction (Knapik 1999);
- topsoil stockpiles utilized as long-term storage and with high potential for erosion will be seeded with a non-invasive weed free seed mix that establishes quickly;
- reclaimed landscapes that have a high probability of erosion (*i.e.*, steep side slopes) will be reseeded with a quick establishing, non-invasive cover crop to minimize the length of time bare soil is exposed to potential wind and water erosion. In addition, soil stabilizers or other measures will be utilized (where necessary) to minimize the effect of water erosion (*i.e.*, check bales, silt fences, sediment traps, etc.) on susceptible slopes; and
- monitoring of stockpiled soils and reclaimed areas will be conducted to ensure mitigative measures are effective.

If erosion concerns arise throughout the life of Phase 2, STP will devise and implement an erosion control plan on a case by case basis. Determination of erosion control methods for the

Phase 2 footprint will depend on many variables related to soils, landscape, vegetation, weather, level of disturbance, and distance to sensitive receptors (*i.e.,* adjacent water bodies). Pertinent factors that will be considered when determining specific erosion control methods include:

- cause of erosion – wind or water or both;
- dominant soil texture in area of concern – coarse medium or fine textured surface soils;
- vegetative cover establishment – sparse cover, moderate cover or good establishment;
- slope length and steepness – a combination of estimated slope length and slope gradient (%);
- distance to any water bodies or other sensitive receptors (if applicable);
- expected level of runoff – is the area of concern considered to be a large catchment area with respect to surface runoff;
- location of erosion issues – is the area of concern easily accessible by equipment or, is access difficult; and
- likelihood of reoccurrence – based on site specific characteristics and cause of potential erosion; is the likelihood of future erosion expected?

The protocol to determine erosion control methods will involve an evaluation of all the aforementioned factors to decide which erosion control methods would be best suited. This assessment will be completed on a site specific basis and will be used for all landscape s that occur within the Phase 2 footprint. Potential erosion control methods that STP may utilize throughout the life of the Phase 2 Project include, but are not limited to:

- silt fencing;
- brush or rock berm;
- continuous (earth-filed geotextile) berm;
- earth dyke barrier;
- hydroseeding or hydromulching;
- live staking or brush-layering;
- addition of tackifiers; and/or
- slope texturing.

E.3.4 Final Reclamation

The reclamation program will include implementation of the following procedures to reclaim Phase 2 Project components to an equivalent capability once operations have ceased:

- determination of pre-disturbance land capability prior to construction;

- removal of facilities;
- remediation of contaminated areas (ongoing throughout operations as well as at decommissioning);
- completion of appropriate reclamation of peat lands as per the end land use objectives, including;
    - removal of pads in areas of deep organic material; and/or
    - re-contouring of pads to create upland transitional or upland landscapes followed by replacement of salvaged organic materials;
- ripping well pads, roadways, and facility pad areas, as required, to alleviate surface compaction;
- re-contouring and re-establishment of natural drainage patterns;
- placing subsoil over areas in which subsoil material was salvaged prior to topsoil placement;
- placing salvaged topsoil (litter and mineral A horizons) over the disturbed area with replacement depths similar to what existed prior to development;
- 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 and revegetation in order to assess reclamation success, identify areas of concern, and apply adaptive management strategies where applicable to improve reclamation and revegetation; and
- undertaking a post-reclamation site assessment to determine the status of the site prior to applying for a reclamation certificate.

E.3.5 Soil Resources

An assessment of soil resources for the Phase 2 Project has been conducted and is included in the Baseline Soil Survey and Environmental Effects Assessment Report (Section D.9 and CR #9).

An assessment has been completed on the proposed Initial Development of the Phase 2 Project as per AENV's *Guidelines for Submission of a Pre-Disturbance Assessment (PDA) and Conservation and Reclamation Plan* (AENV 2009) (PDA/C&R report). Figures E.3.1 a to c display the Initial Development components at a 1:5,000 scale and includes component areas, labelled soil inspections sites and vegetation plot locations, baseline soil map units within each component, and corresponding topsoil and subsoil thickness values (where appropriate). All baseline soil map units provided in Tables E.3.2, E.3.3 and E.3.4 are based on the soil survey

provided in CR #9 and summarized in Section D.9. The detailed PDA level information collected for the Initial Development area has been utilized to estimate average soil thickness values for map units and estimated volumes of material available for salvage in Table E.3.2. Detailed baseline soils summary information as required in the PDA/C&R report (AENV 2009) is provided in Table E.3.1 for all soil map units recorded within the Initial Development.

A detailed PDA level assessment of the Future Development will be completed by STP and submitted to AENV prior to development.

Table E.3.1 PDA Level Soil Map Unit Summary Description – Initial Development

Baseline Soil Map Unit[1]	Soil Variant Modifier Description[1]	Parent Material[1]	Range of Map Unit Averages Litter/Organic Material Depth (cm)	Range of Map Unit Averages Mineral Topsoil Depth (cm)	Range of Combined Litter and Topsoil Depth within Map Unit (cm)	Color Contrast (TS/SS)	Moisture Regime	Nutrient Regime	Slope (%)	Rec. Suitability[1] (TS/SS)2
ALG20/L1**	np – < 15 cm of overlying peat	Water laid sediments, some soils have till like features	10	10	(5-58)	Fair	6-8 (Subhygric-Subhydric)	B-C (Poor-Medium)	0-2	G-F/P
CHT21/L1	xc – fine textured water laid material between 30 to 99 cm	Water laid sediments, some soils have till like features	10-25	0-10	(12-42)	Fair	7-8 (Hygric-Subhydric)	B (Poor)	0-2	G-F/F-P
DOLV2/U1l	np – < 15 cm of overlying peat xc – fine textured water laid material at 30 to 99 cm	Fine to medium textured water laid sediments, some soils have till like features	5-10	15	(12-53)	Fair-Good	5 to 7 (Mesic-Hygric)	C-D (Medium)	1-3	G-F/F-P
HRLV2/U1l	aa – soil series not modal in SCA 20 xt – medium textured till at 30 to 99	Medium textured water laid veneers over till	10	10-15	(5-40)	Fair-Good	5 to 7 (Mesic-Hygric)	C-D (Medium)	1-2	G-F/F
HRLV18/U1h	xt – medium textured material at 30 to 99cm gl –profile contains evidence of gleyed conditions	Medium textured water laid veneers over till	5-10	15-20	(10-39)	Fair-Good	6 to 7 (Subhygric-Hygric)	C-D (Medium)	2-5	G-F/F
WHM20/L1	aa – soil series not modal in SCA 20	Medium textured water laid materials and medium textured	10	10-15	(2-43)	Fair	6 to 8 (Subhygric-	C-D (Medium)	0-2	G-F/F

Table E.3.1 PDA Level Soil Map Unit Summary Description – Initial Development

Baseline Soil Map Unit[1]	Soil Variant Modifier Description[1]	Parent Material[1]	Range of Map Unit Averages Litter/Organic Material Depth (cm)	Range of Map Unit Averages Mineral Topsoil Depth (cm)	Range of Combined Litter and Topsoil Depth within Map Unit (cm)	Color Contrast (TS/SS)	Moisture Regime	Nutrient Regime	Slope (%)	Rec. Suitability[1] (TS/SS)2
	gl –profile contains evidence of gleyed conditions xc – clay at 30 to 90 cm	over fine textured water laid materials					Subhydric)			
MLD1m-G/O1	xm – medium textured materials at 30 to 90 cm xc – clay at 30 to 90 cm aa – soil series not modal in SCA 20 pt – 15-40 cm of overlying peat	Organic material over medium to fine textured materials and areas of fine textured to medium textured water laid materials	50	0	(6-124)	NA	8-9 (Subhydric-Hydric)	C-D (Medium)	0-1	NR/F
MLD1m-G/O3	xm – medium textured material at 30 to 99 pt – 15 to 40 cm of overlying peat xc – clay at 30 to 90 cm	Organic material over medium to fine textured materials and areas of fine textured to medium textured water laid materials	55	0	(55)	NA	8-9 (Subhydric-Hydric)	C (Medium)	0-1	NR/F

Table E.3.1 PDA Level Soil Map Unit Summary Description – Initial Development

Baseline Soil Map Unit[1]	Soil Variant Modifier Description[1]	Parent Material[1]	Range of Map Unit Averages Litter/Organic Material Depth (cm)	Range of Map Unit Averages Mineral Topsoil Depth (cm)	Range of Combined Litter and Topsoil Depth within Map Unit (cm)	Color Contrast (TS/SS)	Moisture Regime	Nutrient Regime	Slope (%)	Rec. Suitability[1] (TS/SS)2
MLD1f/O1	xm – medium textured material at 30 to 99 xc – clay at 30 to 90 cm yc – clay at 100 to 200 cm	Organic material over fine textured materials and areas of 100-200 cm of organic material over fine textured water laid materials	60-90	0	(30-130)	NA	8-9 (Subhydric-Hydric)	C-D (Medium)	0-1	NR/F
MLD2m/O1	xm – medium textured material at 30 to 90 cm ym – medium textured material at 100 to 200 cm	Organic material (100-200 cm) over medium textured materials and areas of thinner deposits (40-100 cm) organic material over medium textured materials	50-95	0	(48-130)	NA	8-9 (Subhydric-Hydric)	C-D (Medium)	0-1	NR/NR
MRN1m-G/O1	xm – medium textured material at 30 to 99 xc – clay at 30 to 90 cm aa – soil series not modal in SCA 20 zr – regosolic profile	Organic material over medium to fine textured materials and areas of fine textured to medium textured water laid materials	50-60	0	(14-72)	NA	7-8 (Hygric-Subhydric)	B (Poor)	0-1	NR/F
MRN1m/O1	xm – medium textured material xc – clay at 30 to 90 cm	Organic material over medium to fine textured materials and areas of fine	80-90	0	(30-130)	NA	8 (Subhydric)	B (Poor)	0-1	NR/F

Table E.3.1 PDA Level Soil Map Unit Summary Description – Initial Development

Baseline Soil Map Unit[1]	Soil Variant Modifier Description[1]	Parent Material[1]	Range of Map Unit Averages Litter/Organic Material Depth (cm)	Range of Map Unit Averages Mineral Topsoil Depth (cm)	Range of Combined Litter and Topsoil Depth within Map Unit (cm)	Color Contrast (TS/SS)	Moisture Regime	Nutrient Regime	Slope (%)	Rec. Suitability[1] (TS/SS)2
	xs – coarse material at 30 to 99 ym – medium textured material at 100 to 200 cm	textured to medium textured water laid materials								
MUS2m/O1	xm – medium textured material yc – clay at 100 to 200 cm ym – medium textured material at 100 to 200 cm	Organic material (100-200 cm) over medium to fine textured materials and areas of thinner deposits (40-100 cm) organic material over medium textured materials	80-110	0	(6-124)	NA	8-9 (Subhydric-Hydric)	B (Poor)	0-1	NR/NR

[1]Soil Map unit information adapted from the *Baseline Soil Survey and Impact Assessment Report for the STP McKay Thermal Project – Phase 2* (Consultant Report #9 (CR #9))

[2] Reclamation suitability ratings: G – Good, F – Fair, P- Poor as per the *Soil Quality Criteria Relative to Disturbance and Reclamation* Guidelines as specified for the Northern Forest Region of Alberta (SQCWG 1987).

** The distribution of the ALG21/L1 map unit is limited in the footprint (0.4 ha) soil map unit data taken form soils information collected for the LSA was utilized to determine baseline characteristics.

NR – Not rated for reclamation suitability, organic profiles are not rated for reclamation suitability as per the *Soil Quality Criteria Relative to Disturbance and Reclamation* Guidelines as specified for the Northern Forest Region of Alberta (SQCWG 1987).

E.3.6 Soil Salvage

Soil salvage will include the salvage of all topsoil, shallow organic soil and, for the CPF and well pads, subsoil material. Handling of deep organic soils are dependent on the development component, thickness of the organic soil and preferred construction methods. However, in most instances STP plans on padding over deep organics.

There are two distinct development phases for Phase 2 (Initial and Future Development) and five distinct development components that will have unique soil salvage requirements. Phase 2 components which are described further in this section include:

- CPF;
- roads / utility corridors;
- operators camp;
- well pads; and
- borrow pits.

The Initial and Future Developments are discussed separately. A description of upland and organic soil salvage activities for each development component is provided in Section E.3.6.6 for the Initial Development and Section E.3.6.7 for the Future Development. A summary of available soil materials (upland and organic) for each component is provided in Tables E.3.2 and E.3.3 for the Initial and Future Developments respectively. The data supplied in Table E.3.2 is based on the findings of the PDA level assessment for the initial footprint. Data provided in Table E.3.3 is based on the soil interpretation data from the baseline soil survey (CR #9).

E.3.6.1 Topsoil

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

- all organic horizons (L, F, H, and O) as defined in The Canadian System of Soil Classification, 3rd Edition (CSSC) (Soil Classification Working Group (SCWG) 1998);
- A horizons as defined in the CSSC rated as good, fair or poor, as described in the Quality Criteria Relative to Disturbance and Reclamation (Soil Quality Working Group (SQWG1987) (AENV 2010b); and
- the replaced topsoil layer in a reclaimed soil.

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. The upland and

organic soils that are found within the Phase 2 footprint (Initial and Future Developments) are shown on Figure E.3.2.

E.3.6.2 Subsoil

Subsoil is defined by AENV as the layer of soil directly below the topsoil layer and consist of all B horizons defined in the CSSC and rated as good, fair, or poor, as described in the *Quality Criteria Relative to Disturbance and Reclamation* (SQWG1987) (AENV 2010b).

AENV requires subsoil material (to a maximum depth of 30 cm) be salvaged from the CPF and well pads as a part of soil conservation for SAGD developments. This salvaged subsoil will stockpiled separately from the topsoil material.

E.3.6.3 Deep Organics

Based on the PDA level assessment of the Initial Development components STP intends to pad over all deep organic soils (greater than 40 cm thick). However, all borrow pits will have all topsoil and organic materials (deep or shallow) salvaged for replacement at reclamation.

For the Future Development areas the prime assumption is that STP will pad over all deep organic soils, similarly to what is planned for the Initial Development. STP will provide more detailed information in regards to the handling of organic materials for the construction of the Future Development through submission of a PDA/C&R report. Based on the findings of the PDA/C&R report, modifications to the organic soil handling plan provided in this document may be made, where some or all the organic material may be salvaged from various Phase 2 Project components.

E.3.6.4 Areas of Special Concern

Areas of special concern are soil map units that, due to soil and/or landscape characteristics, may require additional mitigation or monitoring measures to minimize potential impacts during soil salvage, storage and replacement (*i.e.*, coarse textured soils, steep slopes, or areas of instability). Within the Initial Development area there are no soil map units that are of concern that may require additional management inputs.

Within the Future Development footprint two soil map units are of special concern. The MIL18/L3 and ZUN18/I3h map units. The MIL18/L3 map unit accounts for 0.2 ha of the future road / utility corridor. This soil map unit is comprised of mainly coarse textured soils (sandy loam to loamy sand) and occurs on relatively subdued terrain. The ZUN18/I3h map unit is of concern due to the steep slopes and accounts of 0.7 ha of the future road / utility corridor. More detailed information relating to baseline conditions and potential mitigation and monitoring (if required) of these areas will be provided to AENV in the PDA/C&R report for the Future Development footprint.

E.3.6.5 General Soil Conservation Practices

To mitigate risk of topsoil, salvaged organic material, and subsoil loss during soil salvage and initial handling the following will be implemented during soil salvage activities:

- a qualified site supervisor will be present for salvage, handling, and stockpiling activities during Phase 2 development;
- soil salvage activities related to expected soil layer thickness values and locations of potential sensitive areas will be guided by the information presented in this report , the advice of an accredited soils expert or information contained in future PDA's;
- materials will not be salvaged during extremely windy or wet conditions; and
- soil salvage operations will likely occur during frozen conditions, areas to be salvaged will be ripped to the expected soil salvage depth prior to salvage activities to minimize admixing of materials.

E.3.6.6 Initial Development

Approximately 104.2 ha of the total 163.0 ha of the Initial Development is considered upland and will have topsoil material salvaged and stockpiled for replacement at reclamation. A summary of the soil materials available for the Initial Development footprint is provided in Table E.3.2. The following sections detail the topsoil, subsoil, and organic material salvage and handling and associated volumes of soil materials per component based on the estimated values in Table E.3.2.

Table E 3.2 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Initial Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Initial Development - CPF (28.8 ha)										
CHT21/L1	Upland	0.2	20	5	13-42	407	25	20-33	488	-
MRN1m/O1	Organic	2.9	95	0	65-130	-	-	-	-	27,778
HRLV18/U1h	Upland	22.1	10	15	11-39	55,257	40	16-62	66,308	-
WHM20/L1*	Upland	3.6	10	15	13-35	8,982	25	0-41	8,982	-
Subtotal[4]	-	28.8	-	-	-	64,645	-	-	75,778	27,778
Initial Development - CPF Soil Storage Area (16.2 ha)										
ALG20/L1**	Upland	0.4	10	10	5-58	867	40	7-79	1,301	-
CHT21/L1	Upland	2.8	20	5	13-42	6,887	25	20-33	6,887	-
HRLV18/U1h	Upland	12.9	10	15	14-37	32,290	40	13-60	38,748	-
WHM20/L1	Upland	0.1	10	15	13-35	236	25	0-41	283	-
Subtotal[4]	-	16.2	-	-	-	40,280	-	-	47,219	0
Initial Development - Roads and Utility Corridors (24.5 ha)										
CHT21/L1	Upland	1.6	25	5	19-28	4,855	30	14-21	4,855	-
DOLV2/U1l	Upland	3.0	5	15	22-24	5,946	40	39-41	8,918	-
HRLV18/U1h	Upland	0.3	5	20	20-26	642	40	37-38	771	-
HRLV2/U1l	Upland	0.7	10	10	5-22	1,350	25	15-32	1,687	-
MLD1f/O1	Organic	11.0	80	0	43-120	-	-	-	-	87,639
MLD1m-G/O3	Organic	0.3	55	0	55-55	-	-	-	-	1,688
MLD2m/O1	Organic	1.3	95	0	60-130	-	-	-	-	12,779
MRN1m-G/O1	Organic	2.8	50	0	14-65	-	-	-	-	13,759
MUS2m/O1	Organic	3.4	80	0	6-105	-	-	-	-	27,440

Table E 3.2 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Initial Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
WHM20/L1**	Upland	0.1	10	10	2-43	299	20	15-80	299	-
Subtotal[4]	-	24.5	-	-	-	13,092	-	-	16,530	143,304
Initial Development - Operators Camp (2.8 ha)										
HRLV2/U1l	Upland	2.8	10	15	14-40	6,876	45	20-69	8,252	-
WHM20/L1*	Upland	0.1	10	15	13-35	223	25	0-41	223	-
Subtotal[4]	-	2.8	-	-	-	7,099	-	-	8,474	0
Initial Development - Well Pad 201 (7.1 ha)										
MLD1f/O1	Organic	5.4	90	0	65-130	-	-	-	-	48,706
MRN1m/O1	Organic	1.7	80	0	30-125	-	-	-	-	13,257
Subtotal[4]	-	7.1	-	-	-	0	-	-	0	61,963
Initial Development - Well Pad 202 (7.9 ha)										
MLD1f/O1	Organic	7.9	70	0	35-120	-	-	-	-	55,454
Subtotal[4]	-	7.9	-	-	-	0	-	-	0	55,454
Initial Development- Well Pad 203 (6.8 ha)										
MLD1f/O1	Organic	5.0	85	0	65-117	-	-	-	-	42,170
MUS2m/O1	Organic	1.8	110	0	90-124	-	-	-	-	19,464
Subtotal[4]	-	6.8	-	-	-	0	-	-	0	61,634
Initial Development - Well Pad 204 (4.9 ha)										
CHT21/L1	Upland	1.7	10	10	12-27	3,382	60	35-68	5,073	-
DOLV2/U1l	Upland	2.7	5	10	12-30	4,101	60	35-77	8,201	-
MLD2m/O1	Organic	0.5	50	0	48-50	-	-	-	-	2,499
Subtotal[4]	-	4.9	-	-	-	7,483	-	-	13,274	2,499

Table E 3.2 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Initial Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Initial Development- Well Pad 205 (7.1 ha)										
DOLV2/U1l	Upland	7.0	10	15	12-53	17,484	45	25-60	20,981	-
MLD1m-G/O1**	Organic	0.1	75	0	40-105	-	-	-	-	528
Subtotal[4]	-	7.1	-	-	-	17,484	-	-	20,981	528
Initial Development - Well Pad 206 (6.8 ha)										
MLD1f/O1	Organic	2.2	60	0	30-86	-	-	-	-	13,124
MUS2m/O1	Organic	4.7	85	0	45-105	-	-	-	-	39,574
Subtotal[4]	-	6.8	-	-	-	0	-	-	0	52,699
Initial Development - Well Pad 207 (7.1 ha)										
CHT21/L1	Upland	0.8	15	10	19-24	1,938	60	55-64	2,325	-
DOLV2/U1l	Upland	6.3	10	15	12-30	15,735	55	23-73	18,881	-
Subtotal[4]	-	7.1	-	-	-	17,672	-	-	21,207	0
Initial Development Well Pad 208 (7.1 ha)										
MLD1f/O1	Organic	7.1	80	-	45-100	-	-	-	-	56,551
Subtotal[4]		7.1	-	-	-	0	-	-	0	56,551
Initial Development - Borrow Pit 1 (19.2 ha)										
HRLV18/U1h	Upland	18.4	10	15	10-38	45,995	40	17-72	55,194	-
WHM20/L1	Upland	0.8	10	10	7-23	1,660	25	20-32	2,075	-
Subtotal[4]	-	19.2	-	-	-	47,655	-	-	57,269	0
Initial Development - Borrow Pit 2 (10.3 ha)										
CHT21/L1	Upland	0.8	25	0	18-35	1,999	25	0-52	1,999	-
HRLV18/U1h	Upland	8.6	5	15	11-29	17,260	35	8-65	25,889	-

Table E 3.2 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Initial Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
MRN1m-G/O1	Organic	0.8	60	0	46-72	-	-	-	-	4,839
Subtotal[4]	-	10.3	-	-	-	19,259	-	-	27,889	4,839
Initial Development - Borrow Pit 3 (6.5 ha)										
CHT21/L1	Upland	0.5	20	5	23-37	1,259	35	32-36	1,511	-
DOLV2/U1l	Upland	6.0	10	15	13-31	15,010	45	31-64	18,013	-
Subtotal[4]	-	6.5	-	-	-	16,270	-	-	19,524	0
TOTALS[4]	-	163.0	-	-	-	250,938	-	-	308,144	467,250

Dash (-): a particular component does not contain a value associated with a row and/or column.

[1] Upland – contains a shallow organic and/or topsoil material at surface. Organic – contains a surface peat layer > 40 cm thick. Disturbed lands - well sites, pipelines, roads. Water - mapped as open water. Undiff - lands that were not investigated, *i.e.*, steep slopes, partial open water bodies.

[2] Includes mineral topsoil and litter layer combined.

[3] Subsoil salvage will be completed to a maximum depth of 30 cm, as a result a maximum value of 30 cm is utilized to calculate available subsoil material for salvage, baseline values recorded may exceed 30 cm.

[4] Due to rounding, total values may not equal the sum of the individual values.

NR - Not rated. Disturbed lands (ZDL).

NS - No salvage of a particular type of soil material for a Phase 2 component.

* Soil Map Unit averages taken from immediately adjacent component if polygons was continuous and a small fragment was located in the component of interest

** Soil Map unit averages from the study area were used in instances where the polygon within the component was small (<0.4 ha) and there were no digs in immediately adjacent components.

Central Processing Facility

The CPF is comprised of 25.9 ha of upland and 2.9 ha of deep organic soils (Figure E.3.2). All upland topsoil material within the CPF will be salvaged and stockpiled in the designated soil storage areas for replacement at reclamation. Subsoil material will also be salvaged from the CPF and stockpiled separately from topsoil material within the designated CPF soil storage area. All deep organic soils will be padded over with clay fill material from borrow pit 1. The following is a summary of the soil material available within the CPF and the amount planned for salvage:

- Available Soil Materials:
  - upland topsoil material (25.9 ha) = 64,645 m^3;
  - upland subsoil material (25.9 ha) = 75,778 m^3; and
  - deep organic material (2.9 ha) - total available = 27,778 m^3.
- Planned Salvage:
  - upland topsoil material (25.9 ha) = 64,645 m^3;
  - upland subsoil material (25.9 ha) = 75,778 m^3; and
  - deep organic material (0.0 ha)= no salvage, organic soils to be padded over.

Soil Storage Areas - Central Processing Facility

Two soil storage areas are designated for the CPF (Figure E.1.1) totalling 16.2 ha, all of which is considered upland. Topsoil and organic material salvaged from the CPF will be stockpiled within the storage areas. STP will be stockpiling soil materials on “like” material. In areas where topsoil material will be stockpiled the topsoil material within these areas will not be salvaged prior to topsoil material placement. In locations where subsoil material is to be stockpiled the topsoil material will be salvaged and stockpiled separately from the subsoil material. The salvaged subsoil material from the CPF will be stored on subsoil material within the soil storage area. The topsoil material salvaged from the soil storage area will stockpiled within the soil storage areas and marked to ensure that this material is replaced within the soil storage area at reclamation.

No subsoil material will be salvaged from the soil storage areas. The topsoil summary values recorded within Table E.3.2 display all available topsoil material within soil storage areas. The following is a summary of the soil material available within the soil storage areas and the amount planned for salvage:

- Available Soil Materials:
  - upland topsoil material (16.2 ha) = 64,645 m^3;

- upland subsoil material (16.2 ha) = 47,219 m^3; and
- deep organic material (0.0 ha) = no organic soils within component.

- Planned Salvage:
  - upland topsoil material (16.2 ha) = 64,645 m^3, NOTE: not all topsoil material within the soil storage areas will be salvaged only in areas where subsoil stockpiles will be located;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

Road / Utility Corridor

The road / utility corridors include access between the Initial Development well pads (well pads 201 to 208), borrow pits (1 to 3), the CPF, and the operators camp. The corridor also includes above ground pipelines for internal processes that run from the Phase 2 CPF to the well pads. Below ground pipelines for dilbit and diluent will be installed to join the existing Phase 1 CPF and the proposed Phase 2 CPF (Figure E.1.1). Natural gas and source water will be supplied to the Phase 2 facility from systems already in place for the Phase 1 operation.

A total of 5.7 ha of the road / utility corridors are considered upland (Figure E.3.2). The topsoil will be salvaged, by pushing the soil material to the edge of the right of way, out of the way of construction activities. For access roads this topsoil material will be spread evenly along the ditches after construction is complete to provide a growing medium for vegetation establishment. Excess soil material will be left in a windrow on the edge of the right of way from where it was salvaged. On the deep organic soils (18.8 ha) no salvage of organic soil is planned. Deep organic soil areas will be padded over using clay fill material from borrow sources (borrows 1-3).

Soil disturbance will be minimal, so salvage is not expected to take place within the above ground pipeline right-of-way (RoW). Pilings will be installed to suspend the pipeline above the ground; negligible soil disturbance is expected. STP does not anticipate any soil salvage or replacement for this development.

Installation of the below ground pipelines (between the Phase 1 CPF and proposed Phase 2 CPF) will occur in the existing road corridor (disturbed lands). Within upland portions of the existing corridor the disturbed topsoil layer (if present) will be bladed to the edge of the workspace for the duration of line installation and stored separately from any subsoil material excavated for placement of the pipeline(s). In deep organic portions of the existing corridor the organic material will be excavated and stored at the edge of the workspace separately from any subsoil material excavated for line installation.

No subsoil will be salvaged within the road / utility corridors.

The following is a summary of the soil material available within the road / utility corridor and the amount planned for salvage:

- Available Soil Materials:
  - upland topsoil material (5.7 ha) = 13,092 m^3;
  - upland subsoil material (5.7 ha) = 16,530 m^3; and
  - deep organic material (18.8 ha) = 143,304 m^3.
- Planned Salvage:
  - upland topsoil material (5.7 ha) = 13,092 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Operators Camp

The operators' camp is located entirely within upland soils (Figure E.3.2). All upland topsoil material will be salvaged and stockpiled on-site for replacement at reclamation. The following is a summary of the soil material available within the operators' camp and the amount planned for salvage:

- Available Soil Materials:
  - upland topsoil material (2.8 ha) = 7,099 m^3;
  - upland subsoil material (25.9 ha) = 8,474 m^3; and
  - deep organic material (0.0 ha) - total available = 27,778 m^3.
- Planned Salvage:
  - upland topsoil material (2.8 ha) = 7,099 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

Well Pad(s)

There are eight well pads planned for the Initial Development (well pads 201-208) totalling 54.7 ha. Approximately 18.5 ha of the well pad(s) are considered upland and the remaining 36.2 ha are located in deep organics (Figure E.3.2). All upland areas will have the topsoil material salvaged as per the average thickness values provided in Table E.3.2 and stockpiled on-site for replacement. Subsoil material will also be salvaged from upland well pads and stockpiled on-site separately from topsoil material. Well pads that will have upland topsoil and

subsoil salvaged for replacement include well pads 204, 205, and 207 all other well pads are located entirely in deep organics.

Deep organics will not be salvaged from the well pads, all deep organic soils will be padded over with clay fill material from borrow pits. The following is a summary of the soil material available within the eight well pads and the amount planned for salvage:

Well Pad 201 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.1 ha) = 61,963 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 202 (7.9 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.9 ha) = 55,454 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 203 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (6.8 ha) = 61,634 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;

- upland subsoil material (0.0 ha) = no subsoil within component; and
- deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 204 (4.9 ha)

- Available Soil Materials:
  - upland topsoil material (4.4 ha) = 7,483 m^3;
  - upland subsoil material (0.0 ha) = 13,274 m^3; and
  - deep organic material (0.5 ha) = 2,499 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = 7,483 m^3;
  - upland subsoil material (0.0 ha) = 13,274 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 205 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (7.0 ha) = 17,484 m^3;
  - upland subsoil material (7.0 ha) = 20,981 m^3; and
  - deep organic material (0.1 ha) = 528 m^3.
- Planned Salvage:
  - upland topsoil material (7.0 ha) = 17,484 m^3;
  - upland subsoil material (7.0 ha) = 20,981 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 206 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (6.8 ha) = 52,699 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 207 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (7.1 ha) = 17,672 m^3;
  - upland subsoil material (7.1 ha) = 21,207 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (7.1 ha) = 17,672 m^3;
  - upland subsoil material (7.1 ha) = 21,207 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.

Well Pad 208 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.1 ha) = 56,551 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Borrow Pits

There are three borrow pits proposed for the initial stage of development. Approximately 35.1 ha of the total 36.0 ha of the borrow pits are considered upland and will have the topsoil material salvaged and stockpiled on-site for replacement at reclamation. All of the deep organic soil (0.9 ha, located in borrow 2) will also be salvaged for replacement. The deep organic material will be salvaged with the topsoil material and stockpiled in the same location. The stockpiled topsoil and organic materials will be used at final reclamation of the borrow pits. In addition to the topsoil and organic material salvage, STP will also stockpile materials excavated during borrow pit development that are not suitable for construction purposes. This poor construction material will be stockpiled separately from the salvaged topsoil and organic material and used to re-contour the borrow disturbance at reclamation.

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

Borrow Pit 1 (19.2 ha)

- Available Soil Materials:
  - upland topsoil material (19.2 ha) = 47,655 m^3;
  - upland subsoil material (19.2 ha) = 57,269 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (19.2 ha) = 47,655 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

Borrow Pit 2 (10.3 ha)

- Available Soil Materials:
  - upland topsoil material (9.4 ha) = 19,259 m^3;
  - upland subsoil material (9.4 ha) = 27,889 m^3; and
  - deep organic material (0.9 ha) = 4,839 m^3.
- Planned Salvage:
  - upland topsoil material (9.4 ha) = 47,655 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.9 ha) = 4,839 m^3.

Borrow Pit 3 (6.5 ha)

- Available Soil Materials:
  - upland topsoil material (6.5 ha) = 16,270 m^3;
  - upland subsoil material (6.5 ha) = 19,524 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (6.5 ha) = 47,655 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

E.3.6.7 Future Development

Approximately 144.5 ha of the total 325.1 ha of the Future Development 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 the Future Development of Phase 2 is provided in Table E.3.3. The following sections detail the topsoil, subsoil, and organic material salvage and handling and associated volumes of soil materials per component based on the estimated values in Table E.3.3.

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Roads and Utility Corridors (75.5 ha)										
ALG20/L1	Upland	0.1	10	10	5-58	202	40	10-79	303	-
CHT21/L1	Upland	1.7	25	5	6-105	5,148	30	0-50	5,148	-
DOKM9/U1l	Upland	2.1	10	15	5-58	5,323	40	6-79	6,387	-
DOLV2/U1l	Upland	3.9	5	15	5-58	7,858	45	10-80	11,787	-
DOLV9/U1l	Upland	7.8	5	15	2-43	15,559	45	18-80	23,339	-
HRLV18/U1h	Upland	1.5	10	15	6-58	3,766	40	8-85	4,519	-
HRLV2/U1l	Upland	0.5	10	15	6-38	1,136	40	8-85	1,364	-
KME9/U1l	Upland	0.2	10	10	5-42	390	40	6-79	585	-
LVK18/U1l	Upland	2.2	5	15	5-43	4,351	40	8-85	6,526	-
MIL18/L3	Upland	0.2	5	15	6-46	360	45	20-97	541	-
MLD1f/O1	Organic	9.0	75	-	40-130	-	-	-	-	67,500
MLD1m/O1	Organic	9.1	75	-	30-200	-	-	-	-	68,377
MLD1m/O3	Organic	1.6	85	-	30-200	-	-	-	-	13,719
MLD1m-G/O1	Organic	8.0	55	-	40-105	-	-	-	-	43,896
MLD1m-G/O3	Organic	1.3	60	-	16-105	-	-	-	-	7,792
MLD2m/O1	Organic	2.1	120	-	40-200	-	-	-	-	24,735
MRN1f/O1	Organic	5.1	80	-	30-140	-	-	-	-	40,539
MRN1m/O1	Organic	13.8	85	-	30-185	-	-	-	-	117,090
MRN1m-G/O1	Organic	1.6	55	-	6-90	-	-	-	-	9,005

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
MUS2m/O1	Organic	2.5	145	-	30-220	-	-	-	-	36,437
WHM20/L1	Upland	0.3	10	10	2-43	545	40	15-80	818	-
ZDL	Disturbed	0.04	NR	NR	NR	-	NR	-	-	-
ZGWA20/SC1l	Undiff.	0.2	NR	NR	NR	-	NR	-	-	-
ZUN18/I3h	Undiff.	0.7	NR	NR	NR	-	NR	-	-	-
Subtotal[4]	-	75.5	-	-	-	44,639	-	-	61,317	429,091
Future - Well Pad 105 (6.9 ha)										
MRN1m/O1	Organic	6.1	85	-	30-85	-	-	-	-	51,686
WHM20/L1	Upland	0.8	10	10	2-43	1,542	40	15-80	2,312	-
Subtotal[4]	-	6.9	-	-	-	1,542	-	-	2,312	51,686
Future - Well Pad 106 (7.1 ha)										
MLD1m-G/O3	Organic	2.5	60	-	16-105	-	-	-	-	15,220
MRN1m/O1	Organic	4.5	85	-	30-185	-	-	-	-	38,524
Subtotal[4]	-	7.1	-	-	-	0	-	-	0	53,744
Future - Well Pad 107 (6.8 ha)										
MLD1m/O1	**Organic**	**0.07**	**75**	**-**	**30-200**	**-**	**-**	**-**	**-**	**562**
MRN1m/O1	Organic	6.8	85	-	30-185	-	-	-	-	57,522
Subtotal[4]	-	6.8	-	-	-	0	-	-	0	58,084

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Future - Well Pad 108 (7.0 ha)										
LVK18/U1l	Upland	4.1	5	15	5-43	8,174	40	8-85	12,261	-
MLD1m/O3	Organic	2.9	85	-	30-200	-	-	-	-	24,938
Subtotal[4]	-	7.0	-	-	-	8,174	-	-	12,261	24,938
Future - Well Pad 109 (6.8 ha)										
DOLV9/U1l	Upland	1.8	5	15	2-43	3,587	45	18-80	5,381	-
MLD1m/O1	Organic	5.0	75	-	30-200	-	-	-	-	37,669
Subtotal[4]	-	6.8	-	-	-	3,587	-	-	5,381	37,669
Future - Well Pad 110 (7.1 ha)										
LVK18/U1l	Upland	0.6	5	15	5-43	1,139	40	8-85	1,709	-
MLD1m/O1	Organic	6.5	75	-	30-200	-	-	-	-	48,745
Subtotal[4]	-	7.1	-	-	-	1,139	-	-	1,709	48,745
Future - Well Pad 111 (7.1 ha)										
DOLV9/U1l	Upland	3.0	5	15	2-43	6,063	45	18-80	9,094	-
MLD1m/O1	Organic	3.4	75	-	30-200	-	-	-	-	25,202
ZGWA20/SC1l	Undiff.	0.7	NR	NR	NR	-	NR	NR	-	-
Subtotal[4]	-	7.1	-	-	-	6,063	-	-	9,094	25,202
Future - Well Pad 112 (7.1 ha)										
DOLV9/U1l	Upland	6.6	5	15	2-43	13,222	45	18-80	19,833	-
MLD1m-G/O1	Organic	0.4	55	-	40-105	-	-	-	-	1,987
MMY9/SC1l	Upland	0.1	10	5	5-42	145	0	0	-	-
Subtotal[4]	-	7.1	-	-	-	13,367	-	-	19,833	1,987

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Future - Well Pad 113 (7.1 ha)										
CHT21/L1	Upland	0.5	25	5	6-105	1,563	30	0-50	1,563	-
MLD1m/O1	Organic	0.7	75	-	30-200	-	-	-	-	4,947
MRN1m/O1	Organic	5.9	85	-	30-185	-	-	-	-	50,052
Subtotal[4]	-	7.1	-	-	-	1,563	-	-	1,563	54,998
Future - Well Pad 114 (7.9 ha)										
CHT21/L1	Upland	0.03	25	5	6-105	91	30	0-50	91	-
DOLV2/U1l	Upland	0.04	5	15	5-58	84	45	10-80	127	-
DOLV9/U1l	Upland	3.8	5	15	2-43	7,576	45	18-80	11,363	-
MLD1m-G/O1	Organic	3.5	55	-	40-105	-	-	-	-	19,089
MLD1m-G/O3	Organic	0.6	60	-	16-105	-	-	-	-	3,610
Subtotal[4]	-	7.9	-	-	-	7,751	-	-	11,581	22,700
Future - Well Pad 209 (6.8 ha)										
DOLV2/U1l	Upland	1.6	5	15	5-58	3,285	45	10-80	4,928	-
MLD1m/O1	Organic	3.7	75	-	30-200	-	-	-	-	27,727
MLD2m/O1	Organic	1.2	120	-	40-200	-	-	-	-	13,854
ZWA	Water	0.3	NR	NR	NR	-	NR	NR	-	-
Subtotal[4]	-	6.8	-	-	-	3,285	-	-	4,928	41,581
Future - Well Pad 210 (7.1 ha)										
MLD1f/O1	Organic	4.9	75	-	40-130	-	-	-	-	36,662
MLD1m/O1	Organic	2.2	75	-	30-200	-	-	-	-	16,355

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Subtotal[4]	-	7.1	-	-	-	0	-	-	0	53,017
Future - Well Pad 211 (7.1 ha)										
CHT21/L1	Upland	1.2	25	5	6-105	3,548	30	0-50	3,548	-
HRLV18/U1h	Upland	0.5	10	15	6-58	1,278	40	8-85	1,534	-
MRN1m-G/O1	Organic	5.4	55	-	6-90	-	-	-	-	29,562
Subtotal[4]	-	7.1	-	-	-	4,826	-	-	5,082	29,562
Future - Well Pad 212 (7.1 ha)										
CHT21/L1	Upland	1.8	25	5	6-105	5,515	30	0-50	5,515	-
DOLV2/U1l	Upland	5.1	5	15	5-58	10,298	45	10-80	15,446	-
MLD1m-G/O1	Organic	0.1	55	-	40-105	-	-	-	-	449
Subtotal4	**-**	**7.1**	**-**	**-**	**-**	**15,813**	**-**	**-**	**20,962**	**449**
Future - Well Pad 213 (7.1 ha)										
CHT21/L1	Upland	4.5	25	5	6-105	13,534	30	0-50	13,534	-
MLD1f/O1	Organic	0.1	75	-	40-130	-	-	-	-	442
MLD1m/O3	Organic	0.2	85	-	30-200	-	-	-	-	1,621
MRN1m/O1	Organic	2.3	85	-	30 to 185	-	-	-	-	19,616
Subtotal[4]	-	7.1	-	-	-	13,534	-	-	13,534	21,679
Future - Well Pad 214 (5.1 ha)										
CHT21/L1	Upland	0.04	25	5	6-105	117	30	0-50	117	-
DOLV2/U1l	Upland	5.0	5	15	5-58	10,030	45	10-80	15,045	-

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Subtotal[4]	-	5.1	-	-	-	10,147	-	-	15,162	0
Future - Well Pad 215 (6.8 ha)										
CHT21/L1	Upland	3.1	25	5	6-105	9,383	30	0-50	9,383	-
DOLV9/U1l	Upland	3.5	5	15	2-43	7,012	45	18-80	10,518	-
MIL18/L3	Upland	0.1	5	15	6-46	102	45	20-97	153	-
MLD1f/O1	Organic	0.1	75	-	40-130	-	-	-	-	500
Subtotal[4]	-	6.8	-	-	-	16,497	-	-	20,054	500
Future - Well Pad 216 (5.0 ha)										
DOKM9/U1l	Upland	3.7	10	15	4-58	9,370	40	6-79	11,244	-
MRN1f/O1	Organic	1.2	75	-	40-130	-	-	-	-	9,296
Subtotal[4]	-	5.0	-	-	-	9,370	-	-	11,244	9,296
Future - Well Pad 217 (4.3 ha)										
KME9/U1l	Upland	3.3	10	10	5-42	6,567	40	6-79	9,850	-
MLD1m/O1	Organic	1.0	75	-	30-200	-	-	-	-	7,381
Subtotal[4]	-	4.3	-	-	-	6,567	-	-	9,850	7,381
Future - Well Pad 218 (4.4 ha)										
MRN1f/O1	Organic	4.4	75	-	40-130	-	-	-	-	32,679
Subtotal[4]	-	4.4	-	-	-	0	-	-	0	32,679
Future - Well Pad 219 (4.3 ha)										
DOKM9/U1l	Upland	0.7	10	15	5-58	1,808	40	6-79	2,169	-
MLD1m/O1	Organic	3.2	75	-	30-200	-	-	-	-	24,157
MLD1m-G/O3	Organic	0.3	60	-	16-105	-	-	-	-	1,941

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Subtotal[4]	-	4.3	-	-	-	1,808	-	-	2,169	26,098
Future - Well Pad 220 (7.1 ha)										
MLD1f/O1	Organic	7.1	75	-	40-130	-	-	-	-	53,016
Subtotal[4]	-	7.1	-	-	-	0	-	-	0	53,016
Future - Well Pad 221 (7.1 ha)										
ALG20/L1	Upland	1.0	10	10	5-58	1,907	40	10-79	2,861	-
DOLV9/U1l	Upland	6.1	5	15	2-43	12,231	45	18-80	18,346	-
Subtotal[4]	-	7.1	-	-	-	14,138	-	-	21,207	0
Future - Well Pad 222 (7.1 ha)										
HRLV18/U1h	Upland	5.4	10	15	6-58	13,426	40	8-85	16,111	-
MLD2m/O1	Organic	1.7	120	-	40-200	-	-	-	-	20,342
Subtotal[4]	-	7.1	-	-	-	13,426	-	-	16,111	20,342
Future - Borrow Pit 4 (11.8 ha)										
ALG20/L1	Upland	8.3	10	10	5-58	16,621	40	10-79	24,931	-
HRLV2/U1l	Upland	2.7	10	15	6-38	6,644	40	8-85	7,973	-
MLD1m-G/O1	Organic	0.8	55	-	40-105	-	-	-	-	4,447
Subtotal[4]	-	11.8	-	-	-	23,265	-	-	32,904	4,447
Future - Borrow Pit 5 (6.5 ha)										
HRLV18/U1h	Upland	6.5	10	15	6-58	16,298	40	8-85	19,557	-
Subtotal[4]	-	6.5	-	-	-	16,298	-	-	19,557	0

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		
Future - Borrow Pit 6 (19.6 ha)										
HRLV18/U1h	Upland	19.5	10	15	6-58	48,746	40	8-85	58,495	-
WHM20/L1	Upland	0.1	10	10	2-43	155	40	15-80	233	-
Subtotal[4]	-	19.6	-	-	-	48,901	-	-	58,728	0
Future - Borrow Pit 7 (20.7 ha)										
HRLV18/U1h	Upland	12.6	10	15	6-58	31,597	40	8-85	37,916	-
MLD1f/O1	Organic	2.7	75	-	40-130	-	-	-	-	20,304
MLD1m-G/O3	Organic	0.1	60	-	16-105	-	-	-	-	564
WHM20/L1	Upland	5.2	10	10	2-43	10,425	40	15-80	15,637	-
Subtotal[4]	-	20.7	-	-	-	42,021	-	-	53,553	20,868
Future - Borrow Pit 8 (15.5 ha)										
MLD1m/O1	Organic	1.0	75	-	30-200	-	-	-	-	7,854
MLD1m/O3	Organic	6.8	85	-	30-200	-	-	-	-	57,763
MRN1m/O1	Organic	7.6	85	-	30-185	-	-	-	-	64,897
Subtotal[4]	-	15.5	-	-	-	0	-	-	0	130,514
Future - Borrow Pit 9 (18.7 ha)										
DOLV9/U1l	Upland	0.3	5	15	2-43	512	45	18-80	768	-
MLD1m/O1	Organic	18.4	75	-	30-200	-	-	-	-	138,008
Subtotal[4]	-	18.7	-	-	-	512	-	-	768	138,008
TOTALS[4]	-	325.1	-	-	-	328,233	-	-	430,865	1,398,280

Table E 3.3 Soil Material Available for Salvage from Within the Phase 2 Footprint for the Future Development

Soil Map Unit	Map Unit Type [1]	Area (ha)	Anticipated Depth of Soil/Organic Materials Available for Salvage (cm)			Volume of Upland Topsoil Available for Salvage[2] (m^3)	Anticipated Depth of Subsoil Material Available for Salvage (cm)		Volume of Subsoil[3] Available for Salvage (m^3)	Volume of Deep Organic Soil Available for Salvage (m^3)
			Ave. Litter / Organic Material	Ave. Topsoil	Combined Topsoil / Litter Range		Estimated Subsoil Thickness	Subsoil Thickness Range		

Dash (-): a particular component does not contain a value associated with a row and/or column.

[1] Upland – contains a shallow organic and/or topsoil material at surface. Organic – contains a surface peat layer > 40 cm thick. Disturbed lands - well sites, pipelines, roads. Water - mapped as open water. Undiff - lands that were not investigated, *i.e.*, steep slopes, partial open water bodies.

[2] Includes mineral topsoil and litter layer combined.

[3] Subsoil salvage will be completed to a maximum depth of 30 cm, as a result a maximum value of 30 cm is utilized to calculate available subsoil material for salvage, baseline values recorded may exceed 30 cm.

[4] Due to rounding, total values may not equal the sum of the individual values.

NR - Not rated. Disturbed lands (**ZDL**), water (**ZWA**), miscellaneous undifferentiated lands - Undiff. (**ZGWA** - water with estimated peaty Gleysols / organics, and **ZUN** - steep undifferentiated failure slopes).

NS - Likely no salvage of a particular type of soil material for a Phase 2 component.

Road / Utility Corridor

The road / utility corridors for the Future Development accounts for 75.5 ha of disturbance area and includes; access between the Future Development well pads (well pads 105 to 114 and 209 to 222), and the planned initial well pads, and borrow pits (4 to 9). The corridor also includes above ground pipelines for internal processes that run from the future well pads to the appropriate processing facility.

A total of 21.2 ha of the road / utility corridors are considered upland (Figure E.3.2). The topsoil will be salvaged, by pushing the soil material to the edge of the right of way, out of the way of construction activities. For access roads this topsoil material will be spread evenly along the ditches after construction is complete to provide a growing medium for vegetation establishment. Excess soil material will be left in a windrow on the edge of the right of way from where it was salvaged. No salvage of the 54.3 ha of deep organic soil is planned. Deep organic soil areas will be padded over using clay fill material. No subsoil will be salvaged within the road / utility corridors.

The following is a summary of the soil material available within the road / utility corridor and the amount planned for salvage:

- Available Soil Materials:
  - upland topsoil material (21.2 ha) = 44,639 m^3;
  - upland subsoil material (21.2 ha) = 61,317 m^3; and
  - deep organic material (54.3 ha) = 429,091 m^3.
- Planned Salvage:
  - upland topsoil material (21.2 ha) = 44,639 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pads

There are 24 well pads planned for the Future Development (well pads 105 to 114 and 209 to 222) totalling 156.9 ha. Approximately 68.1 ha of the well pad(s) are considered upland and the remaining 88.7 ha are located in deep organics and undifferentiated organic map units (Figure E.3.2). All upland areas will have the topsoil material salvaged and stockpiled on-site for replacement. Subsoil material will also be salvaged from upland well pads and stockpiled on-site separately from topsoil material.

A majority of the well pads have some upland topsoil and subsoil that will be salvaged for replacement. The following well pads are located entirely in deep organics and will not have any soil material salvaged: well pads 106, 107, 210, 218 and 220.

The following is a summary of the soil material available within the 24 well pads and the amount planned for salvage:

Well Pad 105 (6.9 ha)

- Available Soil Materials:
  - upland topsoil material (0.8 ha) = 1,542 m^3;
  - upland subsoil material (0.8 ha) = 2,312 m^3; and
  - deep organic material (6.1 ha) = 51,686 m^3.
- Planned Salvage:
  - upland topsoil material (0.8 ha) = 1,542 m^3;
  - upland subsoil material (0.8 ha) = 2,312 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 106 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.1 ha) = 53,744 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 107 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (6.8 ha) = 58,084 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;

- upland subsoil material (0.0 ha) = no subsoil within component; and
- deep organic material (6.8 ha) = no salvage, organic soils to be padded over.

Well Pad 108 (7.0 ha)

- Available Soil Materials:
  - upland topsoil material (4.1 ha) = 8,174 m^3;
  - upland subsoil material (4.1 ha) = 12,261 m^3; and
  - deep organic material (2.9 ha) = 24,938 m^3.
- Planned Salvage:
  - upland topsoil material (4.1 ha) = 8,174 m^3;
  - upland subsoil material (4.1 ha) = 12,261 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 109 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (1.8 ha) = 3,587 m^3;
  - upland subsoil material (1.8 ha) = 5,331 m^3; and
  - deep organic material (5.0 ha) = 37,669 m^3.
- Planned Salvage:
  - upland topsoil material (1.8 ha) = 3,587 m^3;
  - upland subsoil material (1.8 ha) = 5,331 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 110 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.6 ha) = 1,139 m^3;
  - upland subsoil material (0.6 ha) = 1,709 m^3; and
  - deep organic material (6.5 ha) = 48,745 m^3.
- Planned Salvage:
  - upland topsoil material (0.6 ha) = 1,139 m^3;
  - upland subsoil material (0.6 ha) = 1,709 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 111 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (3.0 ha) = 6,063 m^3;
  - upland subsoil material (3.0 ha) = 9,094 m^3; and
  - deep organic material (4.1 ha) = 25,202 m^3.
- Planned Salvage:
  - upland topsoil material (3.0 ha) = 6,063 m^3;
  - upland subsoil material (3.0 ha) = 9,094 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 112 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (6.7 ha) = 13,367 m^3;
  - upland subsoil material (6.7 ha) = 19,833 m^3; and
  - deep organic material (0.4 ha) = 1,987 m^3.
- Planned Salvage:
  - upland topsoil material (6.7 ha) = 13,367 m^3;
  - upland subsoil material (6.7 ha) = 19,833 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 113 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.5 ha) = 1,563 m^3;
  - upland subsoil material (0.5 ha) = 1,563 m^3; and
  - deep organic material (6.6 ha) = 54,998 m^3.
- Planned Salvage:
  - upland topsoil material (0.5 ha) = 1,563 m^3;
  - upland subsoil material (0.5 ha) = 1,563 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 114 (7.9 ha)

- Available Soil Materials:
  - upland topsoil material (3.8 ha) = 7,751 m^3;

- upland subsoil material (3.8 ha) = 11,581 m^3; and
- deep organic material (4.1 ha) = 22,700 m^3.

- Planned Salvage:
  - upland topsoil material (3.8 ha) = 7,751 m^3;
  - upland subsoil material (3.8 ha) = 11,581 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 209 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (1.6 ha) = 3,285 m^3;
  - upland subsoil material (1.6 ha) = 4,928 m^3; and
  - deep organic material (5.2 ha) = 41,581 m^3.
- Planned Salvage:
  - upland topsoil material (1.6 ha) = 3,285 m^3;
  - upland subsoil material (1.6 ha) = 4,928 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 210 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.1 ha) = 53,017 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 211 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (1.7 ha) = 4,826 m^3;
  - upland subsoil material (1.7 ha) = 5,082 m^3; and
  - deep organic material (5.4 ha) = 29,562m^3.

- Planned Salvage:
  - upland topsoil material (1.7 ha) = 4,826 m^3;
  - upland subsoil material (1.7 ha) = 5,082 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 212 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (7.0 ha) = 15,813 m^3;
  - upland subsoil material (7.0 ha) = 20,962 m^3; and
  - deep organic material (0.1 ha) = 449 m^3.
- Planned Salvage:
  - upland topsoil material (7.1 ha) = 15,813 m^3;
  - upland subsoil material (7.1 ha) = 20,962m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 213 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (4.5 ha) = 13,534 m^3;
  - upland subsoil material (4.5 ha) = 13,534 m^3; and
  - deep organic material (2.6 ha) = 21,679 m^3.
- Planned Salvage:
  - upland topsoil material (4.5 ha) = 13,534 m^3;
  - upland subsoil material (4.5 ha) = 13,534 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 214 (5.1 ha)

- Available Soil Materials:
  - upland topsoil material (5.1 ha) = 10,147 m^3;
  - upland subsoil material (5.1 ha) = 15,162 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (5.1 ha) = 10,147 m^3;
  - upland subsoil material (5.1 ha) = 15,162 m^3; and

- deep organic material (0.0 ha) = no organic soils within component.

Well Pad 215 (6.8 ha)

- Available Soil Materials:
  - upland topsoil material (6.7 ha) = 16,497 m^3;
  - upland subsoil material (6.7 ha) = 20,054 m^3; and
  - deep organic material (0.1 ha) = 500 m^3.
- Planned Salvage:
  - upland topsoil material (6.8 ha) = 16,497 m^3;
  - upland subsoil material (6.8 ha) = 20,054 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 216 (5.0 ha)

- Available Soil Materials:
  - upland topsoil material (3.8 ha) = 9,370 m^3;
  - upland subsoil material (3.8 ha) = 11,244 m^3; and
  - deep organic material (1.2 ha) = 9,296 m^3.
- Planned Salvage:
  - upland topsoil material (3.7 ha) = 9,370 m^3;
  - upland subsoil material (3.7 ha) = 11,244 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 217 (4.3 ha)

- Available Soil Materials:
  - upland topsoil material (3.3 ha) = 6,567 m^3;
  - upland subsoil material (3.3 ha) = 9,850 m^3; and
  - deep organic material (1.0 ha) = 7,381 m^3.
- Planned Salvage:
  - upland topsoil material (3.3 ha) = 6,567 m^3;
  - upland subsoil material (3.3 ha) = 9,850 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 218 (4.4 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (4.4 ha) = 32,679 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 219 (4.3 ha)

- Available Soil Materials:
  - upland topsoil material (0.7 ha) = 1,808 m^3;
  - upland subsoil material (0.7 ha) = 2,169 m^3; and
  - deep organic material (3.5 ha) = 26,098 m^3.
- Planned Salvage:
  - upland topsoil material (0.7 ha) = 1,808 m^3;
  - upland subsoil material (0.7 ha) = 2,169 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 220 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (7.1 ha) = 53,016 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Well Pad 221 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (7.1 ha) = 14,138 m^3;

- upland subsoil material (7.1 ha) = 21,207 m^3; and
- deep organic material (0.0 ha) = no organic soils within component.

- Planned Salvage:
  - upland topsoil material (7.1 ha) = 14,138 m^3;
  - upland subsoil material (7.1 ha) = 21,207 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.

Well Pad 222 (7.1 ha)

- Available Soil Materials:
  - upland topsoil material (5.4 ha) = 13,426 m^3;
  - upland subsoil material (5.4 ha) = 16,111 m^3; and
  - deep organic material (1.7 ha) = 20,342 m^3.
- Planned Salvage:
  - upland topsoil material (5.4 ha) = 13,426 m^3;
  - upland subsoil material (5.4 ha) = 16,111 m^3; and
  - deep organic material (0.0 ha) = no salvage, organic soils to be padded over.

Borrow Pits

There are six borrow pits proposed for the Future Development area and comprise 92.7 ha of the Future Development area (Borrow Pit 4 to Borrow Pit 9). Approximately 55.2 ha of the borrow pits are located in uplands and will have the topsoil material salvaged and stockpiled on-site for replacement at reclamation. All 37.5 ha of the deep organic soil material will also be salvaged for replacement. The stockpiled topsoil and organic materials will be used at final reclamation of the borrow pits. In addition to the topsoil and organic material salvage, STP will also stockpile materials excavated during borrow pit development that are not suitable for construction purposes. This poor construction material will be stockpiled separately from topsoil and organic material and used to re-contour the borrow disturbance at reclamation.

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

Borrow Pit 4 (11.8 ha)

- Available Soil Materials:
  - upland topsoil material (11.0 ha) = 23,265 m^3;
  - upland subsoil material (11.0 ha) = 32,904 m^3; and

- deep organic material (0.8 ha) = 4,447 m^3.

- Planned Salvage:
  - upland topsoil material (11.0 ha) = 23,265 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.8 ha) = 4,447 m^3.

Borrow Pit 5 (6.5 ha)

- Available Soil Materials:
  - upland topsoil material (6.5 ha) = 16,298 m^3;
  - upland subsoil material (6.5 ha) = 19,557 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (6.5 ha) = 16,298 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

Borrow Pit 6 (19.6 ha)

- Available Soil Materials:
  - upland topsoil material (19.6 ha) = 48,901 m^3;
  - upland subsoil material (19.6 ha) = 58,728 m^3; and
  - deep organic material (0.0 ha) = no organic soils within component.
- Planned Salvage:
  - upland topsoil material (19.6 ha) = 48,901 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (0.0 ha) = no organic soils within component.

Borrow Pit 7 (20.7 ha)

- Available Soil Materials:
  - upland topsoil material (17.9 ha) = 42,021 m^3;
  - upland subsoil material (17.9 ha) = 53,553 m^3; and
  - deep organic material (2.8 ha) = 20,868 m^3.
- Planned Salvage:
  - upland topsoil material (17.9 ha) = 42,021 m^3;

- upland subsoil material (0.0 ha) = no salvage of subsoil; and
- deep organic material (2.8 ha) = 20,868 m^3.

Borrow Pit 8 (15.5 ha)

- Available Soil Materials:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (15.5 ha) = 130,514 m^3.
- Planned Salvage:
  - upland topsoil material (0.0 ha) = no topsoil within component;
  - upland subsoil material (0.0 ha) = no subsoil within component; and
  - deep organic material (15.5 ha) = 130,514 m^3.

Borrow Pit 9 (18.7 ha)

- Available Soil Materials:
  - upland topsoil material (0.3 ha) = 512 m^3;
  - upland subsoil material (0.3 ha) = 768 m^3; and
  - deep organic material (18.4 ha) = 138,008 m^3.
- Planned Salvage:
  - upland topsoil material (17.9 ha) = 512 m^3;
  - upland subsoil material (0.0 ha) = no salvage of subsoil; and
  - deep organic material (2.8 ha) = 138,008 m^3.

E.3.7 Soil Storage

All upland and organic materials that are salvaged, as described in Sections E.3.6.6 and E.3.6.7, will be placed in designated stockpiles as follows:

- soil material salvaged along the road / utility corridors in upland locations will be windrowed along the right-of-way and some of this topsoil material will be spread along the ditches after construction of the road is complete and some will be stored along the right of way and used at final reclamation of the utility corridor;
- topsoil and subsoil materials salvaged from the well pads will be stockpiled separately at the respective well pads and utilized at reclamation. Topsoil will be stored on topsoil and salvaged subsoil material will be stored in areas where the topsoil layer has been salvaged;

- soil materials salvaged from the borrow pit will remain at the borrow location in stockpile until required for reclamation; and
- topsoil and subsoil materials salvaged from the CPF will be stored within the designated soil storage areas. Topsoil will be stored on topsoil and salvaged subsoil material will be stored in areas where the topsoil layer has been salvaged.

The stockpiles will be constructed as follows:

- soil will be stockpiled on like material (*i.e.*, topsoil stockpiled on topsoil);
- long-term stockpiles will have a set-back of 5 m from standing timber;
- 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 constructed out of the way of surface water flow;
- stockpiles will be accessible and retrievable;
- stockpiles will be revegetated and controlled for weeds;
- stockpiles will include signage that indicates the type of reclamation material; and
- the average height of the stockpiles will vary and depend on the volume and type of material to be stored. It is expected that the average height of soil stockpiles will vary from 3 to 5 m in height with slopes not exceed 3:1 slopes.

Figure E.3.3a to e displays the estimated stockpile locations and material types of all salvaged materials within the Initial Development footprint at a scale of 1:5,000 (PDA level requirement (AENV 2009)). Figures E.3.4a to c displays the estimated soil stockpile locations of the Future Development footprint at a smaller scale (1:20,000). Materials salvaged from the road / utility corridor are not displayed on Figures E.3.3 or E.3.4. It is expected that all topsoil material salvaged along the road / utility corridor in upland areas will be stored along the edge of the right of way and a replaced within the ditches and stockpiled (if excess material is available) once construction is complete.

E.3.7.1 Soil Material Balance

The reclamation material balance for the Phase 2 Project is shown in Table E.3.4. The estimated volume of soil material that is expected to be salvaged in the Phase 2 footprint is based on the summary of soil salvage information provided for the Initial and Future Developments.

The soil volumes provided in Table E.3.4 for the Initial Development are based on PDA level soil inspection information and the soil volumes for the Future Development phase are based on soil results adapted from the baseline soil map and thickness information (CR #9).

Table E.3.4 Reclamation Material Balance for Phase 2

Project Component	Total Component Area (ha)	Area of Upland Soils to be Disturbed (ha)	Area of Deep Organic Soils to be Disturbed (ha)	Average Depth of Topsoil / Deep Organic Salvage[1] (cm)		Volume of Upland topsoil to be Salvaged (m^3)[3]	Volume of Deep Organic Material to be Salvaged (m^3)	Total Volume of Topsoil & Deep Organic Material to be Salvaged for Reclamation (m^3)	Average Replacement Depth of Topsoil and Deep Organic Material (cm)	Average Depth of Subsoil Salvage[4] (cm)	Volume of Subsoil to be Salvaged (m^3)	Average Replacement Depth of Salvaged Subsoil (cm)[5]
				Deep Organic	Upland Litter Plus Topsoil[2]							
Phase 2 - Initial Development												
CPF	28.8	25.9	2.9	NS	25	64,645	NS	64,645	25	29	75,778	29
CPF Soil Storage Area*	16.2	16.2	0.0	-	25*	40,280*	-	40,280*	25*	NS	NS	NS
Road and Utility Corridors	24.5	5.7	18.8	NS	23	13,092	NS	13,092	23	NS	NS	NS
Operators Camp	2.8	2.8	0.0	-	25	7,099	-	7,099	25	NS	NS	NS
Well Pad 201	7.1	0.0	7.1	NS	-	-	NS	-	-	-	-	-
Well Pad 202	7.9	0.0	7.9	NS	-	-	-	-	-	-	-	-
Well Pad 203	6.8	0.0	6.8	NS	-	-	NS	-	-	-	-	-
Well Pad 204	4.9	4.4	0.5	NS	17	7,483	NS	7,483	15	30	13,274	30
Well Pad 205	7.1	7.0	0.1	NS	25	17,484	NS	17,484	25	30	20,981	30
Well Pad 206	6.8	0.0	6.8	NS	-	-	NS	-	-	-	-	-
Well Pad 207	7.1	7.1	0.0	-	25	17,672	-	17,672	25	30	21,207	30
Well Pad 208	7.1	0.0	7.1	NS	-	-	NS	-	-	-	-	-
Borrow Pit 1**	19.2	19.2	0.0	-	25	47,655	-	47,655	47	NS	NS	NS
Borrow Pit 2**	10.2	9.4	0.8	60	20	19,259	4,839	24,098	38	NS	NS	NS

Table E.3.4 Reclamation Material Balance for Phase 2

Project Component	Total Component Area (ha)	Area of Upland Soils to be Disturbed (ha)	Area of Deep Organic Soils to be Disturbed (ha)	Average Depth of Topsoil / Deep Organic Salvage[1] (cm)		Volume of Upland topsoil to be Salvaged (m^3)[3]	Volume of Deep Organic Material to be Salvaged (m^3)	Total Volume of Topsoil & Deep Organic Material to be Salvaged for Reclamation (m^3)	Average Replacement Depth of Topsoil and Deep Organic Material (cm)	Average Depth of Subsoil Salvage[4] (cm)	Volume of Subsoil to be Salvaged (m^3)	Average Replacement Depth of Salvaged Subsoil (cm)[5]
				Deep Organic	Upland Litter Plus Topsoil[2]							
Borrow Pit 3**	6.5	6.5	0.0	-	25	16,270	-	16,270	36	NS	NS	NS
Subtotal[6]	163.0	104.2	58.8	-	-	250,938	4,839	255,778	-	-	131,239	-
Stage 2 - Future Development												
Road and Utility Corridors	75.5	21.2	54.3	NS	21	44,639	NS	44,639	21	NS	NS	NS
Well Pad 105	6.9	0.8	6.1	NS	20	1,542	NS	1,542	20	30	2,312	30
Well Pad 106	7.1	0.0	7.1	NS	-	-	NS	-	-	-	-	-
Well Pad 107	6.8	0.0	6.8	NS	-	-	NS	-	-	-	-	-
Well Pad 108	7.0	4.1	2.9	NS	20	8,174	NS	8,174	20	30	12,261	30
Well Pad 109	6.8	1.8	5.0	NS	20	3,587	NS	3,587	20	30	5,381	30
Well Pad 110	7.1	0.6	6.5	NS	20	1,139	NS	1,139	20	30	1,709	30
Well Pad 111	7.1	3.0	4.0	NS	20	6,063	NS	6,063	20	30	9,094	30
Well Pad 112	7.1	6.7	0.4	NS	20	13,367	NS	13,367	20	30	19,833	30
Well Pad 113	7.1	0.5	6.5	NS	30	1,563	NS	1,563	30	30	1,563	30
Well Pad 114	7.9	3.8	4.1	NS	20	7,751	NS	7,751	20	30	11,581	30
Well Pad 209	6.8	1.6	5.2	NS	20	3,285	NS	3,285	20	30	4,928	30
Well Pad 210	7.1	0.0	7.1	NS	-	-	NS	-	-	-	-	-
Well Pad 211	7.1	1.7	5.4	NS	28	4,826	NS	4,826	28	30	5,082	30
Well Pad 212	7.1	7.0	0.1	NS	23	15,813	NS	15,813	23	30	20,962	30

Table E.3.4 Reclamation Material Balance for Phase 2

Project Component	Total Component Area (ha)	Area of Upland Soils to be Disturbed (ha)	Area of Deep Organic Soils to be Disturbed (ha)	Average Depth of Topsoil / Deep Organic Salvage[1] (cm)		Volume of Upland topsoil to be Salvaged (m^3)[3]	Volume of Deep Organic Material to be Salvaged (m^3)	Total Volume of Topsoil & Deep Organic Material to be Salvaged for Reclamation (m^3)	Average Replacement Depth of Topsoil and Deep Organic Material (cm)	Average Depth of Subsoil Salvage[4] (cm)	Volume of Subsoil to be Salvaged (m^3)	Average Replacement Depth of Salvaged Subsoil (cm)[5]
				Deep Organic	Upland Litter Plus Topsoil[2]							
Well Pad 213	7.1	4.5	2.6	NS	30	13,534	NS	13,534	30	30	13,534	30
Well Pad 214	5.1	5.1	0.0	-	20	10,147	-	10,147	20	30	15,162	30
Well Pad 215	6.8	6.7	0.1	NS	25	16,497	NS	16,497	25	30	20,054	30
Well Pad 216	5.0	3.7	1.2	NS	25	9,370	-	9,370	25	30	11,244	30
Well Pad 217	4.3	3.3	1.0	NS	20	6,567	NS	6,567	20	30	9,850	30
Well Pad 218	4.4	0.0	4.4	NS	-	-	NS	-	-	-	-	-
Well Pad 219	4.3	0.7	3.5	NS	25	1,808	NS	1,808	25	30	2,169	30
Well Pad 220	7.1	0.0	7.1	NS	-	-	NS	-	-	-	-	-
Well Pad 221	7.1	7.1	0.0	-	20	14,138	-	14,138	20	30	21,207	30
Well Pad 222	7.1	5.4	1.7	NS	25	13,426	NS	13,426	25	30	16,111	30
Borrow Pit 4**	11.8	10.9	0.9	55	21	23,265	4,447	27,712	45	NS	NS	NS
Borrow Pit 5**	6.5	6.5	0.0	-	25	16,298	-	16,298	35	NS	NS	NS
Borrow Pit 6**	19.6	19.6	0.0	-	25	48,901	-	48,901	49	NS	NS	NS
Borrow Pit 7**	20.7	17.9	2.8	74	24	42,021	20,868	62,889	53	NS	NS	NS
Borrow Pit 8**	15.5	0.0	15.5	84	-	-	130,514	130,514	154	-	-	-

Table E.3.4 Reclamation Material Balance for Phase 2

Project Component	Total Component Area (ha)	Area of Upland Soils to be Disturbed (ha)	Area of Deep Organic Soils to be Disturbed (ha)	Average Depth of Topsoil / Deep Organic Salvage[1] (cm)		Volume of Upland topsoil to be Salvaged (m^3)[3]	Volume of Deep Organic Material to be Salvaged (m^3)	Total Volume of Topsoil & Deep Organic Material to be Salvaged for Reclamation (m^3)	Average Replacement Depth of Topsoil and Deep Organic Material (cm)	Average Depth of Subsoil Salvage[4] (cm)	Volume of Subsoil to be Salvaged (m^3)	Average Replacement Depth of Salvaged Subsoil (cm)[5]
				Deep Organic	Upland Litter Plus Topsoil[2]							
Borrow Pit 9**	18.7	0.3	18.4	75	20	512	138,008	138,520	136	NS	NS	NS
Subtotal[6]	325.0	144.3	180.6	-	-	328,233	293,836	622,069	-	-	204,038	-
TOTALS[6]	488.1	248.5	239.4	-	-	579,171	298,676	877,847	-	-	335,277	-

Dash (-): a particular component does not contain a value associated with a row and/or column.

[1]Reported as an average of topsoil and organic depths based on individual soil map units within a particular component

[2] Upland litter plus topsoil is the total estimated salvage thickness of all upland litter and topsoil layers as well as shallow organic soil (< 40 cm thick).

[3] Considers topsoil to be shallow organics and mineral topsoil horizons salvaged as one lift.

[4] Reported as an average of subsoil depths based on individual soil map units within a particular component. NOTE: the maximum subsoil depth used in the calculation of average subsoil thickness for salvage is 30 cm.

[5] The subsoil replacement depth ranges and in some cases is < 30 cm. This due to the replacement of subsoil material over a larger area from which it was salvaged - a typical scenario for the borrow pit developments

[6] Due to rounding, total values may not equal the sum of the individual values.

NS – No salvage of organic materials or subsoil materials planned for a particular Phase 2 component

*Within the soil storage area the volumes provided include salvage of the entire area, however, topsoil salvage will only occur where storage of subsoil is to occur. The actual amount salvaged will depend on the final size and dimensions of the subsoil stockpiles.

**The borrow areas are expected to be reclaimed with a wetland or waterbody occupying approximately 30 t0 50% of the reclaimed land, therefore soil replacement will occur over a smaller area from which it was salvaged. Resultant replacement depths will be thicker then pre-disturbance.

Approximately 877,847 m^3 of topsoil and deep organic material and 335,277 m^3 of subsoil is planned to be salvaged for the Initial and Future Development phases of the Phase 2 Project (Table E.3.4). The total volumes of soil materials estimated for salvage for each phase of the development are provided below:

- Phase 2 – Initial Development (163.0 ha)
  - topsoil material = 250,938 m^3;
  - subsoil material = 131,239 m^3; and
  - deep organic material = 4,839 m^3
- Phase 2 – Future Development (325.1 ha)
  - topsoil material = 328,233 m^3;
  - subsoil material = 293,836 m^3; and
  - deep organic material = 204,038 m^3.

E.4 SOIL CONSERVATION – OPERATIONS

E.4.1 Erosion and Sediment Control

Throughout the project life, operational areas and stockpiled materials will be monitored for signs of erosion. If erosion concerns arise an Environmental Professional will devise an erosion control plan based on specific needs required as detailed in Section E.3.3 Sediment and Erosion Control.

All erosion control implemented will be site-specific with monitoring and maintenance performed as required.

E.4.2 Soil Quality of Stockpiles

Soil stockpiles will be placed in locations that are not expected to be impacted by operations throughout the life of the Phase 2 Project. If soil stockpiles are impacted as a result of operations STP will remediate the impacted materials (to meet regulatory standards in place at the time of the incident) and the details related to the release and subsequent remediation of the material will be detailed in Annual C&R Report to be submitted to AENV.

Topsoil and subsoil stockpiles will have signage identifying the material that is stored, and stockpiled material salvaged from well pads, access corridors, the operators camp, and the CPF will not be used for reclamation activities other then the Phase 2 component from which the material originated. Relocation of stockpiled material (if required) within a Phase 2 component will be done under the supervision of a qualified professional and all details related to the relocation of the material provided in the Annual C&R Report to AENV and include; material

type relocated, estimated volume, reason for re-location, and description of new storage location within the component.

E.4.3 Interim Revegetation Strategies

Where required, STP will undertake revegetation of areas disturbed during operations to reduce impacts to disturbed soils, minimize erosion potential and minimize the spread of invasive or weedy species in the development area. If seeding is required, STP will use an approved designed seed mix incorporating native species that will provide rapid emergence and provide erosion control. Only Weed Free Certified Seed will be used and STP will consult *Alberta Environment's Revegetation Using Native Plant Materials: Guidelines for Industrial Development Sites* (AENV 2003) as well as ASRD when designing an appropriate seed mix.

E.4.3 Weed Control

STP will undertake a weed mitigation program throughout the life of Phase 2. Details on weed and invasive species control are provided in as detailed in Section E.6.4 Weed Control.

E.5 RECLAMATION AND SOIL REPLACEMENT PROGRAM

E.5.1 Final Site Grading and Re-contouring

STP will re-contour disturbed land such that the reclaimed lands approximate the natural landforms in the areas adjacent to the footprint. STP will re-establish surface drainage on all reclaimed areas such that it is integrated with the adjacent land. Specific objectives in relation to reconstruction of topography and surface drainage include:

- construct geotechnical stable landforms that will resist slumping, sliding or any other alterations;
- provide functional drainage pathways and effective hydrologic regimes through a site specific re-contouring plan;
- re-establish surface drainage on all reclaimed areas such that it is integrated with the adjacent land;
- provide strategically designed contours to enhance the initiation of habitat in both upland and wetland areas; and
- remove any facility related land disturbance that is not desired in the end land use (*i.e.*, culverts, roads, fill material, etc.).

Deep organic material padded over for Project development will likely require some conditioning as the deep organic layer will be compressed in comparison to pre-disturbance conditions. Conditioning of organic materials will include decompaction of the organic material. This may include deep ripping and cross ripping the deep organic profile using a dozer or a

backhoe. The process of ripping and scarifying the deep organic layer will allow for increased water and air movement through the upper portion of the profile and raise portions of the compressed organic layer to allow for the surface of the organic layer to be slightly above, slightly below or at the surface water level. Creating an environment that maintains the water level at or near surface is beneficial for future organic material development (Quinty and Rochefort 2003 & Alberta Environment 2008). The process of ripping and scarifying the deep organic material will also create channels that will allow for water movement across the disturbed organic landscape.

Detailed information provided in Sections E.5.3 – E.5.7 with respect to re-contouring is discussed by disturbance component. The re-contouring prescription is inclusive of the Initial and Future Developments. Re-contouring process and prescriptions for the Future Development areas may be modified and updated based on the findings of a PDA/C&R report which will be submitted to AENV prior to development of the Future Development components.

E.5.1.1 Re-contouring - Compaction Issues

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 undisturbed soils.

STP will ensure that compacted sub-grades along the access roads are deep ripped or “subsoiled” prior to replacement of topsoil material. 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 deep organic landforms.

E.5.2 Soil Replacement

STP 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. Replacement of soil materials for the Initial and Future Developments are based on the expected soil salvage procedures as listed in Sections E.3.6.6 and E.3.6.7 and the material balance as provided in Table E.3.4.

Soil replacement activities will be determined for each development component by the type of soil salvage that occurred during site construction. STP will replace salvaged topsoil and subsoil materials on re-contoured areas such that the average depth of the replaced soil material 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). STP will aim to replace all salvaged soil materials at reclamation.

Deep organic soils will not be salvaged for a majority of the Phase 2 Project components and soil replacement of salvaged deep organic materials will be discussed for the borrow pits only. However, STP may also utilize salvaged organic materials from the borrow areas to spread over the reclaimed deep organic areas. Addition of this biologically active material (transplanting) will assist re-vegetation efforts (Quinty and Rochefort 2003 & Alberta Environment 2008). In some instances excess organic material will be available upon completion of reclamation in borrow developments (*i.e.*, borrow pits 7, 8, and 9 contain notable deep organic areas). This excess material may be used to enhance reclamation of various components developed in deep organics. The proximity of excess organic material, reclamation timing, and availability of the organic material will determine the feasibility of adding additional organic material to deep organic areas padded over for the Phase 2 development. Any movement of excess deep organic material from borrow developments to other Phase 2 components will be recorded and details provided in the Annual C&R Report submitted to AENV.

Salvaged topsoil and subsoil 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.

Equivalent forested land 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.

Within the Phase 2 footprint, the amount of salvaged soil material to be replaced is variable and depends on the Phase 2 components within the Initial and Future Developments.

A description of re-contouring and expected soil replacement activities for each component is summarized in the following sections.

E.5.3 CPF and Soil Storage Areas

The CPF and associated soil storage areas occur in the Initial Development. Once decommissioning of the CPF is complete (facility removal and remediation of potentially impacted materials) all of the surface gravel will be removed. In upland areas (25.9 ha) final re-contouring will involve the removal of fill material where applicable, ripping/decompaction and contouring of the reclaimed landscape to blend with surrounding areas through the reallocation of fill material. The reclaimed landscape will provide similar surface drainage patterns as pre-disturbance conditions. This will be accomplished by ensuring connectivity between the adjacent undisturbed lands and the re-contoured reclaimed landscape.

Within the soil storage areas no re-contouring will be required. For a majority of the storage areas the landscape will not be altered as the soil profile will only be disturbed in the subsoil storage locations. In these areas, once the stockpiled subsoil has been replaced, the salvaged topsoil will be replaced.

Deep organics that were padded over for development of the CPF (2.9 ha) will have the fill material removed. The clay fill will be excavated, loaded, and hauled for re-use in construction activities or replaced back into the borrow pits. This may include uses such as additional road infrastructure, well pads, or –re-contouring of other components.

Dee organic material organic material will likely require some conditioning as detailed in Section E.5.1.

Upon completion of site re-contouring of upland landscapes all stockpiled topsoil and subsoil material will be replaced over the re-contoured and conditioned landscape. Before subsoil replacement begins, base material on site will be disked to alleviate compaction caused by heavy machinery and equipment. After preparation of the base material approximately 75,788 m^3 of subsoil be spread evenly across the CPF to a target depth of 30 cm as required by EPEA Approval requirements. Once replaced, upper subsoil will be alleviated of compaction prior to placement of the topsoil material.

After replacement of subsoil, approximately 40,280 m^3 of topsoil will be distributed across the CPF to an average target replacement depth of 25 cm. This value is expected to be variable as topsoil material will be replaced on the landscape to allow for the development of a variety of moisture and nutrient regimes in the reclaimed landscape. For example, topsoil replacement will likely result in thicker topsoil layers in mid to lower slope positions and thinner topsoil layers in upper slope and crest positions.

Soil replacement within the soil storage areas will require the replacement of topsoil in areas where subsoil material had been stockpiled. No soil replacement or reclamation activities will be

required in locations where topsoil material was stockpiled on topsoil material as no topsoil salvage will be completed.

No soil replacement activities will be completed on deep organic landscapes as no soil material was salvaged for the development of the CPF or the soil storage areas. A summary of the estimated volumes and replacement depths of salvaged soil materials for the CPF and soil storage areas are provided in Table E.3.4.

E.5.4 Road / Utility Corridor

STP will reclaim all access roads and corridors by removing culverts and other structures (*e g.*, surface pipelines) and all watercourse crossings will be removed as part of the final reclamation.

In upland areas (5.7 ha of the initial development and 21.2 ha for the Future Development), upon removal of gravel, all topsoil material that was replaced within the corridor ditches will be salvaged by blading the material to the edge of the corridor and placed into stockpiles until re-contouring and decompaction activities are completed. Road bases will be de-compacted and re-contoured to restore natural surface drainage patterns perpendicular and parallel to the former corridor. The re-contoured base materials will then be de-compacted and prepared for topsoil replacement.

In organic landscapes (18.8 ha of the Initial Development and 54.3 ha for the Future Development), upon removal of gravel, fill material used to create the road base will be removed to expose the underlying organic material. Some conditioning of this organic material may be required to relieve compaction and promote vegetation establishment. Conditioning of deep organic material is detailed in Section E.5.1.

Subsoil material is not expected to be salvaged prior to the development of the road / utility corridor. Topsoil replacement will occur on all upland landscapes within the road / utility corridor (a total of 26.9 ha inclusive of both phases of development). Upon completion of topsoil re-salvage and re-contouring all upland topsoil will be replaced evenly over the re-contoured and conditioned subsoil material. Approximately 57,731 m^3 of topsoil will be distributed across the re-contoured upland areas within the former road / utility corridors to an average target replacement depth of 22 cm. This value is expected to be variable as topsoil material will be replaced on the landscape to allow for the development of a variety of moisture and nutrient regimes in the reclaimed landscape.

No soil replacement activities will be completed on deep organic landscapes as no soil material was salvaged for the development of the road / utility corridors. A summary of the estimated volumes and replacement depths of salvaged soil materials for the road and utility corridors for the Initial and Future Developments are provided in Table E.3.4.

E.5.5 Operators Camp

The operators' camp occurs in the Initial Development. Once decommissioning of the camp is complete all surface gravel will be removed. Final re-contouring will involve the removal of fill material where applicable, ripping/decompaction and contouring of the reclaimed landscape to blend with surrounding areas through the reallocation of fill material. The reclaimed landscape will provide similar surface drainage patterns as pre-disturbance conditions. The operators' camp is located entirely in upland landscapes and no handling of deep organic soils will be required.

Upon completion of site re-contouring of upland landscapes all stockpiled topsoil material will be replaced over the re-contoured and conditioned reclaimed landscape. Approximately 7,099 m^3 of topsoil will be distributed to an average target replacement depth of 25 cm. This value is expected to be variable as topsoil material will be replaced on the landscape to allow for the development of a variety of moisture and nutrient regimes in the reclaimed landscape.

No subsoil is to be salvaged prior to the development of the operators' camp and there are no deep organic soils located in the proposed disturbance area. No handling of subsoil or deep organic soils is anticipated for reclamation of the operators' camp. A summary of the estimated volumes and replacement depths of salvaged soil materials for the operators' camp are provided in Table E.3.4.

E.5.6 Well Pads

The well pads will remain active for approximately 10 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. Approximately 86.6 ha of well pad disturbances will be located in upland terrain, 18.5 ha in the Initial Development and 68.1 ha in the Future Development. Distribution of upland and deep organics for the Initial and Future Developments are as follows:

- Initial Development – 18.5 ha of upland landscapes and 36.2 ha of deep organic soils; and
- Future Development – 68.1 ha of upland landscapes and 88.7 ha of deep organic soils.

In upland areas final re-contouring of well pads will involve the removal of fill material where applicable, ripping/decompaction and re-contouring of the reclaimed landscape to blend with surrounding areas through the reallocation of fill material as appropriate. The reclaimed landscape will provide similar surface drainage patterns as pre-disturbance conditions and allow connectivity of surface drainage patterns across the re-contoured lands and undisturbed lands.

Upon completion of final re-contouring the base material will be decompacted prior to placement of salvaged subsoil material.

If fill is removed from deep organic landscapes padded over at construction, the fill material will be removed to expose the underlying organic material. Some conditioning of this organic material may be required to relieve compaction and promote vegetation establishment. The process to be used for conditioning of deep organic material is detailed in Section E.5.1.1.

Within upland terrain, after re-contouring and decompaction of the base material, approximately 257,187 m^3 of subsoil be spread evenly across the upland well pad disturbances to a target depth of 30 cm as required by EPEA Approval requirements. Once replaced, subsoil will be alleviated of compaction prior to placement of topsoil material.

Topsoil replacement for the Initial and Future well pad developments are as follows;

- Initial development – estimated volume of topsoil material to be replaced on well pads 201-208 (8 well pads) is 42,639 m^3. The estimated range of soil replacement is 15 to 25 cm with an overall average replacement depth of 23 cm.
- Future Development – estimated volume of topsoil material to be replaced on well pads 105 - 222 (24 well pads) is 152,597 m^3. The estimated range of soil replacement is 20 to 30 cm with an overall average replacement depth of 22 cm.

A total of 36.2 of the Initial Development well pads and 88.7 ha of the Future Development well pads are located on deep organic soils. No soil replacement activities will be completed on deep organic landscapes as no soil material is to be salvaged for the development of the well pads in areas where deep organic soils are located (Section E.3.6.6 and E.3.6.7, soil salvage activities). STP may elect to utilize excess organic material resources from various borrow locations to supplement reclamation efforts in deep organic landscapes upon removal of the pad material and subsequent conditioning.

A summary of the estimated volumes and replacement depths of salvaged soil materials for all well pads are provided in Table E.3.4.

E.5.7 Borrow Pits

Distribution of upland and deep organics for the borrow pits for the Initial and Future Developments are as follows (Figure E.3.2):

- Initial Development – 3 borrow pits totalling 36.0 ha;
  - borrow pit 1 – 19.2 ha of upland;
  - borrow pit 2 – 9.5 ha of upland and 0.8 ha of deep organics;

  - borrow pit 3 – 6.5 ha of upland;
- Future Development – 6 borrow pits totalling 92.7 ha;
  - borrow pit 4 – 11.0 ha of upland and 0.8 ha of deep organics;
  - borrow pit 5 – 6.5 ha of upland;
  - borrow pit 6 – 19.6 ha of upland;
  - borrow pit 7 – 17.8 ha of upland and 2.8 ha of deep organics;
  - borrow pit 8 – 15.5 ha of deep organics; and
  - borrow pit 9 – 0.3 ha of upland and 18.4 ha of deep organics.

All topsoil and deep organic material will be salvaged for the development of the borrow pits. STP expects that 30-50% of the borrow disturbances will likely be reclaimed as a waterbody and/or wetland depending on the location of the borrow pit in the landscape and volume of material extracted for construction. The completed borrow pit will be contoured to have side slopes graded to be no steeper than 3:1 with the side slopes grading into a depression in the center of the depleted borrow area. Poor construction material and subsoil material stockpiled during borrow pit development will be used for re-contouring of the depleted borrows.

The techniques and procedures to reclaim borrow pits will encourage connectivity to adjacent habitats and will differ based on the location of the depleted borrow pit. Re-contouring of the depleted borrow pits will depend on the adjacent drainage patterns, landscapes and vegetation communities and volume of material removed from the borrow locations. STP will aim to provide connectivity to surrounding natural drainage patterns and provide water inflow – outflow from the reclaimed borrow landscapes. However, the ability to create surface water connectivity will depend on the landform in which the borrow area is developed as well as the adjacent landforms. Borrow pits that are located in upland areas will be re-contoured to encourage eventual development into upland sites; the lowest portion of the borrow area may fill with water while the upper portions will be reclaimed and revegetated to create upland sites similar to adjacent lands. Borrow pits located primarily in transitional and organic landscapes will be re-contoured to provide a reclaimed landscape with similar relief and provide water inflow – outflow through the borrow area to maintain surface water flow patterns across the re-contoured lands.

In instances where the landforms adjacent to the borrow location are conducive to establishing surface water outflow-inflow, the borrow disturbance will be contoured to facilitate connectivity (*i.e.,* borrows located in uplands adjacent to a nearly level or poorly drained organic map units may contain a suitable elevation gradient to allow surface water movement from the wetland area in the reclaimed borrow to the adjacent undisturbed lands).

In instances where borrows are isolated by upland features and adjacent landforms are not conducive to the establishment of surface water outflow-inflow, they will rely on surface water inflow from the re-contoured slopes surrounding the borrow pit. In addition, subsurface water movement into the depressional areas in the reclaimed borrow will also provide water movement into the lowest portions of the reclaimed borrow areas.

Conceptual reclaimed cross sections of the re-contoured borrows are provided in Figures E.5.1a to i. The depth of the reclaimed borrow pit is dependent on the volume of material extracted. Borrow pits will be re-contoured to a 3:1 side slope. Salvaged peat and other material not suitable for use in construction will be placed over the re-contoured surfaces. The salvaged peat, which contains moss fragments and other wetland propagules, will be directly placed on the re-contoured surface to aid in establishment of wetland species.

Once a borrow pit has been completed and re-contoured soil replacement will commence. The estimated soil volumes for replacement and the replacement depths are based on a reduction of replacement area by 30 to 50% (due to formation of a waterbody and/or wetland) This area is based on a conceptual design of the borrows. Expected soil replacement for the Initial and Future Developments borrow pits is based on the conceptual disturbance areas as follows:

- Initial Development – 3 borrow pits totalling 36.0 ha;
  - borrow pit 1 (19.2 ha) – 47,655 m^3 of salvaged topsoil material replaced over approximately 10.0 ha of re-contoured lands; average replacement depth of 47 cm;
  - borrow pit 2 (10.2 ha) – 24,098 m^3 of salvaged topsoil and deep organic material replaced over approximately 6.3 ha of re-contoured lands; average replacement depth of 38 cm;
  - borrow pit 3 (6.5 ha) – 16,270 m^3 of salvaged topsoil material replaced over approximately 4.5 ha of re-contoured lands; average replacement depth of 36 cm;
- Future Development – 6 borrow pits totalling 92.7 ha;
  - borrow pit 4 (11.8 ha) – 27,712 m^3 of salvaged topsoil and deep organic material replaced over approximately 6.2 ha of re-contoured lands; average replacement depth of 45 cm;
  - borrow pit 5 (6.5 ha) – 16,298 m^3 of salvaged topsoil material replaced over approximately 4.6 ha of re-contoured lands; average replacement depth of 35 cm;
  - borrow pit 6 (19.6 ha) – 48,901 m^3 of salvaged topsoil material replaced over approximately 10.1 ha of re-contoured lands; average replacement depth of 49 cm;
  - borrow pit 7 (20.7 ha) – 62,889 m^3 of salvaged topsoil and deep organic material replaced over approximately 11.9 ha of re-contoured lands; average replacement depth of 53 cm;

- borrow pit 8 (15.5 ha) – 130,514 m^3 of salvaged deep organic material replaced over approximately 8.5 ha of re-contoured lands; average replacement depth of 154 cm; and
- borrow pit 9 (18.7 ha) – 138,520 m^3 of salvaged topsoil and deep organic material replaced over approximately 10.2 ha of re-contoured lands; average replacement depth of 136 cm.

Topsoil and deep organic replacement depths provided are average values based on the estimated disturbance area requiring topsoil replacement. The actual replacement values will be variable as topsoil material will be replaced on the landscape to allow for the development of a variety of moisture and nutrient regimes in the reclaimed landscape.

Subsoil material will not be discretely salvaged from the borrow pit developments, however, it is likely that some subsoil material will be salvaged and stored on-site as the material may not be suitable for construction purposes. Any subsoil material salvaged and not used in construction will be used for re-contouring of the depleted borrows. A summary of the estimated volumes and replacement depths of salvaged soil materials for all borrow pit developments are provided in Table E.3.4.

E.5.8 Post Reclamation Land Capability for Forestry

STP 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 forested land capability equivalent to that which existed prior to disturbance.

The post reclamation forest 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 soil profiles are presented in Table E.5.1 and are shown on Figure E.5.2. Details on the methods and assumptions used to calculate baseline and reclaimed land capability using the *Land capability Classification System for Forest Ecosystems in the Oil Sands* (CEMA 2006) is provided in CR #9.

Table E.5.1 Predicted Reclaimed Forest Land Capability for Phase 2							
Component	**Class 2**	**Class 3**	**Class 4**	**Class 5**	**Water***	**NR**	**Total Area (ha)**
Phase 2 – Initial Development							
Central Processing Facility (CPF)	22.1	3.6	0.2	2.9	0.0	0.0	28.8
CPF – Soil Storage Areas	12.9	0.1	3.2	0.0	0.0	0.0	16.2
Well Pads (8)	16.0	0.0	1.6	37.1	0.0	0.0	54.7
Borrow Pits (3)	18.6	0.8	0.7	0.7	15.2	-	36.0
Operators Camp	2.8	<0.1	-	0.0	-	<0.1	2.8
Utility Corridor	3.9	0.1	1.6	18.8	-	-	24.5
Sub-total[1]	76.3	4.7	7.3	59.5	15.2	0.0	163.0
Phase 2 – Future Development							
Well Pads (24)	25.7	30.4	12.2	88.0	-	0.8	156.9
Borrow Pits (6)	23.6	2.0	4.0	21.8	41.3	-	92.7
Utility Corridor	8.2	10.5	1.8	54.0	0.0	1.0	75.5
Sub-total[1]	57.3	42.9	18.0	163.8	41.3	1.8	325.1
Total Area[1]	133.6	47.6	25.3	223.3	56.5	1.8	488.1
% of Phase 2 Area	27.4	9.8	5.2	45.7	11.6	0.4	100

* Wetland/pond created as a result of the creation of the Borrow pits.
Dash (-): a particular component does not contain a value associated with a row and/or column.
[1] Due to rounding, total values may not equal the sum of the individual values.

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, with the exception of the borrow areas where waterbodies and/or wetlands are expected to develop. The reclaimed land capability classification system (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 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, however, they do estimate the expected reclaimed land capability based on the known soil chemical and physical attributes of the soil materials (that existed in a baseline map unit) coupled with the reclamation processes to be used.

The reclaimed LCCS ratings incorporate assumptions of salvaged soil characteristics and the likely composition of expected reclaimed soil profiles. For example, the WHMaapt soil series 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 to the mixing of the topsoil material and litter layer / shallow organic layer during salvage and stockpile activities.

The reclaimed suitability ratings anticipated for the proposed Phase 2 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). 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, specifically in the replaced topsoil layer. Table E.5.2 presents a comparison of the reclaimed and baseline LCCS ratings for soil map units within the proposed footprint.

Table E.5.2 Comparison of the Baseline and Reclaimed Land Capabilities

Capability Class	Baseline Capabilities		Reclaimed Capabilities		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
Phase 2 – Initial Development					
Class 2	90.7	55.6	76.3	46.8	-8.83
Class 3	4.8	2.9	4.7	2.9	-0.06
Class 4	7.9	4.8	7.3	4.5	-0.37
Class 5	59.6	36.6	59.5	36.5	-0.06
NR	<0.1	<0.1	-	-	0.0
Water*	-	-	15.2	9.3	9.3
Sub-Total[1]	163.0	100	163.0	100	0.0
Phase 2 – Future Development					
Class 2	75.0	23.1	57.3	17.6	-5.44
Class 3	46.3	14.2	42.9	13.2	-1.05
Class 4	22.3	6.9	18.0	5.5	-1.32
Class 5	179.4	55.2	163.8	50.4	-4.80
NR	2.1	0.6	1.8	0.6	-0.09
Water*	-	-	41.3	12.7	12.70
Sub-Total[1]	325.1	100	325.1	100.0	0.0

* Wetland/pond created as a result of the creation of the Borrow pits.
Dash (-): a particular component does not contain a value associated with a row and/or column.
[1] Due to rounding, total values may not equal the sum of the individual values.

The major difference between the reclaimed and baseline land capability ratings for the Phase 2 Project is a result of the creation of wetlands / waterbodies in the former borrow pits. The development of Phase 2 will result in an decrease of 32.2 ha Class 2 lands, a decrease of 3.6 ha of Class 3 lands, a decrease of 4.9 ha of Class 4 lands and a decrease of 15.9 ha of Class 5 lands as a result of borrow pit development.

E.6 REVEGETATION

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

STP will follow the recommendations in the following documents for revegetation of the reclaimed areas:

- *Guidelines for Reclamation to Forest Vegetation in the Athabasca Oil Sands Region* (Oil Sands Vegetation Reclamation Committee (OSVRC) 1998);
- *Guideline for Wetland Establishment on Reclaimed Oil Sands Leases* (2nd edition; AENV 2008);
- A Guide to Using Native Plants on Disturbed Lands (Gerling et al. 1996); and
- *Native Plant Revegetation Guidelines for Alberta* (Native Plant Working Group 2000).

Revegetation is intended to follow an ecosystem-based approach for establishment of suitable reclaimed site conditions for the Phase 2 Project. The target reclaimed vegetation communities for upland sites will be similar to adjacent undisturbed communities. Specific revegetation programs for each disturbance area will consider reclaimed landforms and surface drainage, reclaimed soil profiles and pre-disturbance vegetation communities (pre-disturbance ecosite phases). Final consultation with ASRD prior implementation of the revegetation program.

E.6.1 Revegetation Practices

Revegetation practices are designed to enhance the natural recovery of vegetation communities. Natural recovery of revegetated plant communities is determined in large part by the degree of disturbance and the expected time required for natural recovery processes to adequately re-establish disturbed areas. On those sites where the level of disturbance is low, natural recovery is expected to occur without additional revegetation activities; nonetheless, additional revegetation activities may need to be employed where following revegetation monitoring inspections, establishment of revegetated species does not occur. As well, where the degree of disturbance is higher tree and shrub planting may be required.

On those sites with a 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 (propagules) transferred with the soil. Directly replaced soil requires less revegetation effort to achieve revegetation objectives. Soil to be used in the revegetation program for Phase 2 will be either organic or upland mineral 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 (propagules) 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. STP will utilize direct replacement of soil material where opportunities arise during interim and final reclamation.

Revegetation of disturbances will be coordinated with construction / reclamation activities to limit the area of exposed soil at any one time. Revegetation practices to be employed as part of the reclamation program are discussed in terms of the degree of disturbance experienced with respect to the vegetation communities:

- **Low degree of disturbance** –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 additional revegetation inputs, (*e.g.,* a steeper, potentially erodable slope that needs runoff diversion work and/or revegetation) or monitoring results indicate additional revegetation activities are required.
- **Moderate degree of disturbance** – borrow pits and underground pipeline facilities. On these sites, soil materials are expected to be in stockpiles for a relatively short period of time, therefore propagules and seed banks will likely be viable at soil replacement. Upon replacement of soil materials 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 would 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 likely be conducted on those upland reclaimed disturbances that had tree cover prior to disturbance, tree species and distribution will be similar to adjacent ecosite communities. On poorly drained sites and depressional areas in reclaimed borrow pits, natural recovery will be relied upon for woody species re-establishment. Tree planting would 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.

- **Highest degree of disturbance** - well pads, operators' camp, road grades and the plant site. After the soil profile on these sites has been reclaimed, natural recovery will be encouraged, especially on deep organic sites. On upland areas the application of a short-lived nurse crop 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. Planting of trees will be site specific and prescriptions will be based on the adjacent ecosites in upland areas. In deep organic landscapes completion of organic material conditioning will create suitable microhabitat and various moisture regimes to allow for the establishment of desirable vegetation species. Addition of similar organic material from reclaimed borrow pits will also assist in establishment of desirable wetland vegetation species in the reclaimed organic areas.

Some areas located in the vicinity of watercourses or waterbodies 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 ASRD, STP will utilize an appropriate agronomic seed mix for erosion control. Any agronomic mixes used throughout the life of Phase 2 will be detailed in the Annual C&R Report to AENV.

E.6.2 Revegetation Species

Revegetation of the reclaimed disturbances using appropriate species, and representative proportions of species will allow for the establishment of reclaimed vegetation communities that provide similar plant communities to pre-disturbance conditions.

E.6.2.1 Trees and Shrubs – Uplands and Transitional Areas

Tree and shrub species expected to be utilized in revegetation of upland areas on moderate to high disturbance areas are provided in Table E.6.1. The tree and shrub species lists are based on the ecosite phases which will be disturbed by the Phase 2 development. The species information provided in Table E.6.1 is to be used as a guideline for revegetation. The species composition may be altered on a site specific basis to provide similar species and proportions of species that are present within the adjacent undisturbed ecosites. The planting prescription is premised upon target site characteristics of the reclaimed lands (soil types and texture, aspect, slope, and drainage) plant communities, and land use objectives.

Table E.6.1 Proposed Tree and Shrub Prescriptions for Representative Upland Target Ecosite Phases in Phase 2

Target Ecosite Phase	Native Tree Species[1]	Native Shrub Species[1]
b1	jack pine, aspen, white spruce	blueberry, bearberry, Labrador tea, green alder
b2	aspen, white birch, white spruce	blueberry, bearberry, Labrador tea, green alder
b3	aspen, white spruce, white birch	blueberry, bearberry, Labrador tea, green alder
b4	white spruce, jack pine	blueberry, bearberry, Labrador tea, green alder
c1	jack pine, black spruce	Labrador tea, green alder, bog cranberry, blueberry
d1	aspen, white spruce, balsam poplar, white birch	low bush cranberry, buffalo berry, Saskatoon, green alder, rose, raspberry
d2	aspen, white spruce, balsam poplar, white birch	low bush cranberry, Canada buffalo berry, Saskatoon, green alder, prickly rose, raspberry
d3	white spruce, aspen, balsam poplar, white birch	low bush cranberry, Canada buffalo berry, Saskatoon, green alder, rose, raspberry,
e1	aspen, balsam poplar, white spruce, white birch	red osier dogwood, low bush cranberry, raspberry, green alder, rose currants/gooseberry
e2	white spruce, aspen, balsam poplar, white birch	dogwood, low bush cranberry, raspberry, green alder, rose, currants/gooseberry
e3	White spruce, aspen, balsam poplar, white birch	Dogwood, low bush cranberry, raspberry, green alder, rose, currents/gooseberry
f1	balsam poplar, aspen, birch, white spruce	rose, green alder, dogwood, raspberry, low bush cranberry
f2	white spruce, aspen, balsam poplar, birch	rose, dogwood, low bush cranberry
f3	white spruce	rose, low bush cranberry, twin flower
g1	black spruce, jack pine	Labrador tea, bog cranberry, twinflower
h1	white spruce, black spruce, white birch	Labrador tea, bog cranberry, rose, twin flower

[1] Species selected for each ecosite phase are based on the *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996), *A guide to using Native Plants on Disturbed Lands* (Sinton Gerling et. al. 1996), *Guidelines for Reclamation to Forest Vegetation in the Alberta Oil Sands Region* (1998), and species data collected from vegetation plots within the Phase 2 study area.

E.6.2.2 Wetlands / Poorly Drained Sites – Transitional and Poorly Drained

In organic landscapes (deep organic deposits) no salvage of soil materials are expected and the original soil profile will remain intact. The conditioning of deep organic soils to allow for creation of micro sites and water movement through the disturbed organic profile is the preferred method of revegetation in these disturbances. No specific tree or shrub species planting or seeding prescriptions are planned in deep organic soils. STP may decide to seed, or transplant vegetation species onto disturbed deep organic areas if (based on monitoring results) additional revegetation efforts are required. Potential species that STP may decide to utilize in areas with

organic deep soils to supplement revegetation efforts are listed in Table E.6.2 under the Subhydric to Hydric moisture regimes.

STP may also utilize excess organic material from various borrow locations to assist in revegetation efforts of deep organic landscapes. Transplanting of organic material may assist in re-establishment of desirable reclaimed vegetation communities.

Table E.6.2 Potential Revegetation species for Wetlands and Depressional Pond Areas in Reclaimed Borrows

Moisture Regime[1]	Associated Ecosites[2]	Potential Species to be used in Revegetation
Subhygric to Hygric	Subhygric – g Hygric – g, h, f	*Carex aquatilis* (water sedge) *Carex atherodes* (awned sedge) *Poa palustris* (fowl bluegrass) *Glyceria striata* (manna grass) *Mentha arvensis* (wild mint) *Rubus arcticus* (dwarf raspberry) *Vaccinium vitis-idea* (Bog cranberry) *Deschampsia caespitosa* (tufted hair grass) *Rumex occidentalis* (western dock) *Salix species* (willows) *Picea mariana* (black spruce) *Larix laricina* (tamarack)
Subhydric to Hydric	Subhydric – i, j, k Hydric - l	*Lemna minor* (duckweed) *Utricularia spp*. (bladderwort *Hippuris vulgaris* (mare's tail) *Callitriche verna* (water starwort) *Ranunculus aquatilis* (white water crowfoot) *Ranunculus gmelinii* (yellow water crowfoot) *Ceratophyllum demersum* (hornwort) *Nuphar variegatum* (pond lily) *Potamogeton gramineus* (pondweed) *Typha latifolia* (cat tail) *Scirpus lacustris* (common bulrush) *Sagittaria cuneata* (arum leaved arrowhead) *Sparganium eurycarpum* (giant bur reed) *Salix species* (willows) *Larix laricina* (tamarack) *Picea mariana* (black spruce)

[1] Moisture regimes based on definitions and descriptions adapted from Table 9 of the *Land capability Classification System for Forest Ecosystems in the Oil Sands* (CEMA 2006).
[2] Ecosites as defined and described in the *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996).

E.6.2.3 Borrow Pits

Revegetation of reclaimed borrow pits will require a wide range of species as a result of the potential to have a wide range of moisture gradients in reclaimed borrow pits. Upland and various transitional areas within the borrow areas could be revegetated as per the species list provided in Table E.6.1. Revegetation of portions of the transitional zones, depressional areas, and margins around water bodies will require a range of different species depending on the resultant moisture regime. The moisture regime and amount of surface water within the reclaimed borrows will depend on the location of the borrow and the adjacent vegetation communities and topography.

A mix of plant species selected from Table E.6.2 is recommended for revegetating areas of higher relief within and immediately adjacent the wetlands/Ponds in the reclaimed borrows (margins of the wetlands and portions of the transitional areas), this corresponds to a Subhygric to Hygric moisture regime. Species presented for the Hydric and Subhydric moisture regimes are suitable for revegetating areas of lower relief within and adjacent to open water (Hydric and subhydric moisture regimes) for the Central Mixedwood Subregion of the Boreal Natural region.

The wetlands / ponds within borrow developments will initially be open water and are expected to transition to marsh once revegetated and established. Over time these areas may through the process of natural succession become peatland type wetlands (bogs or fens).

E.6.2.4 Seeding

Prior to any seeding, STP will design a native seed mix in consultation with ASRD at time of reclamation. Only weed free certified seed will be used and accompanied with a seed analysis. Seeding will occur in areas where:

- stockpiles have a high potential for erosion;
- various disturbed areas within the Phase 2 footprint where seeding is required to reduce the potential of invasive species;
- natural revegetation is expected to occur slowly and a cover crop is necessary to minimize invasive species and reduce erosion potential of soils; and/or
- site monitoring indicates additional revegetation efforts are required.

Table E.6.3 displays a range of native species that STP may be included in seed mixes for the Phase 2 Project. Seed mixes will be based on expected moisture regimes and intended target use (*i.e.*, soil stabilization on stockpiles or cover crops for a range of revegetated landscapes).

Table E.6.3 Potential native Species for Use in Seeding of Disturbed Areas

Moisture Regime[1]	Associated Ecosites[2]	Potential Species to be used in Revegetation[3]
Sub-xeric to Submesic	Subexric – b Submesic – b, c	*Carex obtusata/siccata* (blunt / hay sedge) *Oryzopsis pungens* (northern rice grass) *Festuca saximontana* (rocky mountain fescue) *Elymus innovates* (hairy wild rye) *Koeleria macrathia* (june grass) *Poa arida* (plains bluegrass) *Schizachne purpurascens* (purple oat grass) *Elymus Canadensis* (Canada wild rye) *Hedysarum boreale* (northern sweet vetch)
Mesic	Mesic – c, d	*Elymus innovates* (hairy wild rye) *Schizachne purpurascens* (purple oat grass) *Bromus ciliatus* (fringed brome) *Agropyron trachycaulum var. unilaterale* (awned wheat grass) *Oryzopsis asperifolia* (mountain rice grass) *Trisetum spicatum* (spike trisetum) *Agrostis scabra* (tickle grass) *Poa interior/glauca/palustris* (bluegrass) *Vicia Americana* (American Vetch)
Subhygric to Hygric	Subhygric – g Hygric – g, h, f	*Carex aquatilis* (water sedge) *Carex atherodes* (awned sedge) *Poa palustris* (fowl bluegrass) *Glyceria striata* (manna grass) *Mentha arvensis* (wild mint) *Deschampsia caespitosa* (tufted hair grass)

[1] Moisture regimes based on definitions and descriptions adapted from Table 9 of the *Land capability Classification System for Forest Ecosystems in the Oil Sands* (CEMA 2006).
[2] Ecosites as defined and described in the *Field Guide to Ecosites of Northern Alberta* (Beckingham and Archibald 1996).
[3] Potential species adapted from *A guide to using Native Plants on Disturbed Lands* (Sinton Gerling et. al. 1996).

Some areas located in the vicinity of watercourses or waterbodies 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 ASRD, STP will utilize an appropriate agronomic seed mix for erosion control. Any agronomic mixes used throughout the life of the Phase 2 Project will be detailed in the Annual C&R Report to AENV.

The species provided in Table E.6.1, E.6.2, and E.6.3 is not exclusive and STP may also utilize other suitable native species appropriate for the resultant target ecosites and moisture regimes.

E.6.3 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 Phase 2 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 (see Table E.6.1). Typically the tree species that will be planted will include jack pine, white spruce, black spruce and aspen; nonetheless, tamarack may also be planted to enhance the re-establishment of certain ecosite phases.

E.6.4 Post Reclamation Ecosites

A comparison between the predicted post disturbance/reclaimed ecosites and the baseline ecosites are provided in Table E.6.4. The reclaimed ecosites are shown on Figure E.6.1.

Table E.6.4 Baseline and Estimated Reclaimed Ecosites

Ecosite	Baseline		Reclaimed		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
B - Blueberry - submesic	1.4	0.3	0.6	0.1	-0.2
C - Labrador tea - mesic	7.6	1.6	8.8	1.8	0.2
D - low bush cranberry	186.2	38.1	161.8	33.1	-5.0
E - dogwood	5.0	1.0	2.9	0.6	-0.4
F- horsetail	7.1	1.5	6.0	1.2	-0.2
G - Labrador tea - subhygric	21.8	4.5	8.9	1.8	-2.6
H - Labrador tea - horsetail	5.7	1.2	3.7	0.8	-0.4
I - treed bog	95.6	19.6	106.6	21.8	2.3

Table E.6.4 Baseline and Estimated Reclaimed Ecosites

Ecosite	Baseline		Reclaimed		Difference (%)
	Area (ha)	Proportion (%)	Area (ha)	Proportion (%)	
J - treed poor fen	69.8	14.3	72.4	14.8	0.5
K - treed rich fen	71.0	14.5	59.2	12.1	-2.4
L - marsh	0.1	<0.1	19.9	4.1	4.1
AlH - permanent right - of - way	9.3	1.9	0.0	0.0	-1.9
CIW - Geophysical well sites	7.1	1.5	0.0	0.0	-1.5
NWL – natural wet lake	0.4	0.1	0.4	0.1	0.0
Water *	-	-	36.9	7.5	7.5
Total[1]	488.1	100	488.1	100	0.0

* Wetland/pond created as a result of the creation of the Borrow pit.
Dash (-): a particular component does not contain a value associated with a row and/or column.
[1] Due to rounding, total values may not equal the sum of the individual values.

The addition of the waterbodies and/or wetlands in the reclaimed borrow disturbances result in the largest change to post disturbance ecosites. A total of 36.9 ha of waterbodies / ponds and approximately 19.8 ha of marsh (l) are expected to form as a result of the projected post reclamation landscape. Increase in estimated distribution of various other ecosites (*i.e,*, ecosites i, j, and c) are based on proposed vegetation communities that are expected to form immediately adjacent reclaimed borrow areas due to re-contoured landscapes that are designed to provide appropriate drainage (in flow and outflow) through the reclaimed borrow developments.

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.

E.6.5 Weed Control

STP is committed to undertaking weed and invasive species management and control throughout all stages of the Phase 2 Project as per *The Alberta Weed Control Act* (Province of Alberta 2010). STP will also comply with ASRD's *Weed Management in Forestry Operations - Directive 2001-06* (ASRD 2001).

Control of invasive weed species will be completed through the establishment of native vegetation on soil stockpiles as well as during interim reclamation to mitigate weed populations in disturbance areas. Regular inspections for the presence of weed species will be performed throughout the construction, operations, reclamation and post reclamation stages of the Phase 2

Project to identify the occurrence of weeds and invasive species. Non-chemical control of weeds is the preferred method and includes mowing, cultivation, and/or hand picking. Herbicides applied will be appropriate for site conditions, and only non – residual herbicides will be considered.

The following identifies best management and regulatory practices that will be utilized by STP in development and implementation of a weed management program:

- disturbance areas will be monitored for weeds. Pre-disturbance information on weeds will be used to monitor for known weeds. Weed control will be undertaken in a timely manner and records of weed control activities will be kept and detailed in the Annual C&R Report;
- equipment mobilized to the Phase 2 Project will be cleaned to be free of soil and debris, to mitigate the potential for transport of weed seeds or other invasive species;
- physical removal of weeds (mowing, cultivation, and/or hand picking) is the preferred method, particularly near water and riparian areas; herbicides will be used only where necessary;
- a seed certificate will be obtained for each native seed component used in seed mixtures. This documentation will be provided in the Annual C&R report;
- erosion control products that do not contain agronomic straw will be preferred (*i.e.*, erosion control matting);
- an annual cereal crop may be used to control erosion if it is more appropriate than other methods and soil stabilization, sediment loading, or slope stability are considered a priority. STP will consult with ASRD prior to seeding of any agronomic species. Use of any agronomic species will be reported in the Annual C&R report and include; location (and area seeded), seed mix, seeding rate, and planned mitigation and monitoring (to control the agronomic species);
- species defined as “prohibited noxious” in the *Weed Control Act* (Province of Alberta 2001) must be destroyed, and those classified as ‘noxious’ must be controlled. The document *Weed Management in Forestry Operations – Directive 2001-06* (ASRD 2001) will be followed as appropriate;
- herbicides will be selected and applied by a licensed industrial pesticide applicator to comply with the *Pesticide (Ministerial) Regulation* (Alberta Regulation 43/1997) and federal regulations; and
- soil sterilants will not be used for control of weeds.

E.7 RECLAMATION TIMING

The conceptual well pad reclamation schedule for Phase 2 is displayed in Table E.7.1.

Table E.7.1 Conceptual Reclamation Schedule

Year	Pad Number
1 to 10	Borrow Pits 1 to 3
11	201, 202, 203, 204
12	104
13	205, 206, 207, 208
14	
15	
16	209, 105
17	210, Borrow Pit 4
18	211, 106, Borrow Pit 5
19	212, 213, Borrow Pit 6
20	107, Borrow Pit 7
21	214
22	215, 216, 108
23	217
24	218, 109, Borrow Pit 8
25	219, 220, 110
26	221
27	222, 111, Borrow Pit 9
28	112
29	113
30	114
	To be determined[1]

1 Additional pad locations will be determined based on results of future exploration

The development and reclamation progress at Year 10 is shown on Figure E.7.1. The Initial and Future Developments are displayed along with the existing disturbances. The reclamation that is proposed during this phase of Phase 2 is limited to borrow areas.

The expected development and reclamation status for Phase 2 components at Year 20 is shown on Figure E.7.2. During this phase of development, all the well pads, associated corridors and borrow pits from the Initial Developments will be reclaimed. Various well pads, access corridors, and borrow areas from the Future Development will also be reclaimed by Year 20.

Active areas will include the CPF, operators' camp, soil storage areas and a variety of Future Development well pads, corridors and borrow pits.

Expected development and reclamation status at Year 30 is shown on Figure E.7.3. All remaining well pads, the CPF, operators camp, and remaining borrows utilized for the development of the last phase of well pads and access corridors will also be reclaimed by year 30.

If additional bitumen reserves are found in the Phase 2 area, then the life of Phase 2 could be extended beyond the expected 25 years, following development and reclamation regulations in place at that time.

E.8 RECLAMATION MONITORING PROGRAM

Development of Phase 2 will progress in a phased manner, allowing for sequential reclamation of well pads, roads and facilities over the operating period of Phase 2. This development schedule minimizes the active footprint within the Phase 2 area at any one time and will allow for C&R program improvements to be implemented through adaptive management as reclamation, revegetation and monitoring progress through the various stages of the Phase 2 Project. Reclamation monitoring will be incorporated into the Annual C&R Report to document the success of reclamation efforts and, over time, to refine measures according to site-specific conditions.

E.8.1 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;
- weed and invasive species control;
- establishment of the designated end land uses; and
- reclamation certification.

The objectives will be met through regular site inspections and implementation of additional reclamation measures (if necessary). STP will also evaluate the results of monitoring programs on reclaimed areas and update reclamation practices as necessary to allow for adaptive management and continual improvement of the reclamation program throughout the life of the Phase 2 Project.

E.8.2 Monitoring Schedule

Reclamation monitoring will be consistent with the 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.*, re-contouring, 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.8.2.1 Revegetation Monitoring

Each reclaimed and revegetated area will be inspected after the first growing season following site landscaping, soil replacement and revegetation, according to best current practices. The inspections will be used to gauge the success of initial revegetation activities and to evaluate conditions designed to encourage success of the revegetation efforts and natural recovery. The inspections will provide information regarding soil stabilization, erosion control and the status of tree, shrub, forb and graminoid vegetation composition and structure, and will include other pertinent information as required.

Subsequent annual inspections will be undertaken to monitor the continued establishment of the vegetative cover and progress towards reestablishment 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 and revegetated sites. Noxious weeds will also be identified and removed in consultation with ASRD.

Assessments of older reclaimed areas will be conducted on a less frequent basis if deemed necessary at the time.

E.8.2.2 Terrain and Soils Monitoring

The performance of reconstructed soils and reclaimed landscapes is a key element in erosion control, watershed protection and ecosystem sustainability. Soil and slope stability monitoring of all reclaimed sites will be undertaken in conjunction with the revegetation assessment. Soils will be monitored for signs of erosion or compaction issues through examination of surface soil profiles and STP 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). Reclaimed landscapes will be inspected for slumping, ponding, and improper drainage patterns.

If subsequent monitoring events (after the initial assessment) indicate that the reclaimed soil and landscapes are appropriate for the desired end land use then less frequent monitoring events will be implemented up until a reclamation certificate is received.

E.8.2.3 Wildlife Monitoring

STP will include a wildlife monitoring program as a component of its 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.

Initially, the wildlife monitoring program will largely be confined to observational recordings and incidental information on general wildlife use of the reclaimed areas. More systematic approaches to monitoring the reclaimed sites for wildlife will be considered as the reclaimed areas mature.

E.9 ABANDONMENT AND CLOSURE

At the end of the project life the Phase 2 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 Phase 2;
- 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 all unused 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 deep organic landscapes to ensure reclaimed lands 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.

R 15 | R 14 | R 14 | R 13 W4M

T 91

Well Pad 111
Well Pad 109
Borrow Pit 9
Well Pad 107
River
McKay
River
Well Pad 218
Well Pad 219
Well Pad 212
Well Pad 216
Well Pad 104
Well Pad 207
Well Pad 205
Well Pad 209
Borrow Pit 3
Well Pad 112
Well Pad 217
Well Pad 206
Well Pad 210
Well Pad 214
Well Pad 204
Well Pad 203
Well Pad 208
Operations Camp
Borrow Pit 8
Well Pad 113
Borrow Pit
Well Pad 102
Borrow Pit
Well Pad 101
Well Pad 103
Well Pad 114
WSW 15-8
WSW 16-8
Utility Corridor
Access Road
Soil Storage
Borrow Pit 4
Well Pad 215
Well Pad 213
Well Pad 201
Well Pad 202
Well Pad 211
CPF
Utility Corridor
CPF
Borrow Pit
Operators Camp
Construction Camp
10
Soil Storage
WSW 8-8
Well Pad 106
Well Pad 105
Borrow Pit 6
Borrow Pit 1
Well Pad 221
Borrow Pit 7
Borrow Pit 5
Access Road
Well Pad 110
Well Pad 108
Well Pad 220
Well Pad 222

Legend

Existing Phase 1 Development

- CPF
- Well Pad
- Utility Corridor
- Borrow Pit
- Construction Camp
- Operations Camp
- Soil Storage
- Access Road
- Water Source Well

Proposed Phase 2 Development

- CPF
- Operations Camp
- Utility Corridor
- Well Pad
- Borrow Pit
- Proposed Project Area
- Proposed Development Area
- Future Development

- Approved Project Area
- Streams with defined channels
- Drainages without defined channels

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

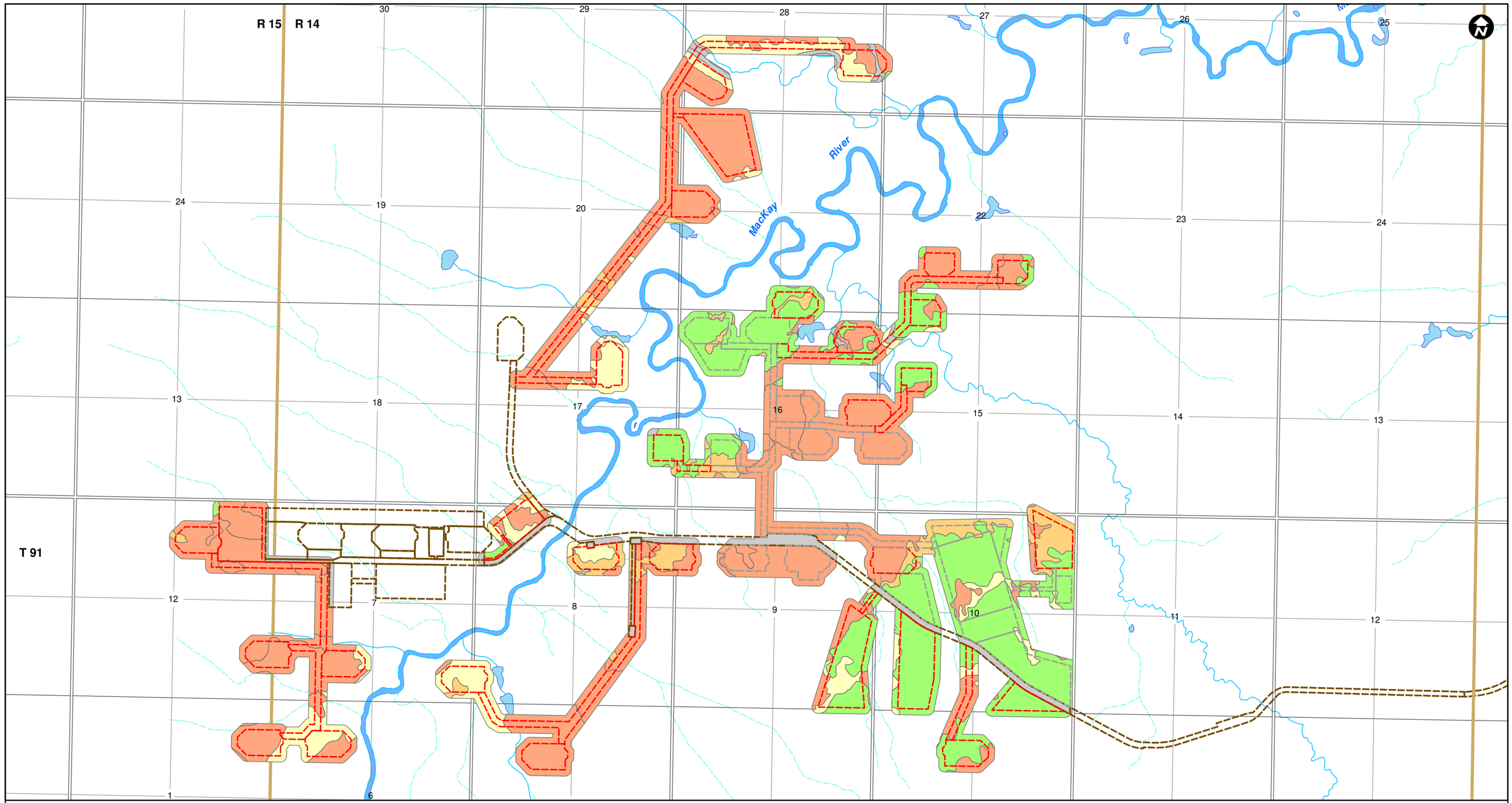
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Development Area and Disturbance Footprint

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 27/11
PROJECT:	10-037

FIGURE: **E.1.1**



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Land Capability Class

- Class 2
- Class 3
- Class 4
- Class 5
- NR-Not Rated

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

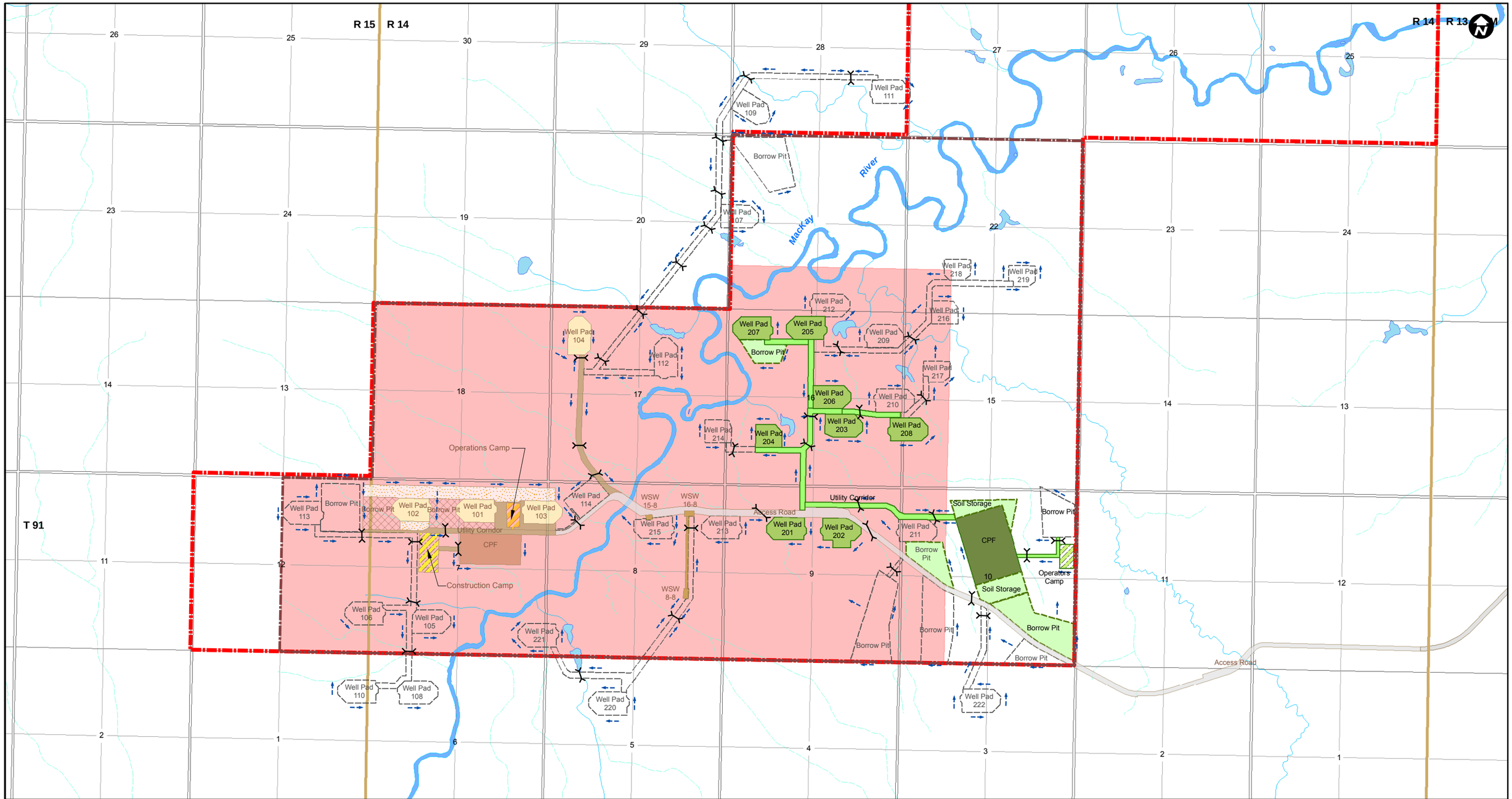
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Pre-Disturbance Forest Soil Capabilities

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 13/11
PROJECT:	10-037

FIGURE:
E.2.1



Legend

Existing Phase 1 Development

- Approved Project Area
- CPF
- Well Pad
- Utility Corridor
- Borrow Pit
- Construction Camp
- Operations Camp
- Soil Storage
- Access Road
- Water Source Well

Proposed Phase 2 Development

- CPF
- Operations Camp
- Utility Corridor
- Well Pad
- Borrow Pit
- Proposed Project Area
- Proposed Development Area
- Future Development

Drainage Management

- Drainage Direction
- Culvert
- Drainages without defined channels
- Streams with defined channels

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

SOUTHERN PACIFIC RESOURCE CORP.

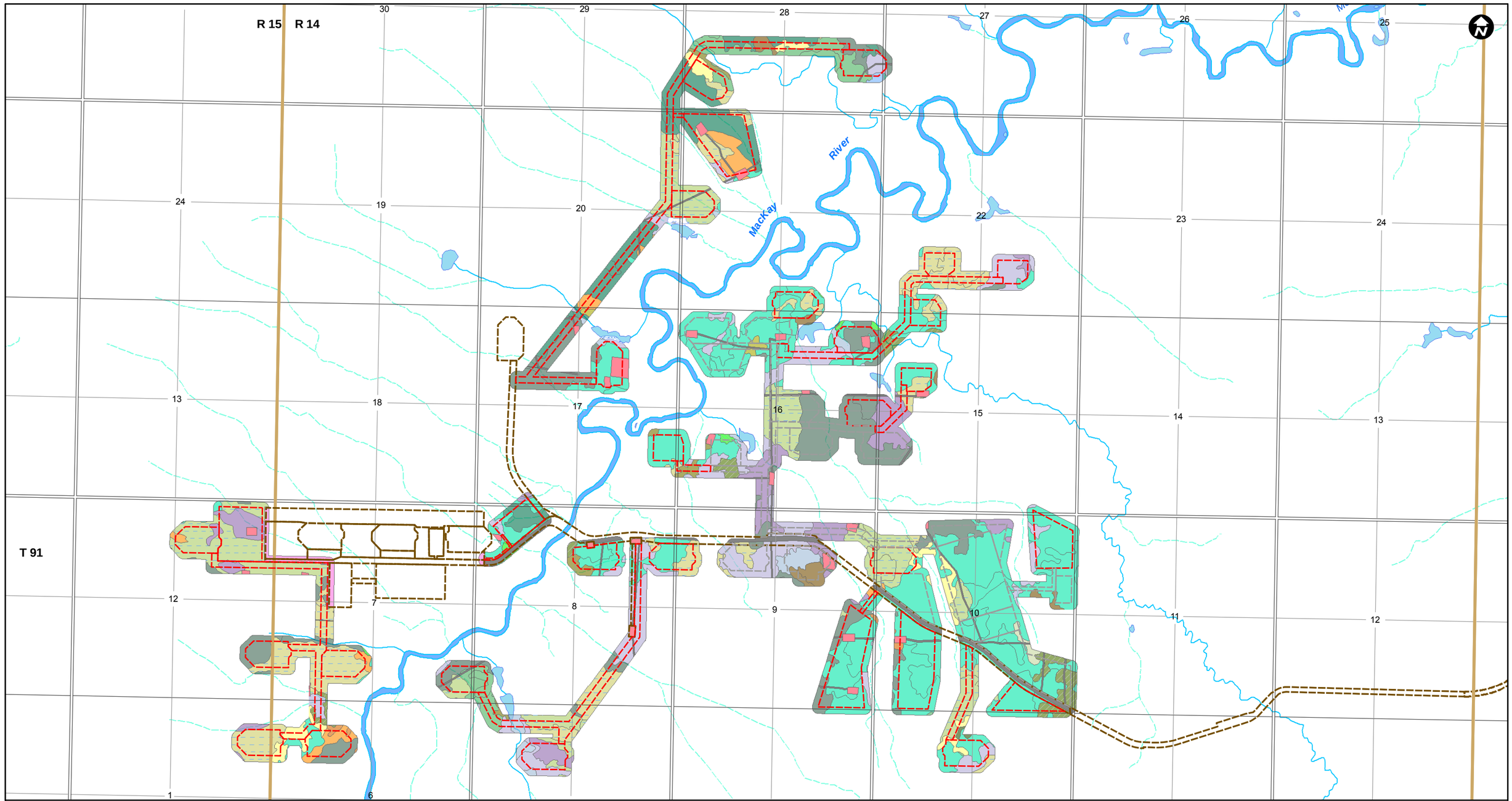
STP McKay Thermal Project - Phase 2

TITLE:

Conceptual Drainage Management Plan

DRAWN:	PS
CHECKED:	KY
DATE:	Oct 17/11
PROJECT:	10-037

FIGURE: **E.2.2**



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Ecosite Phase

- B1 - Pj-Aw blueberry
- B4 - Sw-Pj blueberry
- C1 - Pj-Sb Labrador tea-mesic
- D1 - Aw low-bush cranberry
- D2 - Aw-Sw low-bush cranberry
- D3 - Sw low-bush cranberry
- E1 - Pb-Aw dogwood
- E2 - Pb-Sw dogwood
- E3 - Sw dogwood
- F3 - Sw horsetail
- G1 - Sb-Pj Labrador tea-subhygric
- H1 - Sw-Sb Labrador tea horsetail
- I1 - Treed bog
- I2 - Shrubby bog
- J1 - Treed poor fen
- J2 - Shrubby poor fen
- K1 - Treed rich fen
- K2 - Shrubby rich fen
- K3 - Graminoid rich fen
- L1 - Marsh

Other

- NWL - Lake
- CIW - Well Site
- AIH - Access Road
- AII - Petroleum Facility

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Pre-Disturbance Ecosites

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 13/11
PROJECT:	10-037

FIGURE:
E.2.3

CPF Soil Storage N

CPF

CPF Soil Storage S

Borrow Pit 2

Borrow Pit 1

Utility Corridor

Operators Camp

Legend

Vegetation Plots

- 2011 Plot Location
- 2010 Plot Location
- 2008-2009 Plot Location

Soil Inspection Site

- 2011
- 2009-2010
- Sampled Site

T28 Topsoil + Litter/Shallow Peat (cm)
S37 Subsoil Depth (cm)
P90 Organic Depth (cm)

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit
Topsoil (cm)
T28 / S37 / P90 – Shallow or Deep Organic Material (cm)
Subsoil Depth (cm)

- Proposed Initial Phase 2 Development
- Existing Phase 1 Development
- Drainages without defined channels
- Streams with defined channels

Index Map

0 50 100 200
Metres

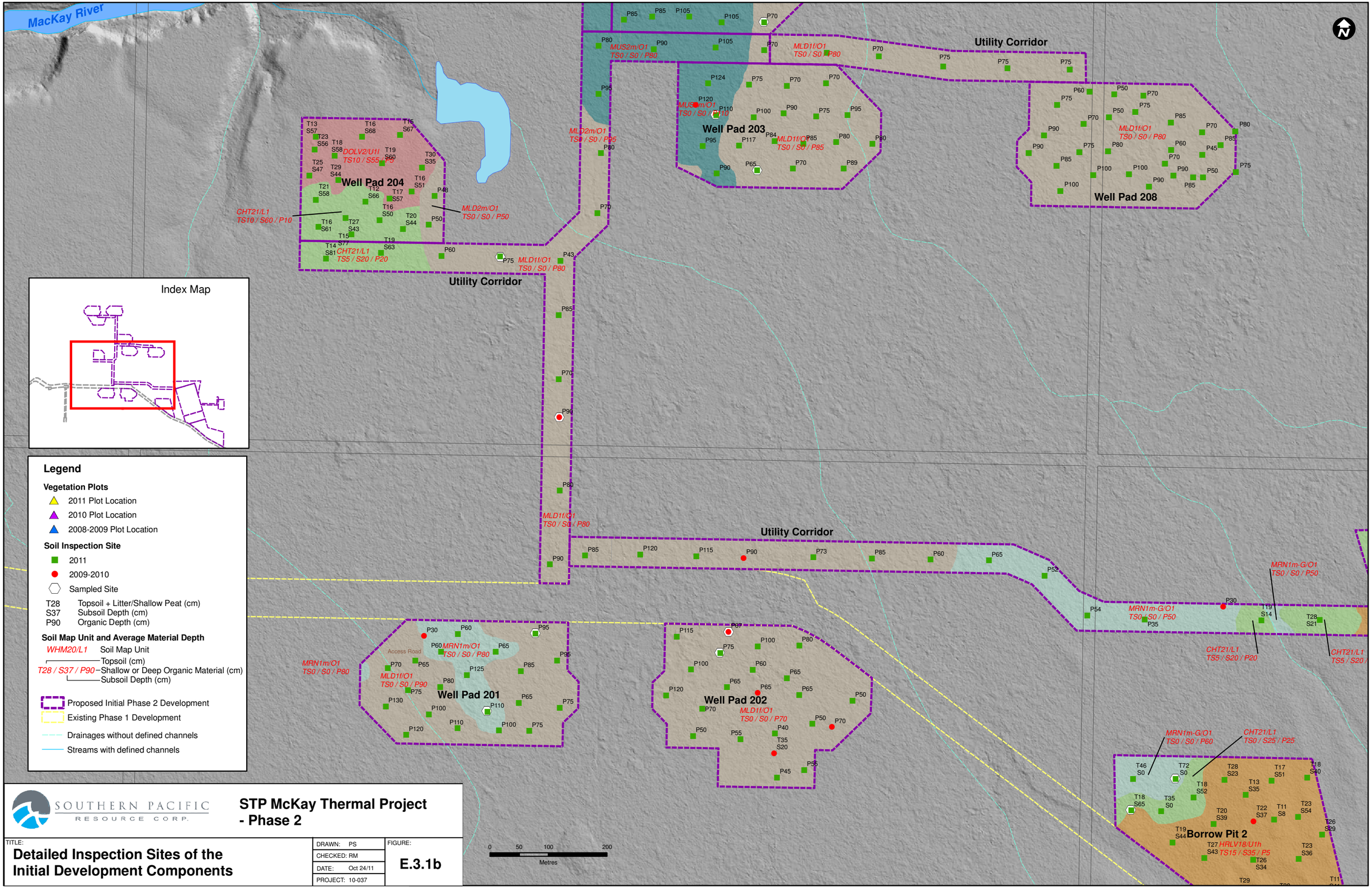
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Detailed Inspection Sites of the Initial Development Components

DRAWN: PS
CHECKED: RM
DATE: Oct 24/11
PROJECT: 10-037

FIGURE:
E.3.1a



Legend

Vegetation Plots

- 2011 Plot Location
- 2010 Plot Location
- 2008-2009 Plot Location

Soil Inspection Site

- 2011
- 2009-2010
- Sampled Site

T28 Topsoil + Litter/Shallow Peat (cm)
S37 Subsoil Depth (cm)
P90 Organic Depth (cm)

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit
T28 / S37 / P90 — Topsoil (cm); Shallow or Deep Organic Material (cm); Subsoil Depth (cm)

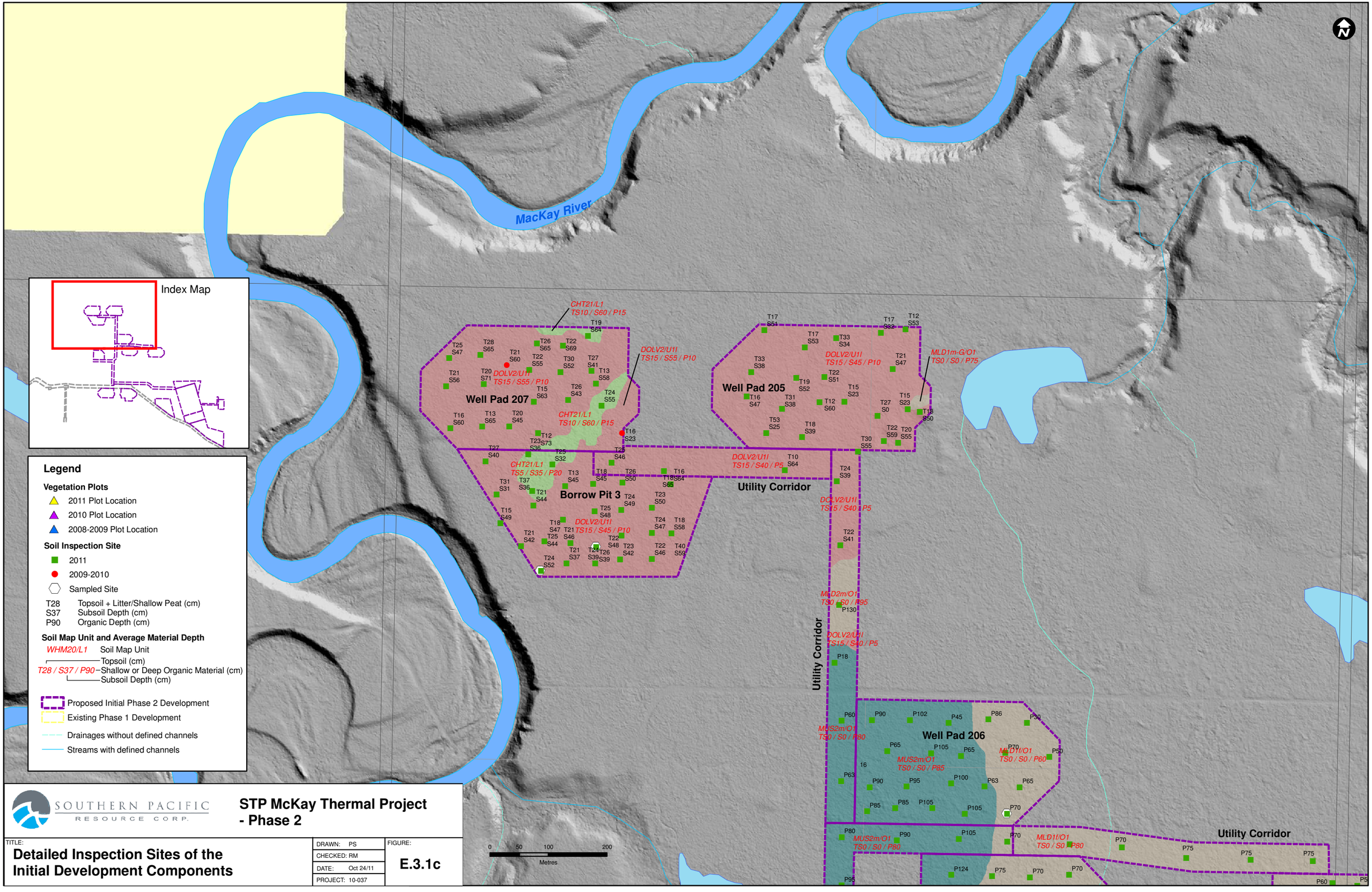
- Proposed Initial Phase 2 Development
- Existing Phase 1 Development
- Drainages without defined channels
- Streams with defined channels

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Detailed Inspection Sites of the Initial Development Components

DRAWN: PS	FIGURE: E.3.1b
CHECKED: RM	
DATE: Oct 24/11	
PROJECT: 10-037	



Legend

Vegetation Plots

- 2011 Plot Location
- 2010 Plot Location
- 2008-2009 Plot Location

Soil Inspection Site

- 2011
- 2009-2010
- Sampled Site

T28 Topsoil + Litter/Shallow Peat (cm)
S37 Subsoil Depth (cm)
P90 Organic Depth (cm)

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit
T28 / S37 / P90 – Topsoil (cm) / Subsoil Depth (cm) / Shallow or Deep Organic Material (cm)

- Proposed Initial Phase 2 Development
- Existing Phase 1 Development
- Drainages without defined channels
- Streams with defined channels

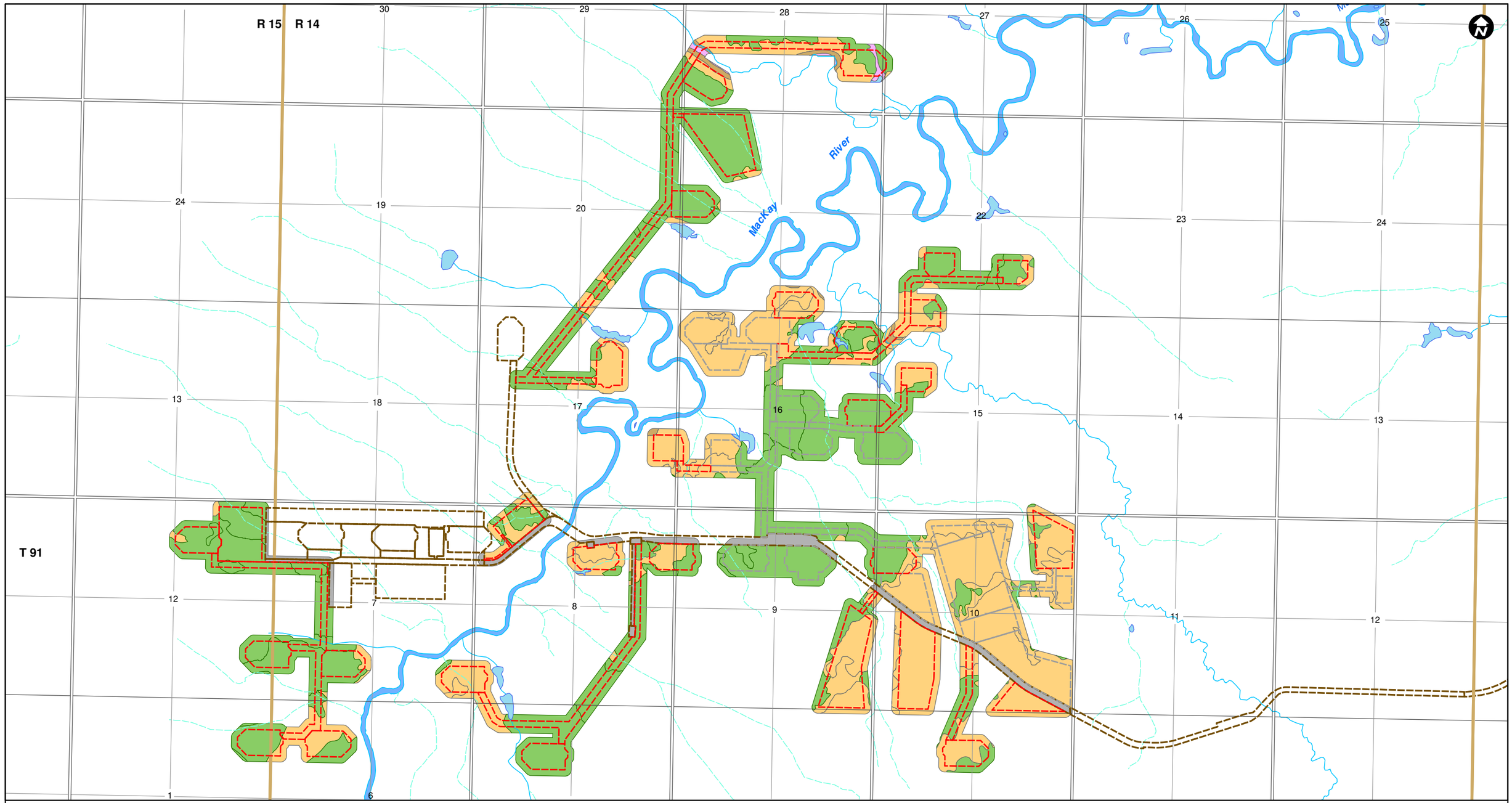
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Detailed Inspection Sites of the Initial Development Components

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE: **E.3.1c**



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Upland and Organic Soils

- Upland
- Organic
- ZDL - Disturbed Land
- ZGW - Undifferentiated Land
- ZUN - Undifferentiated Land
- ZWA - Water

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Upland and Organic Soils with the Project Footprint

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE:
E.3.2

CPF Soil Storage N

CHT21/L1
TS5 / S20 / P20

MRN1m-G/O1
TS0 / S0 / P50

HRLV18/U1h
TS15 / S40 / P8

ALG20/L1
TS10 / S40 / P10

HRLV18/U1h
TS15 / S40 / P10

MRN1m-G/O1
TS0 / S0 / P60

CHT21/L1
TS0 / S25 / P25

Borrow Pit 2

HRLV18/U1h
TS15 / S35 / P5

WHM20/L1
TS15 / S25 / P10

MRN1m/O1
TS0 / S0 / P95

CPF

HRLV18/U1h
TS15 / S40 / P10

10

CPF Soil Storage S

WHM20/L1
TS10 / S20 / P10

HRLV2/U1l
TS10 / S25 / P10

MLD1m-G/O3
TS0 / S0 / P55

Utility Corridor

HRLV2/U1l
TS15 / S45 / P10

WHM20/L1
TS15 / S25 / P10

Operators Camp

WHM20/L1
TS10 / S25 / P10

WHM20/L1
TS10 / S25 / P10

Borrow Pit 1

HRLV18/U1h
TS10 / S40 / P10

Index Map

Legend

- Proposed Initial Phase 2 Development
- Existing Phase 1 Development

Stockpile

- Topsoil
- Subsoil
- Drainages without defined channels
- Streams with defined channels

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit

T28 / S37 / P90 Topsoil + Litter/Shallow Peat (cm)/ Subsoil Depth (cm)/ Peat Depth (cm)

0 50 100 200
Metres

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Potential Soil Stockpiles for the Initial Development

DRAWN: PS
CHECKED: RM
DATE: Oct 24/11
PROJECT: 10-037

FIGURE:
E.3-3a

MacKay River

MUS2m/O1
TS0 / S0 / P80

MLD1f/O1
TS0 / S0 / P80

Utility Corridor

MUS2m/O1
TS0 / S0 / P110

Well Pad 203

MLD1f/O1
TS0 / S0 / P85

MLD2m/O1
TS0 / S0 / P85

Well Pad 208

MLD1f/O1
TS0 / S0 / P80

DDLY2/W1
TS10 / S55 / P5

Well Pad 204

CHT21/L1
TS10 / S60 / P10

CHT21/L1
TS5 / S20 / P20

Utility Corridor

MLD1f/O1
TS0 / S0 / P80

Index Map

MLD1f/O1
TS0 / S0 / P80

Utility Corridor

CHT21/L1
TS5 / S20 / P20

MRN1m-G/O1
TS0 / S0 / P50

MRN1m-G/O1
TS0 / S0 / P50

CHT21/L1
TS5 / S20 / P20

MRN1m/O1
TS0 / S0 / P80

Access Road

MRN1m/O1
TS0 / S0 / P80

MLD1f/O1
TS0 / S0 / P90

Well Pad 201

Well Pad 202

MLD1f/O1
TS0 / S0 / P70

MRN1m-G/O1
TS0 / S0 / P60

CHT21/L1
TS0 / S25 / P25

Borrow Pit 2

HRLV18/U1h
TS15 / S35 / P5

Legend

- Proposed Initial Phase 2 Development
- Existing Phase 1 Development

Stockpile

- Topsoil
- Subsoil
- Drainages without defined channels
- Streams with defined channels

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit

T28 / S37 / P90 Topsoil + Litter/Shallow Peat (cm)/ Subsoil Depth (cm)/ Peat Depth (cm)

0 50 100 200
Metres

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Potential Soil Stockpiles for the Initial Development

DRAWN: PS
CHECKED: RM
DATE: Oct 24/11
PROJECT: 10-037

FIGURE:
E.3-3b

MacKay River

CHT21/L1
TS10 / S60 / P15

DOLV2/U1I
TS15 / S55 / P10

Well Pad 207

DOLV2/U1I
TS15 / S55 / P10

CHT21/L1
TS10 / S60 / P15

DOLV2/U1I
TS15 / S45 / P10

Well Pad 205

MLD1m-G/O1
TS0 / S0 / P75

Utility Corridor

DOLV2/U1I
TS15 / S40 / P5

CHT21/L1
TS5 / S35 / P20

Borrow Pit 3

DOLV2/U1I
TS15 / S45 / P10

Utility Corridor

MLD2m/O1
TS0 / S0 / P95

DOLV2/U1I
TS15 / S40 / P5

MUS2m/O1
TS0 / S0 / P80

Well Pad 206

16

MUS2m/O1
TS0 / S0 / P85

MLD1I/O1
TS0 / S0 / P60

MUS2m/O1
TS0 / S0 / P80

MLD1I/O1
TS0 / S0 / P80

Utility Corridor

Index Map

Legend

Proposed Initial Phase 2 Development

Existing Phase 1 Development

Stockpile

Topsoil

Subsoil

Soil Map Unit and Average Material Depth

WHM20/L1 Soil Map Unit

T28 / S37 / P90 Topsoil + Litter/Shallow Peat (cm)/ Subsoil Depth (cm)/ Peat Depth (cm)

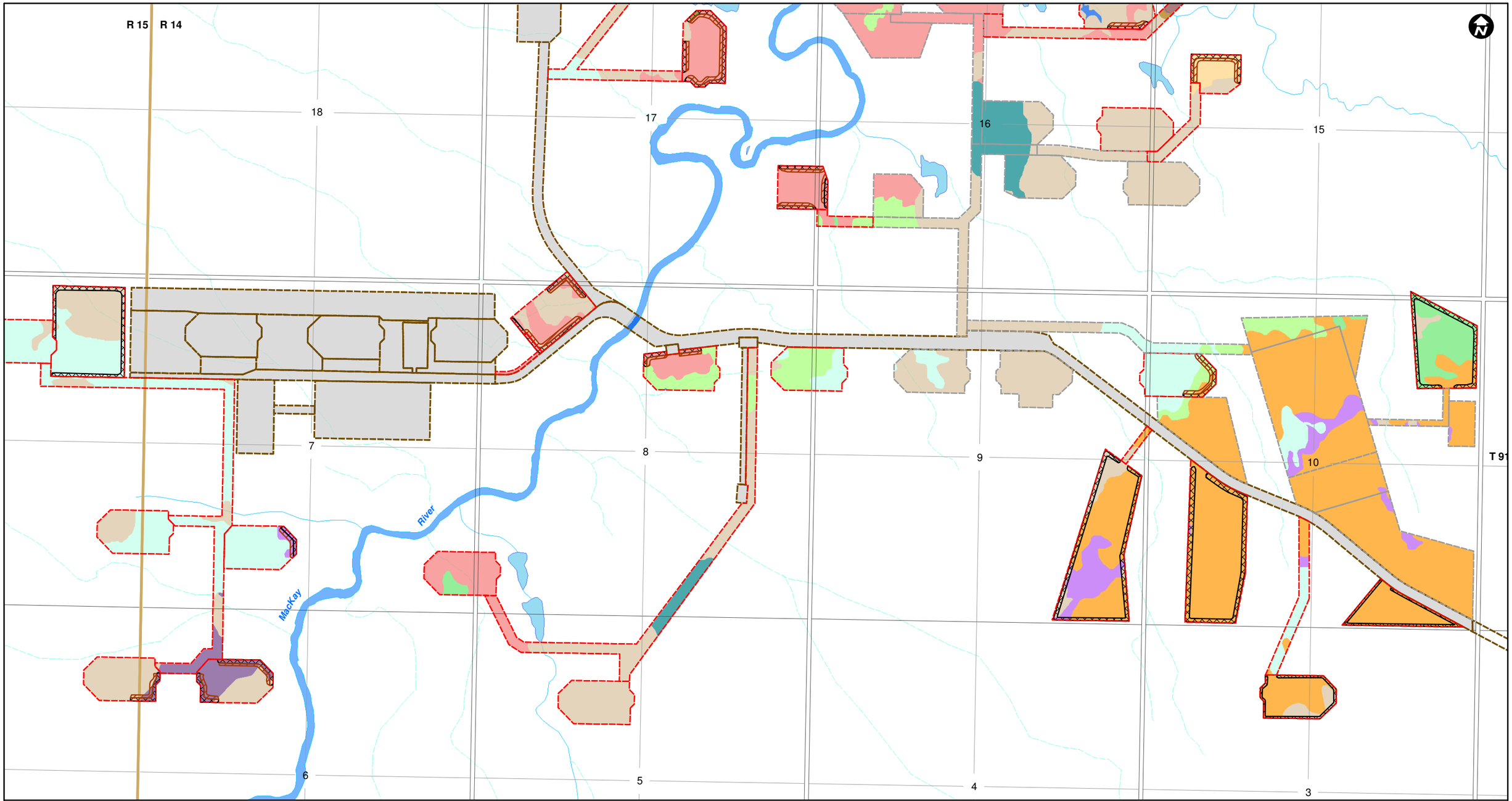
0 50 100 200
Metres

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Potential Soil Stockpiles for the Initial Development

DRAWN: PS	FIGURE:
CHECKED: RM	**E.3-3c**
DATE: Oct 24/11	
PROJECT: 10-037	



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Stockpile

- Topsoil
- Subsoil

Soil Series

- Algar (ALG)
- Chateh (CHT)
- Dover/Livok (DOV/LVK)
- Dover/Kilome (DOV/KME)
- Horse River (HRR)
- Kilome (KME)
- Livock (LVK)
- Mildred (MIL)
- McClelland (MLD)
- McMurray (MMY)
- Wanham (WHM)
- Mariana (MRN)
- Muskeg (MUS)
- Undifferentiated (ZUN)
- Water
- Disturbed

0 250 500 1,000
Metres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

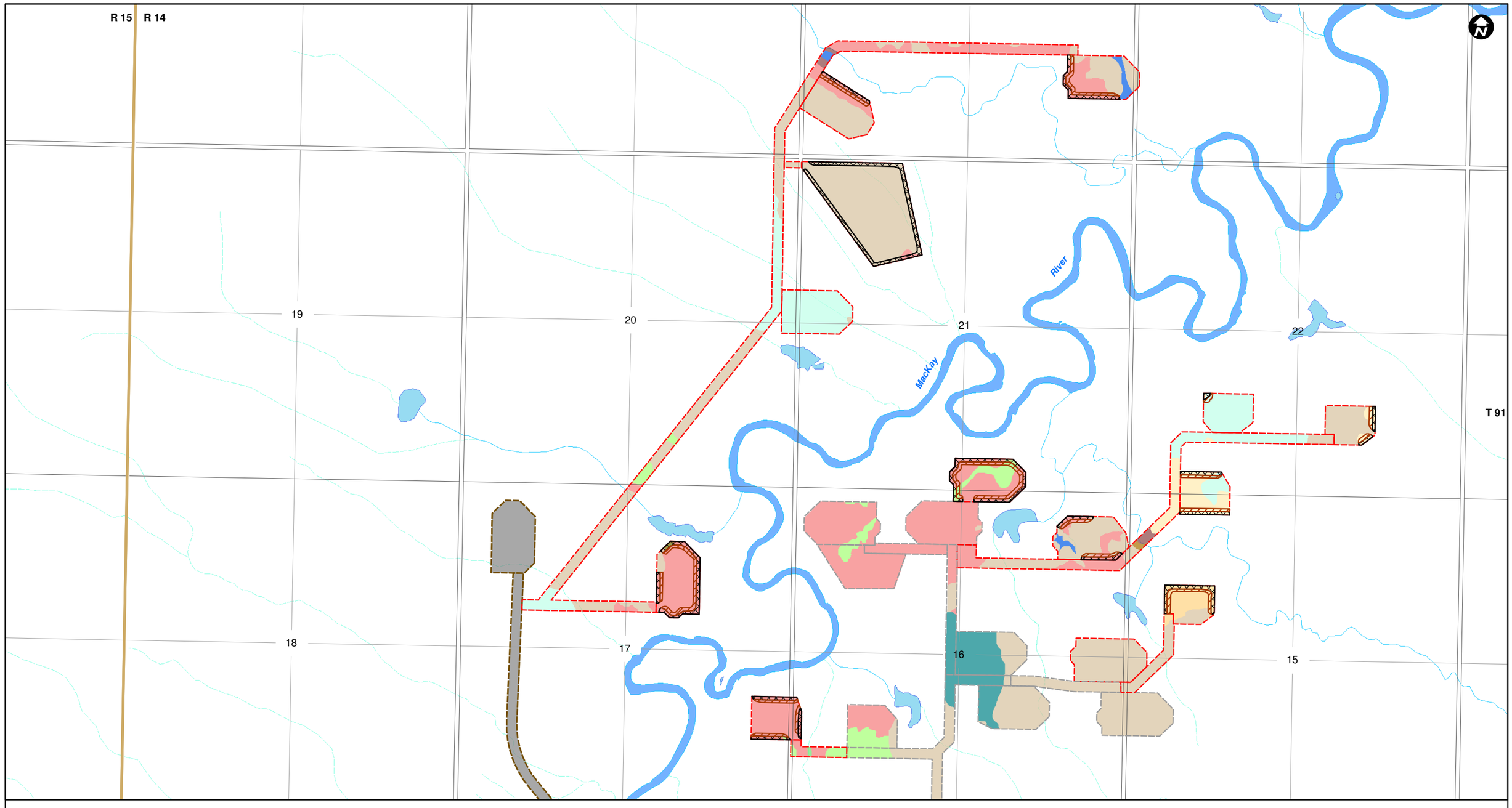
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Potential Soil Stockpile Locations for the Future Development Area

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE:
E.3.4a



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Stockpile

- Topsoil
- Subsoil

Soil Series

- Algar (ALG)
- Chateh (CHT)
- Dover/Livok (DOV/LVK)
- Dover/Kilome (DOV/KME)
- Horse River (HRR)
- Kilome (KME)
- Livock (LVK)
- Mildred (MIL)
- McClelland (MLD)
- McMurray (MMY)
- Wanham (WHM)
- Mariana (MRN)
- Muskeg (MUS)
- Undifferentiated (ZUN)
- Water
- Disturbed

0 250 500 1,000
Metres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

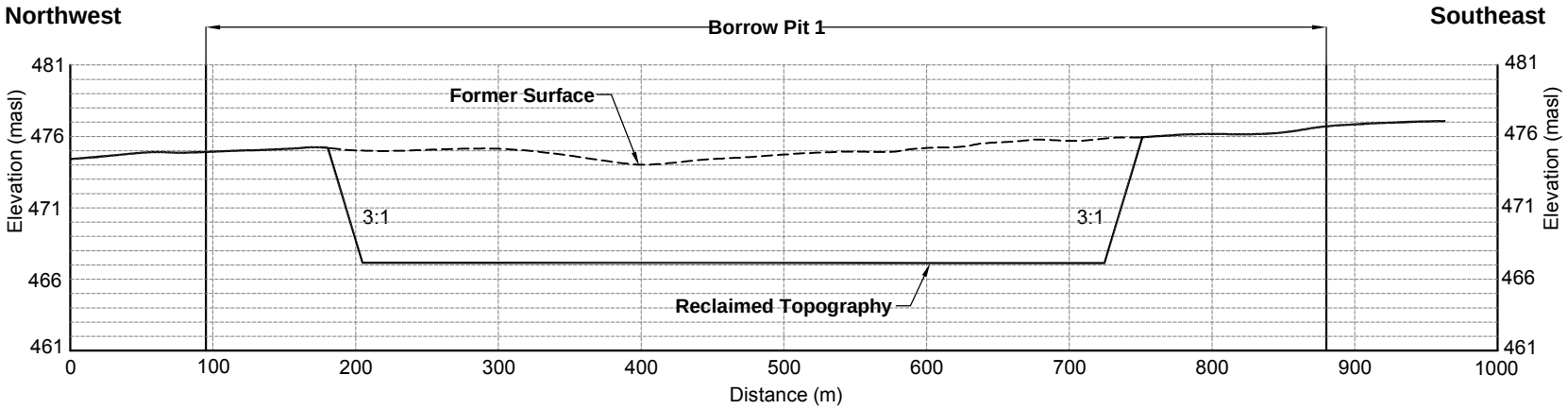
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Potential Soil Stockpile Locations for the Future Development Area

DRAWN: PS
CHECKED: RM
DATE: Oct 24/11
PROJECT: 10-037

FIGURE:
E.3.4b



Horizontal Scale

0 50 100 200m

Scale 1 : 5 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 1

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

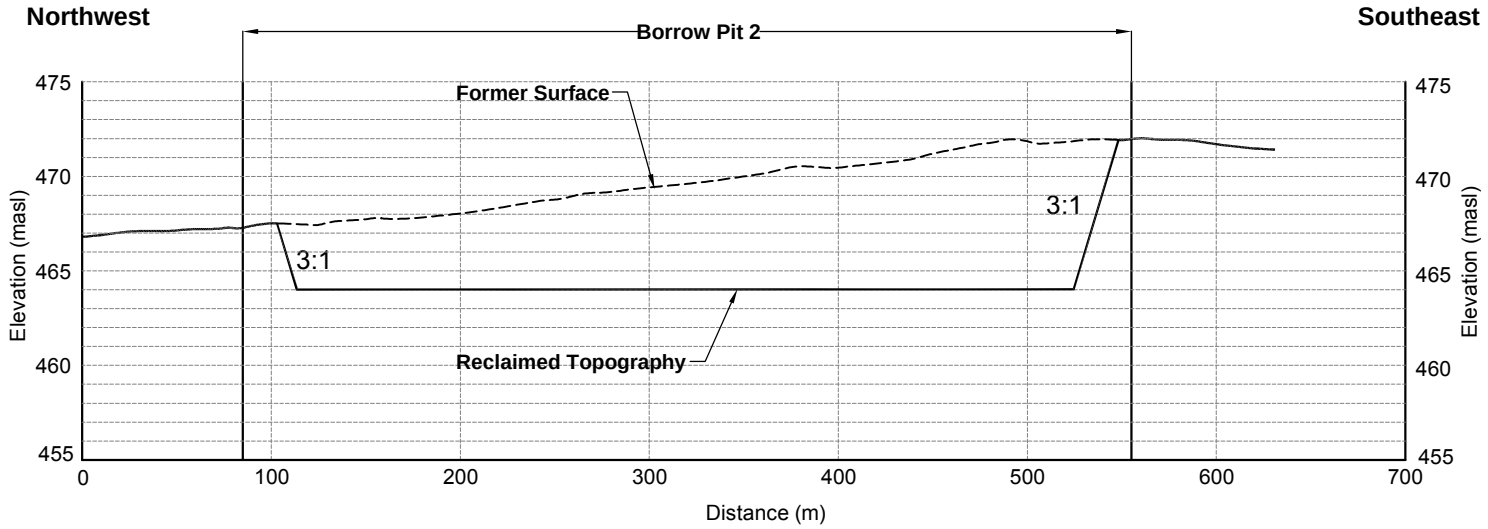
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1a



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 2

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

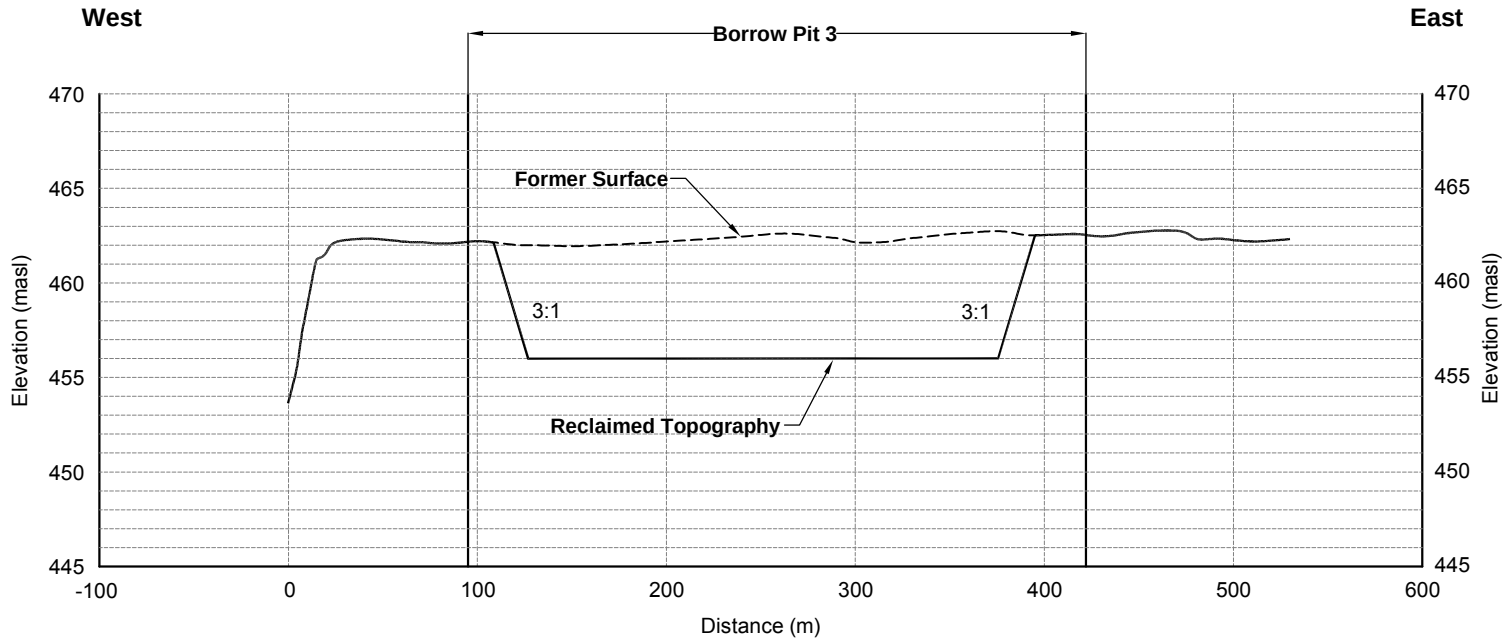
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1b



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 3

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

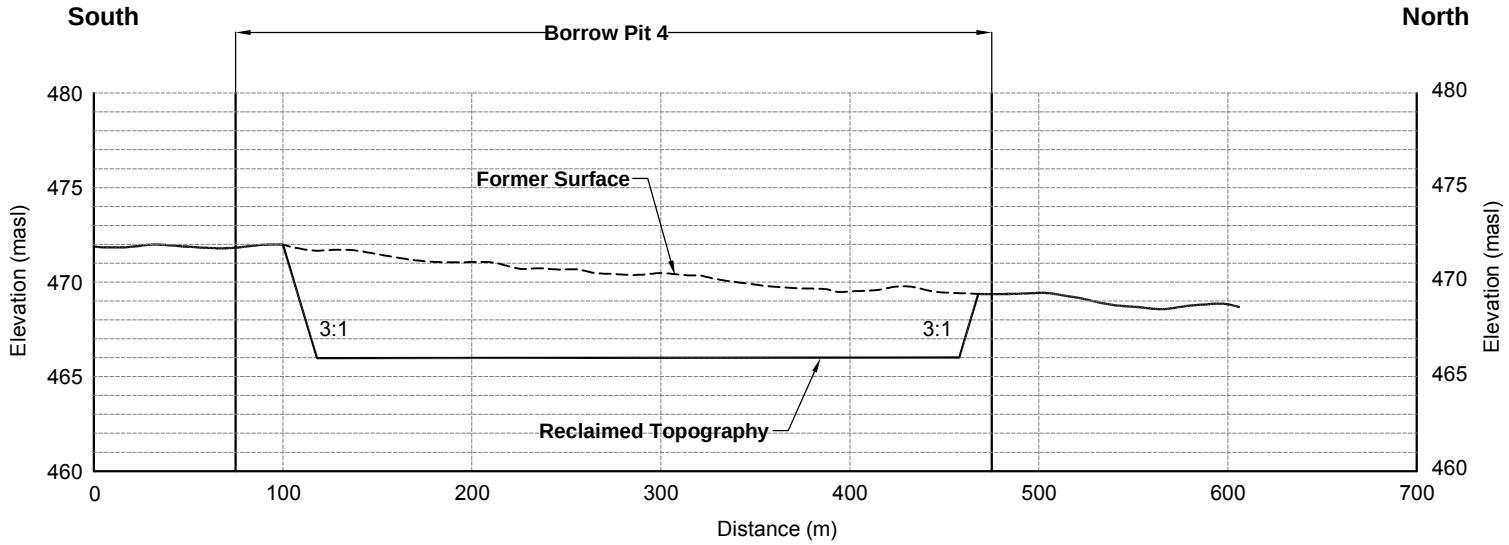
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1c



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

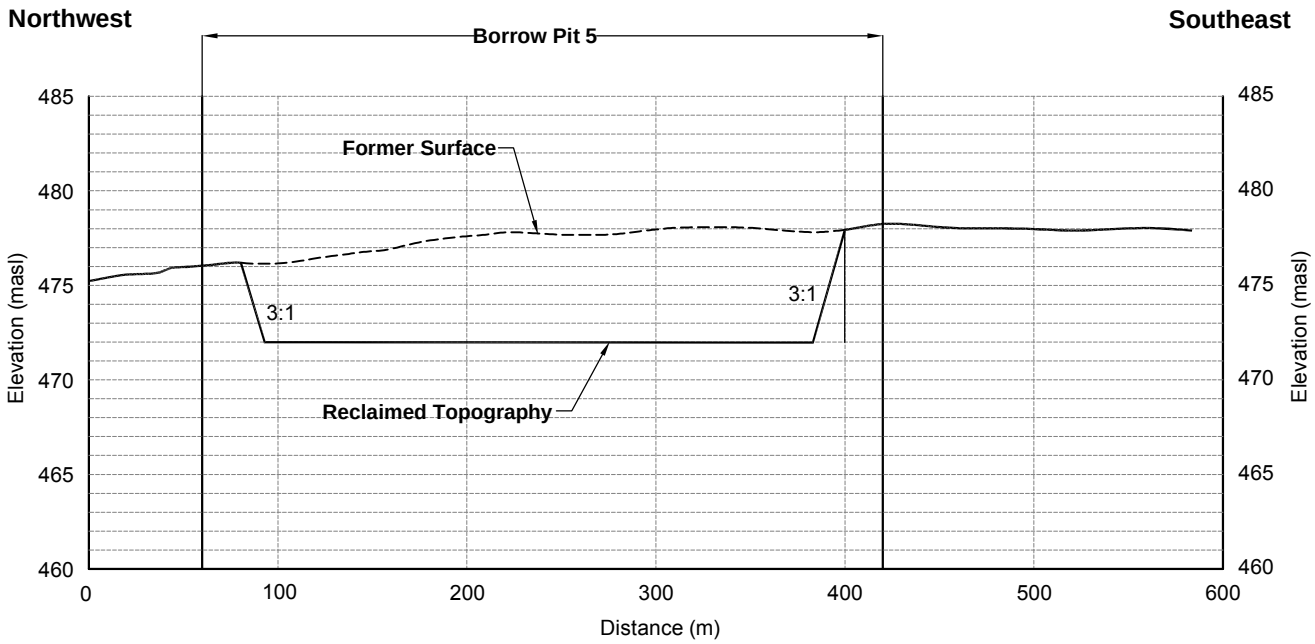
TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 4

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN:	JDC
CHECKED:	RM
DATE:	Oct 13/11
PROJECT:	10-037

FIGURE: **E.5.1d**



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 5

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

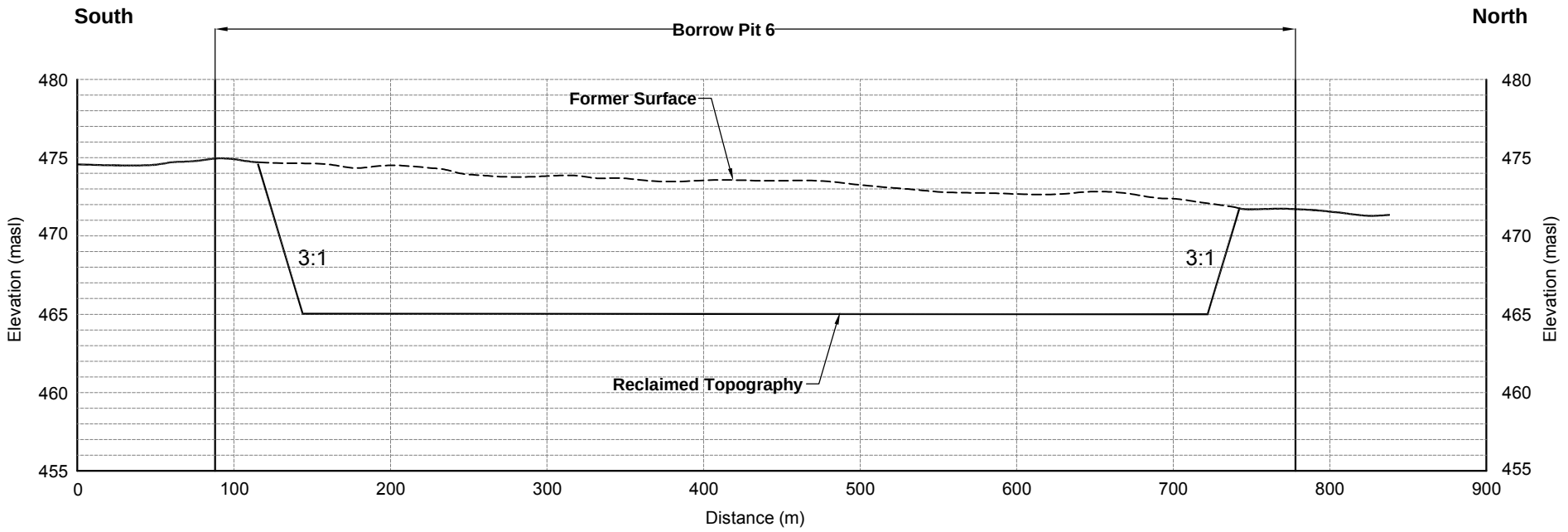
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1e



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 6

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

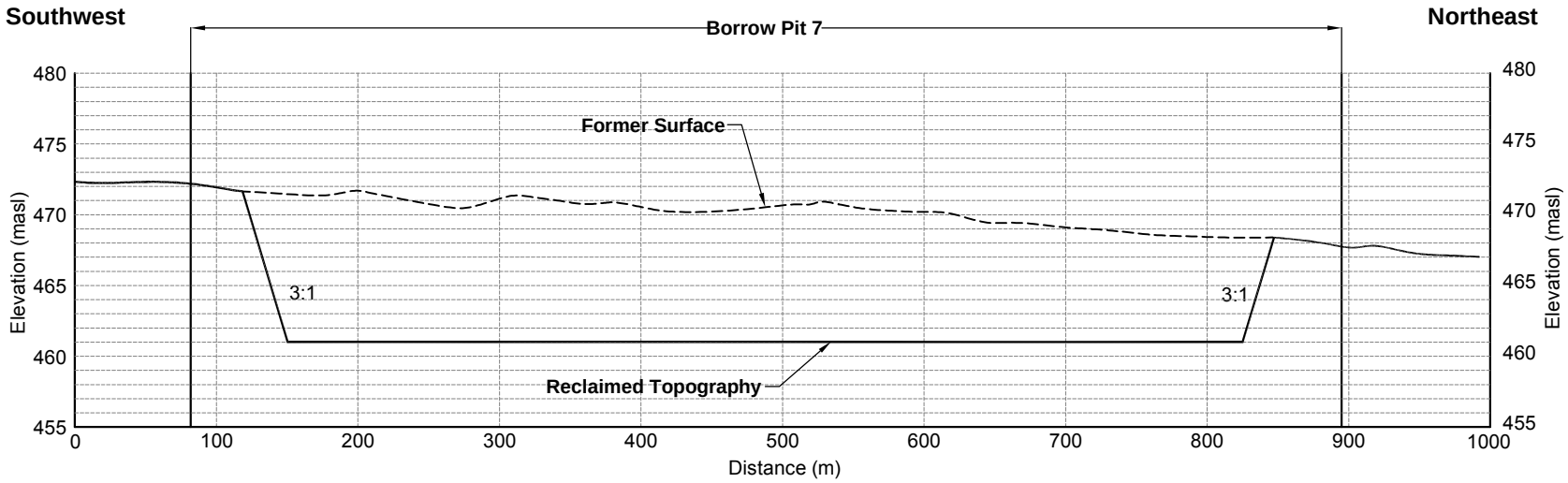
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1f



Horizontal Scale

0 50 100 200m

Scale 1 : 5 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 7

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

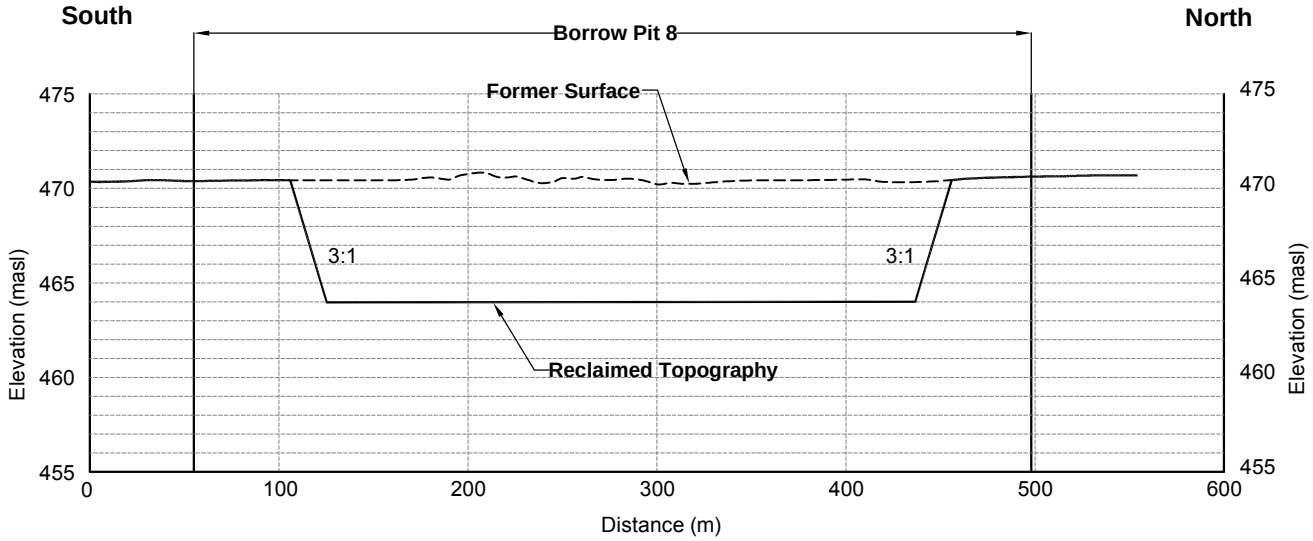
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1g



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 8

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN: JDC

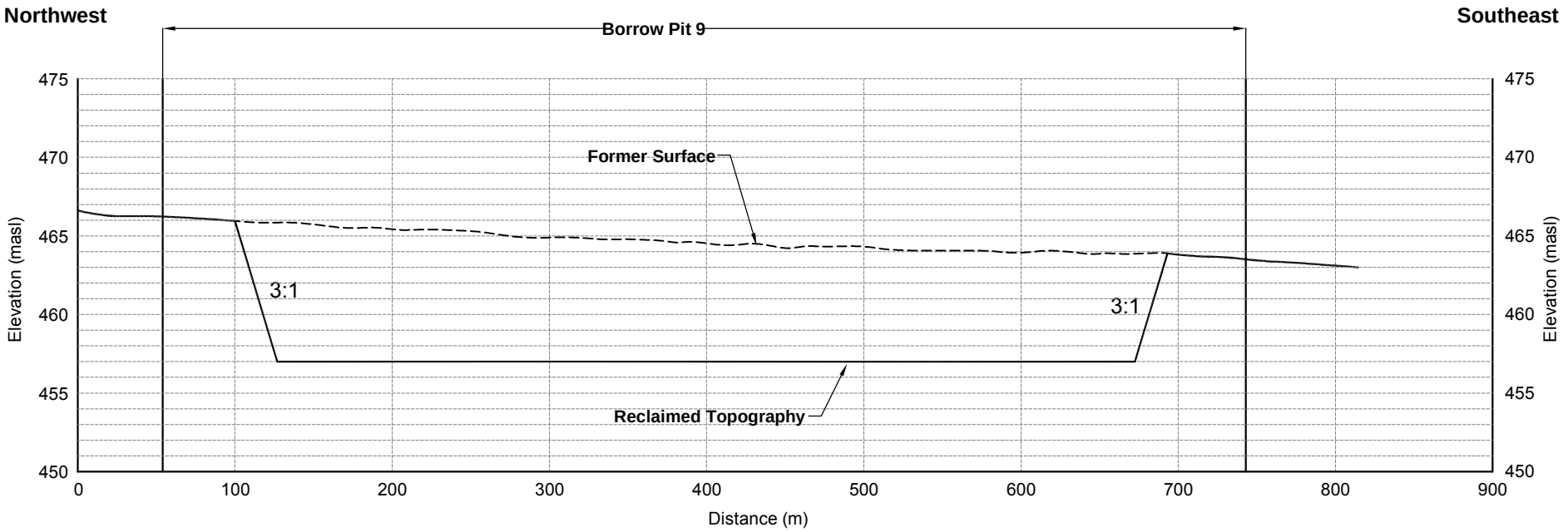
CHECKED: RM

DATE: Oct 13/11

PROJECT: 10-037

FIGURE:

E.5.1h



Horizontal Scale

0 40 80 160m

Scale 1 : 4 000

Vertical Exaggeration 10X

REF: Elevation data from Lidar.

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay SAGD Project

TITLE:

Conceptual Reclaimed Cross-Section of Borrow Pit 9

FILE: Fig E Borrow Pit Profiles.dwg

DRAWN:	JDC
CHECKED:	RM
DATE:	Oct 13/11
PROJECT:	10-037

FIGURE: **E.5.1i**

R 15 R 14

T 91

River

McKay

30 29 28 27 26 25
24 19 20 21 22 23 24
13 18 17 16 15 14 13
12 7 8 9 10 11 12
1 6

Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Land Capability Class

- Class 2
- Class 3
- Class 4
- Class 5
- NR-Not Rated
- Pond

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

SOUTHERN PACIFIC RESOURCE CORP.

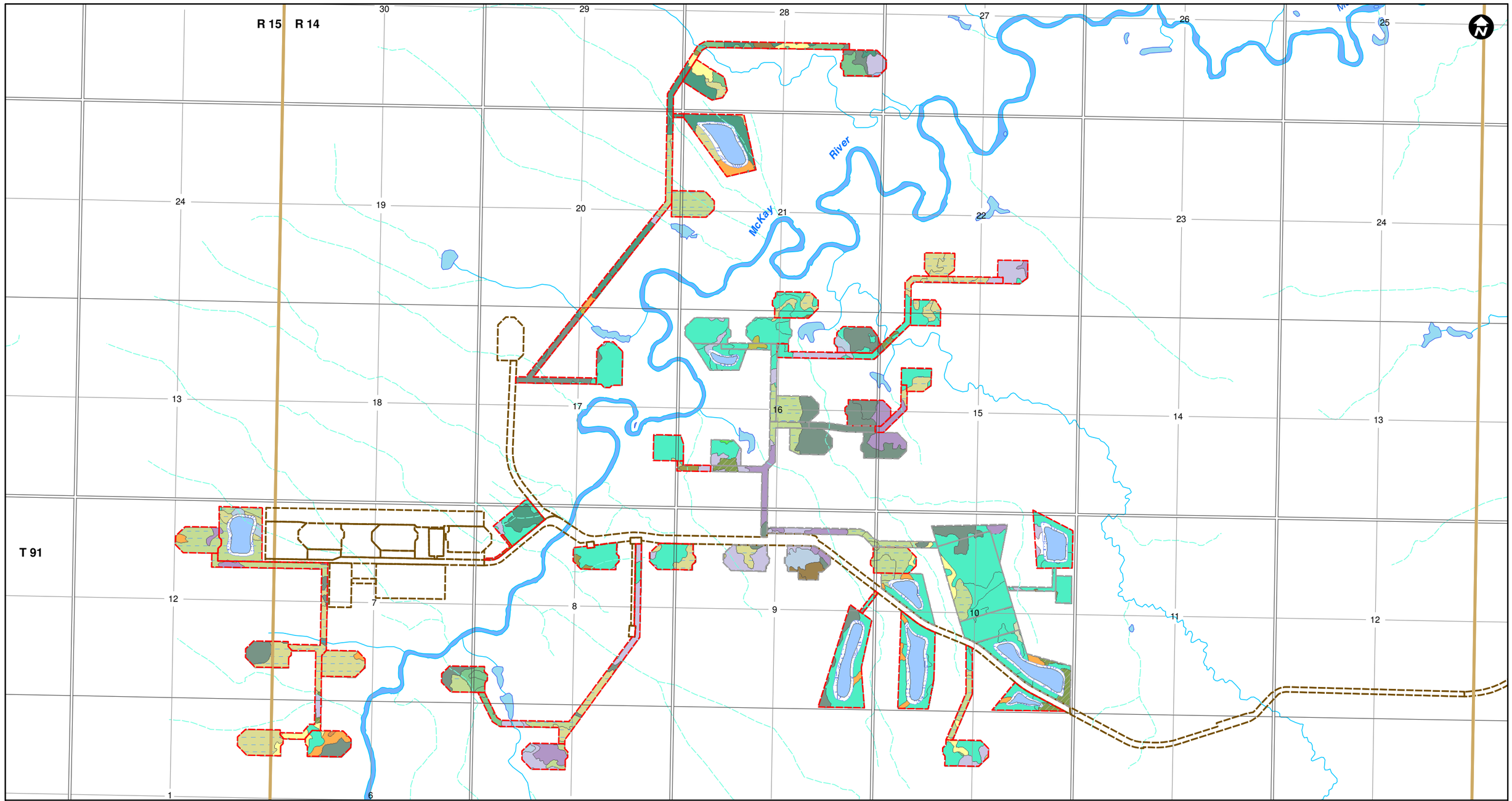
STP McKay Thermal Project - Phase 2

TITLE:

Reclaimed Forest Soil Capability

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE: **E.5.2**



Legend

- Existing Phase 1 Development
- Proposed Initial Phase 2 Development
- Proposed Future Development
- Drainages without defined channels
- Streams with defined channels

Ecosite Phase

- B4 - Sw-Pj blueberry
- C1 - Pj-Sb Labrador tea-mesic
- D1 - Aw low-bush cranberry
- D2 - Aw-Sw low-bush cranberry
- D3 - Sw low-bush cranberry
- E1 - Pb-Aw dogwood
- E2 - Pb-Sw dogwood
- E3 - Sw dogwood
- F3 - Sw horsetail
- G1 - Sb-Pj Labrador tea-subhygric
- H1 - Sw-Sb Labrador tea horsetail
- I1 - Treed bog
- I2 - Shrubby bog
- J1 - Treed poor fen
- J2 - Shrubby poor fen
- K1 - Treed rich fen
- K2 - Shrubby rich fen
- K3 - Graminoid rich fen
- L1 - Marsh

Other

- NWL - Lake

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

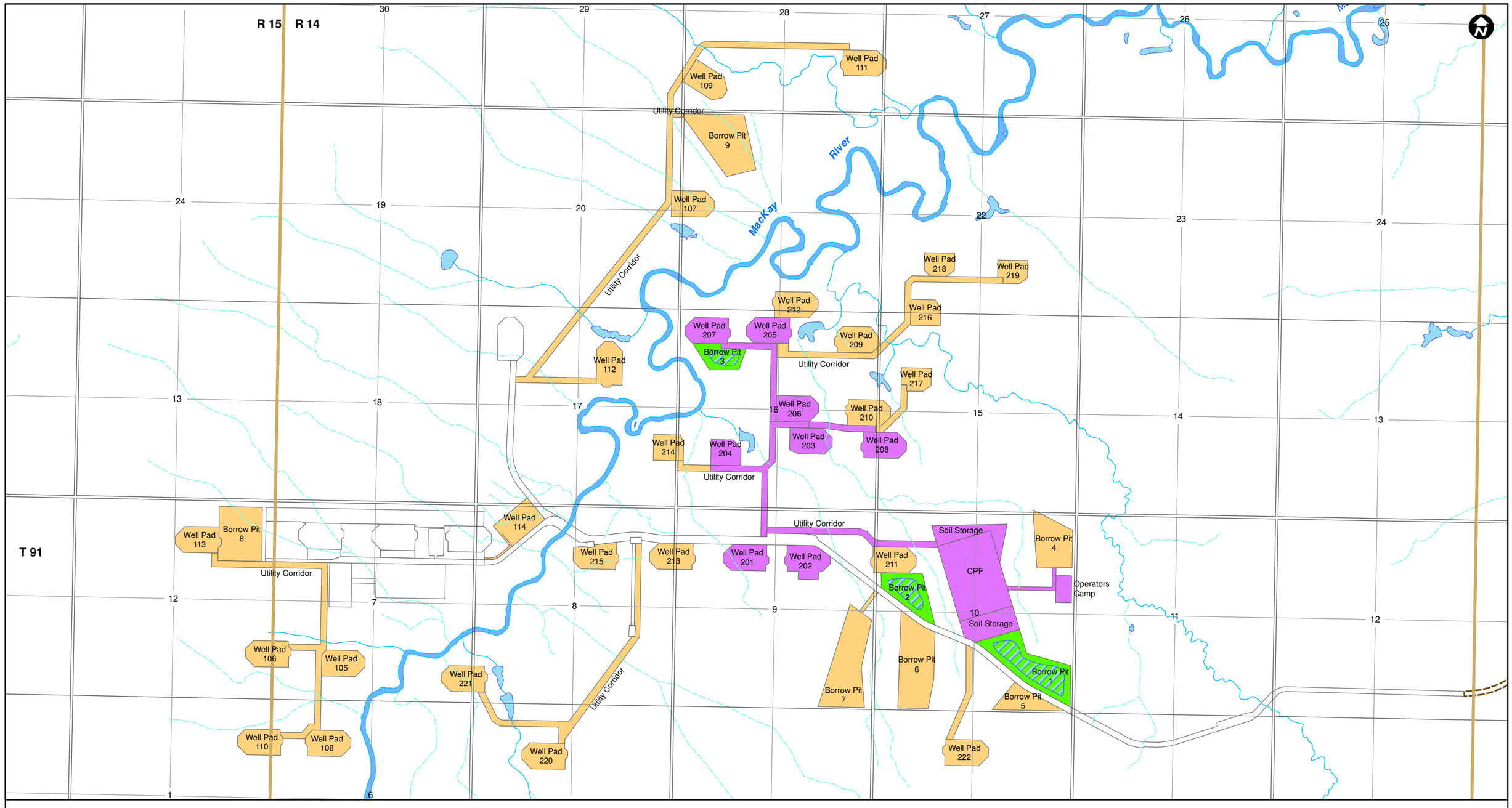
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Reclaimed Ecosites

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 25/11
PROJECT:	10-037

FIGURE:
E.6-1



Legend

Year 10

- Developed
- Reclaimed
- Future Development
- Phase 1
- Pond

- Drainages without defined channels
- Streams with defined channels

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

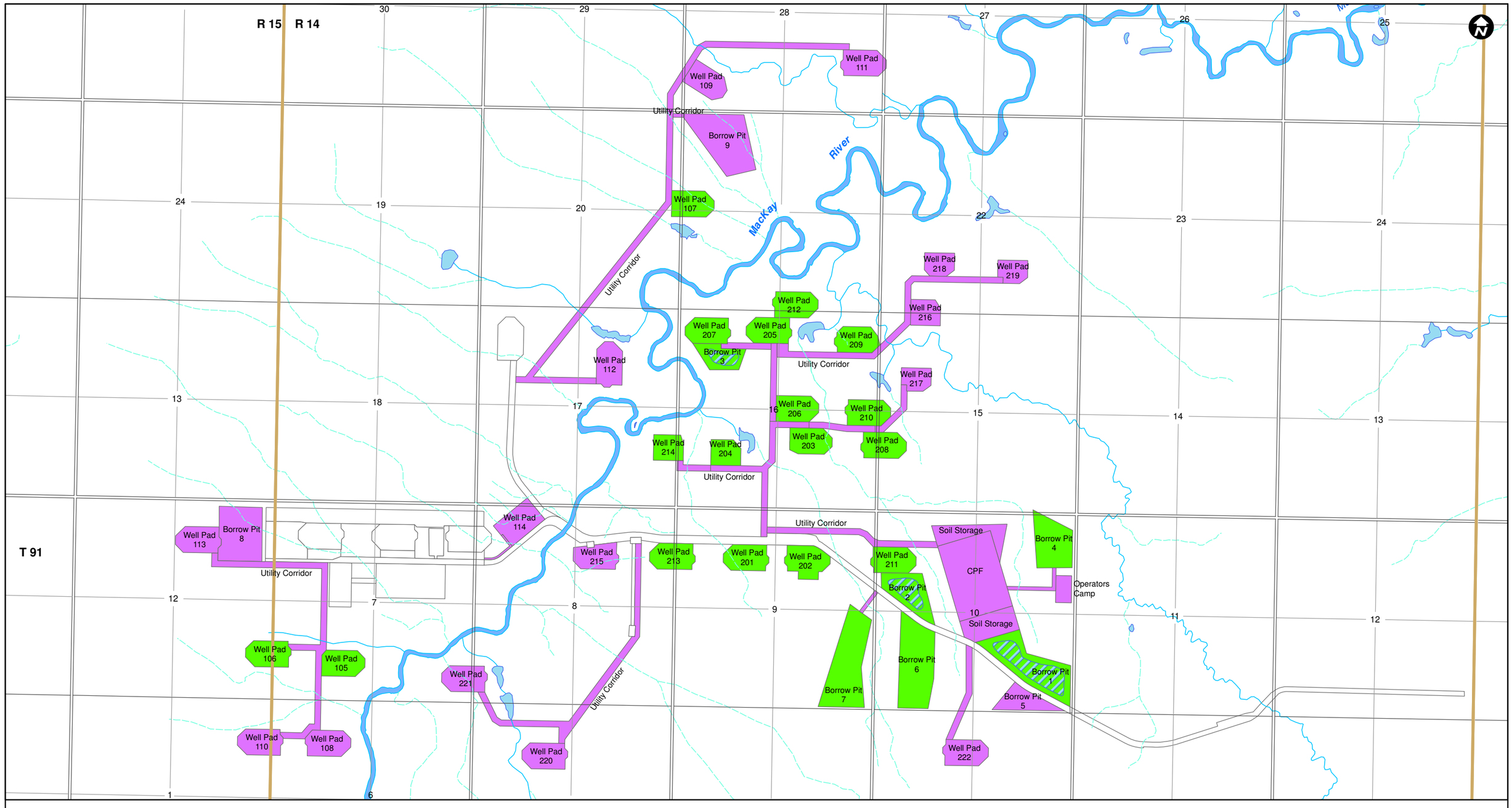
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Development and Reclamation Status at Year 10

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE:
E.7.1



Legend

Year 20

- Developed
- Reclaimed
- Future Development
- Phase 1
- Pond

- Drainages without defined channels
- Streams with defined channels

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

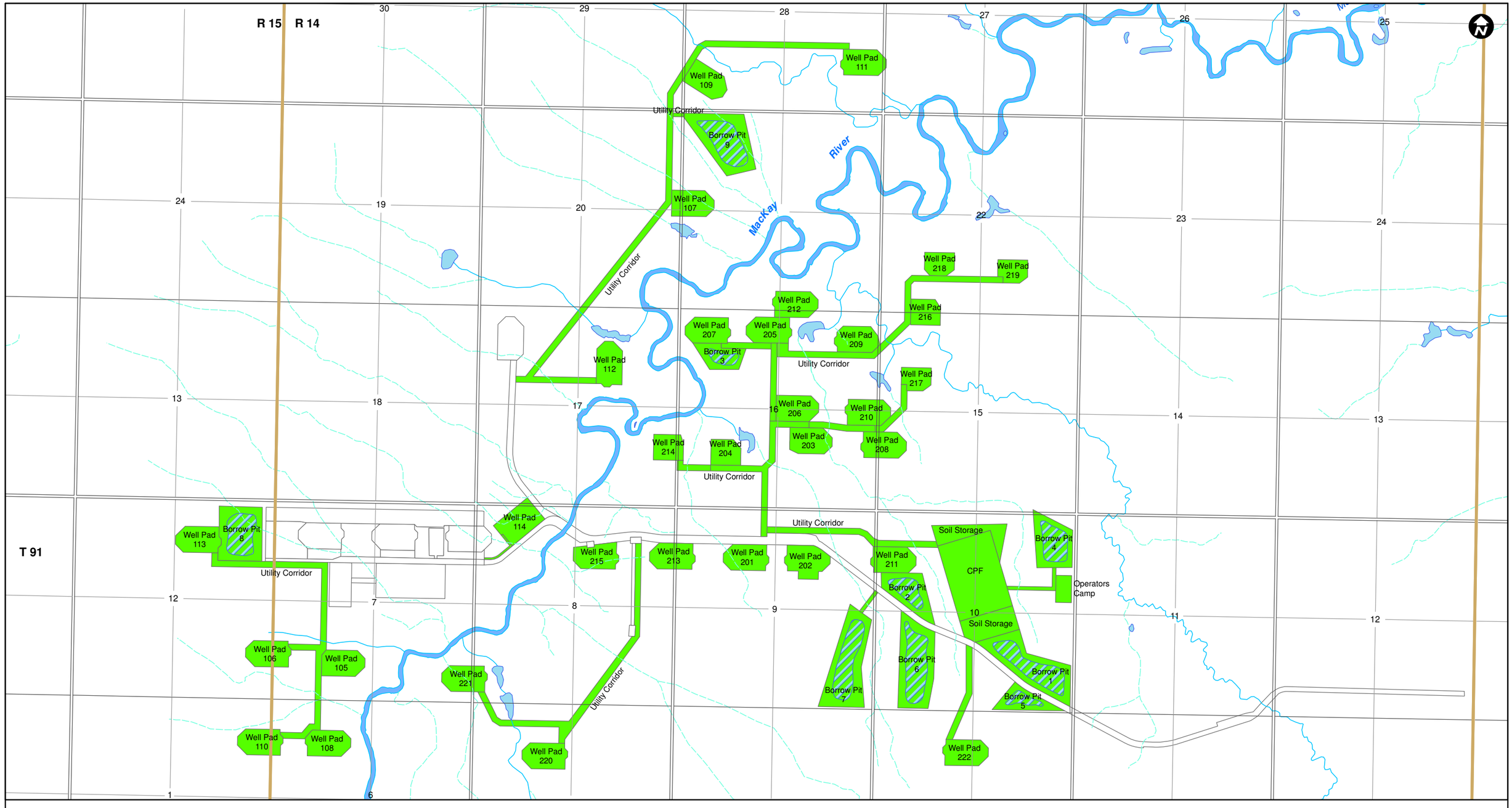
SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

TITLE:
Development and Reclamation Status at Year 20

DRAWN:	PS
CHECKED:	RM
DATE:	Oct 24/11
PROJECT:	10-037

FIGURE:
E.7.2



Legend

Year 30
- Reclaimed
- Phase 1
- Pond

Drainages without defined channels
Streams with defined channels

0 0.5 1 2
Kilometres

REF:David Loucks Consulting Drifter Projects Ltd., 2011; NHC (Hydrology) 2010,

SOUTHERN PACIFIC RESOURCE CORP.

STP McKay Thermal Project - Phase 2

Millennium EMS Solutions Ltd.

TITLE:
Development and Reclamation Status at Year 30

DRAWN: PS	FIGURE:
CHECKED: RM	**E.7.3**
DATE: Oct 20/11	
PROJECT: 10-037	