

2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands

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1. Preface

The Government of Alberta protects the province's land resources by ensuring land used for industrial activities is reclaimed in an environmentally sound manner. This is directed through the *Environmental Protection and Enhancement Act* (EPEA), and the *Conservation and Reclamation Regulation*. Under EPEA. After an upstream oil and gas facility has been decommissioned, operators must obtain a reclamation certificate. Reclamation certificates are managed through the Alberta Upstream Oil and Gas Reclamation and Remediation Program.

In 2005, the Reclamation Criteria Advisory Group (RCAG) was established to review and provide recommendations for upgrading the 1995 Updated Reclamation Criteria for Wellsites and Associated Facilities (Alberta Environment, 1995). The review of the 1995 Reclamation Criteria was done according to Alberta Environment's Sustainable Resource and Environmental Management (SREM) model, which requires specified outcomes and science-based policy development. The process brought together representative stakeholders to ensure balanced and thorough outcomes. RCAG included representation from landowners (independent, Alberta Surface Rights Federation, Wildrose Agricultural Producers), Alberta Environment (AENV), Alberta Forest Products Association (AFPA), Alberta Sustainable Resource Development (ASRD), Alberta Agriculture and Rural Development (ARD), Canadian Association of Petroleum Producers (CAPP), and Alberta Energy Resources and Conservation Board (ERCB). RCAG members attended task groups for cultivated, grass, forested and peat lands in order to address the unique issues for each land type.

A review of reclamation standards for upstream oil and gas facilities is timely because of improvements in reclamation practices, scientific developments and recommendations for improving the former criteria. The Reclamation Criteria Advisory Group (RCAG) began with an assessment of the 1995 Criteria: intending to retain the parts that worked and improving the parts that did not. These Criteria themselves will be continually improved as knowledge of ecosystem processes improves.

Task groups for cultivated, grass, forested and peat lands addressed the unique issues for each land type. Ecological health & function and land operability were objective indicators of equivalent land capability after successful reclamation. Importantly, according to the following litmus tests these criteria are to be:

- Science-based, reproducible and testable as they address ecosystem and management functions on a landscape basis.
- Workable as they offer alternatives or options, where applicable, to promote efficiency and recognize constraints.
- Enforceable as they compel compliance through explicit performance measures and decision, acceptable to all stakeholders with risk transferred to the Government of Alberta.
- Equitable as per cost vs. benefit analysis for all stakeholders after agreed upon changes in land use.
- Transparent as they offer clear rationale for assumptions and decisions (*e.g.*, choice of parameters).

It is recommended that the 2010 Criteria be updated periodically as knowledge of ecosystem processes improves.

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2. Introduction

2.1. Background

The aim of reclamation under Environmental Protection and Enhancement Act is to obtain equivalent land capability. “*Equivalent land capability*” is defined in the Conservation and Reclamation Regulation as “*the ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical.*” The 2010 Criteria are to be used to evaluate whether a site has met equivalent land capability. The criteria are based on land function and operability that will support the production of goods and services consistent in quality and quantity with the surrounding landscape.

The intent of the 2010 Criteria is to measure appropriate parameters and evaluate whether land function and operability is comparable to the surrounding area or an appropriate reference. The certification criteria describe the allowable changes in site conditions. They typically require landscape, vegetation and soils assessments as was a component of the 1995 Update. In special cases, the operator may have to find representative land, soil and vegetation a short distance from the site or use available reference plant community or ecosite descriptions.

It is necessary to characterize the natural variability associated with various land uses and landscapes and make a reasonable comparison using appropriate sampling methodologies. Given the complexity of the different land use types, soil zones and landscapes, it is acknowledged the 2010 Criteria may not be applicable to all sites under all circumstances. The operator, inspector, land manager or reviewer is not limited to the methods identified in the criteria to draw his/her conclusion on ‘equivalent capability’. Where such circumstances occur and the operator is satisfied that the site is ready to certify, an application can be submitted but must be accompanied with a detailed justification as to why the methodologies in the criteria do not support certification yet the site does meet ‘equivalent capability’. This application will be nonroutine and may require consultations with the Inspector or regulatory land manager (ASRD) prior to submission to avoid a refusal if the justification is found unacceptable.

The certification criteria apply to wellsite leases and access roads, and associated facilities such as borrow pits, campsites, and offsite sumps. They do not apply to facilities or features that are left in place as developed (e.g., roads, pads, dugouts) with the land owner/manager written approval although these facilities or features will be covered by the reclamation certificate. These facilities or features must be stable, nonerosive and nonhazardous and have no impact to off-lease lands.

Based on experience with the 1995 Update (Alberta Environment, 1995) and 2007 Forested Guideline (Alberta Environment, 2007), the consensus was the need for a staged criteria that allowed for more rapid assessment of satisfactorily reclaimed sites (*i.e.*, that will qualify for *Reclamation Certification* after a Level 1 assessment) versus sites that have anomalies that might still pass after a more detailed (Level 2) assessment. Sites that fail either the Level 1 or Level 2 and must be mitigated.

A fundamental principle carried forward in these criteria is that the success of land reclamation is measured against the representative (adjacent) site conditions with due consideration for construction norms at the time of development. The criteria will be used to judge reclamation success and issue the reclamation certificate. The operator must supply information relative to the criteria on the Wellsite Reclamation Certificate Application. The Assessment Tools for each land type pose Yes/No questions based on what is present onsite compared to offsite and whether it meets the standard set out in the Rationale. The answers to measured and ratings questions are automatically generated as the operator fills in the data in the Record of Observations.

The 2010 Reclamation Criteria is comprised of two components that include:

Rationale and Methodology: This outlines the standards and methodology used for assessing various components of the Landscape, Vegetation, and Soil Assessments that make up the 2010 Reclamation Criteria.

Assessment Tool and Record of Observation (RoO) Datasheets: The Assessment Tool for each land type pose Yes/No questions based on what is present onsite compared to offsite and whether it meets the standard set out in the Rationale. The answers to measured and ratings questions are automatically generated as the operator fills in the data in the Record of Observations (RoO) Datasheets. These can be found in Appendix D.

3. Land Types in the 2010 Criteria

Under the 2010 Criteria, the following land types have been identified: Forested, Cultivated, Grasslands and Peatlands. The definitions of the land uses follow:

Forested lands includes any treed land, whether or not the forest vegetation is utilized for commercial ventures. Treed (bush) lands in the White Area (deedable land) that is to be maintained as 'treed' shall meet the forested criteria. Land in the White Area where a land use has been changed to cultivation must meet the cultivated criteria. In the Green Area (crown land), native meadows or range improvement areas in grazing dispositions may be assessed using the grasslands or cultivated lands criteria, with approval from the land manager.

Cultivated lands include lands managed under conventional, minimum or zero till practices for agricultural purposes. Land use changed from peatland, forested land or grassland to cultivated land is included here. The cultivated land criteria also applies to tame forages, hay lands or areas seeded to perennial agronomics.

Grasslands include lands that are permanently grassed that include a native component. Native grasslands commonly present a mixture of different native grass species, forbs (flowering/broad-leaved species), shrubs (woody species) and tree species, whereas tame grasslands produce agronomic seeded grass and legume species such as timothy and alfalfa. Grasslands may have a percentage of both native and tame species, hence the name modified and are to be assessed under Grassland Criteria. For grasslands that have been cultivated/seeded to agronomic species

and the land use goal is to be managed as tame forage for hay or pasture, they shall be assessed under the Cultivated Land criteria.

Peatlands include areas where the end land use is to be a functioning bog or fen. Where disturbed peatlands are to be reclaimed to an alternative end land use (*i.e.*, cultivated land or forested land), agreement with the landowner/manager must be reached and the reclamation criteria for that agreed land use is to be used for assessment purposes.

3.1. Land use changes

If a site changes land use (Figure 1), the landowner/occupant/manager should be involved in the discussion but any such changes will require their written approval. Should a landuse change occur Assessors should refer to Figure 1 for the appropriate Criteria to use for conducting the reclamation assessment.

3.1.1. Changed landuse from Peatland to Forested

On former peatland sites that have been reclaimed to a forested ecosystem, the soils quantity criteria does not apply, however the site must be assessed for soil stability, vertical processes and vegetation. The area must not cause offsite impacts. Vegetation may not be representative of the adjacent offsite (wetland) but must be on the same trajectory as a corresponding offsite upland eco-site based on the eco-site guide for the region.

3.1.2. Changed landuse from Cultivated to Forested

On former cultivated sites that have been reclaimed back into a forested ecosystem, such as a managed woodlot, the forested criteria would apply. For cultivated sites that have been reclaimed back into intensively managed short rotation systems (e.g. plantations, biomass plantations, etc.) the cultivated criteria would still be applicable. Vegetation may not be representative of the adjacent offsite and would rely on the professional judgement of the assessor with respect to the successional trajectory of the replanted area.

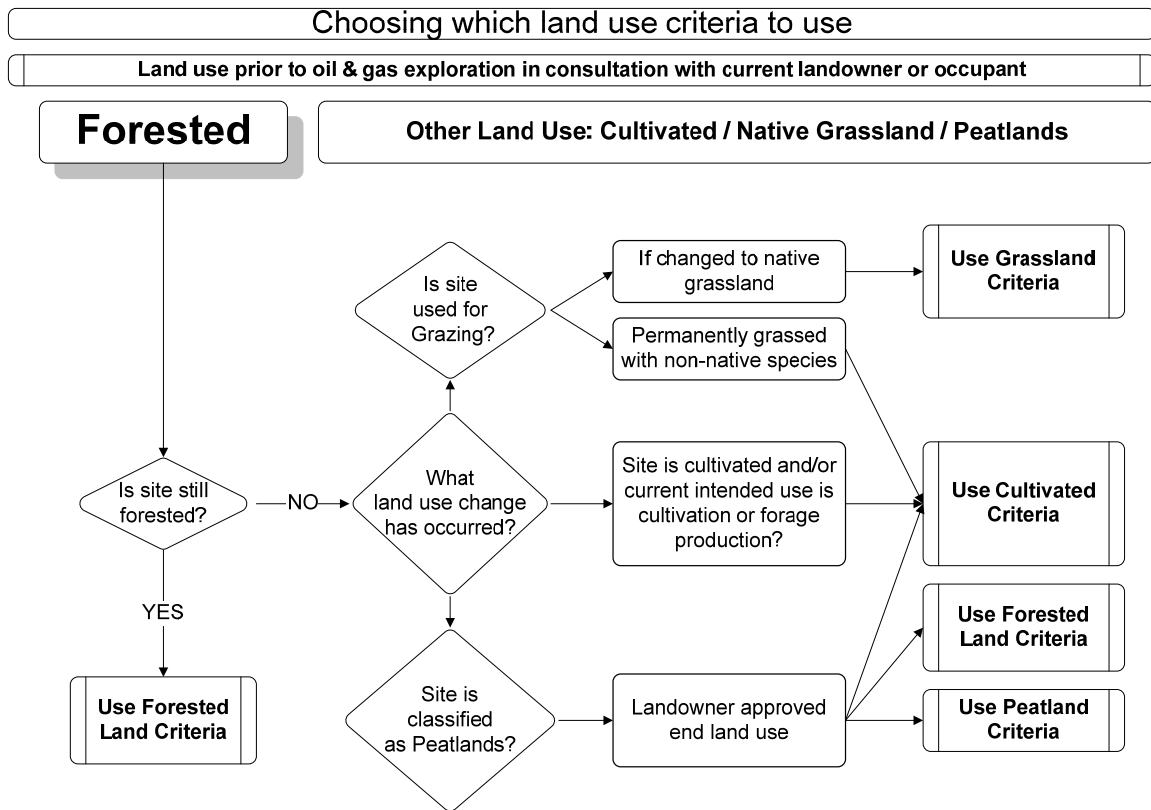


Figure 1. Selection process for Forested sites on selecting an appropriate land use criteria for sites which may or may not have undergone a land-use change.

Note: If a site changes land use, written approval from the land owner/manager is required.

4. THE ASSESSMENT PROCESS ON FORESTED LANDS

Forested Lands includes any treed land, whether or not the forest vegetation is utilized for commercial ventures. The Forested Land reclamation criteria have been developed with an understanding that where forest presently exists, the post-reclamation land use will also be forested. Successful reclamation of forested landscapes will involve the establishment of woody and herbaceous forest plant communities. These criteria assess the development of the site along the trajectory towards the target forest community.

Table 1 outlines the various construction periods that shall apply to the implementation of the 2010 Reclamation Criteria for Forested Lands. The assessment includes sections on Landscape, Vegetation and Soils. Under the **Landscape Assessment**, landscape criteria are assessed by looking at the site as a whole, in the context of adjacent land and if available, the pre-disturbance

conditions. Differences between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or offsite. For the **Vegetation Assessment** there is a greater emphasis on vegetation as an indicator of equivalent land capability, ecosystem function and/or operability. This equates to greater assessment requirements for vegetation. For the **Soil Assessment** the depth of topsoil distribution onsite is allowed to vary similar to the measured natural variability of the offsite control. All surface soil must be salvaged and replaced on the site as per the 95 Update and 2007 Forested Guideline. The depth of topsoil distribution onsite is allowed to vary similar to the measured natural variability of the offsite control. However, topsoil replacement requirements/tolerances acknowledge different eras in construction practices, natural variability and sampling error.

The process involves a staged assessment with Level 1 and Level 2 methodologies for all land uses. Should on and offsite conditions support 'Yes' answers in the Level 1 Assessment Tool, the site passes. A Level 2 is triggered on marginal sites or where anomalies are encountered at a Level 1 and further investigation assists in making a Pass/Fail decision. The Level 2 offers both focused or broad-spectrum diagnostic tests, chosen according to the discretion of the reclamation practitioner, on either the Vegetation, Soils or both in order to discover whether a problem exists. After ruling out any problems in Level 2, the site passes. If a problem persists, mitigation will be necessary.

Assessment density and level of detail are described in the document are the minimum acceptable. On sites with a great deal of variability, or sites where justification for deviation from the criteria is submitted, more detail may be required. If some parameters do not pass, an application may still be submitted if it is accompanied by a defensible rationale of why the site is eligible for certification.

4.1. Vegetation override

Where reasonable forest cover (*i.e.*, amount, species and distribution) is present, and where activities to meet the conditions described in this criteria risk existing ecosystem functioning, a vegetation override may be appropriate. Equivalent capability for forested landscapes must be demonstrated. The use of a vegetation override will result in a nonroutine application and will result in greater scrutiny by the landowner/land manager.

4.2. Items out of scope

Contamination: Drilling and other oilfield wastes must be properly disposed of according to ERCB guidelines. All contamination must be treated prior to application for certification. Specific criteria for the assessment and remediation of contaminants (*e.g.*, salts, metals, sterilants, organic chemicals) are addressed by Alberta Environmental Tier 1 (Alberta Environment, 2009a) and 2 (Alberta Environment, 2009b) criteria.

4.3. Implementation of the 2010 Forested Lands Criteria

All disturbed sites (*i.e.*, stripped, compacted) are to be assessed for all landscape, vegetation and soils parameters. If soils have not been disturbed then the site is to be assessed for landscape and vegetation parameters. If access the is impeded due to large trees or hazardous site conditions, approval for an alternate assessment is needed from the land manager. The implementation schedule in Table 1 is intended to outline the pass/fail parameters.

Table 1. Implementation dates for the new reclamation criteria based on construction period.

Constructed Before April 30, 1994		Constructed from April 30, 1994 to June 1, 2007		Constructed After June 1, 2007
^a Sites abandoned and/or reclaimed		^a Sites abandoned and/or reclaimed		^a Sites abandoned and/or reclaimed
Before June 1, 2007	After June 1, 2007	Before June 1, 2007	After June 1, 2007	After June 1, 2007
Landscape Criteria				
Sites are expected to comply with all aspects of the Landscape components of the 2010 Criteria				
Vegetation Criteria				
Sites are encouraged but not required to comply with vegetation expectations.	Sites are expected to comply with all vegetation components of the 2010 Criteria.	Sites are encouraged but not required to comply with the vegetation expectations.	Sites are expected to comply with all aspects of the 2010 Criteria.	Sites are required to comply with all aspects of the 2010 Criteria.
Topsoil Replacement Pass or Fail Conditions by Construction Period				
Sites are encouraged but not required to comply with soils expectations.	Sites are encouraged but not required to comply with soil expectations.	Sites are expected to comply with the soil components (extenuating soil situations may arise).	Sites are expected to comply with all aspects of the Criteria. Where extenuating conditions exist, topsoil justifications may be accommodated upon written request.	Sites are required to comply with all aspects of the 2010 Criteria.

WHITE ZONE: For forested white areas going to forested reclamation with landowner acceptance sites are required to comply with all aspects of the 2010 Criteria and must meet the following:

- a) Sites constructed before April 30, 1994: Topsoil depth replacement must have less than 40% variance between the lease mean and the control mean (*i.e.*, Lease Mean = $\geq 60\%$ of Control Mean); or,
- b) Sites constructed after April 30, 1994: Topsoil depth replacement must have less than 20% variance between the lease mean and the control mean (*i.e.*, Lease Mean = $\geq 80\%$ of Control Mean).

^a ‘Reclaimed’ in this situation refers to sites that have had site re-contouring, soil replacement and seeding completed. If there is no indication of the reclamation date in the company’s or the land owner/manager’s file then default to the abandonment date.

Assurances of soil conditions will not be required provided that documentation is submitted indicating that soils have not been disturbed (*i.e.*, stripped, compacted) and all other criteria have been met.

4.4. Assessing and Sampling The Site

4.4.1. Assessment Tool and Record of Observation Datasheets

The 2010 Reclamation Criteria include additional tools for conducting the landscape, soil and vegetation assessments. The Assessment Tool for each land type pose Yes/No questions based on a comparison of onsite to offsite conditions and whether the site meets the standard set out in the Rationale. The answers to measured and ratings questions are recorded in the Record of Observations (RoO) Datasheets. These can be found in Appendix D. These are also included within the Excel workbook that accompanies the 2010 Reclamation Criteria. Also in the Excel workbook are the following:

- **Title Page:** Title page for the site
- **Table of Contents:** Table of Contents for the Assessment Tool Workbook
- **Site Background:** For documenting the site background, special land management conditions, landowner/occupant/manager comments
- **Site, Lease, and Access Sketches:** The site sketch should delineate the areas of the lease affected by soils handling or other activities. Careful attention shall be paid to these areas. The site sketch should include changes to drainage patterns, slope, vegetation and any anomalies of offsite versus onsite (Appendix D).
- **Assessment Tool:** Contains questions related to the Landscape, Vegetation and Soils Criteria which may or maynot require either a Yes/No answer, rating, measurement or some combination thereof (Appendix D).

Note: *The use of justifications (e.g. Appendix F) to explain why a 'Yes' response was not always possible indicates a "nonroutine" assessment and triggers a technical review.*

- **Record of Observation (RoO) - Soil Datasheets:** Datasheet for recording soil information, measurements and observations. Separate sheets are included for the Level 1 and Level 2 soil assessments (Appendix D).
- **Record of Observation (RoO) - Vegetation Datasheets:** Datasheet for recording vegetation information, measurements and observations (Appendix D).
- **Rating Tables:** Rating tables for the vegetation and soil parameters requiring ratings for the Forested Land Criteria (Appendix E; FRT – Forested Rating Table).

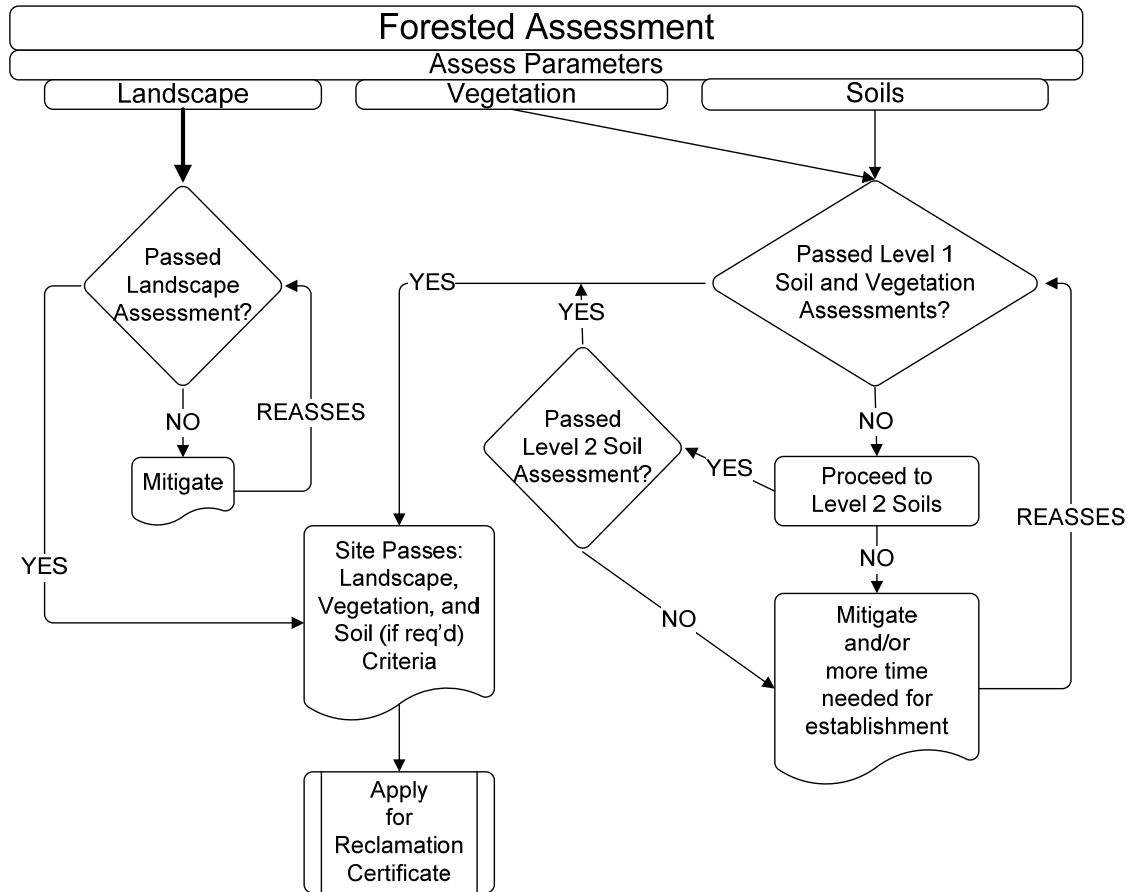


Figure 2. Assessment decision path for Forested sites

4.4.2. Sampling the Access

4.4.2.1. ACCESS ROADS (<400 M)

Assessment of linear leases poses additional limitations as the spatial distribution of both the control and onsite assessment locations must address variability in site conditions. Use of assessment locations randomly located within the lease width and along the lease length can compensate for the anticipated variability. On and offsite assessment locations shall be paired and representative of either the disturbed or control areas. For access roads of less than 400 m, assessment locations within the lease shall be every 100 m (Figure 3).

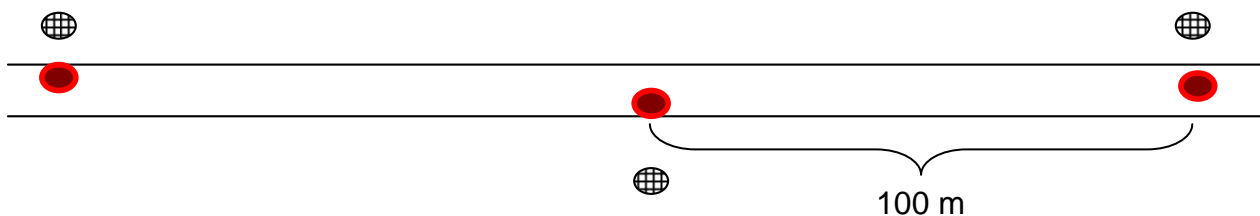


Figure 3. Soil assessment locations along an access route <400 m in length.

4.4.2.2. ACCESS ROADS (>400 M)

An assessment scheme recognizing distinctly different mapping units, *i.e.*, topographic, vegetation and/or soils variability as *per* the AENV '2001 Draft Reclamation Assessment Criteria for Pipelines' shall be used (Figure 4). In this scenario, differing map units must be identified within the assessment and a minimum of one (1) assessment point per per map unit or a minimum of one (1) assessment point *per* 800 m.

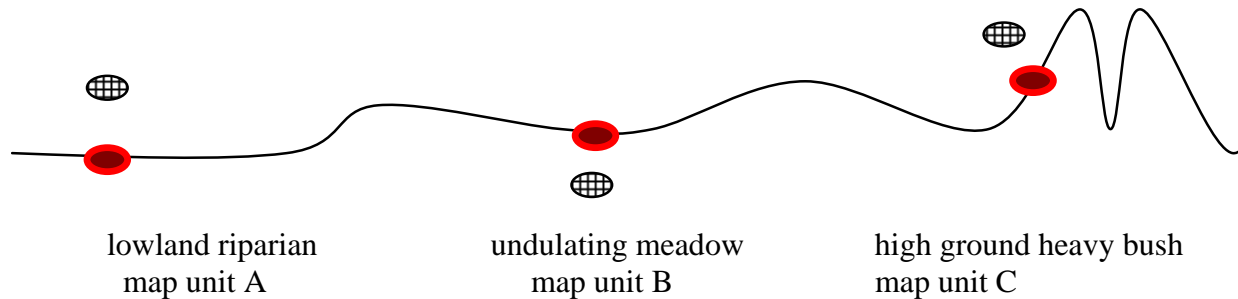


Figure 4. Soil assessment locations along an access route >400 m in length.

4.4.3. Sampling the Site

To ensure that small anomolous conditions are not used to describe the site, the basic soil and vegetation sampling method is a grid system (Table 2; maximum 40x40 m grid size). The basic sampling unit is a circular plot with a 1.78 m radius totaling 10 m². The assessment locations need not be located equidistant across the lease and should include the following five locations if known: well centre, sump, flare pit, production areas and entrance to the lease. The well-centre plot shall be as close to the wellbore location as possible to assess the reclamation conditions at this heavily affected location.

The access road plot shall be placed to assess conditions at the point where high levels of traffic impacts likely affected the site. Based on landscape variability more control locations may be required .

Table 2. Sampling intensity based on size of disturbance on the site.

Maximum disturbance size (m)	Minimum number of sampling locations based on 40 x 40 m grid size	Minimum number of Controls
40 m x 40 m (1600 m ²)	1	1
80 m x 80 m (6400 m ²)	4	2
120 m x 120 m (14, 400 m ²)	9	4
>120 m (>14, 000 m ²)	X	x/2 (round up to nearest whole number)

On *minimum disturbance sites* only a Level 1 Landscape and vegetation assessment is needed on the nondisturbed areas within the lease, whereas the remainder of the lease requires a complete Level 1 assessment (including landscape, vegetation and soils). At least one assessment location for each maximum 40x40m disturbed or nondisturbed area an equivalent representative control is required.

The assessment locations are not point assessments. To accommodate soil and vegetation variability, assessments shall be completed on a 1.78 m radius totaling 10 m² representative of the entire grid (Figure 5).

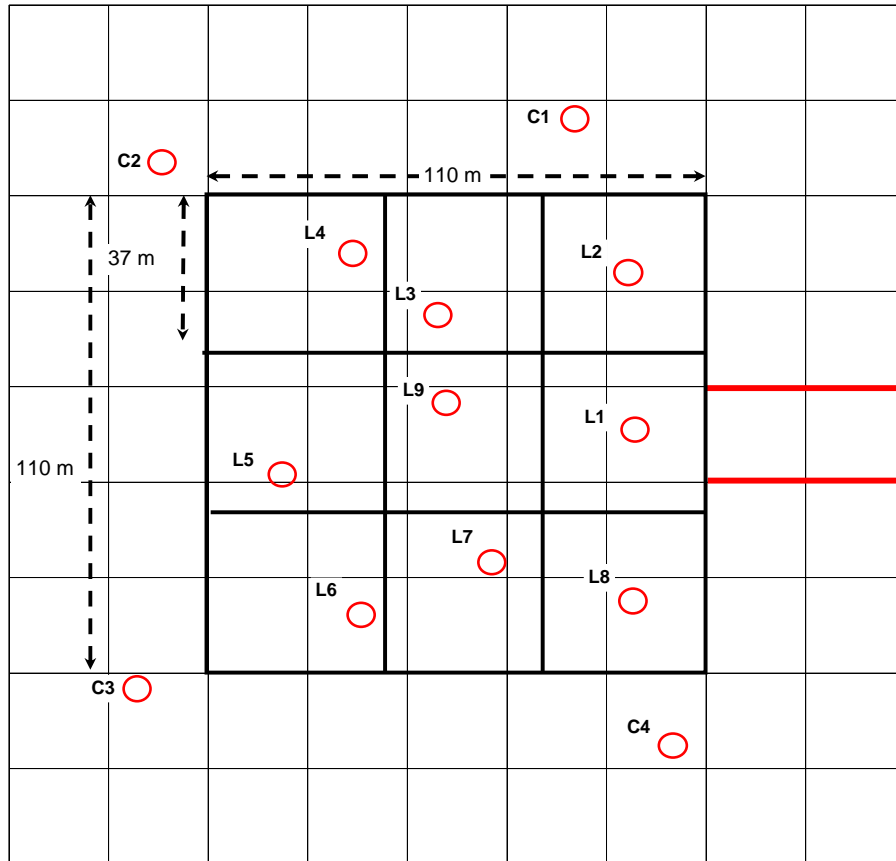


Figure 5. Level 1 assessment locations with an approximate 37 m x 37 m grid. Assessment points are representative sampling area is a circular plot with a 1.78 m radius totaling 10 m²

4.4.4. Sampling on variable sites

On variable sites (such as sites with higher slope percentages or a different land type) more than the standard nine assessment points may be required to accurately estimate topsoil depth. The key is to have representative controls.

In order to provide an understanding of topsoil replacement expectations, it is suggested that several controls be assessed, or published soil variability information consulted, prior to assessing the soils onsite.

If the landscape has two distinct zones, do assessments points on and offsite in each of the two zones (Figure 6).

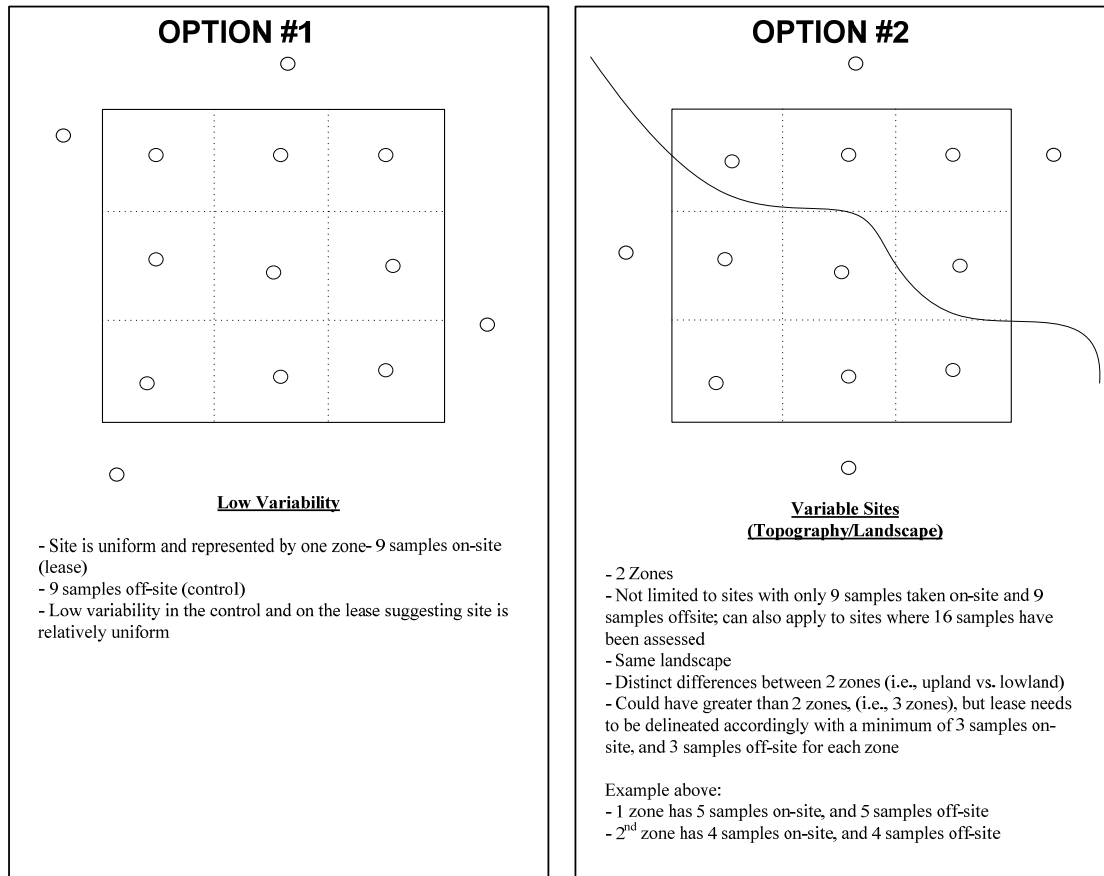


Figure 6. Site stratification the figure on the left shows two zone stratification while the figure on the right shows stratification using three zones

4.5. Assessment Comparisons

This assessment comparison methodology represents a hybrid of a capability assessment system and criteria. The assessment comprises pass/fail decisions based on rating comparisons, surrogates of ecosystem function, between on and offsite (control) assessments. Sampling differences are observed in undisturbed natural settings, even over relatively short distances. Therefore, tolerances have been incorporated into the rating system to account for this and variability in measuring. The system is designed so that no individual site can have a demonstrable adverse effect. A pass/fail for the Landscape, Vegetation and Soils assessment questions is based on Implementation Dates (Table 1) and the tolerances for rating categories and physical measurements (Table 3).

4.5.1. Rating Categories

For the Landscape, Vegetation, and Soil Assessments various parameters will require the assessor to assign ratings based on the Rating Tables found in the Rating Table Tab of the Assessment Tool. Where appropriate record the average rating, for the appropriate parameters, in either the Assessment Tool or or the RoO. The difference in the average rating between onsite compared to the offsite control rating must not be greater than 0.50. No parameter can drop more than two rating categories onsite compared to the lowest rating category offsite. Ratings for noxious weeds onsite must be comparable to the control rating offsite; no rating drops would be allowed. A pass/fail for the Landscape, Vegetation and Soils assessment questions is based on the tolerances for the ratings (Table 3).

4.5.2. Physical Measurements

For the Vegetation and Soil Assessments various parameters will require the assessor to conduct physical measurements such as topsoil depth and stem counts. These measurements are recorded in the RoO and used to compare onsite measurements with the offsite control measurements. A pass/fail for the Vegetation assessment measurements are based on the construction periods and on the tolerances (Table 3).

Table 3. Tolerances for rating categories and physical measurements for the vegetation and soil criteria according to sampling size

	For 1 lease and 1 control assessment point:	For 4 lease and 2 control assessment points:	For 9 lease and 4 control Assessment points (or larger leases):
Pass:			
Rating Categories	If only one assessment point onsite no rating drops are allowed compared to the control offsite.	The maximum total allowable drop is 2. The maximum allowable drop is one (1) rating for two (2) sampling location or two (2) ratings for one (1) sampling location.	The maximum total allowable drop is 4. The maximum allowable drop is two (2) ratings for two (2) sampling locations or one (1) rating for four sampling locations.
	Additional requirements: The difference in the average rating between onsite compared to the offsite control rating must not be greater than 0.50. No Assessment point(s) can drop more than two ratings below the minimum control rating		
Pass:	Soils: On private lands the average topsoil depth onsite must be $\geq 85\%$ of the control average		
Physical Measurements	Vegetation: Minimum 25% canopy cover of herbaceous species and ; either Minimum 25% canopy cover of woody species, Minimum stem/plant count of 5 (natural recovery); or, Minimum stem/plant count of 3 (planted) within 1.78 m radius assessment area		
Fail	Does not meet above conditions		

5. Landscape Assessment

To meet the landscape criteria, surface and subsurface drainage must be consistent with the surrounding landscape and the landscape of the reclaimed site must not pose a negative impact to site capability. Research has also indicated that restrictions to water or air movement within the soil profile (vertically and horizontally) are one of the major inhibitors to the establishment of a native ecosystem; therefore, newly reclaimed sites must not have any profile restrictions. Identification of negative impacts to site drainage are done by documenting the presence of restricted soil layers, assessment of surface water flow both on and offsite, and assessment of subsurface water flow.

Landscape criteria are assessed by looking at the site as a whole. The landscape criteria (Table 4) will be assessed by comparing the site with the pre-disturbance conditions or adjacent land. Differences between the site and the adjacent land must not interfere with normal land use and not show a negative impact on or offsite. Landscape observations are recorded in the Forest Assessment Tool.

Table 4. Landscape methodology parameters none of which require a rating.

Parameter	Assessment Tool Question
Drainage	L-1a Surface Water Flow L-2a Sub-Surface Water Flow L-3 Riparian Areas
Erosion and Stability	L-4a Soil Stability - Erosion. L-4b Soil Stability – Slumping L-4c Soil Stability – Subsidence
Bare Areas	L-5 Bare Areas
Contour	L-6a Operability – Macro- and Meso-contour L-6b: Operability – Micro-contour
Gravel and Rock	L-6c Operability - Gravel and Rock
Debris	L-7a Woody Debris L-7b Woody Debris L-7c Woody Debris L-8 Refuse

5.1. Drainage

Pre-disturbance aerial photographs, observations of the surrounding landscape and landowner consultation can help to establish what the normal direction and dispersion patterns should be. Visually assess the direction/dispersion of onsite drainage to determine whether it conforms to

the drainage of the surrounding area. If ponding is found, its presence must be documented and an explanation given regarding the site-specific conditions which indicate ponding is consistent with the site's normal state. For example, ponding may be normal depending on the pre-disturbance conditions, the surrounding landscape (*e.g.*, knob and kettle landscape) and/or the timing of assessment relative to moisture events (*i.e.*, snow melt or recent precipitation).

5.1.1. Surface water flow

Onsite drainage: Direction and dispersion of water on the lease helps to assess whether surface drainage has been adequately restored. Sites with significant soil compaction; those with sub-surface hard-pans; or those that have been poorly re-contoured often exhibit ponding. Another indicator of disrupted water direction and/or drainage is the presence of erosion on the lease. Note, however, standing water (ponding) may be normal depending on the surrounding landscape (*i.e.*, knob and kettle topography) and/or the timing of the assessment relative to moisture events (*i.e.*, snow melt or recent precipitation) and therefore not evidence of poor reclamation. Check offsite for indications of ponding, such as the presence of 'bathtub rings', water-loving vegetation types (either alive or recently dead) or lack of vegetation in depressions. The use of pre-disturbance air-photos can help establish what 'normal' direction and dispersion patterns should be.

Offsite drainage (cross-site flow; water movement off the lease): Surficial water movement is often more readily apparent than sub-surface flow, however, the impact of the lease to soil conditions may extend into the immediate sub-surface and disrupt water movement. Cross-site flow disruptions are most likely to occur with long linear features (roads) or large facilities, but the extent of the impact depends on the local hydrology and geology. The location of a lease may result in drainage patterns being disrupted. Ensuring the surrounding contours are carried into the lease and that landscape features adjacent to it are conserved should prevent a change in the pattern of flow. Where onsite drainage may serve to collect and re-direct water, offsite sediment fans, deposition of organic matter fans, and/or ponding on the up- or downslopes adjacent to the lease are evidence of offsite impacts to surficial drainage.

5.1.2. Drainage

Pattern of drainage: Changes in sub-surface flow can be indicated by changes in offsite vegetation health and vigour or yield and/or cover density. Assessment of the criteria is visual and there shall be no evidence of offsite impacts to sub-surface hydrological patterns.

5.1.3. Ponding

Ponding: Evidence of offsite (upstream) ponding could indicate the lease has interrupted subsurface drainage. The presence of offsite ponding must be documented and where present, explain how this is due to conditions other than the presence of the reclaimed lease. Assessment is visual and there shall be no evidence of offsite ponding as a result of the reclaimed lease.

5.1.4. Riparian functions

Riparian lands are transition zones between land and water bodies and include any geographic area that adjoins or directly influences a water body (*e.g.*, streams, lakes, ponds, wetlands

including floodplains) and land that directly influences alluvial aquifers and may be subject to flooding. These lands fall under the Water Act, which protects all water resources in the province (Appendix A). See ERCB Directive (in process).

5.1.4.1. *BANK OR SHORE STABILITY*

There shall be no evidence of shore/bank instability (slumping, channelling within banks) greater than is found on the offsite bank or shore.

The ERCB's Directive 56 along with other applicable provincial and federal legislation (Environmental Protection and Enhancement Act, Water Act, Public Lands Act and the Navigable Waters Protection Act) requires water bodies be protected during construction and through the operating life of the project.

For reclamation, if the lease abuts a water body's bank or shore, there should be no evidence of shore/bank instability (slumping, channeling within banks) greater than is found on the offsite bank or shore. The vegetation must be a comparable, self-sustaining native vegetative community or is on a corresponding successional trajectory to the surrounding area. Short lived nonnative species may be appropriate to assist with shore/bed stabilization. If the reclamation strategy was not discussed upfront with the landowner/regulator, than it is suggested the reclamation strategy should be discussed with the landowner before initiating reclamation.

5.2. Erosion

5.2.1. Water erosion

Gullyng: This is evidence of a major flow problem and its presence would normally preclude reclamation certification; however, gullyng may be part of the normal processes on certain sites. If so, evidence must be provided to substantiate that the degree, spatial extent, rate and severity of the documented onsite gullyng is consistent with the surrounding area or pre-disturbance conditions.

Rilling, pedestaling or presence of offsite soil-fans: These are evidence of excessive surface water flow and often result in a loss of the nutrient-rich topsoil. Movement of soil across the site and especially to offsite areas are significant concerns as these conditions can reduce the productivity of the site. Evidence of small-scale erosion (*i.e.*, movement of materials at the centimetre scale) does not constitute risks to a site's functioning and is not considered a negative characteristic. Small scale is erosion occurring only on site and the material remaining on site rather than loss of soil.

5.2.2. Wind erosion

Leaf abrasion, plant pedestaling and soil deflation are evidences of wind erosion, which may result in a loss of vegetative health. Evidence of wind erosion cannot be greater than in the surrounding landscape.

5.3. Soil Stability

5.3.1. Slumping/wasting

Slumping and wasting (mass movement of soil) is not normally seen on most forested sites; however, locations may exist where naturally unstable slopes move and slumping/wasting are normal. Any slumping and/or wasting on a reclaimed site must be documented and evidence from adjacent areas (or pre-disturbance information) should demonstrate that the scale and amount of slumping/wasting seen onsite is normal for the area.

5.3.2. Subsidence

Where localized and small (<4 m²) areas of subsidence are stable and unlikely to risk the site's stability, subsidence may be deemed acceptable. Stable is identified by no ongoing slumping subsidence or erosion. Rounded smooth edges rather than sharp breaks. In such cases provide documentation of the size, location and severity of the subsided area(s) and an explanation of why further reclamation efforts are not needed.

5.4. Bare Areas

Bare areas are devoid of vegetation. It does not apply to sparse vegetation on natural recovery sites.

5.5. Contour and Stone Content

5.5.1. Meso- and Macro-contours

Meso & macro contour (1 to 100 m scale): Meso- and macro-contours should be integrated with adjacent offsite landscape features and retain the character of the adjacent area's relief. It shall not result in excessive erosion, slumping/wasting or altered water flow patterns.

5.5.2. Micro-contours

Micro-contour (cm scale): Minor variations in topography on reclaimed areas often enhances conditions that promote forest vegetation species recruitment, survival and growth. Obstacle planting is a common practice in forestry where tree seedlings are planted adjacent to large woody debris or rocks to enhance protection from excess wind or sun and/or to provide a vegetationfree space for plant development. Creation of small elevated sites (*i.e.*, soil ridges) can enhance localized drainage, and increase soil temperature to enhance root development. Reclaiming the site to a 'flat' lease is not recommended.

5.5.3. Stone Content

Surface stoniness: Presence of naturally occurring stones within reclaimed areas is assumed to present no significant risks to ecosystem functioning, or normal forested land uses and can often aid in creating small-scale roughness to enhance vegetation development. Vegetation and soil

quality criteria should capture any detrimental effects should there be excessive concentrations of stones/rocks present beyond that found in the surrounding area.

5.6. Debris

5.6.1. Woody Debris

Coarse woody debris shall be spread over the site and may not be piled, windrowed or concentrated in one area as this may pose a fire-hazard. As with micro-contours and stones, coarse woody debris can moderate environmental extremes and enhance vegetation development. As it decomposes, woody debris will also contribute to soil litter and organic matter content and provide habitat requirements for smaller species.

Fine chipped woody debris such as mulched sites can be detrimental to both soil thermal conditions, the C:N ratio and plant recruitment. Excess fine chipped woody debris would require management (Alberta Sustainable Resource Development, 2009).

Managing fuel risks for wildfire threats must also be considered where accumulation techniques are practiced, particularly in areas near settlements (Alberta Sustainable Resource Development, 2007a).

5.6.2. Industrial and domestic refuse

Industrial and domestic refuse is not acceptable and must be removed.

6. Vegetation Assessment

Vegetation assessment locations are not point assessments. To accommodate vegetation variability, assessments shall be completed on a 1.78-m radius (10 m²) area representative of the max 40x40m sampling grid. The assessment includes measurements that are to be recorded in the Forest Vegetation RoO sheets and Assessment Tool. Table 5 identifies vegetation methodology parameters and their respective questions that need to be answered in the Assessment Tool and/or RoO datasheets.

Table 5. Vegetation methodology parameters and their respective Assessment Tool Questions which may or may not also require either a rating and/or physical measurement.

Parameter:	Assessment Tool Question	^a RoO Information Required (Yes / No)	
		Measurement	Rating
Desired Plants:	V-1: Desired Plants - General	Yes, document species type	No
Desired Plants	V-2: Herbaceous	Yes, document species type	No
Desired Plants	V-3a: Planted Woody Stems and Shrub Count	Yes	No
	V-3b: Planted Woody Stems and Shrub Count	No	No
Desired Plants	V-4: Unplanted Shrubs and Trees	Yes	No
Desired Plants	V-5: Herbaceous and Woody Species	Yes	No
Quantity	V-6a: Limiting Factors: Browsing V-6b: Limiting Factors: Drought V-6c-d: Limiting Factors: Health V-6e: Limiting Factors: Other	Yes, document degree of pressure	No
Undesired Plants	V-7a: Prohibited Noxious V-7b: Noxious V-7c: Problem / Volunteer	Yes	Yes
Water and Nutrient Cycling	V-8: Water and Nutrient Cycling	No	No

^a Yes = An answer to an Assessment Tool question is required in addition to a rating and/or physical measurement; No = An answer to an Assessment Tool question is required but a rating and/or physical measurement is not be required.

6.1. Desired Plants

The desired plants for forested lands are those species which are representative of that natural sub-region, ecosite, and plant community.

6.1.1.1. PLANT COMMUNITY/DIVERSITY

The assemblage of woody species should indicate development of an early successional community for the target forest type as described in one of the Guides to Ecosites of Northern Alberta, West-Central Alberta or Southwestern Alberta (Alberta Sustainable Resource Development, 2007b). These guides provide lists of species typically found on different mature forest site-types in Alberta.

6.1.2. Structure and Layers

A properly reclaimed site should contain the presence of both herbaceous and woody species that are distributed across the site. Complete colonization of a site by herbaceous vegetation (*i.e.*, grass) can preclude the recruitment of shrubs and/or trees due to the lack of appropriate micro-sites. Preventing competitive herbaceous colonizers that could inhibit or preclude the recruitment and/or development of the target forest community is desirable. If provided space to establish, larger stature species (woody shrubs and tree seedlings) will eventually out-compete the herbaceous vegetation and reduce their extent on the site. Thus, an added assurance that the site is progressing along the target trajectory will be observation of encroachment of desirable species onto the site from the adjacent forest.

A minimum stem count of 5 is required for natural recovery sites. If the site has been planted with merchantable seedlings as per the reforestation standard the minimum allowable stem count is 2. These counts must occur within the assessment location.

For sites planted with merchantable species the expected planting density is 2000 stems per hectare, or 2 stems per assessment location.

If the site has been planted to merchantable seedlings a minimum of 2 growing seasons are required prior conducting the Vegetation Assessment for the submission of a reclamation certificate application.

6.1.2.1. WOODY SPECIES

List dominant desirable woody species: vegetation assessments at control locations are intended to identify the target community, ecosite and community variability. Ecosite site guides may be used to identify appropriate vegetation targets. Onsite vegetation species must be appropriate for the representative ecosites. Nonrepresentative species do not count towards species diversity or percent live cover. Onsite measurements for the dominant desirable species include:

- List three dominant desirable species
- Average Height (m)
- Percent canopy cover (shrub and tree *sp.*). Data should be recorded in both the Assessment Tool and RoO.
- Woody Stem count (tree *sp.*) and Plant count (shrubs) Stem and Plant counts are one option for assessing vegetation establishment and success on a reclaimed site. Stem and Plant counts of trees and shrubs are to be conducted within the basic sampling unit, a circular plot with a 1.78 m radius (10 m²) (FRT.1; Appendix E). For sites planted with merchantable species the expected planting density is 2000 stems per hectare , or 2 stems per assessment location. Data should be recorded in both the Assessment Tool and RoO.
- Branch leader growth (cm) for previous year: record tree growth indicators of leader increment (length of past year's terminal growth using bud scale scars) and crown expansion.

- Branch leader growth (cm) for current year: record tree growth indicators of leader increment (length of the current year's terminal growth using bud scale scars) and crown expansion.

6.1.2.2. *HERBACEOUS SPECIES*

List dominant desirable herbaceous (grass and forb) species: vegetation assessments at control locations are intended to identify the target community, ecosite and community variability. Ecosite site guides may be used to identify appropriate vegetation targets. Onsite vegetation species must be appropriate for the representative ecosites. Nonrepresentative species do not count towards species diversity or percent live cover. Onsite measurements include:

- List three dominant desirable species (grass and forb) and their % canopy cover
 - Total Percent canopy cover of all desirable species (FRT.1; Appendix E). Data should be recorded in both the Assessment Tool and RoO.
-

6.2. Quantity

6.2.1. Production

Historically, reclamation of forested lands focused solely on rapid vegetation using grasses or forages in order to retard erosion and prevent weeds. Where structural impediments to erosion (*i.e.*, surface roughness, adequate vertical water flow) are in place, the use of vegetation for erosion control is unnecessary. Instead, there should be a development of a greater variety of species that will facilitate the redevelopment of the target forest plant community. The actual amount of cover will be a function of the timing of the assessment and the type of target forest community. Rather than a single minimum cover value as a measure of equivalent capability for all forest types, evidence of the presence and a reasonable spatial distribution of appropriate vegetation will suffice. Evidence of woody plant growth provides an assurance that there are no significant site limitations. Where growth is inconsistent across the lease and/or poor relative to similar-sized off-lease vegetation for similar time periods, the presence of site limitations to plant productivity are likely.

Heavy wildlife or domestic animal browsing, drought conditions and/or third-party impacts (*e.g.*, recreational use) may account for poor growth not linked to inadequate site conditions. If so, documentation must be included.

6.2.2. Grazing/browsing pressure

Document the occurrence and extent of browsing if observed. Data should be recorded in both the Assessment Tool and RoO.

6.3. Quality

6.3.1. Plant Growth, Development

Vegetation health or quality is partially assessed through a visual assessment of health. Onsite vegetation should not appear chlorotic (yellow), as this is often an indication of poor plant health or severe limitations caused by poor soil/site conditions (*i.e.*, excessive surface soil moisture, compacted subsoils, lack of adjacent organic matter). Localized chlorosis within one area of a lease may indicate localized site limitations. Widespread chlorosis may be indicative of significant site limitations or plant response to severe weather conditions (*i.e.*, drought).

6.3.2. Limitations affecting vegetation

Document visual indications affecting growth including (drought, health or other third party impacts). Data should be recorded in both the Assessment Tool and RoO.

6.4. Undesirable Plants / Weeds

Nonnative species are to be used only where their benefits to site properties are known and the species are part of a plan to improve and/or stabilize a site. These species should not be persistent and cannot be used to contribute to meeting the vegetation criteria. For example, the use of agronomic annuals for early erosion control is an appropriate use of nonnative species. Persistent weeds require active management to control or eradicate, and are a barrier to the vegetation developing into the desired plant community.

Weeds must be assessed and managed as per the Weed Control Act. Enforcement of the Weed Control Act falls under the jurisdiction of the local authority. There are two main classifications of weeds: Prohibited Noxious and Noxious.

Weeds are generally defined as undesirable or unwanted plants. Undesired plants shall be controlled (*i.e.*, noxious, volunteer crop, incompatible species, etc.) or destroyed (*i.e.*, prohibited noxious) so that they do not impede landowner/occupant/manager operability and/or management. The distribution of weeds may have been influenced by wellsite activity, particularly in adjacent areas offsite. Therefore, ensure that the control samples are representative of the surrounding area or parcel of the land. Enforcement of the Weed Control Act falls under the jurisdiction of the municipality, who should be contacted for their list of noxious and restricted weeds.

A minimum of one growing season is required following the use of herbicide before submitting a reclamation certificate application.

Weed species shall be recorded, identified as prohibited noxious, noxious, problem, or volunteer and each species' or category distribution rated. For problem and/or volunteer (*i.e.*, invasives) weeds, concentration and distribution shall not interfere with land management practices or the functioning of the native plant community. Data shall be recorded in both the Assessment Tool and RoO (Appendix E; FRT.2).

6.5. Water and Nutrient Cycling

6.5.1. Litter and LFH

The amount of litter and/or thickness of the surface organic horizons (LFH) are surrogate measures of the redevelopment of a site's nutrient cycling function. LFH depth and/or form can be a useful indicator for assessing the extent of a site's re-establishment of nutrient cycling. Litter development data shall be recorded in both the Assessment Tool and RoO.

7. Soil Assessment

Surface soil or topsoil is defined as the uppermost mineral material, valued as a growing medium. All surface soil must be salvaged and replaced. (Both mineral topsoil and organic horizons, *i.e.*, LFH & Of, should also be salvaged.) Topsoil replacement requirements/tolerances acknowledge different eras in construction practices, natural variability and sampling error.

Soils assessment locations are not point assessments. To accommodate soils variability, assessments shall be completed on a location within the 1.78 m radius totaling 10 m² area representative of the max 40x40m grid. If documentation that soils have not been disturbed (stripping, compaction, etc) soils assessment will not be required. Determining physical properties of soil (*i.e.*, compaction and soil structure) may be restricted to the well-centre and access road locations as appropriate. The assessment includes measurements that are to be recorded in the Forest Soils RoO sheets. Table 6 identifies soil parameters and their respective questions that need to be answered in the Assessment Tool and/or RoO datasheets.

7.1.1. Soil Quantity and Quality

Relevant soil parameters include the presence, quality and consistence/structure of topsoil. The absence of rooting restrictions is an indication of soil quality.

7.2. Level 1 Soil Assessment

7.2.1. Surface characteristics

Surface soil compaction or slaking may prevent germination of seeds and/or impede water infiltration. Lack of surface organic matter and vegetation will increase the likelihood of the development of compacted surface soils and excessive surface water flow. The impacts of inappropriate surface characteristics are captured through the vegetation and/or landscape criteria.

7.2.2. Evidence of soil disturbance

The assessor should document the evidence of soil disturbance in both the Assessment Tool and RoO.

7.2.3. Topsoil Depth: Nutrient storage and delivery

Top soil salvage and appropriate re-distribution is required. Appropriate site preparation includes the salvage of forest floor (LFH) and all the topsoil (Ah, Ahe and Ae). If the topsoil depth is <15 cm, conservation must include the topsoil plus the B-horizon up to a total depth of 15 cm unless the B-horizon is considered unsuitable (chemical or physical limitations).

Table 6. Soil methodology parameters and their respective Assessment Tool Question which may or may not also require either a rating and/or physical measurement.

Parameter:	Assessment Tool Question	^a RoO Information Required (Yes / No)	
		Measurement	Rating
Soil Quantity	S-1 Disturbance	No	No
Soil Quantity	S-2 Distribution	Yes	No
Vertical Processes	S-3a-b: Texture S-4a-b: Consistence S-5a-b: Structure S-6a-c: Rooting Restrictions	No	Yes
Level 2 Soil Assessment	S-7a-b: Texture S-8a-b: %-Clay S-9a-b: Organic Carbon S-10a-b: pH S-11a-b Electrical Conductivity (EC) S-12a-b: Sodium Adsorption Ration (SAR)	Yes	Yes

^a Yes = An answer to an Assessment Tool question is required in addition to a rating and/or physical measurement; No = An answer to an Assessment Tool question is required but a rating and/or physical measurement is not be required.

A principle in salvage and redistribution of topsoil is not to dilute and/or bury the nutrient-rich LFH and A horizons by over- or under-stripping. Where a thick Ae horizon exists (*i.e.*, >15 cm), the intent would be not to mix the nutrient rich layers (LFH, Ah, Ahe) with the less nutrient rich Ae horizon. Generally, however, the Ae horizon has better soil physical qualities than the underlying B-horizon. Two-lift stripping (LFH, Ah, and Ahe) and (Ae) is recommended as it helps to ensure all organic rich and texturally valuable topsoil is available for reclamation. In order to represent the soil salvaged from the site, when determining Control soil quantity and quality, collect a representative sample from the A horizons (Ahe, Ah, Ae) or, in thin soils, a mix of the top 15 cm of the mineral soils.

7.2.3.1. TOPSOIL DEPTH

Topsoil depth shall be assessed at each assessment location to determine quantity, including spatial distribution requirements, and quality. The LFH is not included when measuring the control topsoil depth. The assessor should Data should be recorded in both the Assessment Tool and RoO. Topsoil depth estimation may be most effectively assessed and documented immediately after topsoil redistribution rather than at the time of site assessment, however, use of a larger soil assessment area should overcome problems where topsoil has been disturbed due to site rehabilitation techniques (*i.e.*, plowing).

7.2.3.2. TOPSOIL DISTRIBUTION

For each assessment point, measure topsoil depth and calculate its percentage of the control mean. Rate each assessment point from 1 – 4 (FRT.3; Appendix E), and average the rating numbers, compare the average on and offsite ratings. If the average of the lease rating is greater than 0.50 compared to the average offsite control rating, then lease fails.

7.2.4. Vertical process

7.2.4.1. SOIL TEXTURE: MOISTURE STORAGE CAPACITY

The **soil textural class** is an indicator of water-holding capacity, nutrient storage and soil tilth and shall be comparable on the reclaimed and undisturbed landscape. Admixing of lower horizons with upper soil horizons may result during stripping, hauling and replacement of the thin upper forest soil horizons. Improvements in texture class, or water holding capacity, on the lease compared to the control are acceptable; however, changes to texture may result in a change in land capability and, in some cases, the need for special management. Soil decompaction practices (*i.e.*, deep ripping) may contribute to admixing but the benefit of decompaction—*relief of rooting restrictions and the creation of improved soil structure*—are considered of greater benefit to vegetation development and ecosystem function than the negative impacts of soil textural change.

To maintain similar quality, soil textures on the lease and the control shall be the same class. These conditions are reflected in the ratings. Improvements in texture class, or water holding capacity, on the lease compared to the control would be acceptable. To determine soil texture, collect a representative handful from the surface horizon, crush it by hand, and determine texture and rated (FRT.4; Appendix), Data should be recorded in both the Assessment Tool and RoO.

7.2.4.2. SOIL CONSISTENCE AND STRUCTURE

Consistence (the strength of soil described as friable, firm, plastic, *etc.*) and **structure** (the shape of soil aggregates resulting from the combination and arrangement of sand, silt and clay held together by net charges and organic matter) provides a qualitative measure of the soil's ability to allow root penetration, and air and water movement through the profile. Consistence refers to the combination of soil properties that determines its resistance to having its structure changed either through crushing or being remolded into a different shape. Degradation of structure and progression to firmer consistence are indicators of admixing, compaction or poor reclamation procedures, which make the soil vulnerable to water and/or wind erosion inhibit rooting, which may impair productivity. A large change in soil structure, particularly to a massive structure,

would constitute a significant limiting condition that could negatively impact normal soil processes and vegetation development.

Soil consistence (Table FRT.4; Appendix E) and structure (FRT.5; Appendix E) provide a subjective measure of the suitability or limitation of the soil air and water movement and root penetration. Soil moisture conditions at the time of the assessment shall be noted. Moist conditions are the most suitable for determining consistence. Use the mesostructure (e.g. subangular or angular blocky) rather than the macrostructure (e.g. prismatic) when rating the structure. If the macrostructure is more limiting to roots it takes precedence over the mesostructure. For example, in Solonetzic soils the columnar macrostructure often takes precedence over the angular blocky mesostructure. Similarly, in compacted soils, the compacted macroscale layers take precedence over the angular blocky peds. If topsoil or subsoil consistence are rated (1), there is no further assessment required. If it is rated 2 or lower, determine the structure rating. The final rating is the most limiting of the two. For example, a consistence rating of 2 and a structure rating of 3 results in a final rating of 3. Note that structure and consistence are rated separately for topsoil and subsoil. Data should be recorded in both the Assessment Tool and RoO.

7.2.4.3. *ROOTING RESTRICTIONS*

Evidence of exped rooting or root mats may indicate restrictions in the vertical moisture processes (to 50 cm deep). Indicators identified in Table 7 provide operationally feasible assessment indicators of impaired vertical moisture dynamics. Document the presence of any of these indicators and if necessary provide justification that root habit, form and distribution are consistent with that found on the offsite controls. The assessor should visually assess the absence or presence of any rooting restrictions in the soil profile and rate according to the Rating Table provided in the Assessment Tool (FRT.6; Appendix E), Data should be recorded in both the Assessment Tool and RoO.

7.2.4.4. *MOISTURE DYNAMICS*

Compacted soils and/or the presence of compacted soil layers can severely limit the soil's functioning and vegetation development. Ponding (beyond that in adjacent controls) results from impeded vertical and surface drainage. The presence of massive, dense or layered structure (compacted horizon within the soil profile) or abrupt textural or structural changes are indicators of poor vertical moisture flow. The presence of hardpans in offsite control areas (e.g., solonetzic soils) shall be documented to justify the presence of onsite restricted layers consistent with adjacent land. Normally, gleying will not be evident within the timeframe of reclamation assessment; however, should mottles and/or gleyed horizons be found on the lease, their presence and depth should be similar to the controls.

Table 7. Commonly observed indicators or root, permeability and aeration restrictions

Vertical Root Elongation	Water Permeability	Soil Aeration
<ul style="list-style-type: none"> • Presence of root mats and bunches; • Presence of flattened and highly branched roots; • Presence of exped roots; • Presence of soil layers or abrupt texture or structure changes; • Absence of roots within or below reconstructed soil zones; • Absence of roots within soil aggregates; • Presence of earlyl maturing crop with reduced height and density • In mixed pature or haylands, uneven distribution of species; • Uneven crop height and density in cropland 	<ul style="list-style-type: none"> • Presence of surface ponding; • Presence of surface vehicle (equipment) ruts; • Presence of stratified or abrupt mositure changes within the soil profile; • Presence of dense, massive, or layered structure (compaction); • Presence of flooded (yellow or stunted) crop conditions; • Presence of abrupt texture or structure transitions. 	<ul style="list-style-type: none"> • Prensence of dense, massive, or layered soil structure (compaction); • Presence of reduced pore size and pore space; • Presence of brownish-red ped surfaces; • Presence of sour odors

7.3. Level 2 Soil Assessment

A Level 2 assessment can be triggered by a problem in either the vegetation or soils. A Level 2 assessment is intended to quantify relative differences between on and off the site as flagged by the Level 1 assessment (*i.e.*, rooting, consistence/structure, vegetation productivity, soil fertility, pH, salinity, sodicity); the process of which may help to isolate the problem issues requiring mitigation. Sample the Assessment points that failed the Level 1 assessment. There shall be paired sampling on and off-site, with a minimum of three lease and three control sample points. The control sample points should represent a cross-section of quality (based on ratings assigned for the Level 1 Soils). The Level 2 is therefore focused or systematic. The assessor should record information in the RoO and Assesment Tool and RoO for the following in topsoil (FRT.6;Appendix): Particle size analysis, Organic carbon, pH, EC, and SAR and in subsoil pH, EC, and SAR

7.3.1. Sampling

If a problem with the soil is indicated at Level 1 check targeted Level 2 soil parameters. If the site fails Level 2 Soils parameters, then the site fails, unless failure is unrelated to the wellsite (*i.e.*, third-party impacts).

7.3.2. Tolerances for laboratory measured values

For assessment points where a Level 1 Soil Assessment showed too great a rating drop and a Level 2 Soil Assessment was conducted to validate infield measurements assessors should examine the laboratory value for the assessment location. For sites where the lab analyses results indicate the site was within the acceptable range identified by the comparison to the control values, the site passes; if not, the site should be mitigated and re-assessed. The following ratings apply to the Level 2 soil assessment portion of the criteria with respect to soil analyses. The ratings are based on the unit differences (*i.e.*, percentage for clay and OC, dS/m for electrical conductivity (salinity)).

7.3.2.1. SOIL TEXTURE AND ORGANIC CARBON

The Level 2 component contains particle size analysis (PSA) and organic carbon content analyses with the Pass/Fail threshold based on a change in clay content or organic carbon (FRT.7; Appendix), If the Control average for %-Clay was 29.1%, and an Assessment point in the Control had a clay content of 25.6% (a difference of 3.5% from the Control), it would be given a #1 Rating. If an Assessment point on the Lease had a clay content of 35.6%, it would be given a #2 rating (a difference of 6.5% from the control). The assessor should record information in the RoO and Assesment.

7.3.2.2. SOIL PH

The ratings for pH would to some degree be based on a logarithmic scale, as the ranges represent pH unit differences from the control up to a 2 unit difference (FRT.7; Appendix), If the Lease average for pH was 7.1, and an Assessment point in the Control had a pH of 6.4 (a difference of 0.7 from the Control), it would be given a #2 Rating. If an Assessment point on the Lease had a pH of 6.9, it would be given a #1 rating (a difference of 0.2 from the control). The assessor should record information in the RoO and Assesment.

7.3.2.3. SOIL ELECTRICAL CONDUCTIVITY (EC) AND SODIUM ADSORPTION RATIO (SAR)

The Alberta Tier 1 Soil and Groundwater Remediation Guidelines (AENV, 2009) will be used for EC and SAR to determine pass/fail.

8. OTHER CONSIDERATIONS

8.1. Pests and Weeds

Alberta's Agricultural Pests Act and Weeds Control Act name a number of serious disease, insect and weed pests that spend all or most of their life cycle in the soil and/or attack below-ground parts of plants. Preventing their introduction is the first approach followed by restricting their spread. Preventive strategies include, using pest-free seed or transplants, disinfecting equipment used to work the soil, applying chemical and biological control products, and using caution when importing straw, manure and topsoil.

8.2. Topsoil additions

Although not recommended, at times where additional topsoil is desirable (*e.g.*, to avoid re-stripping a site where desirable vegetation is already established), it shall be described (*e.g.*, source, texture, volume, weed count) and shall be similar or as close as possible to the control topsoil (*e.g.*, addition of Orthic Black Chernozem to Orthic Black Chernozem). The date and method of application and incorporation, and documentation showing land manager acceptance are required.

Where the soil is not being sourced directly from the land manager, it must not be imported from areas of known weed and disease infestations. In these cases, it is recommended that testing be conducted for foreign weeds (*i.e.*, weeds not normally found in that area) and problematic diseases for the area (*e.g.*, club root).

8.3. Amendments

Amendments such as manure, compost, gypsum, straw and peat can provide physical, biological and nutrient improvements to soils. Any use of amendments must comply with the applicable guidelines and have approval from the appropriate regulator. Amendments (including peat) are **not** topsoil replacements. Where amendments are added to improve soil quality (and controls are not similarly amended), the physical and chemical properties of the amendments require characterization prior to their use.

A minimum waiting period of two years is required following the use of an amendment before doing a vegetation assessment.

9. Appendix A

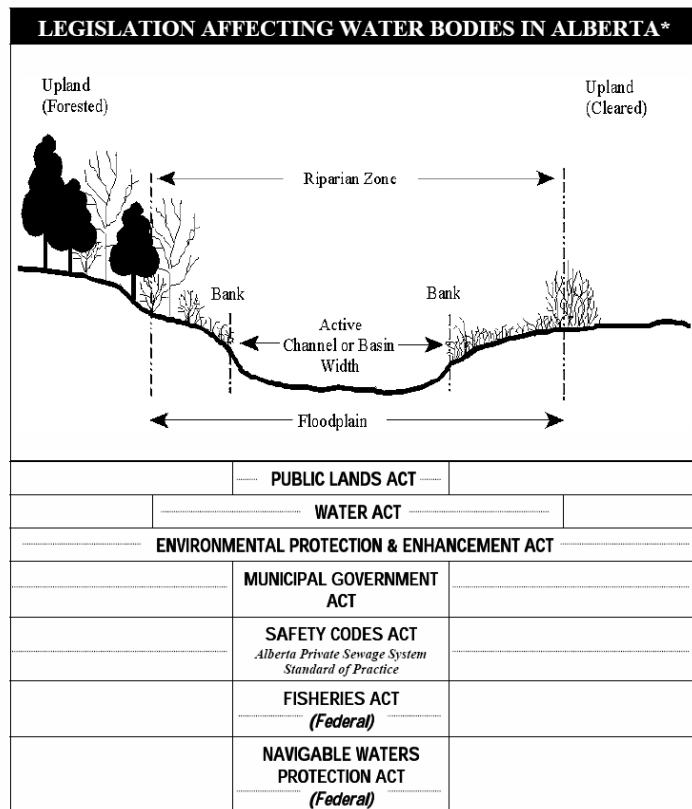
9.1. Water Act & Riparian areas (WR)

9.1.1. Landscape

The Water Act¹ specifies that a water body is any location where water flows or is present, whether or not the flow or the presence of water is continuous, intermittent or occurs only during a flood, and includes, but is not limited to, wetlands and aquifers (generally excluding irrigation works)². There are, therefore, direct implications of the Water Act regarding riparian lands.

Riparian lands are transition zones between the land and the water and include any geographic area that adjoins or directly influences a water body (e.g., streams, lakes, ponds, wetlands including floodplains) and land that directly influences alluvial aquifers and may be subject to flooding.³ In west central Alberta, fens, bogs and marshlands represent a large proportion of riparian areas. Healthy, intact riparian lands deliver broad benefits to society including water quality improvement, flood control and water storage, reduced erosion and the maintenance of terrestrial and aquatic biodiversity.

The protection of riparian zones is therefore a key element of integrated land-water management and an important consideration in the development of these new reclamation policy and guidelines⁴. Conserve slough/marsh wetlands in a natural state; Mitigate degradation or loss of slough/marsh wetlands benefits as near to the site of disturbance as



¹ <http://www.qp.gov.ab.ca/Documents/acts/W03.CFM>

² Except for clause (nn) and section 99), any 'water body' that is part of an irrigation works unless the regulations specify that the location is included in the definition of water body.

³ Fitch, L., B.W. Adams, and G. Hale, Eds. 2001. Riparian health assessment for streams and small rivers – field workbook. Lethbridge, Alberta: Cows and Fish Program. 86 pages.
<http://rwrp60.rwrp.umt.edu/Lasso/DetailSearch.html>

⁴ As per Interim Wetland Policy; Administrative guidelines to protect surface water bodies; Alberta Flood damage reduction program; and, Wetland Compensation Guide.

possible; and, Enhance, restore or create wetlands in areas where wetlands have been depleted or degraded.

The *Mitigation Sequence* includes: (1) Avoidance of impacts to wetlands; (2) Minimization of impacts and the provision of applicable compensation; and, (3) Compensation of impacts that cannot be avoided or minimized.

Restored Wetlands should be: (1) Located within the same watershed; (2) As close to site of impact as possible; (3) Similar wetland class as impacted site; and, (4) An area based upon size of the destroyed wetland and distance from site.

Exemptions can include: fences (placing, constructing, maintaining); crossings for surface water; and landscaping (not in a wetland) with no adverse affect on aquatic environment. Acceptable activities include: the removal of debris from water body with no fish; the removal of beaver dams and excavating a dugout *not* in a wetland or fish bearing water body.

9.1.2. Indicators of Riparian Areas

9.1.2.1. VEGETATION

Riparian areas can be classified using hydrologic indicators as indicated by the types of vegetation and soils. Vegetation indicators are hydrophytic plants classified by their frequency of occurrence in wetlands including cattails, bulrushes, most sedges, some mosses, and many willows (SWCD, 2005). Hydrophytic vegetation occurs in distinct zones adjacent to streams and wetlands. Vegetation zones associated with riparian and aquatic areas include low prairie, wet meadow, shallow and deep marsh, and permanent open water (Stewart and Kantrud, 1971). Descriptions and photographs of the vegetation zones are provided in the City of Calgary's Wetland Conservation Plan (City of Calgary, 2004). Descriptions of plant community types in Alberta can be found in various sources (Thompson and Hansen, 2002; Thompson and Hansen, 2003) including helpful photographic and descriptive guide for key riparian plant species in Alberta (Hale et al., 2003).

9.1.2.2. SOILS

Riparian soils are typically hydric (*i.e.*, usually saturated and subject to flooding or ponding during a portion of the growing season). Detailed wetland soils criteria have been documented by the USDA (NRCS, 2003). Drainage classes found in riparian areas include: moderately well, imperfect, poor, and very poor. Imperfect and moderately-well drained soils can only indicate riparian areas at locations where hydrology and vegetation indicators are also consistent with riparian conditions as imperfect and moderately-well drained soils can also occur in uplands. For example, in central and northern Alberta these soils can also occur in fine-textured parent materials.

9.1.3. Riparian Function: Hydrology

Hydrology is the driving force that creates all wetlands. Hydrologic indicators include standing (lentic) or flowing (lotic) water during at least part of the growing season, water marks or drift lines of debris on trees or shrubs, or thin layers of sediment coating the ground or objects on the ground (SWCD 2005). Riparian areas usually occur in depressional and toe-slope positions, but groundwater springs can occur in mid- and lower-slope positions.

9.1.4. Wellsites In or Near Riparian Areas

Reclamation criteria: The reclamation criteria for riparian lands are addressed in each Land use group. A framework for the health assessment of Alberta wetlands is provided by the Cows and Fish program's user's manual (Cows and Fish, 2004). Legislation that applies to wellsites in and/or near riparian areas:

9.1.4.1. WATER ACT (GOVERNMENT OF ALBERTA, 2009B):

No person may commence or continue an activity without approval unless it is otherwise authorized under the Act; Section 36(1) Subsection 2.

9.1.4.2. DIRECTIVE 056 (ERCB, 2008):

Clause 41: States that the well centre must be sited a minimum of 100 m from a water body.

Clause 42: Provides allowable conditions or measures that can allow a well to proceed if it does not meet the 100 m setback requirement including the availability of a vacuum truck or containment structures using impermeable materials.

Clause 42b: States that the applicant must maintain natural drainage if there is intermittent drainage or a spring/ artesian flow across the well site or access road on freehold or Crown land.

10. Appendix B

10.1. Supplemental Information for Vegetation

No supplemental information for the Forested Criteria has been included in this version.

11. Appendix C

11.1. Supplemental Material for Soils

No supplemental information for the Forested Criteria has been included in this version.

12. Appendix D

12.1. Assessment Tool and Record of Observation Datasheet Example

The following document outlines the example Record of Observation Sheets (RoO) that have been prepared for the *2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands*. The examples have been prepared for both the Vegetation Assessment and the Level 1 Soil Assessment.

12.1.1. Overview

The 2010 reclamation criteria are structured to ensure overall conditions as well as the degree of variability are similar to off-site conditions. The assessor enters the required measurements and ratings into the Record of Observations Sheets (RoO). The RoO automatically calculates averages, maximums, and minimums, assigns ratings and establishes whether the various parameters pass or fail the criteria. Pass/Fail tests for site variability are performed by the RoO using the assessment point rating summary at the end of each row. Pass/Fail tests for overall site conditions are performed by the RoO using the overall site and control summaries at the bottom of the sheet.

12.1.2. Entering Data

- In the Record of Observation sheets, there have been spaces left for 16 assessment points onsite identified as S1 – S16 and 9 assessment points offsite identified as C1-C9. Along the Access Road there is room for entering data for 6 sites along the access road (AR1 – AR8) and their respective controls (AC1 – AC6).
- The areas for data entry in the Record of Observation sheet for tab “RoO-L1” have been shaded in grey.
- For any assessment points that are not used, these cells should be left blank see below. Assessment point C5 was not used so it should be left blank.

C1	Value:			10	8	18	81%
	Obs.	Y / N	(L) / N				
C2	Value:			12	12	24	108%
	Obs.	Y / N	Y / N				
C3	Value:			13	10	23	103%
	Obs.	Y / N	Y / N				
C4	Value:			14	10	24	108%
	Obs.	Y / N	Y / N				
C5	Value:						
	Obs.	Y / N	Y / N				

12.1.2.1. BACKGROUND TAB

- This tab contains any background information for the site such as Operator Name, Assessor's Name(s), Wellsite Location, Dates, etc. for the site.
- This information will carry forward to other sheets within the RoO to avoid having to re-enter information

12.1.2.2. *SITE/LEASE/ACCESS SKETCH TAB*

- This tab contains a sheet for the site, lease or access sketches to accompany the application.
- Background information will be updated from the 'Background Tab' but assessors will need to input data associated with lease spacing, assessment point intervals/spacing, adjacent crop, etc.
- In the example, 16 assessment points were assessed on- (S1 to S16) and offsite (C1-C16). Two access road assessment points were also identified (AR1, AR2, AC1, and AC2).
- Site Sketches: Shows the: well centre (S7), drainage directions (Black solid arrows), areas with soil profile restrictions (SPR; SPR4 - Rating 4, SPR2 - Rating of 2), and Weeds (W; W2 - Rare, W3 - Single Patch), brush off to the south and east sides of the lease. The 'Example-Site' tab contains a sketch showing an overview of the site, the 'Example-Lease Soil' and 'Example-Lease Veg' tabs show the location of the soil and vegetation assessment points. Topsoil depth and plant height are shown as example measurements above each assessment point location.

12.1.2.3. *ASSESSMENT TOOL TAB*

- This tab contains the Assessment Tool and the series of questions that need to be answered for assess the site. Questions are divided into three sections associated with the Landscape (L-#), Vegetation (V-#), and Soil (S-#) Assessments, respectively, from the criteria.
- Each question has two components, one associated with the Lease and the second associated with the access road. For each, assessors must:
 - Answer whether the observation and/or measurement onsite is comparable to offsite (Yes or No);
 - Second, answer whether the parameter on either the Lease or Access Road Passes, Fails, or is Not Applicable. Questions where the reply of Not Applicable may be appropriate are where the Access Road has been signed off by the landowner / land manager as is not part of the assessment.
 - Third, provide the average measurement and/or rating associated with the question if applicable.
- At the end of each section, There is a summary question which asks whether the site passed or failed the assessment. There is a final summary at the end of the tool to identify the results of each Assessment, whether the site Passed / Failed, and the Reason for the Pass/Failure.

12.1.2.4. *RECORD OF OBSERVATION (ROO) TAB*

- This tab contains RoO for both the Vegetation and Soil Assessments
- Each is broken into two sections, one for the Lease and a second for the Access Road

- Each component of the Assessment is made of up a series of Measurements and/or Ratings which need to be assigned to various parameters to determine if a site passes or fails.

12.1.3. Measurement Categories

- Measurements or counts are required for the following parameters user entered ratings for: Woody Vegetation – Dominant woody species, Average height of woody species, % Canopy cover of woody species, Total % cover of woody species, Stem / Plant Count of woody species, Branch/Leader growth of woody species for current and previous year; Herbaceous Vegetation – Dominant herbaceous species, % Cover of herbaceous species, Total % cover of herbaceous species; and, Topsoil – Topsoil Depth,

12.1.3.1. OVERALL COMPARISONS – PLANT MEASUREMENTS

- A) UNPLANTED WOODY VEGETATION: A minimum stem count of 5 is required for natural recovery sites. If the site has been planted with merchantable seedlings as per the reforestation standard the minimum allowable stem count is 2. These counts must occur within the assessment location.
- B) PLANTED WOODY VEGETATION: For sites planted with merchantable species the expected planting density is 2000 stems per hectare, or 2 stems per assessment location.
- C) PLANTED WOODY VEGETATION: If the site has been planted to merchantable seedlings a minimum of 2 growing seasons are required prior conducting the Vegetation Assessment for the submission of a reclamation certificate application.
- D) WOODY AND HERBACEOUS VEGETATION: If assessment points do not meet the above requirements under A, B, or C the woody stem/plant count on the lease must comprise of a minimum of 5 OR the percent canopy cover of desirable woody species >25%?
- E) WOODY AND HERBACEOUS VEGETATION: If assessment points do not meet the above requirements under A, B, C, or D the herbaceous or woody species the total live desirable cover (herbaceous and woody species) must be greater to or equal to 25% (Note: Percent desirable woody species cover must be collected for a level 2 soils evaluation)?
- The average topsoil depth onsite must meet the topsoil depth expectations based on the construction period.

12.1.4. Rated Categories

- Included the following: User entered ratings for: Vegetation – Prohibited Noxious Weeds, Noxious Weeds, Problem / Volunteer Weeds, Grazing Pressure; and Soil –Topsoil Quality (i.e., Texture, Consistence, Structure, Rooting Restrictions); and Subsoil Quality (i.e., Texture, Consistence, Structure, Rooting Restrictions).
- Rating tables can be found in Appendix E of the 2010 Reclamation Criteria.

12.1.4.1. OVERALL RATING COMPARISONS

- Once Assessment point comparisons have been made each comparisons between onsite and offsite ratings must be made for each parameter. Difference in average ratings are compared

to the critical values of 0.50 for equal sample numbers and where fewer control assessment points were used offsite than onsite. Sites where the difference is greater than or equal to the critical value Fail “F”, sites less than these values will Pass “P”.

- These calculations are made in the Lease and Control Data Summary Comparisons within the worksheets.

12.1.5. Example Assessment

The letters A – Z and associated descriptions below correspond to the letters in the attached spreadsheet containing the example soil assessment.

12.1.5.1. VEGETATION ASSESSMENT - ASSESSMENT POINT COMPARISONS

- (A) Background information imported automatically from the 'Background' tab. This will be printed on each of the datasheets.
- (B) **Assessment Point S1:** The site was planted to merchantable seedlings. At S1, 3 white spruce, 3 birch, and 1 willow tree were counted, for a total of 7 stems at this assessment point. They had average heights of 0.30, 0.30, and 1.20-m respectively. All species make up only 15% total canopy cover. Smooth brome (60%), Alsike clover (10%), and fescue (20%) make up about 90% cover at the assessment point. As a result, S1 would pass the stem count assessment because it did meet the requirement of 2 stems.
- (C) **Assessment Point S3:** The site was planted to merchantable seedlings. At S1, 5 white spruce and 5 willow tree were counted, for a total of 10 stems at this assessment point. They had average heights of 0.30 and 1.50-m respectively. All species make up only 10% total canopy cover. Smooth brome (20%), Alsike clover (10%), and fescue (60%) make up about 90% cover at the assessment point. As a result, S1 would pass the stem count assessment because it did meet the requirement of 2 stems.
- (D) **Assessment Point C3:** At C1, the control assessment point contained 2 Aspen, 3 white spruce and 1 willow tree, for a total of 6 stems at this assessment point. They had average heights of 15, 15, and 1.0-m respectively. All species make up 45% total canopy cover. Labrador tea (10%), Dogwood (20%), and Calmagrostis canadensis (5%) make up a total of 35% canopy cover at the assessment point. As a result, S1 would pass the stem count assessment because it did meet the requirement of 2 stems.

12.1.5.2. VEGETATION ASSESSMENT - OVERALL PARAMETER COMPARISONS

Once the comparisons have been made for each Assessment point onsite each of the measured and rated sub-categories are compared on- and offsite.

- (E) Shows a summary of the Woody and Herbaceous measurements and ratings. These values are used for making comparisons on- and offsite. For the stem counts, and total % Cover comparisons assessors will need to refer to the specific construction and/or reclamation requirements. The site passes the weed rating comparisons as shown by the “P” in the summary as the difference between on- and offsite ratings are all less than 0.50.
- (F) Shows the number of assessment points onsite that were greater or equal to 25% cover (0) and the number that were less than 25% of the control average (4).

- (G) Shows the number of assessment points onsite and offsite that had less than the requirement for natural recover sites of 5 stems (0) or less than the requirement of 2 for sites planted with merchantable species (0).
- (H) Shows the number of assessment points onsite and offsite that received each respective rating. For example for Noxious Weeds onsite, 9 sites received a rating of 1, no (0) sites received a rating of 2, no (0) sites received a rating of 3, and no (0) site received a rating of 4.
- (I) Access Road - Site #1: **Assessment Point S1:** The site was planted to merchantable seedlings. At AR1, 2 white spruce, 2 birch, and 2 willow tree were counted, for a total of 6 stems at this assessment point. They had average heights of 0.50, 0.40, and 1.80-m respectively. All species make up only 15% total canopy cover. Smooth brome (35%), Alsike clover (5%), and fescue (10%) make up about 50% cover at the assessment point. As a result, S1 would pass the the stem count assessment because it did meet the requirement of 2 stems.

12.1.5.3. SOIL ASSESSMENT - ASSESSMENT POINT COMPARISONS

- (J) Background information imported automatically from the 'Background' tab. This will be printed on each of the datasheets.
- (K) **Assessment Point S1:** The topsoil depth at this assessment point was 2-cm, the control average topsoil depth was 12-cm. Assessment point S1 receives 4 as the rating for topsoil depth. While the assessment point receives a 4 rating, it would pass based on the construction period and reclamation date requirements. The rest of the ratings are assigned based on those found in the Rating Tables with Appendix E.
- (L) **Assessment Point C1:** The topsoil depth at this control assessment point was 10-cm, the control average topsoil depth was 12-cm. Assessment point S3 receives 1 as the rating for topsoil depth..

12.1.5.4. OVERALL - CATEGORY COMPARISONS

Once the comparisons have been made for each Assessment point onsite each of the measured and rated sub-categories are compared on- and offsite.

- (M) Shows a summary of the Topsoil depth Measurements. These values are used for making Topsoil depth comparisons on- and offsite. Overall, the average topsoil depth onsite was 3-cm (24%) compared to the average control topsoil depth offsite (12-cm). A summary and comparison of on- and offsite ratings is also shown for the remaining soil parameters. There were also issues around topsoil consistence and topsoil structure for the site. For example, for topsoil structure the difference in average ratings between on- and offsite was 1.11 which is greater than the allowable difference of 0.50. However, the site would pass the soil requirements because of the construction and reclamation date period for the site.
- (N) Shows the number of assessment points onsite that were greater or equal to 80% of the control topsoil depth (0) and the number that were less than 80% of the control average (9).

- (O) Shows the number of assessment points onsite and offsite that received each respective rating. For example onsite for toposil depth, no (0) sites received a rating of 1, no (0) sites received a rating of 2, no (0) sites received a rating of 3, and 9 sites received a rating of 4.
- (P) Access Road – Site #1: Each of the sites along the access road is are compared using paired comparisons. For Site #1, the access road (AR1) is compared directly to the paired control offsite (AC1) using the same approach as identified above. The only difference being the Topsoil depth Comparison. The topsoil depth at AR1 is 6-cm compared to the of the control measurement 15-cm. As a result, Site #1 would pass the Topsoil Depth requirement along wit the remaining rated parameters based on the construction and reclamation period requirements.

SITE INFORMATION

	Operator	Soil Assessor	Vegetation Assessor
Name(s):	Operator - Gas Co	Joe Assessor	Mary Assessor

ERCB Unique Well / facility Identifier(s):	Disposition #:	Location	Well Center	Surface	Downhole
16-13-052-14 W6M	MSL - 849246	NAD83	Latitude: xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
			Longitude: xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"

Activity Dates (mm/dd/yr)	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008

Natural Sub-region:	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:
Sub-Region	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:

Special Land Management Considerations

(i.e. problem weeds or conditions identified by County/MD)

- 1) Site seeded with herbaceous species; natural encroachment presently occurring
- 2) Plant community is a mixed wood forest
- 3) Forest Management Unit
- 4)

Landowner/Land manager Comments

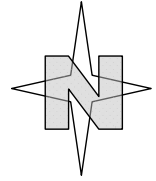
- 1) Name: _____ Position/title: _____ (mm/dd/yr)
- 2) Name: _____ Position/title: _____ (mm/dd/yr)
- 3) Name: _____ Position/title: _____ (mm/dd/yr)
- 4) Name: _____ Position/title: _____ (mm/dd/yr)

ATTACHMENTS: SITE INFORMATION - LEASE SKETCH

Operator		Soil Assessor		Vegetation Assessor				
Name(s): Operator - Gas Co		Joe Assessor		Mary Assessor				
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location				
16-13-052-14 W6M		MSL - 849246		Well Center				
				Surface				
				Downhole				
				Latitude: xx° xx' xx.xx"				
				Longitude: xxx° xx' xx.xx"				
Activity Dates (mm/dd/yr):		Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:
		20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008
Natural Sub-region:		Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:		
Sub-Region		Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:		

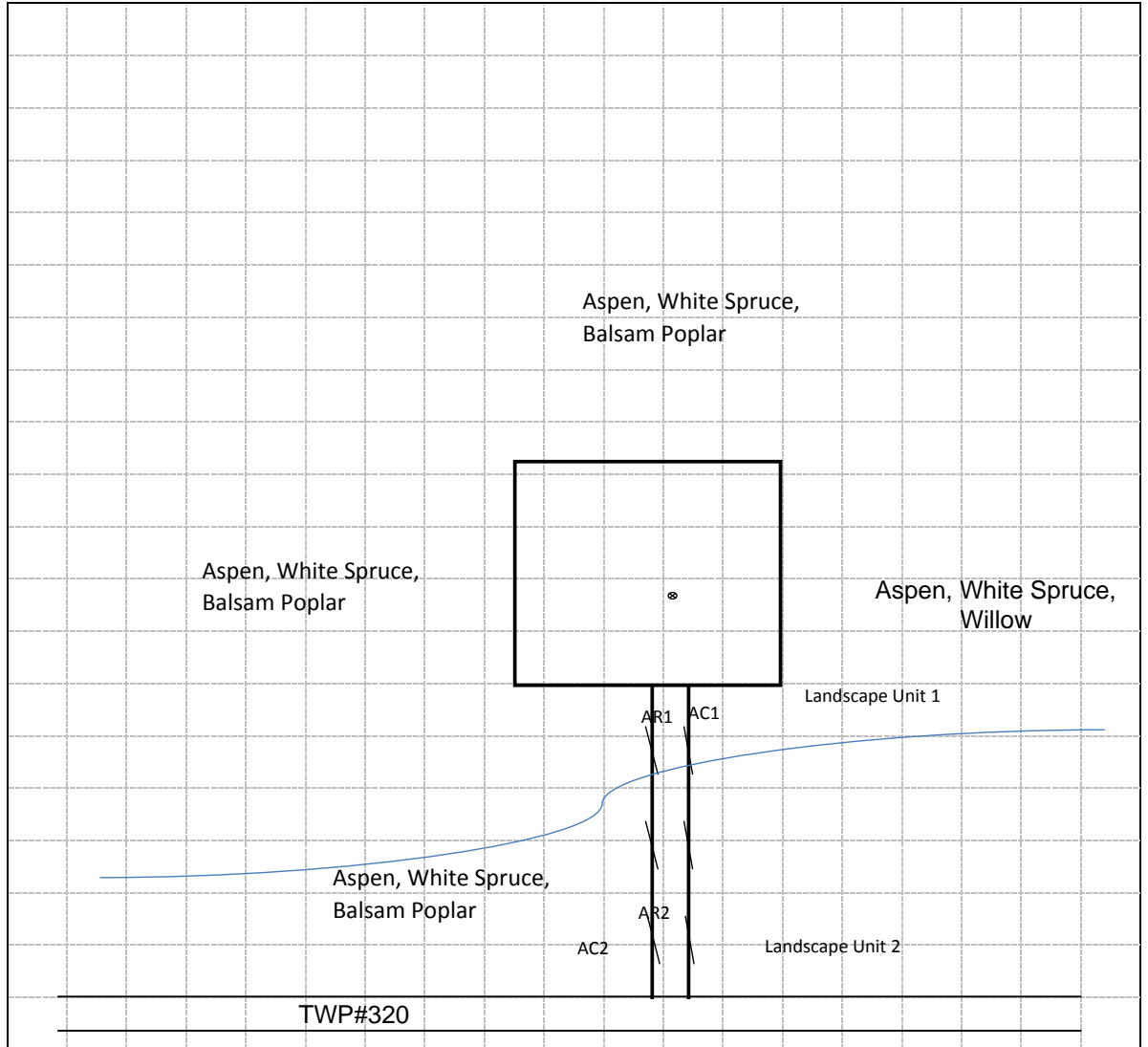
Environmental Setting

Legend:							
Drainage:	Access Road Boundary:	Lease Boundary:	Former Wellhead:	Trees / Brush:	Step Out:	Control Point:	Site Point:
						C#	S#



Abbreviations:	Landscape Criteria		Vegetation		Soil	
	E - Erosion	BA - Bare Areas	V# - Site Vegetation Assessment Point	S# - Site Soil Assessment Point	T - Texture	
	C - Contour	PH - Poor Health Areas	VC - Vegetation Control Point	SC - Soil Control Point	G/R - Gravel / Rock	
	ST - Stability	G/R - Gravel / Rock	W - Weeds	AD - Addmixing		
	D - Debris	PD - Poor Drainage	PH - Poor Health Areas	SPR - Soil Profile Restriction		

Crop On-site:			
On-site:	White Spruce & Willow		
North:	Aspen & White Spruce		
East:	Aspen, Balsalm & White Spruce		
South:	Aspen, Balsalm & White Spruce		
West:	Aspen, Balsalm & White Spruce		
Topography:			
Undulating			
Typical Slopes:			
2-5%			
Usual Soil Moisture:			
Moist			
Soil Assessment Date:			
September 15, 2006			
Veg. Assessment Date:			
August 20, 2007			
Lease Area:			
2 ha	5 ac		
110 m	X	110 m	
Inspection Spacing			
Lease:	27.5 m	X	27.5 m
Access:			
Length: 500 m			



Notes:

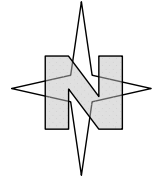
[Redacted notes area]

ATTACHMENTS: SITE INFORMATION - LEASE SKETCH

Operator		Soil Assessor		Vegetation Assessor	
Name(s): Operator - Gas Co		Joe Assessor		Mary Assessor	
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location	
16-13-052-14 W6M		MSL - 849246		Well Center	
				Surface	
				Downhole	
		NAD83		Latitude: xx° xx' xx.xx"	
				Longitude: xxx° xx' xx.xx"	
Activity Dates (mm/dd/yr):		Soils		Vegetation	
Survey: 20-Jul-85		Reclamation: 15-Sep-06		Other: 20-Aug-07	
Construction: 5-Aug-85		Vegetation: 20-Aug-07		Vegetation 2: July 15, 2008	
Abandonment: 15-Jul-05		Reclamation: 17-Aug-06			
Natural Sub-region:		Ecosite:		Soil Zone	
Sub-Region		Ecosite:		Soil Zone	
		Soil Series		Construction Practice:	
		Soil Series		Reclamation Practice:	

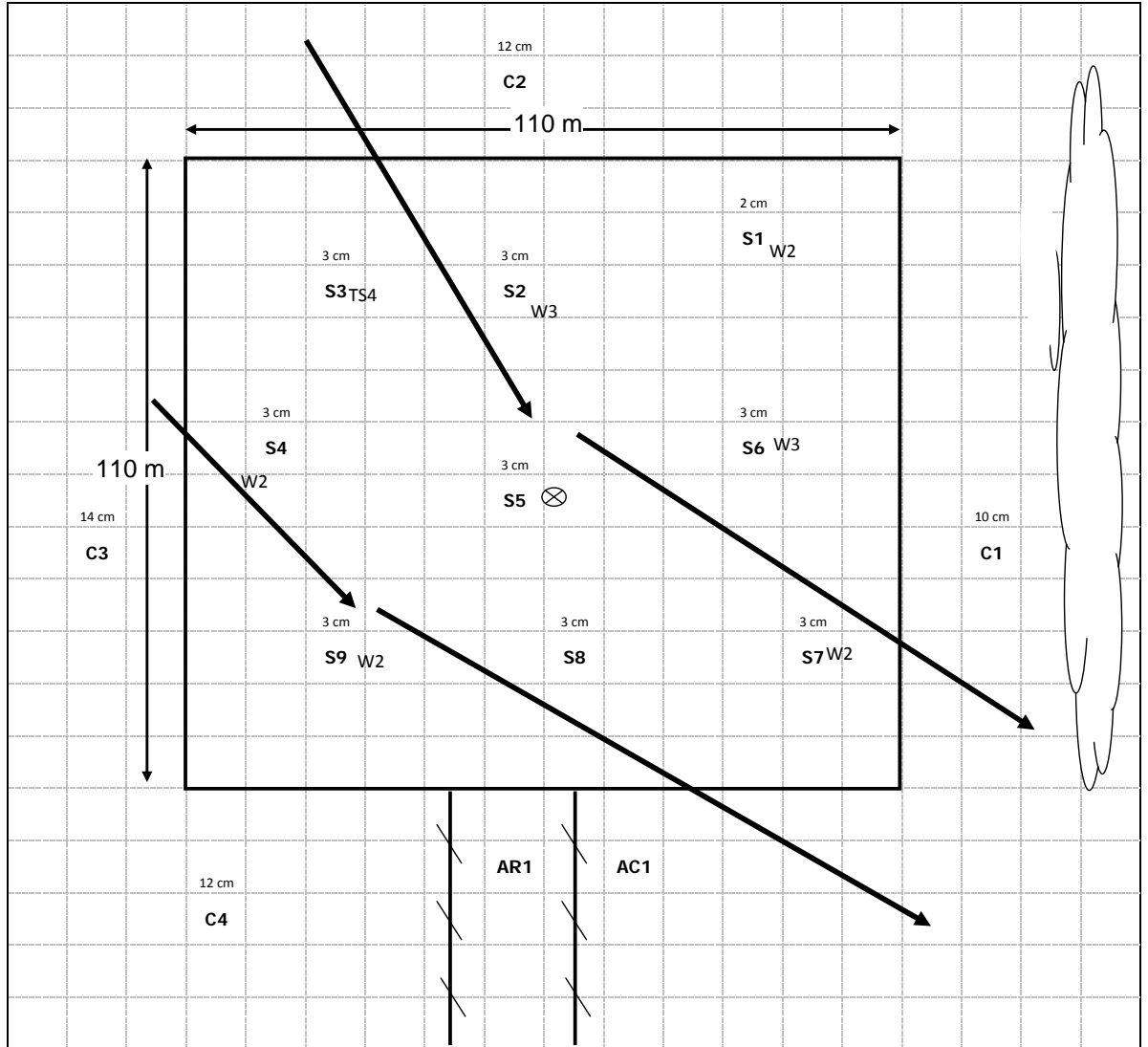
Environmental Setting

Legend:							
Drainage:	Access Road Boundary:	Lease Boundary:	Former Wellhead:	Trees / Brush:	Step Out:	Control Point:	Site Point:
						C#	S#



Landscape Criteria		Vegetation		Soil	
E - Erosion	BA - Bare Areas	V# - Site Vegetation Assessment Point	S# - Site Soil Assessment Point	T - Texture	
C - Contour	PH - Poor Health Areas	VC - Vegetation Control Point	SC - Soil Control Point	G/R - Gravel / Rock	
ST - Stability	G/R - Gravel / Rock	W - Weeds	AD - Addmixing		
D - Debris	PD - Poor Drainage	PH - Poor Health Areas	SPR - Soil Profile Restriction		

Crop On-site:	
On-site:	White Spruce & Willow
North:	Aspen & White Spruce
East:	Aspen, Balsalm & White Spruce
South:	Aspen, Balsalm & White Spruce
West:	Aspen, Balsalm & White Spruce
Topography:	
Typical Slopes:	
Usual Soil Moisture:	
Soil Assessment Date:	
Veg. Assessment Date:	
Lease Area:	
ha ac	
110 m X 110 m	
Inspection Spacing	
Lease: 27.5 m X 27.5 m	
Access: Length: m	



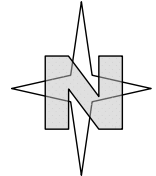
Notes: measurements show are for topsoil depth.

ATTACHMENTS: SITE INFORMATION - LEASE SKETCH

Operator		Soil Assessor		Vegetation Assessor	
Name(s): Operator - Gas Co		Joe Assessor		Mary Assessor	
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location	
16-13-052-14 W6M		MSL - 849246		Well Center	
				Surface	
				Downhole	
				xx° xx' xx.xx"	
				xxx° xx' xx.xx"	
				xxx° xx' xx.xx"	
				xxx° xx' xx.xx"	
Activity Dates (mm/dd/yr):		Reclamation		Soils	
Survey		Abandonment		Vegetation	
20-Jul-85		15-Jul-05		20-Aug-07	
5-Aug-85		17-Aug-06		Other:	
15-Sep-06				Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:		Construction Practice:	
Sub-Region		Ecosite:		Construction Practice:	
		Soil Zone		Reclamation Practice:	
		Soil Series		Reclamation Practice:	

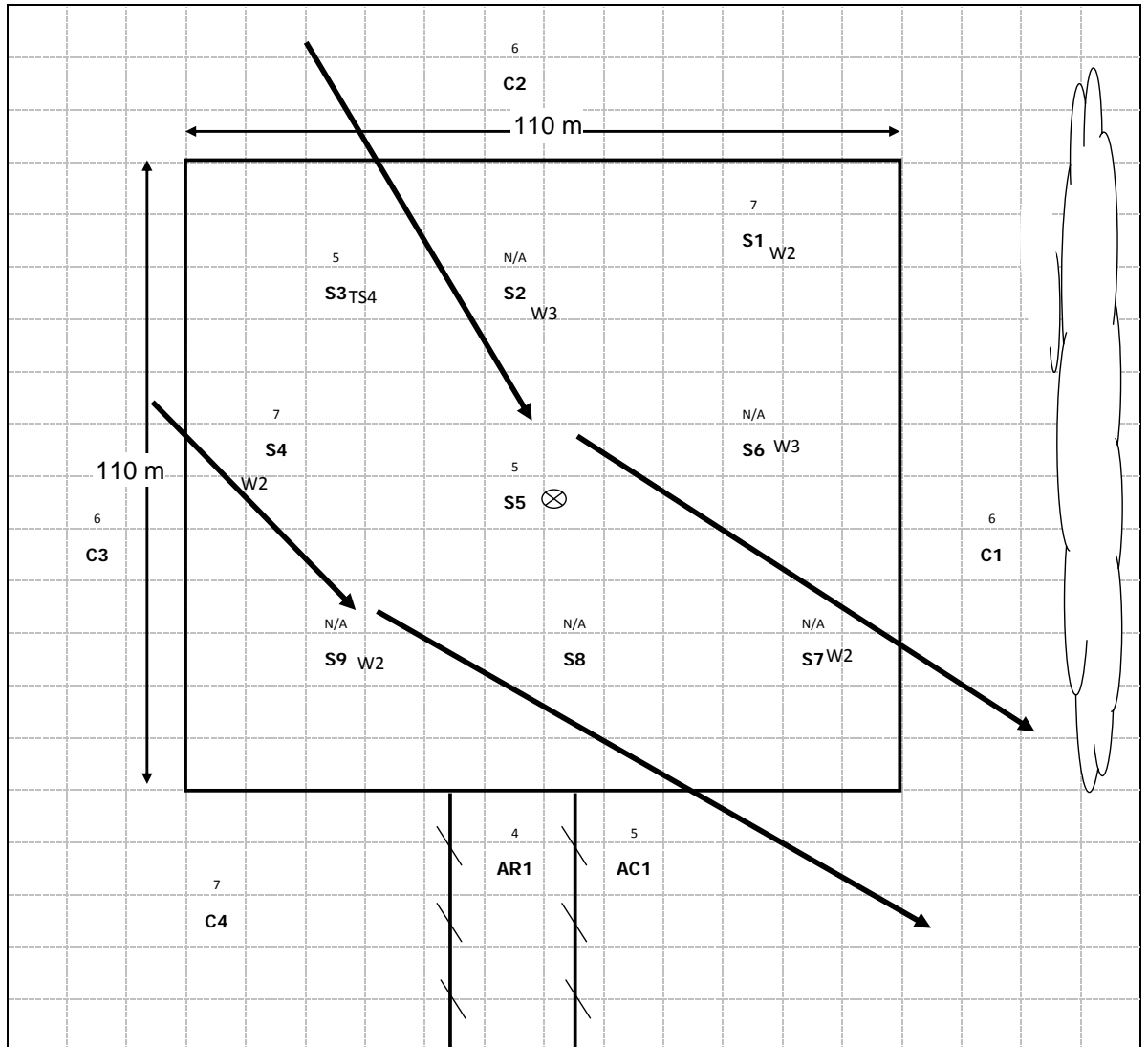
Environmental Setting

Legend:							
Drainage:	Access Road Boundary:	Lease Boundary:	Former Wellhead:	Trees / Brush:	Step Out:	Control Point:	Site Point:
						C#	S#



Landscape Criteria		Vegetation		Soil	
E - Erosion	BA - Bare Areas	V# - Site Vegetation Assessment Point	S# - Site Soil Assessment Point	T - Texture	
C - Contour	PH - Poor Health Areas	VC - Vegetation Control Point	SC - Soil Control Point	G/R - Gravel / Rock	
ST - Stability	G/R - Gravel / Rock	W - Weeds	AD - Admixing		
D - Debris	PD - Poor Drainage	PH - Poor Health Areas	SPR - Soil Profile Restriction		

Crop On-site:	
On-site:	White Spruce & Willow
North:	Aspen & White Spruce
East:	Aspen, Balsalm & White Spruce
South:	Aspen, Balsalm & White Spruce
West:	Aspen, Balsalm & White Spruce
Topography:	
Typical Slopes:	
Usual Soil Moisture:	
Soil Assessment Date:	
Veg. Assessment Date:	
Lease Area:	
ha	ac
110 m	X
110 m	
Inspection Spacing	
Lease:	
27.5 m	X
27.5 m	
Access:	
Length:	m



Notes: measurements shown are total woody stem counts

Forested Lands Reclamation Tool (FT)

Implementation and Interpretation of New Criteria: All sites are to be assessed for landscape, vegetation and soils parameters. If soils have not been disturbed (i.e., stripped, compacted) then the site is to be assessed for landscape and vegetation par

- A. Sites that have been constructed after June 1, 2007 are required to comply with all aspects of this document.
- B. Sites that have been abandoned and/or reclaimed* after June 1, 2007 but constructed prior to June 1, 2007 shall be compliant as follows:
 - i. Sites constructed after April 30, 1994 and prior to June 1, 2007: Sites are expected to comply with all aspects of the Criteria. Where extenuating conditions exist, topsoil justifications may be accommodated upon written request.
 - ii. Sites constructed prior to April 30, 1994: Sites are expected to comply with all landscape and vegetation components of the 2010 Criteria and are encouraged but not required to comply with soil expectations.
- C. Sites that have been constructed after June 1, 2007 are required to comply with all aspects of this document.
 - i. Sites constructed after April 30, 1994: Sites are expected to comply with the soil and landscape components (extenuating soil situations may arise) and encouraged but not required to comply with the vegetation expectations.
 - ii. Sites constructed prior to April 30, 1994: Sites are expected to comply with all landscape components of this document and are encouraged but not required to comply with soils and vegetation expectations

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:	Soil Zone	Soil Series	Construction Practice:		Reclamation Practice:	
Sub-Region		Ecosite:	Soil Zone	Soil Series	Construction Practice:		Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

LANDSCAPE ASSESSMENT METHODOLOGY

L-1 SURFACE WATER FLOW: Is the surface water flow and onsite drainage (direction, dispersion, ponding, depressional storage) comparable to offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required
 ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-2 SUB-SURFACE WATER FLOW: Is the sub-surface water flow and onsite drainage (direction, dispersion, ponding, depressional storage) comparable to offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required
 ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-3 RIPARIAN AREAS: Has the bank or shore stability onsite been restored and is it comparable to offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required
 ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-4a SOIL STABILITY - EROSION: Is the presence of channels/gullyng, rilling, or pedestaling caused by flowing water onsite consistent with offsite? (Based on a qualitative assessment of bare soil in relation to cover)

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required
 ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor		Vegetation Assessor	
Name(s): Operator		Soil Assessor		Vegetation Assessor	
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location	
16-13-052-14 W6M		MSL - 849246		Well Center	
				Surface	
				Downhole	
				NAD83	
				Latitude: xx° xx' xx.xx"	
				Longitude: xxx° xx' xx.xx"	
Activity Dates (mm/dd/yr):		Survey		Construction	
		20-Jul-85		5-Aug-85	
		Abandonment		Reclamation	
		15-Jul-05		17-Aug-06	
		Soils		Vegetation	
		15-Sep-06		20-Aug-07	
		Other:		Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:		Soil Zone	
Sub-Region		Ecosite:		Soil Zone	
				Soil Series	
				Soil Series	
				Construction Practice:	
				Construction Practice:	
				Reclamation Practice:	
				Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

L-4b SOIL STABILITY - SLUMPING: Is slumping/wasting onsite consistent with offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-4c SOIL STABILITY - SUBSIDENCE: Is any subsidence occurring onsite consistent with that observed offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-5 BARE AREAS: Is the amount, frequency, density of landscape scale bare areas onsite comparable with offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-6a OPERABILITY - MACRO- and MESO-CONTOUR: Are meso, and macro-contours present onsite comparable to offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-6b OPERABILITY - MICRO-CONTOUR: Are micro, meso, and macro-contours present onsite comparable to offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-6d OPERABILITY - GRAVEL AND ROCK: Is surface stoniness (overall quantity, size and concentrations) onsite acceptable for forest management?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			
Sub-Region	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			

Forested Lands: Assessment Tool

RATING

ANSWER	PASS / FAIL Decision	LEASE CONT.
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L-7a WOODY DEBRIS: If coarse woody debris (wood, brush) is available, is it spread evenly onsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-7b WOODY DEBRIS: Is fine chipped woody debris is >5 cm thick onsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-7c WOODY DEBRIS: If Yes, is it causing an adverse effect to vegetation establishment?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

L-8 REFUSE: Has industrial (including domestic) refuse been removed?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

Summary of Landscape assessment

Did the site pass the Landscape Assessment?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS

If Yes, proceed with the Vegetation Assessment

If No, mitigate

Comments:

End of Landscape assessment

VEGETATION ASSESSMENT METHODOLOGY

V-1 DESIRED PLANTS - GENERAL: Is the desired plant community or encroachment of local native species present on the site?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor		Vegetation Assessor	
Name(s): Operator		Soil Assessor		Vegetation Assessor	
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location	
16-13-052-14 W6M		MSL - 849246		Well Center	
				Surface	
				Downhole	
				NAD83	
				Latitude: xx° xx' xx.xx"	
				Longitude: xxx° xx' xx.xx"	
Activity Dates (mm/dd/yr):		Survey		Construction	
		20-Jul-85		5-Aug-85	
		Abandonment		Reclamation	
		15-Jul-05		17-Aug-06	
		Soils		Vegetation	
		15-Sep-06		20-Aug-07	
		Other:		Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:		Soil Zone	
Sub-Region		Ecosite:		Soil Zone	
				Soil Series	
				Soil Series	
				Construction Practice:	
				Construction Practice:	
				Reclamation Practice:	
				Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER	PASS / FAIL Decision	LEASE CONT.
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V-2 **DESIRED PLANTS - HERBACEOUS:** Is the total desirable herbaceous species cover greater than 25%?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

V-3a **DESIRED PLANTS - PLANTED WOODY STEMS and SHRUB COUNT:** Has the site been replanted to the reforestation standard?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

V-3b **DESIRED PLANTS - PLANTED WOODY STEMS and SHRUB COUNT:** If the site has been replanted to the reforestation standard, does the woody stem/plant count on the lease comprise of a minimum of 2 stems (or 2000 stems per hectare) OR the percent canopy cover of de

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

V-4 **DESIRED PLANTS - UNPLANTED SHRUBS and TREES:** Does the woody stem/plant count on the lease comprise of a minimum of 5 OR the percent canopy cover of desirable woody species >25%?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

V-5 **DESIRED PLANTS - HERBACEOUS AND WOODY SPECIES:** If either the herbaceous or woody species did not meet the above: Is the total live desirable cover (herbaceous and woody species) 25% (Note: Percent desirable woody species cover must be collected for a level

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

If Yes, a Level 2 soil assessment can be conducted.

If the total live cover (herbaceous and woody species) is <25%, the site fails.

V-6a **QUANTITY - LIMITING FACTORS: BROWSING:** Is there evidence of heavy wildlife or domestic animal browsing?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:	Soil Zone	Soil Series	Construction Practice:		Reclamation Practice:	
Sub-Region		Ecosite:	Soil Zone	Soil Series	Construction Practice:		Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

V-6b **QUANTITY - LIMITING FACTORS: DROUGHT:** Is there evidence of drought conditions?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

V-6c **QUANTITY - LIMITING FACTORS: HEALTH:** Are the onsite plants healthy (i.e., disease-free, appropriate colour, exhibits vigour, good height, etc.)?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

V-6d **QUANTITY - LIMITING FACTORS: HEALTH:** If No, is plant health comparable with offsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

V-6e **QUANTITY - LIMITING FACTORS: OTHER:** Is there evidence of third-party impacts may account for poor growth not linked to inadequate site conditions. If so, documentation must be included.

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

V-7a **UNDESIRE PLANTS - PROHIBITED NOXIOUS:** Have prohibited noxious weeds been eliminated/destroyed as per the Weed Control Act or local requirements?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

If No, mitigate then proceed.

V-7b **UNDESIRE PLANTS - NOXIOUS:** Have noxious weeds been controlled as per the Weed Control Act or local requirements?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

If No, mitigate then proceed.

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor		Vegetation Assessor	
Name(s): Operator		Soil Assessor		Vegetation Assessor	
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location	
16-13-052-14 W6M		MSL - 849246		Well Center	
				Surface	
				Downhole	
				NAD83	
				Latitude: xx° xx' xx.xx"	
				Longitude: xxx° xx' xx.xx"	
Activity Dates (mm/dd/yr):		Survey		Construction	
		20-Jul-85		5-Aug-85	
		Abandonment		Reclamation	
		15-Jul-05		17-Aug-06	
		Soils		Vegetation	
		15-Sep-06		20-Aug-07	
		Other:		Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:		Soil Zone	
Sub-Region		Ecosite:		Soil Zone	
				Soil Series	
				Construction Practice:	
				Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

V-7c **UNDESIRED PLANTS - PROBLEM / VOLUNTEER:** Are the problem and / or volunteer weeds observed onsite consistent those observed offsite, and no special management is required?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

If No, mitigate then proceed.

V-8 **WATER AND NUTRIENT CYCLING:** Is there litter (LFH/forest floor) developing onsite?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS No rating / measurement required

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS No rating / measurement required

Comments:

Summary of Vegetation Assessment

Did the site pass the Vegetation Assessment?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS

If No, mitigate

If Yes, are portions exempt due to justification(s)?

LEASE: N/A YES NO

ACCESS ROAD: N/A YES NO

If Yes, provide supporting documentation (Appendix F). This is now a nonroutine assessment and will be subject to additional review by Alberta Environment.

If No, the Vegetation Assessment passed and no portions are exempt. Pass and proceed with the Soil Assessment.

Comments:

End of Vegetation Assessment

FM S-0 SOIL ASSESSMENT METHODOLOGY

S-1 **SOIL QUANTITY - DISTURBANCE:** Is there evidence of soil disturbance?

LEASE: N/A YES NO No rating / measurement required

ACCESS ROAD: N/A YES NO No rating / measurement required

Comments:

If no, where there has been no soil disturbance (stripping or compaction), and it is documented, no further soils assessment will be required.

S-2 **SOIL QUANTITY - DISTRIBUTION:** Has topsoil been adequately replaced as per topsoil depth requirements by construction date?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS cm cm

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			
Sub-Region	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

SOIL VERTICAL PROCESSES:

S-3a TEXTURE: Is on-/offsite topsoil texture comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1.11 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

S-3b TEXTURE: Is on-/offsite subsoil texture comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1.22 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

S-4a CONSISTENCE: Is on-/offsite topsoil consistence comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1.89 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

S-4b CONSISTENCE: Is on-/offsite subsoil consistence comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

S-5a STRUCTURE: Is on-/offsite topsoil structure comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 2.11 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

S-5b STRUCTURE: Is on-/offsite subsoil structure comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS 1.11 1

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

Comments:

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor		Vegetation Assessor			
Name(s): Operator		Soil Assessor		Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location			
16-13-052-14 W6M		MSL - 849246		Well Center			
				Surface			
				Downhole			
				NAD83			
				Latitude: xx° xx' xx.xx"			
				Longitude: xxx° xx' xx.xx"			
Activity Dates (mm/dd/yr):		Soils		Vegetation		Other:	
Survey: 20-Jul-85		Construction: 5-Aug-85		Abandonment: 15-Jul-05		Reclamation: 17-Aug-06	
						Vegetation 2: July 15, 2008	
Natural Sub-region:		Ecosite:		Soil Zone		Soil Series	
Sub-Region		Ecosite:		Soil Zone		Soil Series	
						Construction Practice:	
						Reclamation Practice:	

Forested Lands: Assessment Tool

ANSWER	PASS / FAIL Decision	RATING
		LEASE CONT.
S-6a ROOTING RESTRICTIONS: Is there a restrictive layer (assess to		
LEASE: <input type="checkbox"/> N/A <input type="checkbox"/> YES <input type="checkbox"/> NO	This parameter on the: LEASE: <input type="checkbox"/> PASSES <input type="checkbox"/> FAILS	<input type="checkbox"/> <input type="checkbox"/>
ACCESS ROAD: <input type="checkbox"/> N/A <input type="checkbox"/> YES <input type="checkbox"/> NO	ACCESS ROAD: <input type="checkbox"/> PASSES <input type="checkbox"/> FAILS	<input type="checkbox"/> Refer to RoO for values
Comments:		
S-6b ROOTING RESTRICTIONS: If yes, is it consistent with offsite		
LEASE: <input type="checkbox"/> N/A <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	This parameter on the: LEASE: <input checked="" type="checkbox"/> PASSES <input type="checkbox"/> FAILS	<input type="checkbox"/> 1 <input type="checkbox"/> 1
ACCESS ROAD: <input type="checkbox"/> N/A <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO	ACCESS ROAD: <input checked="" type="checkbox"/> PASSES <input type="checkbox"/> FAILS	<input checked="" type="checkbox"/> Refer to RoO for values
Comments:		
S-6c ROOTING RESTRICTIONS: If No, is the issue due to the presence of a compacted zone (CT.3.2) or disease?		
LEASE: <input checked="" type="checkbox"/> N/A <input type="checkbox"/> YES <input type="checkbox"/> NO	This parameter on the: LEASE: <input type="checkbox"/> PASSES <input type="checkbox"/> FAILS	No rating / measurement required
ACCESS ROAD: <input checked="" type="checkbox"/> N/A <input type="checkbox"/> YES <input type="checkbox"/> NO	ACCESS ROAD: <input type="checkbox"/> PASSES <input type="checkbox"/> FAILS	No rating / measurement required
Comments:		

Summary of Level 1 Soil Assessment

Did the site pass the Level 1 Soil Assessment?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS

If No, mitigate

If Yes, are portions exempt due to justification(s)?

LEASE: N/A YES NO

ACCESS ROAD: N/A YES NO

If Yes, provide supporting documentation (Appendix F). This is now a nonroutine assessment and will be subject to additional review by Alberta Environment.

If No, the Soil Assessment passed and no portions are exempt. Pass and proceed with the Level 2 Soil Assessment.

Comments: Although some soil parameters failed, the site passes because of the construction and reclamation period.

End of Level 1 Soil Assessment

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			
Sub-Region	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

Level 2 Soil Assessment

S-7a TEXTURE - Topsoil: Is on-/offsite topsoil texture (PSA) comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-7b TEXTURE - Subsoil: Is on-/offsite subsoil texture (PSA) comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-8a % Clay: Is on-/offsite topsoil %Clay comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-8b % Clay: Is on-/offsite subsoil %Clay comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS % %

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-9a ORGANIC CARBON - Topsoil: Is on-/offsite topsoil organic carbon comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-9b ORGANIC CARBON - Subsoil: Is on-/offsite subsoil organic carbon comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-10a pH - Topsoil: Is on-/offsite topsoil pH comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-10b pH - Subsoil: Is on-/offsite subsoil pH comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-11a EC - Topsoil: Is on-/offsite topsoil EC comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-11b EC - Subsoil: Is on-/offsite subsoil EC comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-12a SAR - Topsoil: Is on-/offsite topsoil SAR comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

S-12b SAR - Subsoil: Is on-/offsite subsoil SAR comparable?

LEASE: N/A YES NO This parameter on the: LEASE: PASSES FAILS

ACCESS ROAD: N/A YES NO ACCESS ROAD: PASSES FAILS Refer to RoO for values

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s): Operator		Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			
Sub-Region	Ecosite:	Soil Zone	Soil Series	Construction Practice:	Reclamation Practice:			

Forested Lands: Assessment Tool

ANSWER

PASS / FAIL Decision

RATING
LEASE | CONT.

Summary of Level 2 Soil Assessment

Did the site pass the Level 2 Soil Assessment?

LEASE: N/A YES NO
 ACCESS ROAD: N/A YES NO

This parameter on the: LEASE: PASSES FAILS
 ACCESS ROAD: PASSES FAILS

If No, mitigate

If Yes, are portions exempt due to justification(s)?

LEASE: N/A YES NO
 ACCESS ROAD: N/A YES NO

If Yes, provide supporting documentation (Appendix F). This is now a nonroutine assessment and will be subject to additional review by Alberta Environment.

If No, the Soil Assessment passed and no portions are exempt. Pass.

Comments:

End of Level 2 Soil Assessment

FORESTED LANDS RECLAMATION TOOL: SITE ASSESSMENT INFORMATION

SITE INFORMATION

Operator		Soil Assessor			Vegetation Assessor			
Name(s):	Operator	Soil Assessor			Vegetation Assessor			
ERCB Unique Well / facility Identifier(s):		Disposition #:		Location		Well Center	Surface	Downhole
16-13-052-14 W6M		MSL - 849246		NAD83	Latitude:	xx° xx' xx.xx"	xx° xx' xx.xx"	xx° xx' xx.xx"
					Longitude:	xxx° xx' xx.xx"	xxx° xx' xx.xx"	xxx° xx' xx.xx"
Activity Dates (mm/dd/yr):	Survey	Construction	Abandonment	Reclamation	Soils	Vegetation	Other:	
	20-Jul-85	5-Aug-85	15-Jul-05	17-Aug-06	15-Sep-06	20-Aug-07	Vegetation 2: July 15, 2008	
Natural Sub-region:	Ecosite:	Soil Zone		Soil Series	Construction Practice:		Reclamation Practice:	
Sub-Region	Ecosite:	Soil Zone		Soil Series	Construction Practice:		Reclamation Practice:	

Forested Lands: Assessment Tool

RATING

ANSWER

PASS / FAIL Decision

LEASE | CONT.

4.0 SUMMARY

LEASE

ASSESSMENT STAGE	PASS / FAIL					REASON FOR PASS / FAIL
		N/A	X	PASS	FAIL	
Landscape		N/A	X	PASS	FAIL	Site passed the landscape assessment
Vegetation		N/A	X	PASS	FAIL	Site passed meeting the stem count requirements.
Soils Level 1		N/A	X	PASS	FAIL	Site passed based based on construction and reclamation dates.
Soils Level 2	X	N/A		PASS	FAIL	No soil analyses were conducted

ACCESS ROAD

ASSESSMENT STAGE	PASS / FAIL					REASON FOR PASS / FAIL
		N/A	X	PASS	FAIL	
Landscape		N/A	X	PASS	FAIL	
Vegetation		N/A	X	PASS	FAIL	
Soils Level 1		N/A	X	PASS	FAIL	
Soils Level 2		N/A	X	PASS	FAIL	

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V						
1	Record of Observations: Forested Criteria - Vegetation Assessment																											
3	Assessor Name(s): Mary Assessor											Operator: Operator - Gas Co																
5	ERCB unique Well / Facility Identifier(s):					Disposition #:					Location			Well Center			Surface		Downhole									
6											NAD83			Latitude: xx° xx' xx.xx"			xx° xx' xx.xx"		xx° xx' xx.xx"									
7	16-13-052-14 W6M					MSL - 849246								Longitude: xxx° xx' xx.xx"			xxx° xx' xx.xx"		xxx° xx' xx.xx"									
9	Natural Sub-region:			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:												
10	Sub-Region			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:												
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation			Other:												
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege			Fore - Other												
14																												
16	Site Point																											
17												Vegetation (Woody)					Vegetation (Herbaceous)					Rating Categories						
18												Weed Ratings:													Grazing / Browsing Pressure (Heavy, Moderate, Low, None)	Notes		
19												List three dominant, desirable species					List three dominant, desirable species					Prohibited Noxious:			Problem / Volunteer:			
20												Average Height (m)		Canopy Cover %		Total %	Stem / Plant Count #		Branch / Leader Growth Year		Desireable Herbaceous Cover %		Total %	Prohibited Noxious:	Noxious:	Problem / Volunteer:		
21												Step - out	Vegetation Cover Removed:	List three dominant, desirable species	Average Height (m)	Canopy Cover %	Total %	Sp.	Total	Prev.	Curr.	List three dominant, desirable species	Desireable Herbaceous Cover %	Total %	Prohibited Noxious:	Noxious:	Problem / Volunteer:	
22																												
23	Lease																											
24		S1	Value:	Y N	Yes	1) White Spruce	0.30	5%	15%	3	7	10	Smooth Brome	60	90	ID:	1	1	1	Heavy								
25						2) Birch	0.30	5%				10	Alsike Clover	10														
26						3) Willow	1.20	5%		1		40	Fescue	20														
27						1) N/A							Smooth Brome	20	90	ID:	1	1	1	Heavy								
28		S2	Value:	Y N	Yes	2) Alsike Clover							Alsike Clover	10														
29						3) Fescue							Fescue	20														
30						1) Willow	1.50	5%	10%	3	5	50	Smooth Brome	40	90	ID:	1	1	1	Heavy								
31						2) White Spruce	30.00	5%		2		30	Alsike Clover	10														
32						3) Fescue							Fescue	40														
33						1) Willow	1.50	5%	10%	4	7	50	Smooth Brome	35	85	ID:	1	1	1	Heavy								
34		S4	Value:	Y N	Yes	2) White Spruce	30.00	5%	10%	3		16	Alsike Clover	10														
35						3) Fescue							Fescue	40														
36						1) Willow	1.50	5%	10%	2	5	40	Smooth Brome	35	50	ID:	1	1	1	Heavy								
37		S5	Value:	Y N	Yes	2) White Spruce	30.00	5%	10%	3		8	Alsike Clover	5														
38						3) Calmagrostis-Can							Calmagrostis-Can	10														
39						1) N/A							Smooth Brome	60	90	ID:	1	1	1	Heavy								
40		S6	Value:	Y N	Yes	2) Alsike Clover							Alsike Clover	10														
41						3) Fescue							Fescue	20														
42						1) N/A							Smooth Brome	60	100	ID:	1	1	1	Heavy								
43		S7	Value:	Y N	Yes	2) Calmagrostis-Can							Calmagrostis-Can	5														
44						3) Fescue							Fescue	35														
45						1) Smooth Brome							Smooth Brome	40	90	ID:	1	1	1	Heavy								
46		S8	Value:	Y N	Yes	2) Calmagrostis-Can							Calmagrostis-Can	10														
47						3) Fescue							Fescue	40														
48						1) N/A							Smooth Brome	40	90	ID:	1	1	1	Heavy								
49		S9	Value:	Y N	Yes	2) Alsike Clover							Alsike Clover	10														
50						3) Fescue							Fescue	40														

1	Record of Observations: Forested Criteria - Vegetation Assessment															
3	Assessor Name(s): <u>Mary Assessor</u>						Operator: <u>Operator - Gas Co</u>									
5	ERCB unique Well / Facility Identifier(s):				Disposition #:				Location		Well Center		Surface		Downhole	
6									NAD83		Latitude: xx° xx' xx.xx"		xx° xx' xx.xx"		xx° xx' xx.xx"	
7	16-13-052-14 W6M				MSL - 849246						Longitude: xxx° xx' xx.xx"		xxx° xx' xx.xx"		xxx° xx' xx.xx"	
9	Natural Sub-region:		Ecosite:		Soil Zone		Soil Series		Construction Practice:		Reclamation Practice:					
10	Sub-Region		Ecosite:		Soil Zone		Soil Series		Construction Practice:		Reclamation Practice:					
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:	
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other	
14																

16	Site Point												Rating Categories			Grazing / Browsing Pressure (Heavy, Moderate, Low, None)	Notes
17	Vegetation (Woody)						Vegetation (Herbaceous)						Weed Ratings:				
18	Step - out	Vegetation Cover Removed:	List three dominant, desirable species	Average Height (m)	Canopy Cover %	Total %	Stem / Plant Count		Branch / Leader Growth	List three dominant, desirable species	Desireable Herbaceous Cover %	Total %	Prohibited Noxious:	Noxious:	Problem / Volunteer:		
19							#	Year									
20																Prev.	Curr.
21																	
22																	

80	Control																	
81	☞ Value: Y N No	(D)	1)	Aspen	15.00	10%	45%	2	6	15	Labrador Tea	10	35	1	1	1	Light	
82			2)	White Spruce	15.00	30%		3			Dogwood	20		ID:				
83			3)	Willow	1.00	5%		1			Calmagrostis-Can	5						
84	☞ Value: Y N No	(D)	1)	Aspen	15.00	10%	50%	4	6	25	Labrador Tea	5	30	1	1	1	Light	
85			2)	White Spruce	15.00	40%		2			Dogwood	20		ID:				
86			3)								Calmagrostis-Can	5						
87	☞ Value: Y N No	(D)	1)	Aspen	15.00	5%	75%	3	6	25	Buffalo Berry	5	20	1	1	1	Light	
88			2)	White Spruce	15.00	40%		2			Dogwood	10		ID:				
89			3)	Balsam Poplar	15.00	30%		1			Calmagrostis-Can	5						
90	☞ Value: Y N No	(D)	1)	Aspen	15.00	30%	70%	4	7	15	Dogwood	10	30	1	1	1	Light	
91			2)	White Spruce	15.00	10%		2			Calmagrostis-Can	20		ID:				
92			3)	Balsam Poplar	15.00	30%		1										
93	☞ Value: Y N Y N	(D)	1)														H M L N	
94			2)											ID:				
95			3)															
96	☞ Value: Y N Y N	(D)	1)														H M L N	
97			2)											ID:				
98			3)															
99	☞ Value: Y N Y N	(D)	1)														H M L N	
100			2)											ID:				
101			3)															
102	☞ Value: Y N Y N	(D)	1)														H M L N	
103			2)											ID:				
104			3)															
105	☞ Value: Y N Y N	(D)	1)														H M L N	
106			2)											ID:				
107			3)															

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V			
1	Record of Observations: Forested Criteria - Vegetation Assessment																								
3	Assessor Name(s): Mary Assessor										Operator: Operator - Gas Co														
5	ERCB unique Well / Facility Identifier(s):					Disposition #:					Location				Well Center				Surface		Downhole				
6											NAD83				Latitude: xx° xx' xx.xx"				xx° xx' xx.xx"		xx° xx' xx.xx"				
7	16-13-052-14 W6M					MSL - 849246									Longitude: xxx° xx' xx.xx"				xxx° xx' xx.xx"		xxx° xx' xx.xx"				
9	Natural Sub-region:			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:									
10	Sub-Region			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:									
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:										
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other										
14																									
16	Site Point															Rating Categories			Grazing / Browsing Pressure (Heavy, Moderate, Low, None)		Notes				
17																Weed Ratings:									
18																Vegetation (Woody)			Vegetation (Herbaceous)						
19																List three dominant, desirable species			List three dominant, desirable species						
20																Average Height			Desireable Herbaceous Cover						
21																Canopy Cover			Stem / Plant Count			Branch / Leader Growth			
22																Total			#			Year			
23																(m)			Sp.			Prev.			
24																%			Total			Curr.			
25																%			Total			%			
26																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
27																Noxious:			Prohibited			Noxious:		Problem / Volunteer:	
28																%			%			%		%	
29																Total			Total			Total		Total	
30																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
31																Noxious:			Prohibited			Noxious:		Problem / Volunteer:	
32																%			%			%		%	
33																Total			Total			Total		Total	
34																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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98																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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102																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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106																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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114																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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126																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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129																Total			Total			Total		Total	
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165																Total			Total			Total		Total	
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193																Total			Total			Total		Total	
194																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
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196																%			%			%		%	
197																Total			Total			Total		Total	
198																Prohibited			Noxious:			Noxious:		Problem / Volunteer:	
199																Noxious:			Prohibited			Noxious:		Problem / Volunteer:	
200																%			%			%		%	

1	Record of Observations: Forested Criteria - Vegetation Assessment																													
3	Assessor Name(s): <u>Mary Assessor</u>												Operator: <u>Operator - Gas Co</u>																	
5	ERCB unique Well / Facility Identifier(s):						Disposition #:						Location			Well Center			Surface			Downhole								
6													NAD83			Latitude: xx° xx' xx.xx"			xx° xx' xx.xx"			xx° xx' xx.xx"								
7	16-13-052-14 W6M						MSL - 849246									Longitude: xxx° xx' xx.xx"			xxx° xx' xx.xx"			xxx° xx' xx.xx"								
9	Natural Sub-region:				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:									
10	Sub-Region				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:									
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:															
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other															
14																														
16	Site Point												Vegetation (Woody)						Vegetation (Herbaceous)						Rating Categories			Grazing / Browsing Pressure	Notes	
17																									Weed Ratings:					
18																									Prohibited Noxious:					
19																									Noxious:					
20																									Problem / Volunteer:					
21																														
22																														
133	Number of Assessment Points:																													
134	Lease Measurements/Ratings:																													
135	≥25% Total Cover																													
136	<25% Total Cover																													
137	If natural recovery: # <5																													
138	If merchantable site: # <2																													
139	Rating of: 1																													
140	Rating of: 2																													
141	Rating of: 3																													
142	Rating of: 4																													
144	Control Measurements/Ratings:																													
145	Rating of: 1																													
146	Rating of: 2																													
147	Rating of: 3																													
148	Rating of: 4																													

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V				
1	Record of Observations: Forested Criteria - Vegetation Assessment																									
3	Assessor Name(s): <u>Mary Assessor</u>											Operator: <u>Operator - Gas Co</u>														
5	ERCB unique Well / Facility Identifier(s):					Disposition #:					Location			Well Center			Surface		Downhole							
6											NAD83			Latitude: xx° xx' xx.xx"			xx° xx' xx.xx"		xx° xx' xx.xx"							
7	16-13-052-14 W6M					MSL - 849246								Longitude: xxx° xx' xx.xx"			xxx° xx' xx.xx"		xxx° xx' xx.xx"							
9	Natural Sub-region:			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:										
10	Sub-Region			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:										
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation			Other:										
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege			Fore - Other										
14																										
16	Site Point																									
17												Vegetation (Woody)					Vegetation (Herbaceous)					Rating Categories				
18																						Weed Ratings:				
19												List three dominant, desirable species					List three dominant, desirable species					Prohibited Noxious:			Grazing / Browsing Pressure (Heavy, Moderate, Low, None)	
20												Average Height (m)					Stem / Plant Count #					Desireable Herbaceous Cover %				
21												Canopy Cover %					Branch / Leader Growth Year					Total %				
22												Total %					Prev. Curr.					Noxious: Problem / Volunteer:				
151	ACCESS ROAD (AR) / ACCESS CONTROL (AC) COMPARISONS																									
152	AR1	Value:	Y N	Y N	1) White Spruce	0.50	5%	15%	2	6	7	6	Smooth Brome	35	50	1	1	1	None							
153					2) Birch	0.40	5%		2				Alsike Clover	5		ID:										
154					3) Willow	1.80	5%		2				Calmagrostis-Can	10												
155	AR2	Obs.	Y / N	Y / N																						
157					1) Aspen	25.00	5	15	1	5			Buffalo Berry	5	20	ID:	1	1	1	H M L N						
158					2) White Spruce	25.00	5		2					Dogwood	10											
159				3) Balsam Poplar	1.50	5		2		4	3		Calmagrostis-Can	5												
160	AR3	Obs.	Y / N	Y / N																						
162					1) White Spruce	0.40	5%	15%	3	7	7	6	Smooth Brome	60	90	ID:	1	1	1	H M L N						
163					2) Birch	0.45	5%		2					Alsike Clover	10											
164				3) Willow	1.40	5%		2					Fescue	20												
165	AC1	Obs.	Y / N	Y / N																						
167					1) Aspen	25.00	5	15	2	6			Labrador Tea	5	30	ID:	1	1	1	H M L N						
168					2) White Spruce	25.00	5		1					Dogwood	20											
169				3) Balsam Poplar	1.50	5		3		4	3		Calmagrostis-Can	5												
170	AC2	Obs.	Y / N	Y / N																						
172																										
173																										
174	AC3	Obs.	Y / N	Y / N																						
177																										
178																										
179																										
180																										
181																										

W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ		
1	Record of Observations: Forested Lands Criteria - Soil Assessment																					
3	Assessor Name(s): Joe Assessor										Operator: Operator - Gas Co											
5	ERCB unique Well / Facility Identifier(s):					Disposition #:					Location				Well Center			Surface		Downhole		
6											NAD83				Latitude:			xx° xx' xx.xx"		xx° xx' xx.xx"		
7	16-13-052-14 W6M					MSL - 849246									Longitude:			xxx° xx' xx.xx"		xxx° xx' xx.xx"		
9	Natural Sub-region:			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:						
10	Sub-Region			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:						
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:							
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other							
14																						
16	Site Point				Soil Measurement					Soil Ratings											Notes	
17	(J)									Topsoil Quality				Subsoil Quality								
18																						
19																						
20																						
21					Topsoil Depth (cm)					Topsoil Depth	Texture:	Consistence:	Structure:	Rooting Restrictions:	Texture:	Consistence:	Structure:	Rooting Restrictions:				
22					Horiz. #1 Horiz. #2 Sum %																	
23	Lease																					
24	S1	Value:	Mid	Yes	2	0	2	17%	4	2	2	2	1	1	1	1	1	1	1	1		
25	S1	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Sandy Clay	Firm	Medium Blocky						
26	S2	Value:	L-Mid	Yes	3	0	3	25%	4	1	2	2	1	3	1	1	1	1	1	1		
27	S2	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Sandy Clay	Firm	Medium Blocky						
28	S3	Value:	Upper	Yes	3	0	3	25%	4	1	2	2	1	1	1	1	1	1	1	1		
29	S3	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Sandy Clay	Firm	Medium Blocky						
30	S4	Value:	Upper	Yes	3	0	3	25%	4	1	2	2	1	1	1	1	1	1	1	1		
31	S4	Obs.	Y / N	Y / N						Clay Loam	Friable	Fine Blocky	None	Sandy Clay	Firm	Medium Blocky						
32	S5	Value:	U-Mid	Yes	3	0	3	25%	4	1	2	2	1	1	1	1	1	1	1	1		
33	S5	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Clay	Firm	Medium Blocky						
34	S6	Value:	Upper	Yes	3	0	3	25%	4	1	2	2	1	1	1	1	1	1	1	1		
35	S6	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Clay	Firm	Medium Blocky						
36	S7	Value:	U-Mid	Yes	3	0	3	25%	4	1	2	2	1	1	1	1	1	1	1	1		
37	S7	Obs.	Y / N	Y / N						Clay Loam	Firm	Medium Blocky	None	Clay	Firm	Medium Blocky						
38	S8	Value:	Upper	Yes	3	0	3	25%	4	1	2	3	1	1	1	2	1	1	1	1		
39	S8	Obs.	Y / N	Y / N						Clay Loam	Firm	Coarse Blocky	None	Clay	Firm	Coarse Blocky						
40	S9	Value:	Mid	Yes	3	0	3	25%	4	1	1	2	1	1	1	1	1	1	1	1		
41	S9	Obs.	Y / N	Y / N						Clay Loam	Friable	Fine Blocky	None	Sandy Clay	Firm	Medium Blocky						
42																						
43																						
44																						
45																						
46																						
47																						
48																						
49																						
50																						

W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ		
1	Record of Observations: Forested Lands Criteria - Soil Assessment																					
3	Assessor Name(s): Joe Assessor										Operator: Operator - Gas Co											
5	ERCB unique Well / Facility Identifier(s):				Disposition #:				Location				Well Center		Surface		Downhole					
6									NAD83				Latitude:		xx° xx' xx.xx"		xx° xx' xx.xx"		xx° xx' xx.xx"			
7	16-13-052-14 W6M				MSL - 849246								Longitude:		xxx° xx' xx.xx"		xxx° xx' xx.xx"		xxx° xx' xx.xx"			
9	Natural Sub-region:			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:						
10	Sub-Region			Ecosite:			Soil Zone			Soil Series			Construction Practice:			Reclamation Practice:						
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:							
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other							
14																						
16	Site Point				Soil Measurement				Soil Ratings								Notes					
17	(J)																					
18																						
19																						
20					Topsoil Depth (cm)				Topsoil Depth				Topsoil Quality				Subsoil Quality					
21					Horiz. #1 Horiz. #2 Sum				Texture: Consistence: Structure: Rooting Restrictions:				Texture: Consistence: Structure: Rooting Restrictions:									
22	Step - out		Slope	Evidence of Soil Disturbance:																		
80	Control																					
81	Value:		Mid	No	10	0	10	83%	1	1	1	1	1	1	1	1	1	1	1	1		
82	C1		Obs.	Y / N	Y / N						Clay Loam	Friable	Fine Platy	None	Sandy Clay	Friable	Fine SAB	None				
83																						
84	Value:		U-Mid	No	12	0	12	100%	1	1	1	1	1	1	1	1	1	1	1	1		
85	C2		Obs.	Y / N	(L) N						Clay Loam	Friable	Fine Platy	None	Sandy Clay	Friable	Fine SAB	None				
86																						
87	Value:		L-Mid	No	14	0	14	117%	1	1	1	1	1	1	1	1	1	1	1	1		
88	C3		Obs.	Y / N	Y / N						Clay Loam	Friable	Fine Platy	None	Sandy Clay	Friable	Fine SAB	None				
89																						
90	Value:		L-Mid	No	12	0	12	100%	1	1	1	1	1	1	1	1	1	1	1	1		
91	C4		Obs.	Y / N	Y / N						Clay Loam	Friable	Fine Platy	None	Sandy Clay	Friable	Fine SAB	None				
92																						
93	Value:																					
94	C5		Obs.	Y / N	Y / N																	
95																						
96	Value:																					
97	C6		Obs.	Y / N	Y / N																	
98																						
99	Value:																					
100	C7		Obs.	Y / N	Y / N																	
101																						
102	Value:																					
103	C8		Obs.	Y / N	Y / N																	
104																						
105	Value:																					
106	C9		Obs.	Y / N	Y / N																	
107																						

W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ																																
1	Record of Observations: Forested Lands Criteria - Soil Assessment																																																			
3	Assessor Name(s): Joe Assessor										Operator: Operator - Gas Co																																									
5	ERCB unique Well / Facility Identifier(s):				Disposition #:				Location				Well Center				Surface				Downhole																															
6									NAD83				Latitude:				xx° xx' xx.xx"				xx° xx' xx.xx"				xx° xx' xx.xx"																											
7	16-13-052-14 W6M				MSL - 849246								Longitude:				xxx° xx' xx.xx"				xxx° xx' xx.xx"				xxx° xx' xx.xx"																											
9	Natural Sub-region:				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:																															
10	Sub-Region				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:																															
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:																																					
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other																																					
14																																																				
16	Site Point				Soil Measurement				Soil Ratings																																											
17	(J)								Topsoil Quality				Subsoil Quality																																							
18																																																				
19																																																				
20					Topsoil Depth (cm)				Topsoil Depth				Texture:				Consistence:				Structure:				Rooting Restrictions:				Notes																							
21					Horiz. #1				Horiz. #2				Sum																																							
22	Step - out				Slope				Evidence of Soil Disturbance:																																											
110	Comparison Summary																																																			
112	Lease Data Summary																																																			
113	# Assessment Points On-Site:				9				9				9				9				9				9																											
114	Sum of Values				26																																															
115	Average - Value				3				24%				4.00				1.11				1.89				2.11				1.00				1.22				1.00				1.11				1.00							
116	Minimum Value				10				83%																																											
117	% of Control				24%				24%																																											
119	Control Data Summary																																																			
120	# of Assessment Points				4				4				4				4				4				4				4																							
121	Sum of Values				48																																															
122	Average - Value				12				100%				1.00				1.00				1.00				1.00				1.00				1.00				1.00				1.00											
123	Minimum Value				10				83%																																											
124	% of control				100%				100%																																											
125	Standard Deviation				1.63																																															
126	Standard Error				0.82																																															
127	95% Confidence Interval				1.60																																															
129	Comparisons:				Critical Value:				80.0%				0.50				0.50				0.50				0.50				0.50				0.50				0.50				0.50											
130	Lease vs. Control:				24%				3.00				0.11				0.89				1.11				0.00				0.22				0.00				0.11				0.00											
131	Pass / Fail				F				F				P				F				F				P				P				P				P				P											

W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ					
1	Record of Observations: Forested Lands Criteria - Soil Assessment																								
3	Assessor Name(s): Joe Assessor										Operator: Operator - Gas Co														
5	ERCB unique Well / Facility Identifier(s):				Disposition #:				Location				Well Center			Surface			Downhole						
6									NAD83				Latitude:			xx° xx' xx.xx"			xx° xx' xx.xx"			xx° xx' xx.xx"			
7	16-13-052-14 W6M				MSL - 849246								Longitude:			xxx° xx' xx.xx"			xxx° xx' xx.xx"			xxx° xx' xx.xx"			
9	Natural Sub-region:				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:				
10	Sub-Region				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:				
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:										
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other										
14																									
16	Site Point				Soil Measurement				Soil Ratings				Notes												
17	(J)																								
18																									
19																									
20					Topsoil Depth (cm)				Topsoil Depth				Topsoil Quality				Subsoil Quality								
21					Horiz. #1 Horiz. #2 Sum				Texture: Consistence: Structure: Rooting Restrictions:				Texture: Consistence: Structure: Rooting Restrictions:												
22	Step - out Slope Evidence of Soil Disturbance:				%																				
133	Number of Assessment Points:																								
134	Lease Measurements/Ratings:																								
135	≥80% of the Control Average								0																
136	<80% of the Control Average								(N)				9												
137																									
138																									
139	Rating of: 1								0 8 1 0 9				8 9 8 9												
140	Rating of: 2								0 1 8 8 0				0 0 1 0												
141	Rating of: 3								0 0 0 1 0				1 0 0 0												
142	Rating of: 4								9 0 0 0 0				0 0 0 0												
144	Control Measurements/Ratings:																								
145	Rating of: 1								4 4 4 4 4				4 4 4 4												
146	Rating of: 2								0 0 0 0 0				0 0 0 0												
147	Rating of: 3								0 0 0 0 0				0 0 0 0												
148	Rating of: 4								0 0 0 0 0				0 0 0 0												

W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ					
1	Record of Observations: Forested Lands Criteria - Soil Assessment																								
3	Assessor Name(s): Joe Assessor				Operator: Operator - Gas Co																				
5	ERCB unique Well / Facility Identifier(s):				Disposition #:				Location				Well Center			Surface			Downhole						
6									NAD83				Latitude:			xx° xx' xx.xx"			xx° xx' xx.xx"			xx° xx' xx.xx"			
7	16-13-052-14 W6M				MSL - 849246								Longitude:			xxx° xx' xx.xx"			xxx° xx' xx.xx"			xxx° xx' xx.xx"			
9	Natural Sub-region:				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:				
10	Sub-Region				Ecosite:				Soil Zone				Soil Series				Construction Practice:				Reclamation Practice:				
12	Activity Dates (mm/dd/yr):		Survey		Construction		Abandonment		Reclamation		Soils		Vegetation		Other:										
13			Fore - Survey		Fore - Const		Fore - Aband		Fore - Reclam		Fore - Soil		Fore - Vege		Fore - Other										
14																									
16	Site Point				Soil Measurement				Soil Ratings				Notes												
17	(J)																								
18																									
19																									
20																									
21																									
22	Step - out		Slope	Evidence of Soil Disturbance:	Topsoil Depth (cm)		Topsoil Depth	Texture:	Consistence:	Structure:	Rooting Restrictions:	Texture:	Consistence:	Structure:	Rooting Restrictions:										
					Horiz. #1 Horiz. #2 Sum		%																		
151	ACCESS ROAD (AR) / ACCESS CONTROL (AC) COMPARISONS																								
152	AR1		Value:	Y N	Y N	6	6	40%	3	1	1	1	1	1	1	1	1	1	1	1					
153			Obs.	Y / N	Y / N																				
154																									
155																									
156																									
157	AC1		Value:	Y N	Y N	15	15	100%	1	1	1	1	1	1	1	1	1	1	1	1					
158			Obs.	Y / N	Y / N																				
159																									
160																									
161																									
162	AR2		Value:	Y N	Y N	5	5	33%	3	1	1	1	1	1	1	1	1	1	1	1					
163			Obs.	Y / N	Y / N																				
164																									
165																									
166																									
167	AC2		Value:	Y N	Y N	15	15	100%	1	1	1	1	1	1	1	1	1	1	1	1					
168			Obs.	Y / N	Y / N																				
169																									
170																									
171																									
172	AR3		Value:	Y N	Y N																				
173			Obs.	Y / N	Y / N																				
174																									
175																									
176																									
177																									
178	AC3		Value:	Y N	Y N																				
179			Obs.	Y / N	Y / N																				
180																									
181																									

13. Appendix E

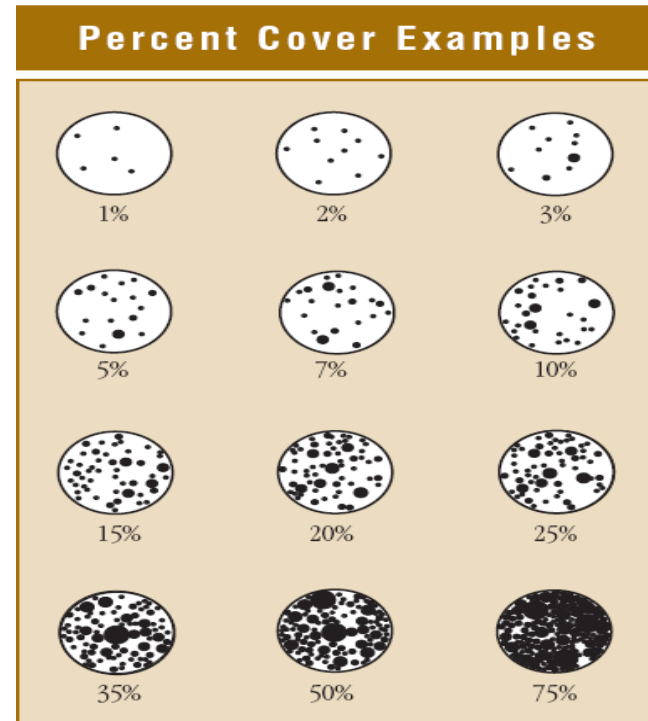
13.1. Forested Land Criteria Rating Tables

FRT.1 Level 1 Vegetation

Woody: % cover and/or stem/plant count	- Visual quantitative estimate of percent cover (shrub and trees) and/or wood stem/plant count (trees and shrubs) using a 1.78 metre radius (10 m ²).
	- Target is to achieve >= 25% shrub cover of control/reference cover, or a stem/plant count of 5 if natural recovery, or 2 if planted.
% herbaceous Cover	- Visual quantitative estimate of percent cover using a using a 1.78 metre circular radius (10 m ²)

FRT.2 Undesirable plant/weed ratings for Forested soils

VEGETATION / WEED RATINGS			
Rating	Class	Description	
1	0	None	
2	1	Rare	
	2	A few sporadically occurring individual weeds and/or undesirable plants	
3	3	A single patch of weeds and/or undesirable plants	
	4	A single patch plus a few sporadically occurring weeds and/or undesirable plants	
4	5	Several sporadically occurring weeds and/or undesirable plants	
	6	A single patch plus several sporadically occurring weeds and/or undesirable plants	
5	7	A few patches of weeds and/or undesirable plants	
	8	A few patches plus several sporadically occurring weeds and/or undesirable plants	
6	9	Several well spaced patches of weeds and/or undesirable plants	
	10	Continuous uniform occurrences of well spaced weeds and/or undesirable plants	
7	11	Continuous occurrence of plants with a few gaps in the distribution of weeds and/or undesirable plants	
	12	Continuous dense occurrence of weeds and/or undesirable plants	



FRT.3 Topsoil Rating for Forest Soils distribution

<i>Rating</i>	<i>% of Control Mean</i>
1	>80% of Control mean
2	50-79% of Control Mean
3	30-49% of Control Mean
4	<30% of Control Mean

FRT.4 Level 1 Soil Parameters for Forested soils

Rating	TEXTURE	
	Clay (C)	Sandy (S)
1	Loam, Silt Loam, Silt	
2	Sandy Clay Loam, Clay Loam, Silty Clay Loam	Sandy Loam
3	Clay, Silty Clay, Sandy Clay	Loamy Sand
4	Heavy Clay, Siltstone	Sand, Gravel, Unconsolidated Bedrock

Rating	Topsoil (TS)			Subsoil (SS)		
	Consistence		Result	Consistence		Result
	Moist	Dry		Moist	Dry	
1	Very friable - Friable	Soft - Slightly Hard	Pass; no structure assessment	Loose, Very friable, Friable, Firm	Loose, Soft, Slightly hard, Hard	Pass; no structure assessment
2	Loose - Firm	Loose - Hard	Proceed to assess structure	Very firm	Very hard	Proceed to assess structure
3	Very firm	Very hard		Extremely firm	Extremely hard	
4	Extremely firm	Extremely hard		NA	NA	

FRT.5 Soil Structure Rating for Forested Soils

<i>Kind</i>	<i>Class</i>	Size (cm)	Topsoil	Subsoil
Single grain $\frac{3}{4}$ loose, incoherent mass of individual particles as in	-	<0.2	2	1
Amorphous (massive) $\frac{3}{4}$ a coherent mass showing no evidence of any distinct arrangement of soil particles.	Breaking to fine fragments	<2	2	1
	Breaking to medium fragments	2-5	3	2
	Breaking to coarse fragments	5-10	4	3
	Breaking to very coarse fragments	>10	4	4
Blocky (angular blocky) $\frac{3}{4}$ faces rectangular and flattened less than 5 sided, vertices sharply angular.	Fine blocky	<1	2	1
	Medium blocky	1-2	2	1
	Coarse blocky	2-5	3	2
	Very coarse blocky	>5	4	3
Subangular blocky $\frac{3}{4}$ faces subrectangular more than 5 sided, vertices mostly oblique, or subrounded.	Fine subangular blocky	<1	2	1
	Medium subangular blocky	1-2	2	1
	Coarse subangular blocky	2-5	3	2
	Very coarse subangular blocky	>5	4	3
Granular $\frac{3}{4}$ spheroidal, characterized by rounded vertices.	Fine granular	<0.2	1	1
	Medium granular	0.2-0.5	1	1
	Coarse granular	0.5-1	1	1
Platy $\frac{3}{4}$ horizontal planes more or less developed.	Fine platy	<0.2	1	1
	Medium platy	0.2-0.5	1	1
	Coarse platy	0.5-1	1	1
Prismatic $\frac{3}{4}$ vertical faces well defined and edges sharp.	Fine prismatic	<2	2	1
	Medium prismatic	2-5	3	2
	Coarse prismatic	5-10	4	3
	Very coarse prismatic	>10	4	4
Columnar $\frac{3}{4}$ vertical edges near top of columns not sharp. Columns may be flat-topped, rounded-topped, or irregular.	Fine columnar	<2	3	2
	Medium columnar	2-5	4	3
	Coarse columnar	5-10	4	4
	Very coarse columnar	>10	4	4
Compacted – relatively dense soil layers/lumps, more or less defined. These layers may break with vertices being sharply angular. Size reflects thickness of layers or diameter of lumps.	Fine compacted	<2	3	2
	Medium compacted	2-5	4	3
	Coarse compacted	5-10	4	4
	Very coarse compacted	>10	4	4

FRT.6 Level 2 Soil Parameters for Forested soils. Values are the difference between the average control value and specific assessment point site being evaluated (Lease - Control).

Rating	PSA: % Clay	Organic Carbon	pH
1	0 - 5%	0 - 1%	0 - 0.5
2	5.1 - 10%	1.1 - 2%	0.6 - 1
3	10.1 - 30%	2.1 - 4%	1.1 - 2
4	>30%	>4.1%	>2.1

14. Appendix F

14.1. Exemption Justification Form

NOTE: This is a sample of the form that must be completed when trying to justify why a wellsite should pass a Level 1 or 2 Vegetation or Soils assessment even though it did not meet the criteria. Justifications initiate a further technical review.

Site:

Category failed:
Indicate the assessment item(s) that failed: ____ and at what level (1 or 2) ____

Write justification here and attach any supporting documentation:

Name of person preparing justification:

Title of person preparing justification:

Signature of person preparing justification: **Date:**

Signature of Approving Official (GAA, etc.): **Date:**

Name of Approving Official: **Title:**

15. Appendix G

15.1. References used for the 2010 Reclamation Criteria for Forested Lands

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16. Appendix H

16.1. Glossary

A horizon (topsoil): A mineral horizon formed at the surface in the zone of removal of material by leaching, or maximum accumulation of organic carbon, or both, as defined by the *Canadian System of Soil Classification (CSSC)*.

Access Roads: In some cases the landowner may wish to have roads left in place. The roads must be stable, nonhazardous and nonerosive.

Admixing: The addition of nontopsoil material to topsoil resulting in a mixture. Nontopsoil materials could include subsoil, spoil and/or project wastes.

Ae: An A horizon that has had clay, iron, aluminum, or organic matter, or all of these, leached from it. Ae horizons are usually gray coloured with a platy structure, as defined by CSSC.

Aggregate: A group of soil particles cohering so as to behave mechanically as a unit.

Ah: An A horizon in which organic matter has accumulated as a result of biological activity, as defined by CSSC.

Ahe: An A horizon that has some organic matter accumulation, as well as some leaching of clay, iron, or aluminum, as defined by CSSC.

Anomaly: A result at an assessment location that does not appear representative of the entire grid being evaluated. If an anomaly is encountered, a 'step-out' assessment procedure may be used to see if the location is anomalous or representative of the grid.

Ap: An A horizon markedly disturbed by cultivation, as defined by CSSC.

Arable: Tillage; agricultural production based on cultivation practices; land that is cultivated or capable of being cultivated. Arable is used as a comparison to agriculture based on grazing (noncultivated) systems.

ARD: Average Replaced Depth. Calculated as the average replaced topsoil depth of all the assessment locations.

Assessment Grid: An approximately 30 m x 30 m grid, to 40 m x 40 m grid, established on the lease to provide a systematic method for collecting soils (and vegetation) data.

Assessment Location: The point in the centre of each grid on the lease; or the location where soil (and vegetation) is assessed on the access road.

Audit: Refers to the Wellsite Audit System: This is a process of issuing reclamation certificates for wellsites (following application review), and then conducting a field assessment on a selected number of certified sites to ensure that criteria have been met.

B horizon: A subsoil horizon characterized by enrichment in organic matter, or clay; or by the development of soil structure; or by change of colour denoting hydrolysis, reduction, or oxidation, as defined by CSSC.

Bare Areas: Areas with exposed soil. For cultivated or forage lands, areas between seed rows are not included.

Bedrock: The solid rock underlying soils and the regolith or exposed at the surface.

Bog: A peat-covered or peat-filled wetland, generally with a high water table. The water of a bog is generally acid and low in nutrients. Bogs usually support a black spruce forest but may also be treeless. They are usually covered with sphagnum and feathermosses and ericaceous shrubs.

Borrow pits: Source of infill.

Brunisolic: An order of soils whose horizons are developed sufficiently to exclude them from the Regosolic Order but lack the degrees or kinds of horizon development specified for soils in other orders. They always have Bm or Btj horizons.

C horizon: A mineral subsoil comparatively unaffected by the pedogenic processes operative in the A and B horizons except for the process of gleying (Cg), or the accumulation of calcium carbonates (Cca) or other salts (Csa), as defined by CSSC. A naturally calcareous horizon is designated Ck.

Calcareous soil: Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with cold 0.1N hydrochloric acid.

Canopy Cover: The area of ground within a quadrat (2 dimensional frame) that is occupied by the above-ground parts of plants (live or dead), when viewed from above. Cover is usually estimated as a percent, but multiple layers of vegetation often result in cover values over 100%. Litter (dead vegetation) is included but weeds are not.

Cation Exchange Capacity (C.E.C.): A measure of the total amount of exchangeable cations that can be held by the soil; it is expressed in terms of mols *per* kg of soil (formerly meq/100g); CEC is largely controlled by the amount of clay and organic matter in the soil.

Cemented horizon: Any horizon that has a hard or brittle consistence because the particles are held together by cementing substances such as humus, calcium carbonate, or oxides of silica, iron and aluminum. They are commonly represented by horizon designations such as Cc or x.

Chernozemic: An order of soils that have developed under xerophytic or mesophytic grasses and forbs, or under grassland-forest transition vegetation, in cool to cold, subarid to subhumid climates. The soils have a dark-coloured surface (Ah, Ahe or Ap) horizon and a B or C horizon, or both, of high base saturation. The order consists of the Brown, Dark Brown, Black and Dark Gray great groups.

Chroma: The relative purity, strength, or saturation of a colour; directly related to the dominance of the determining wavelength of the light and inversely related to grayness; one of the three variables of colour.

Classification, soil: The systematic arrangement of soils into categories and classes on the basis of their characteristics. Broad groupings are made on the basis of general characteristics and subdivisions on the basis of more detailed differences in specific properties.

Clay pads: Built-up wellsite.

Clay: As a particle-size term: a size fraction <0.002 mm equivalent diameter.

Clod: A compact, coherent mass of soil produced by digging, plowing or remoulding.

Coarse fragments: Rock or mineral particles > 2.0mm in diameter.

Coarse texture: The texture exhibited by sands, loamy sands, and sandy loams except very fine sandy loam. A soil containing large quantities of these textural classes.

Compaction: the result of bearing equipment and drilling activity onsite that exceeds the soil strength, increasing the density of the topsoil and/or subsoil, limiting root penetration and water infiltration.

Consistence: The resistance of a soil to deformation, or the degree of cohesion or adhesion of the soil mass. Terms used to describe a moist soil are: loose, very friable, friable, firm, very firm, compact, very compact, and extremely compact. Terms used to describe dry soils are: loose, soft, slightly hard, hard, very hard, and extremely hard.

Construction period: Period when site is being prepared for exploration and/or extraction.

Contamination: The condition or state of soil or water, caused by a substance release or escape that results in an impairment of, or damage to, the environment, human health, safety, or property. Introduction of foreign materials as a result of wellsite activity (construction, drilling, production, or reclamation). Types of contaminants include hydrocarbons, gas leaks, salts, sterilants, etc.

Contouring: Topographic features measured in centimeters (micro) meters (meso) and tens of meters (macro). Such can be lost due to cut and fill wellsite construction activities and need to be restored during reclamation.

Control Depth: Calculated as the depth of a single topsoil control (access roads).

Control: The reference information against which collected information from a reclaimed site will be compared. The control information from adjacent or representative land.

Cover: Usually defined as the area of ground covered by all living (includes stems and leaves) and dead (litter) plant material that is produced naturally on a site, expressed as a percentage of the total area. Bare soil is not cover. This definition of cover is also referred to as ground cover, canopy cover or aerial cover. This is the type of cover that is referred to in the vegetation criteria. In a grassland it is important that cover be estimated where possible, by looking directly down on the plants from above.

Cultivated land: Lands within the White Area that are currently or potentially arable, and utilized for production of field crops (cereals, oilseeds, pulses, hay, and pasture in rotation) (Leskiw 1997). See also the intext definition.

Detailed Site Assessment (DSA): The report that must be attached to the Wellsite Reclamation Certificate Application form that provides all the data collected on the site. The report will also contain the justification used to explain why a site should get a certificate if some of the criteria have not be met.

Distribution Tolerance: Level of acceptable variability as found in representative controls. Two or three grids may have soil ratings below the MRR.

Disturbed soils: Soils that have been stripped, compacted, rutted or otherwise altered.

Drainage: Soil drainage refers to the frequency and duration of periods when the soil is not saturated. Terms used are: excessively, well, moderately, imperfectly and poorly drained.

Droughty soil: Sandy or very rapidly drained soil.

Ecological (or ecosystem) goods and services and services (EGS) are the benefits humans receive from the environment for free. EGS are categorized as: (1) *Regulating Services* - benefits obtained from an ecosystem's control of natural processes: air quality regulation, climate regulation, natural hazard regulation, water regulation, erosion control and sediment retention, waste treatment, pest regulation, pollination; (2) *Supporting Services* - underlying processes that are necessary for the production of all other ecosystem services: soil formation, primary production, nutrient cycling, photosynthesis, water cycling; (3) *Cultural Services* - nonmaterial benefits people obtain from ecosystem services: ethical values, existence values, recreation and ecotourism; and, (4) *Provisioning Services* - the goods or products obtained from ecosystems: water supply, fiber, food production, genetic resources, biomass fuel, biochemicals, natural medicines, and pharmaceuticals.

Ecosystem function: The interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting, and flammability.

Eolian: Material that has been deposited by wind action.

Erosion: The wearing away of the land surface by running water, wind, ice, or other geological agents, including such processes as gravitational creep.

Evapotranspiration: The combined loss of water from a given area and during a specific period of time, by evaporation from the soil surface and by transpiration from plants.

Facilities or Features Left in Place: In some cases, the landowner may wish to have roads or pads left in place. In these cases, the vegetation criteria are not necessarily applied. In other cases, roads or pads may be left in place but will be expected to be vegetated (*e.g.*, peat lands in agricultural areas, roads in Green Area). In these cases, some form of root zone must be established and the vegetation portions of the landscape criteria have to be met.

Fen: A peat-covered or peat-filled wetland with a water table which is usually at or above the surface. The waters are mainly nutrient-rich, minerotrophic waters from mineral soils. The vegetation consists mainly of sedges, grasses, reeds and brown mosses with some shrub cover and at times, a scanty tree layer.

Fibre (rubbed): Amount of fibre in an organic soil, greater than 0.15mm, remaining after a specified amount of abrasion (rubbing). A fibric soil has greater than 40% rubbed fibre, a mesic soil has 10% to 40% rubbed fibre and humic soil has less than 10% rubbed fibre.

Fibric: An organic layer containing large amounts of weakly decomposed material whose origins are readily identifiable.

Fine texture: Consisting of, or containing large quantities of the fine fractions, particularly of silt and clay.

First lift: The top layer of undisturbed soil materials salvaged and separated during excavation to be re-spread as topsoil.

Fluvial: Material that has been transported and deposited by streams and rivers. Also alluvial.

Forage: Perennial agronomic species grown for the purpose of feed.

Friable: A consistency term pertaining to the ease of crumbling of soils.

Gleysolic: An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas, or prominent mottling, or both, in some horizons. The great groups Gleysol, Humic Gleysol and Luvic Gleysol are included in the order.

Gravelly : Containing an appreciable or significant amounts of gravel (particles 2 to 75 mm in diameter)

Green Area: Public Lands General Land Classification. Forest lands not available for agricultural development other than grazing.

Groundwater: That portion of the hydrosphere which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

Gullying: Erosion of soil or soft rock material by running water that forms distinct, narrow channels that are larger and deeper than rills and that usually carry water only during and immediately after heavy rains or following the melting of ice or snow.

Horizon (soil): A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes. Soil horizons may be mineral or organic and differ from adjacent horizons in properties such as colour, structure, texture, and consistence, and in chemical, biological, and mineralogical composition.

Hue : One of the three variables of colour. It is caused by light of certain wavelengths and changes with the wavelength.

Humic : An organic layer of highly decomposed material containing little fibre.

Hummocky : Abounding in rounded or conical knolls or mounds, generally of equidimensional shape and not ridge-like.

Hydraulic conductivity: See Permeability.

Immature soil: A soil with indistinct or only slightly developed horizons.

Impeded drainage: A condition which hinders the movement of water through soils under the influence of gravity.

Impervious : Resistant to penetration by fluids or by roots.

Industry Assessment: The time (or times) when the site is assessed by the operator or his consultant. Data for the certificate application are collected at this time.

Infiltration: The downward entry of water into the soil.

Inquiry: A formal review of the reclaimed site under Sec. 121 of EPEA and Sec. 6 and 8 of the Conservation and Reclamation Regulation. The operator and the landowner are invited to the inquiry. Under the proposed Wellsite Audit System, an inquiry will be held only for those sites selected for a field audit on private lands. On public land, an inquiry will

be held on those sites that have been inspected under the audit and have reclamation problems.

Irrigation : The artificial application of water to the soil for the benefit of growing crops.

Justification: Explanation of why a site should get a certificate if some of the criteria have not been met. This information must be included in the Detailed Site Assessment Report (use Appendix F as template). For sites where justification has been used, the assessment is now nonroutine.

Lacustrine: Material deposited in lake water and later exposed.

Land capability: The nature and degree of limitations imposed by the physical characteristics of a land unit for a certain use.

Land manager: staff from SRD responsible for stewarding public/crown lands.

Land owner/occupant: person(s) residing on the property or holding the deed to the property.

Layers: Structural layers (life form layers) in grasslands include: 1) low shrubs, 2) tall graminoids and forbs 3) medium graminoids and forbs and 4) ground cover (graminoids, forbs, moss, lichen). In Forested, the layers would include trees, shrubs, grasses[?] and herbaceous.

Lease: The wellsite, not the access road, in this document.

Level 1: A wellsite assessment that considers landscape, vegetation and soil components at a low level intensity. It's purpose is to detect any anomalies needing more indepth assessment.

Level 2: A more intensive assessment of vegetation (cover and productivity) and soil (laboratory analyses) to address apparent problematic conditions.

Lithic: A feature of a soil subgroup which indicates a bedrock contact within 50 cm of the soil surface.

Litter: Standing and fallen dead plant material that was produced naturally on site.

Loam: See soil texture. A mixture of sand, silt and clay. It is not related to colour.

Loose: A soil consistence term.

Luvisolic: An order of soils that have eluvial (Ae) horizons, illuvial (Bt) horizons in which silicate clay is the main accumulation product. The soils developed under forest or forest-grassland transition in a moderate to cool climate. The Gray Luvisol great Group is the most common in Western Canada.

Management plan: as established through the Site Conservation Plan.

Medium texture: Intermediate between fine-textured and coarse-textured soils. It includes the following textural classes: very fine sandy loam, loam, silt loam, and silt.

Mesic: An organic layer of intermediately decomposed material (between that of fibric and humic).

Moderately-coarse texture: Consisting predominantly of coarse particles. In soil textural classification it includes all the sandy loams except the very fine sandy loam.

- Moderately-fine texture:** Consisting predominantly of intermediate-size soil particles. In soil textural classification it includes clay loam, sandy clay, sandy clay loam, and silty clay loam.
- Morphology, soil:** The makeup of the soil, including texture, structure, consistence, colour, and other mineralogical, physical, and biological properties of the various horizons of the soil profile.
- Mulch:** Dead plant material (*e.g.*, straw) that is added to a reclaimed site to help promote plant establishment by retaining soil moisture, increasing microbial activity and preventing soil erosion. It is not included in determining cover.
- Munsell soil colour system:** A colour designation system that specifies the relative degree of the three simple variables of colour: hue, value, and chroma. For example: 10YR 6/4 is a colour (of soil) with a hue of 10YR, value of 6, and chroma of 4. Value (grayness) can be used as a proxy for organic matter content.
- Native species:** A plant species that is indigenous to the ecosite.
- Natural recovery:** Long term re-establishment of diverse native ecosystems (*e.g.*, Prairie, forest) by establishment in the short-term of early successional species. This involves revegetation from soil seedbank and/or natural encroachment and no seeding of nonnative agronomic species.
- NonSurface Soil:** Nonsurface soil includes subsoil and other materials that do not normally comprise surface soil.
- Offsite (remote) sump:** A low-lying place, such as a pit, used for temporary storage and/or containment of liquids produced from the site.
- Operability:** The effort required to implement management decisions and practices in order to achieve a desired level of return
- Organic matter (OM):** The decomposition residues of biological materials derived from plant and animal materials deposited on the surface of the soil; and roots and micro-organisms that decay within the soil.
- Organic soil:** An order of soils that have developed dominantly from organic deposits. The majority of organic soils are saturated for most of the year, unless artificially drained. The great groups include Fibrisol, Mesisol, Humisol and Folisol.
- Paralithic:** Poorly consolidated bedrock which can be dug with a spade when moist. It is severely constraining but not impenetrable to roots.
- Parent material:** The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil is developed by pedogenic processes.
- Particle size:** The effective diameter of a particle measured by sedimentation, sieving, or micrometric methods.
- Peat:** Unconsolidated soil material consisting largely of organic remains (mainly derived from mosses or sedges).
- Ped:** Fine soil particles held together in a single cluster, such as in a clod or a crumb. See Aggregate.

Pedology: Those aspects of soil science involving especially the constitution, distribution, genesis and classification of soils.

Percolation, soil water: The downward movement of water through soil. Especially, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of the order of 1.0 or less.

Permeability (soil): The ease with which gases and liquids penetrate or pass through a bulk mass of soil.

Plant Density: The number of plants *per* unit area (*e.g., per* area). An individual plant can usually be defined as the sum of the aerial parts that correspond to a single root system. Plants that spread by underground roots may be more difficult to count. In this case it may be more appropriate to use a cover estimate only.

Platy: Consisting of soil aggregates that are developed predominately along the horizontal axes, laminated; flaky.

Productivity: A measure of the physical yield of a particular crop. It must be related to a specified management. Productivity may be used to describe or define suitability but it would be inappropriate as a definition of capability which puts more emphasis on vulnerability or flexibility – on available options – rather than simply yields. Calculated as the average unit productivity of all the assessment locations. Unit productivity (seeds/area), (plants/area) x ([heads or pods]/plant) x (seeds/[head or pod]).

Profile (soil): A vertical section of the soil through all its horizons and extending into the C horizon.

Profile Restriction Rating (PRR): An index rating system for soil profile restrictions incorporating depth, thickness and degree of restriction.

Quality Tolerance: An acceptable change in soil quality factors. The onsite quality tolerance reflects the offsite (representative control) variability. Two or three grids may drop one soil rating class.

Reaction, soil (soil pH): The degree of acidity or alkalinity of soil, usually expressed as a pH value.

Reclamation certification: indicates the site has passed the criteria.

Reclamation: The process of reconvertng disturbed land to its former or other productive uses.

Reconstructed soil: A soil profile formed by selected placement of suitable overburden materials on reshaped spoils.

Re-disturbance: Going back on a site after reclamation and re-vegetation to address unresolved issues.

Regosolic: An order of soils having no horizon development or development of the A and B horizons insufficient to meet the requirements of the other orders. Included are Regosol and Humic Regosol great groups.

Remediation: A set of activities that results in the decontamination of a contaminated site.

Residual: Unconsolidated and partly weathered mineral materials accumulated by disintegration of consolidated rock in place.

Rilling: A rill is a narrow, very shallow, intermittent watercourse having steep sides. It presents no obstacle to tilling.

Root zone: The part of the soil that is occupied by plant roots.

Saline soil: A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 dS.m (formerly mmhos/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5.

Salinization: The process of accumulation of salts in soils.

Sand: A soil particle between 0.05 and 2.0 mm in diameter.

SAR (Sodium Adsorption Ratio): The proportion of sodium on the soil exchange complex in relation to the proportion of calcium and magnesium.

Saturation percentage: The amount of water required to saturate a unit of soil (often correlated with sodicity).

Second lift: The second layer of undisturbed soil material that underlies the first lift, which is salvaged and separated during excavation to be replaced as upper subsoil.

Seral: Successive changes in flora: the series of different communities of plants that occupy a specific site and create a stable system during the process of ecological succession.

Silt: A soil separate consisting of particles between 0.05 to 0.002 mm in equivalent diameter.

Site: Means the lease, access road and any other associated facility (*e.g.*, campsite, borrow pit, offsite sump, log deck) in this document or The lease and the access road in this document.

Slaking: Initial fragmentation of soil aggregates several millimetres in diameter which may disintegrate further to become microaggregates [*i.e.* < 250 µm diameter] due to air trapped in the aggregates being compressed by the water as it is driven into the soil.

Sodicity: A measure of the amount of sodium on the exchange complex (often expressed as sodium adsorption ratio – SAR).

Soil Assessment: An evaluation of the characteristics of the replaced topsoil and the layer of subsoil just beneath it. The purpose of the assessment is to ensure that there are no restrictions to rooting, or to water or air movement. The soil is assessed to a minimum depth of 50 cm.

Soil exchange complex: The complement of ions adsorbed on soil particles.

Soil fertility: The status of a soil with respect to the amount and availability of elements necessary for plant growth.

Soil map: A map showing the distribution of soil types or other soil mapping units in relation to the prominent physical and cultural features of the earth's surface.

Soil moisture: Water contained in the soil.

Soil Profile Assessment: An evaluation of the characteristics of the replaced surface soil and the layer of subsoil just beneath it. The purpose of the assessment is to ensure that there

are no restrictions to rooting, or to water or air movement. The soil is assessed to a depth of 50 cm.

Soil structure: The combination or arrangement of primary soil particles into secondary particles, units or peds. These secondary units may be, but usually are not, arranged in the profile in such a manner as to give a distinctive characteristic pattern. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctiveness into classes, types, and grades, respectively. Common terms for kind of structure are – single grain, amorphous, blocky, subangular blocky, granular, platy, prismatic and columnar.

Soil survey: The systematic examination, description, classification, and mapping of soils in an area. Soil surveys are ranked according to the kind and intensity of field of field examination.

Soil: The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants.

Solonetzic: An order of soils developed mainly under grass or grass-forest vegetative cover in semiarid to subhumid climates. The soils have a stained brownish or blackish solonetz B (Bn, Bnt) horizon and a saline C horizon. The order includes the Solonetz, Solodized Solonetz, and Solod great groups.

Solum (plural sola): The upper horizons of a soil in which the parent material has been modified and within which most plants roots are confined. It consists usually of A and B horizons.

Species Composition: The different kinds, amounts, and proportions of plants present on a revegetated disturbed area. These can be grasses, forbs, shrubs, or trees.

Specified land: Means land that is being or has been used or held for or in connection with the construction, operation or reclamation of a well, oil production site, battery or pipeline (excerpt from the Conservation and Reclamation Regulation (115/93))

Staged approach: including Level 1 and Level 2 assessments.

Step-Out Assessment: When an anomaly is encountered at an assessment location, the operator may opt to conduct a 'step-out' assessment to determine if it is representative of the whole grid or not. A step-out consists of assessing a minimum of an additional 3 locations. These additional locations will be 3 m from the original point in a triangular shape around it. The average of these three locations is reported for those parameters where numbers are provided (*e.g.* soil depth). The original location data are not reported.

Subsoil: Although a common term it cannot be defined specifically. It may be the B horizon of a soil with a distinct profile. It can also be defined as the zone below the plowed soil in which roots normally grow. For Level 2 it refers to the soil material between 20 cm and 50 cm.

Surface soil (topsoil): The uppermost mineral or organic material, valued as a growing medium and salvaged. More detailed definitions are provided in the text of the criteria for each land use. The uppermost mineral/organic material, valued as a growth medium and salvaged.

Texture: The relative proportions of sand, silt and clay in a soil. It is described in terms such as sand (S), loamy sand (LS), sandy loam (SL), loam (L), silt loam (SiL), clay loam (CL), silty clay loam (SiCL), and clay (C).

Third-party impacts: pre-oil and gas landowner activities, recreational or industrial use, trails, wildlife.

Till: Unstratified glacial drift deposited directly by the ice and consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth: The physical condition of the soil in relation to plant growth
Top soil replacement

Topsoil: Topsoil is normally referred to as the plough layer in agricultural soil and contains the majority of the roots. This is the A horizon including Ap, Ah, Ahe, Ae and sometimes AB as defined in The System of Soil Classification For Canada, 1987 (page 23).

Trajectory: The probable course of plant community development through a series of dynamic changes in ecosystem structure, function and species composition over time (adapted from Dictionary of Natural Resource Management, UBC Press, 1996)

Two-lift stripping : The selective salvage of all surface soil as the first lift and of good quality upper subsoil as the second lift. The lifts are then replaced in the proper order.

Value, colour: The relative lightness or intensity of colour and approximately a function of the square root of the total amount of light. One of the three variables of colour.

Vigour: The relative health of a plant. If a plant is vigorous, it is healthy and is performing as expected, in comparison with the surrounding vegetation or control.

Water table: The upper surface of groundwater or that level below which the soil is saturated with water.

Wetland : Land that has the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation and various kinds of biological activity that are adapted to the wet environment.

White Area: Public Lands General Land Classification. Privately owned lands. Available public lands in this area, which are suitable for the proposed use and are not required for conservation, recreational, wildlife habitat, forestry and other purposes, may be applied for pursuant to the Public Lands Act and associated regulations.

17. Appendix I

17.1. Contact Information

Freedom of Information and Protection of Privacy Office

Environment
6 th Floor South Petroleum Plaza, 9915 - 108 Street
Edmonton, AB T5K 2G8
Phone: (780) 427-4429
Fax: (780) 427-9838
Email: foip.environment@gov.ab.ca

Environmental Law Centre

#800, 10025 - 106 Street NW
Edmonton, AB T5J 1G4
Phone: (780) 424-5099
Fax: (780) 424-5133
Toll Free: 1-800-661-4238
Email: elc@elc.ab.ca

Energy and Resources Conservation Board main office:

640-5th Avenue, SW
Calgary, AB T2P 3G4
Phone: 403-297-8190
Fax: 403-297-7040
Email: Infoservices@ercb.ca

Alberta Environment Groundwater Information Centre

Fax: (780) 427-1214
Phone: (780) 427-2770
Email: gwinfo@gov.ab.ca

Air Photo Distribution

Main Floor, 9920 – 108 Street NW
Edmonton AB T5K 2M4
Phone: (780) 427-3520
Fax: (780) 422-9683
Email: Air.Photo@gov.ab.ca
Web: www.srd.gov.ab.ca/lands/geographicinformation/airphoto

18. Appendix K

18.1. Regional Offices

Alberta Environment - SOUTHERN REGION

2nd Floor, Deerfoot Square
2938 - 11 Street NE
Calgary, AB T2E 7L7
Telephone: (403) 297-8295
Fax: (403) 297-8232

Alberta Environment - CENTRAL REGION

3rd Floor, Provincial Building
4920 - 51 Street
Red Deer, AB T4N 6K8
Telephone: (403) 340-7052
Fax: (403) 340-5022

Alberta Environment - NORTHERN REGION

111 Twin Atria Building
4999 - 98 Avenue
Edmonton AB T6B 2J6
Telephone: (780) 427-7617
Fax: (780) 427-7824

Alberta Sustainable Resource Development District Offices

For a complete list of all Alberta Sustainable Resources Development offices and contact information, visit www.srd.alberta.ca/lands/contactinformation.aspx