

# Reclamation and Approvals Guidelines

Saskatchewan Strip  
Mined Coal Lands

Ministry of Environment

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## I INTRODUCTION

Saskatchewan Environment administers the *Mineral Industry Environmental Protection (“MIEP”) Regulations, 1996*, under which coal mines are regulated. Section 12 of the regulations require that a decommissioning and reclamation plan and an assurance fund be approved by the Minister prior to the operation or permanent closure of a pollutant control facility, mill, or mine. These Reclamation and Approvals Guidelines (“the guidelines”) describe the objectives established by Saskatchewan Environment for the reclamation of strip mined coal lands. They also provide guidance to assist coal companies in achieving the stated reclamation objectives. Flexibility is built into the guidelines to accommodate site specific requirements.

These guidelines address decommissioning and reclamation planning as it relates to reclamation activities only. The guidelines do not address financial assurance approvals. For more information consult Sections 12, 14 and 15 of the *MIEP Regulations, 1996* and contact Saskatchewan Environment.

Generally, the information required for an Environmental Impact Assessment (EIA) or project proposal for proposed new mines or expansion of existing mines can be used as part of a reclamation plan. EIA information is submitted to Saskatchewan in a report called an Environmental Impact Statement. Specific requirements outlined in these guidelines should be followed only if they have not been similarly covered in an approved EIA or project proposal. The environmental assessment process is able to address emerging issues (e.g. biodiversity, climate change, wetlands) therefore they are not specifically addressed in the guidelines. More stringent requirements identified by the environmental assessment process may be incorporated into the reclamation plan and subsequent approvals. Alternatively, where these guidelines are more stringent than past EIA approval conditions, these guidelines should be followed. The guidelines apply to all coal mining disturbance started as of 6 months following finalization of these guidelines. EIA conditions that may be in place for mining disturbance that is already occurring continue to apply until these guidelines take effect.

The guidelines are divided into three sections and four appendices. The first section is the Introduction; the second outlines the Reclamation Guidelines; and the third section presents Approvals Guidelines. Appendix A and B list the general information and soil sampling requirements for the written application for reclamation plan approval. Appendix C contains the soil quality criteria tables for acceptable and unacceptable topsoil /coversoil and subsoil. Appendix D has a list of definitions and Appendix E includes a list of additional resources that may be useful in the planning and assessment of reclamation activities.

Saskatchewan Environment has developed these guidelines in consultation with Saskatchewan Agriculture and Food, Saskatchewan Industry and Resources, SaskPower and Prairie Mines & Royalty Ltd. Questions on the guidelines can be directed to:

Approvals  
Manager, Industrial, Potash, Coal and Spills  
Saskatchewan Environment  
Environmental Protection Branch  
112 Research Drive  
Saskatoon, SK S7K 2H6  
306-933-6542

## II RECLAMATION GUIDELINES

### 1.0 Reclamation Objectives

- 1.1 The main objective of reclamation is to return land disturbed by surface mining to an acceptable, predetermined, sustainable land use. The methods to evaluate

the success in reaching this objective are outlined in Section 2 of the Approval Guidelines (Part III).

- 1.2 Reclamation procedures should ensure that disturbed soils are physically stabilized to provide a secure substrate for revegetation.
- 1.3 Unless otherwise agreed upon in determining the post-reclamation land use, reclamation of native prairie should result in:
  - 1.3.1 the creation of an environment that will allow for the establishment of valued features (e.g. planting of shrub species near wetland habitat, nesting structures for rare or endangered bird species); and/or
  - 1.3.2 the active establishment of special features identified in the pre-mining assessment (e.g. rare plant species identified in rare species survey).
- 1.4 Reclamation should be carried out as soon as possible after mining.

## **2.0 Mine Plan Selection**

- 2.1 Reclamation should be recognized as an integral part of mining. A detailed reclamation plan should be developed during development of the mining plan. Choices made with respect to mining (e.g. mining sequence, equipment used) can greatly increase the ease or success of reclamation.
- 2.2 Mining infrastructure should be located, constructed and operated in a manner that minimizes impacts and the need for later reclamation. Features such as haul roads, maintenance yards, and dewatering facilities should avoid sensitive terrain and areas of native vegetation wherever possible.
- 2.3 Reclamation plans may be included in the Environmental Assessment documents, in addition to the application for an Approval to Operate.

## **3.0 Evaluation of Pre-Mining Conditions**

- 3.1 A detailed pre-mining assessment of the area to be mined should be undertaken as a basis for preparation of the reclamation plan and to provide a benchmark for measuring reclamation success. (This can be done as part of an Environmental Impact Statement (EIS) or project proposal.)
- 3.2 Elements to consider in detail in the pre-mining evaluation should include, on agricultural land: topography, soils, vegetation, surface water flow patterns, rare species, agricultural land capability (Natural Resources Canada, Canada Land Inventory) and on native prairie, pastureland and wetlands: topography, soils, vegetation, habitat quality, rare species (occurrence, distribution, abundance) and surface water bodies and flow, including various classes of wetlands (using Cowardin et al. 1979 classification) and drainage, as may be appropriate.
- 3.3 The level of detail (including mapping) used in describing each feature will depend on the nature of the site before mining and the agreed-upon post-mining land use. A complete list of information to be included in the pre-mining evaluation is found in Appendix A.

### **3.4 Native Prairie**

- 3.4.1 A rare species survey (plant and animal) should be undertaken on areas of native vegetation prior to soil salvage. Should rare species be found and should impacts be considered significant, mitigation measures

should be identified and implemented to minimize impacts to the species. (This can be done as part of the EIS.)

- 3.4.2 Collection of rare plant material (e.g. seed, cuttings, etc.) may be required prior to mining.
- 3.4.3 Since much native seed is wild harvested and may have specific requirements to enhance germination, the preferred species mix should be identified as early in the process as possible and communicated to potential seed suppliers. This step will assist in obtaining sufficient quantities of quality seed when required.

#### **4.0 Determining the Post-Mining Land Use**

- 4.1 Saskatchewan recognizes the importance of the complete range of land types and land uses in the province, and does not require that all mined lands be restored to a particular use.
  - 4.1.1 In general, agricultural land should be reclaimed, at a minimum, to a soil quality that is similar to that which existed prior to mining.
  - 4.1.2 In general, areas of native prairie and wetlands should be replaced in approximately similar amounts and types as existed before mining (see also Section 7.3).
- 4.2 Lands for which pre-mining use is considered inappropriate for the post-mining use, due to site characteristics, should be reclaimed to a more suitable use. For example, only previously cultivated land with relatively good capability for agriculture (Canada Land Inventory Soil Capability for Agriculture Classes 1 to 4) should be reclaimed for crop production. Previously cultivated land with poorer soil capability should be reclaimed to pastureland or native vegetation.
- 4.3 While a general post-mining land use plan, based on pre-mining features, may be established for an area, local exceptions may be made to accommodate unique features such as end cuts, box cuts, haul roads and ramps or to accommodate agreed-upon land-use features.
- 4.4 For agricultural lands, where salvage of coversoil is not possible, justification for this shall be provided to Saskatchewan Environment. Alternate reclamation plans should show how soil quality similar to pre-mining conditions would be achieved in these areas. (This can be done in the EIS.)
- 4.5 For native prairie and wetlands, where reclamation to the existing pre-mine land use is not practical, compensation at a suitable compensation ratio is acceptable. A suitable compensation ratio will be determined in consultation with Saskatchewan Environment, and others, as required.
- 4.6 For native prairie lands, where salvage of topsoil is not possible, justification of this shall be provided in reclamation plans (or EIS/project proposal). Alternate reclamation plans should show how a suitable area of native prairie would be achieved.
  - 4.6.1 An example of an acceptable reason why topsoil cannot be salvaged is excessive stoniness.
  - 4.6.2 If topsoil cannot be salvaged the company may seek approval to:
    - 4.6.2.1. revegetate a suitable area of reclaimed land to native species; or
    - 4.6.2.2. protect a suitable area of native prairie land outside the approved coal mining lands. This can be done through management agreements, conservation easements, direct purchase or other such means.

- 4.7 For native prairie lands, the final location of the revegetated land may be different from the pre-mining location. Justification for this shall be provided in reclamation plans (or EIS/project proposal). Examples of acceptable reasons for planning to relocate native prairie include:
- 4.7.1 inability to salvage native prairie topsoil (see clause 4.6),
  - 4.7.2 direct placement of salvaged native prairie topsoil, especially next to existing native prairie, (preferred to stockpiling topsoil), and
  - 4.7.3 placement adjacent to ecologically similar native prairie (preferred to the creation of islands of native vegetation surrounded by non-native vegetation species).
- 4.8 The reclamation plan should include a strategy to protect native prairie land after reclamation and release. This can be done by management agreements, conservation easements, continued ownership of the land in the long term, by transfer of title to the Fish and Wildlife Habitat Development Fund or by other means.
- 4.9 Local input, including public input obtained during the Environmental Impact Assessment process or other suitable public process should be considered in determining post-mining land use for new mines and major expansions of existing mines.

## **5.0 Soil Salvage**

### **5.1 Agricultural Land**

- 5.1.1 Soils meeting the criteria for Good, Fair or Poor as per the Criteria for evaluating suitability of topsoil and coversoil, (Appendix C) should be salvaged as coversoil. Soils that have organic matter less than 0.1% should not be salvaged. (Soils meeting the "Unsuitable" criterion are not considered acceptable).
- 5.1.2 The reclamation plan or EIS should describe the types and characteristics of soils (including the area of each soil type) and the depths to which coversoil will be salvaged based on the requirements of 5.1.1, above. The information should be presented in a format that will facilitate the calculation of soil volumes available for replacement.
- 5.1.3 If stockpiling of coversoil is required, establishment of an appropriate vegetative cover, if necessary, should be undertaken to minimize erosion of stockpiles.
- 5.1.4 Where noxious weeds are present, soil salvage and stockpiling should be designed to minimize the spread of noxious weeds.

### **5.2 Native Prairie Land**

- 5.2.1 If topsoil cannot be salvaged, e.g. excessive stoniness, alternatives will be considered (see clause 4.6).
- 5.2.2 Where soil salvage is possible, the topsoil or A-horizon, which contains the seedbed, should be salvaged as one lift.
- 5.2.3 To reduce stockpile time, native prairie topsoil may be direct placed on an alternate recontoured site, preferably adjacent to ecologically similar native prairie.
- 5.2.4 If stockpiling of topsoil is required, the time in stockpile shall be as short as possible to maximize viability of the seedbed contained within.
- 5.2.5 If stockpiling of topsoil is required, native prairie soils should be stockpiled separate from agricultural soils and actions to minimize erosion should be undertaken if necessary. These actions should not cause the introduction of non-native species/seeds to the stockpiled native prairie soil.

## 6.0 Recontouring

- 6.1 The aim of recontouring is to shape the land in a manner that is appropriate to its post-mining use.
- 6.2 Hazardous and erosion-prone slopes should not be created. The degree of risk associated with a particular slope should take into account the planned land use, soil type and erodibility, length of slope and any erosion-control measures that are to be incorporated into the plan.
- 6.3 Slopes should be less than 10% on land that is intended for agricultural cropping. Soil type and erodibility should be considered in selecting the final slope.
- 6.4 Slopes on box cuts typically should not exceed 15% and those on end cuts should be less than 20%.
- 6.5 Except for conditions specified in 6.3 and 6.4, steeper slopes may be appropriate to achieve a specific land use objective, subject to consideration of slope stability and erosion potential.
- 6.6 Recontouring normally should be completed within two years of initial disturbance. Haul roads and ramps should be recontoured within two years of completion of mining in a particular area, unless mine plans demonstrate the future need for such infrastructure.

## 7.0 Surface Drainage

- 7.1 Where post-mining land use is cropland, drainage should minimize ponding.
- 7.2 Water flow from cropland may be drained to nearby areas of permanent cover (pastureland), or to created wetlands within the overall reclaimed landscape.
  - 7.2.1 Ponding or the creation of wetlands is favourable in areas of native or tame pasture.
  - 7.2.2 Creation of a limited number of wetlands may be appropriate in large areas of cropland, where they do not significantly inhibit the use of the landscape for cropping.
- 7.3 Creation of permanent or semi permanent wetlands may be appropriate to replace ephemeral wetlands. The shoreline and bottom should be contoured to promote a diversity of habitats.
- 7.4 Surface drainage should be designed so as to minimize erosion during spring runoff and major rainfall events.

## 8.0 Soil Replacement

- 8.1 Soil replacement depth criteria are not specified in these guidelines. In general, replaced topsoil and/or coversoil thickness should be no more limiting to plant growth than it was in the undisturbed state.
- 8.2 Subsoil should meet the criteria for good, fair or poor subsoil as per the "Criteria for evaluating suitability of subsoil material (Appendix C). **Guideline 8.2 may be changed in future based on information to be provided by the mining company.**
- 8.3 Suitable subsoil can be obtained from any stratum of the overburden as long as it is of sufficient depth and quality to support a root zone capable of plant growth

for agriculture. **Guideline 8.3 may be changed in future based on information to be provided by the mining company.**

- 8.4 Salvaged topsoil or coversoil should be applied to re-contoured suitable subsoil at an even depth.
- 8.5 Topsoil or coversoil should cover the same area at approximately the same depth as that from which it was salvaged.
- 8.6 Insufficient coversoil is deemed to occur when conditions specified in the previous clause cannot be achieved (see also clauses 4.4, 4.6, and 5.1.1). The reclamation plan should identify these areas and alternate reclamation procedures.
- 8.7 Replacement of topsoil or coversoil on suitable subsoil should be completed within a year of completion of re-contouring (i.e. within three years of disturbance) or in the case of haul roads and ramps, within three years of completion of mining in the pit.
- 8.8 Where noxious weeds or weed seed is likely present in the topsoil or coversoil, the company should use soil handling and equipment cleaning procedures to prevent the spread of noxious weeds.

## **9.0 Revegetation**

### **9.1 *Agricultural Land***

- 9.1.1 The objectives of revegetation are to control erosion and to return the land to a soil quality that is similar or better than that which existed prior to mining and that will achieve the pre-determined sustainable land use.
- 9.1.2 Revegetation should normally begin in the growing season during which topsoil/coversoil is replaced. When this is not possible, erosion should be controlled by means that are not detrimental to the planned re-vegetation species. Revegetation would then be initiated at the beginning of the next growing season.
- 9.1.3 In revegetation for agricultural uses, good agricultural practices should be followed (e.g. control of noxious weeds).
- 9.1.4 Reclamation plans should include information on proposed cropping practices and soil amendments (e.g. fertilizer, lime, organic matter) to be used.

### **9.2 *Native Prairie Land and Wildlife Habitat***

A search of the literature revealed a range of opinions on the “best” method to perform almost every aspect of reclamation for native prairie, from soil preparation, to seed collection and mixture to how to measure success. Rather than recommend one procedure over another, the guidelines for reclamation of native prairie land have been written to encourage the coal company, with the advice of a vegetation specialist and in consultation with Saskatchewan Environment, to prepare plans, record methods, analyze the results, and modify practices to build upon past success.

At a minimum, the following elements should be considered in development of revegetation plans for native prairie land. **The following guidelines may be changed in future based on information to be provided by the mining company.**

- 9.2.1 In revegetation for establishment of native species, preference should be given to the use of locally adapted native species that simulate the naturally occurring native prairie.
- 9.2.2 If there is insufficient locally produced native plant material, commercial cultivars and ecological varieties (e.g. Ducks Unlimited Ecovars) derived from plants native to Saskatchewan are an acceptable addition to the seed mix.
- 9.2.3 The exact seed mixture and sowing density is dependent upon site specific requirements (e.g. pre-mining conditions). Seed mixes should be those accepted by Saskatchewan Environment for the specific areas to be mined. Planting native seed mixtures early in the spring or in the fall after the first hard frost is recommended to achieve optimum results. In addition, good seed to soil contact is important and may require special techniques (eg. rolling) to achieve this.
- 9.2.4 Crested wheatgrass, alfalfa, and invasive exotic species are not acceptable in the seed mixes. Please also refer to Sections 8.2 in the guidelines entitled "Restoration of Saskatchewan's Agricultural Crown Rangelands" for other prohibited species.
- 9.2.5 All plant material used for reclamation must be free of noxious weeds as specified under *The Seeds Act* (Canada) and *The Noxious Weeds Act* (Saskatchewan). A certificate of seed analysis is required.
- 9.2.6 In areas reclaimed to wildlife habitat, hardy, self-propagating, native species of grasses, shrubs and trees should be selected. Invasive exotic species are not acceptable. Plantings, planned for shelter and food, should be consistent with the needs of wildlife local to the area.
- 9.2.7 Revegetation plans should create habitat or special features that would encourage the establishment of rare species of plants and animals that existed in the area prior to mining.
- 9.2.8 Excessive use of amendments is often detrimental to the establishment of native species; therefore this practice should be avoided. If use of amendments (e.g., fertilizer, organic matter) is intended details should be included in the reclamation plan.
- 9.2.9 If erosion control is necessary, cover crops should not negatively impact the success of native species regeneration.

## **10.0 Soil Sampling and Analysis**

- 10.1 Careful measurement and recording of parameters pertinent to reclamation processes shall be undertaken in order to document pre-and post- mining conditions, identify and rectify problems which occur, document successes and failures so that they are fully considered for future reclamation and to establish a specific history of reclamation efforts on reclaimed land.
- 10.2 Standard, accepted soil science protocols should be followed for sampling and analytical evaluation of topsoil/coversoil, subsoil, and overburden to determine pre-mining conditions, suitable reclamation material and post-mining conditions. Refer to soil sampling requirements in Appendix B.

## **11.0 Maintenance and Monitoring**

Maintenance and monitoring activities will continue only until a reclamation release is acquired pursuant to Section III, Approval Guidelines, Subsection 2.0, Release from Further Reclamation Requirements.

- 11.1 Where germination, growth rates, erosion or other failures occur on agricultural, native or wildlife lands, the company should undertake immediate analysis of the

cause and follow-up with corrective measures to attain the planned revegetation goals.

- 11.2 Qualified persons (e.g. botanists, recognized native prairie specialists) should assess the success of native vegetation establishment during regularly scheduled surveys (e.g. twice per year during the growing season or as recommended by a botanist or native prairie specialist).
- 11.3 Annual progress reports shall be submitted to the Department as outlined in clause 1.9 of the Approvals Guidelines that follow.

These Interim Guidelines will come into effect for all coal mining disturbance (on currently operating and future mine areas) 6 months after guidelines are finalized.

### **III APPROVALS GUIDELINES**

#### **1.0 Preparation of Reclamation Plan**

Subject to Section 12 and Section 13 of the *Mineral Industry Environmental Protection ("MIEP") Regulations, 1996* a decommissioning and reclamation plan that has been approved by the Minister (Saskatchewan Environment) is required in order to operate or permanently close a pollutant control facility, mine or mill. Approvals for Reclamation of Lands to be Strip Mined should be in place before mining commences. The requirement to submit plans and obtain approval for reclamation prior to the start of mining is included as a condition of the Approval to Operate issued to the mining company.

Saskatchewan Environment recommends that reclamation plans be submitted for approval as early in the process as possible. Project-specific guidelines are prepared to assist companies in preparation of Environmental Impact Statements (EIS). Depending upon the project, reclamation plans may be included in the EIS or MIEP application. The level of detail required may be adjusted for different applications. For example an EIA approval granted for 30-year plan would be somewhat conceptual. The level of detail submitted for a 30-year plan may be adequate for an initial remediation plan for MIEP approval. Additional detail for the immediate future (e.g. 5 years) may be more appropriate as mining commences.

General application requirements for reclamation plans are listed in Section 14 of the *MIEP Regulations, 1996*. Appendix A and B provide additional specific requirements for strip mined coal lands. The following is a general list of the information required in an application for reclamation approval. Additional information may be required to remain consistent with the environmental assessment process or to address site specific needs. Every effort will be made to streamline the requirements of environmental assessments with approvals. Requirements for the assurance fund are not included in these guidelines. The company should refer to the *MIEP Regulations, 1996* to make sure that all regulatory requirements are met.

- 1.1 Reclamation Approvals must be obtained in advance of actual mining. The size of the land area included in each approval is dependent upon how far ahead the company wishes or is able to firmly plan their reclamation efforts. It is possible that entire mining blocks may be covered in one Approval.
- 1.2 Reclamation Approvals do not have expiry dates, so unless revised, will normally remain in effect until the company obtains a Release from Further Decommissioning and Reclamation Requirements (Section 2.0).

- 1.3 Reclamation plans must be reviewed at least once every five years, as requested by the Minister or at the time of the permanent closure of the pollution control facility (paraphrase, see *MIEP Regulations, 1996* Section 16 for complete text).
- 1.4 Where reclamation activities are expected to differ from approved plans, proposed changes should be discussed with Saskatchewan Environment and alternative procedures or plans should be submitted for approval. Saskatchewan Environment or the permitted company may request amendments.
- 1.5 A general list of information required in a submission for approval under the Environmental Assessment Act or *MIEP Regulations, 1996* is specified in Appendix A, Section 1. Additional information may be required for specific situations, as determined in consultation with Saskatchewan Environment.
- 1.6 Conditions attached to a Reclamation Approval may vary to fit the circumstance, but will generally reflect the content of the Reclamation and Approvals Guidelines, 2007.
- 1.7 Environmental impact assessment or project proposal conditions of approval for proposed new mines or expansion of existing mines will be incorporated as conditions in MIEP approvals.
- 1.8 Each individual area of disturbance has its own unique characteristics, problems and special requirements; therefore, materials handling and soil replacement techniques may be site specific.
- 1.9 Reclamation Approvals include an annual reporting requirement. A general list of information required in the annual report is specified in Appendix A, Section 2. Annual progress reports will be available to the department and the public and will be of assistance to the company in evaluating and planning future reclamation efforts.

## **2.0 Release from Further Reclamation Requirements**

- 2.1 Reclamation release will be based on
  - (a) For agricultural land, whether the coversoil and subsoil meet the criteria for suitable soil (unsuitable soil is not acceptable) in Tables 1 and 2 of Appendix C AND whether the chosen post-mine land use (eg. forage production) is considered to be sustainable. SE will evaluate the latter criterion with assistance from Saskatchewan Agriculture and Food and/or consultants if necessary.
  - (b) For native prairie, whether an established native species complex (based on the approved seed mix) exists and is expected to be sustainable AND whether it has been protected from future cultivation. SE (inclusive of wildlife biologists) and consultants, if necessary, will evaluate these criteria.
  - (c) Whether a diversity of wetlands exists in the post-mine reclaim and if the area of wetlands is similar to that of pre-mine conditions.
- 2.2 Normally at least a 3 year time period following the first year of reclamation and initial vegetation/cropping will be required to demonstrate achievement and sustainability related to the criteria in point 2.1 above. For reclaimed native prairie or wildlife habitat, more than 3 years may be required to evaluate the establishment of species or habitat.
- 2.3 Upon completion of reclamation in accordance with its Reclamation Approval, the company may submit a written application for release from further reclamation

obligations, to the Minister, pursuant to Section 22 of the *Mineral Industry Environmental Protection Regulations, 1996*.

- 2.4 In the event that the company wishes to obtain release from further reclamation due to a change in final land use (e.g. municipal landfill, racetrack, etc.), an Application for a Release pursuant to Section 22 of the *Mineral Industry Environmental Protection Regulations, 1996* is required.
- 2.5 A general list of information required in the Application for Release is specified in Appendix A, Section 3. Modifications may be made in consultation with Saskatchewan Environment.
- 2.6 Approval for change in land use may also be required from the Environmental Assessment Branch.
- 2.7 Saskatchewan Environment will carry out a site inspection of the reclaimed lands specified in the release application with assistance from other departments and appropriate stakeholders, if required.
- 2.8 When satisfied that the company has carried out the reclamation program and achieved results compatible with point 2.1 above, the Minister will issue a "Release from Further Requirements for Decommissioning and Reclamation", pursuant to MIEP.

## APPENDIX A

### 1.0 Application for Reclamation Plan Approval

This section lists the information that should be submitted with an application for reclamation plan approval for strip mined coal lands. Where applicable, information may be updated from Environmental Impact Statements (EIS) or project proposal.

- 1.1 Area(s) applied for including legal land descriptions.
- 1.2 Present land use
- 1.3 Soils information - this information can be taken from pre-mine EIS or project proposal, if it is sufficient to develop a detailed reclamation plan (see also Appendix B):
  - (a) baseline topsoil, subsoil, calculated coversoil, and overburden data;
  - (b) identification of suitable topsoil/coversoil for salvage;
  - (c) methods of topsoil/coversoil salvage;
  - (d) expected volumes of topsoil/coversoil to be salvaged, based on depths of suitable topsoil/coversoil encountered over the mining area;
  - (e) depth of topsoil/coversoil replacement, based on expected volumes;
  - (f) overburden handling techniques;
  - (g) selection of suitable subsoil;
  - (h) spoil leveling;
  - (i) soil profile reconstruction;
  - (j) any special conditions required;
  - (k) re-establishment of wetlands ; and
  - (l) erosion control;
- 1.4 Revegetation plans:
  - (a) description of revegetation to either long term managed forage production systems on agricultural lands (lands could be converted to annual, zero-tillage, crop production after a considerable period of sustained forage production) or establishment of suitable native or wetland areas where identified; and
  - (b) method by which native prairie or wildlife habitat lands will be established (includes identifying methods for successful reclamation, monitoring schedule, reporting schedule, vegetation commitments, etc).
- 1.5 Clearly identify
  - (a) pre-mining agricultural land capabilities and current land uses;
  - (b) predicted post-mining land capabilities and proposed land uses; and
  - (c) wetland and wildlife habitat replacement.
- 1.6 Compare the pre-mining land use areas (percentages) to the expected post-mining land use to provide a sense of how the landscape might change.
- 1.7 Proposed end land use (e.g. annual cropping, forage, wildlife habitat, wetlands, native prairie):
  - (a) provide rationale where proposed end land use is different from pre-mine land use; and
  - (b) detailed reclamation plan to achieve proposed end land use.

- 1.8 Maps showing proposed end use should be developed that outline the amount and characteristics of the reclaimed area to be returned to wetlands compared to the amount and characteristics of wetlands that existed prior to mining. Wildlife mitigation or enhancement measures should also be included in such an end use plan.
- 1.9 Schedule of stripping, mining, leveling, topsoil/coversoil, and subsoil replacement, and revegetation on agricultural lands and native habitats, including establishment of rare species and habitat as may be appropriate.
  - (a) Schedule variations in the field are anticipated and accepted, except for major unjustified delays in reclaiming mined lands, and for unjustified delays related to areas of native prairie reclamation.
- 1.10 Document the management practices proposed by the company to achieve, on the reclaimed land,
  - (a) acceptable sustained agricultural productivity under normal farming practices (with conversion to annual cropping with zero tillage only after a considerable period of sustained forage production) and
  - (b) an acceptable level of naturally regenerating wetland and native prairie productivity.
- 1.11 A conceptual description of the expected post-mining local drainage system should be outlined.

## **2.0 Reclamation Approval Annual Report**

Additional details (e.g. due date) for submission of annual reports will be specified in the appropriate approval.

The report will normally require the following:

- 2.1 areas for which various reclamation steps were taken;
- 2.2 timing of all reclamation activities;
- 2.3 meteorological summary relevant to plant growth;
- 2.4 description and discussion of soil salvage and replacement activities and potential for achieving the requirements in the approved reclamation plan; such descriptions should include, but not be limited to:
  - (a) the area stripped;
  - (b) the soil depths and volumes that were stripped;
  - (c) the volume of material stockpiled;
  - (d) the volume replaced (coversoil, topsoil and subsoil, as applicable) along with the area of replacement;
  - (e) the depth of replacement in individual reclaimed fields (identify approved future land use);
  - (f) mass balance of soil stripped to soil replacement, by type; and
  - (g) overview of soil stripping, stockpiles, and replacement activities for entire mine area;
- 2.5 soil amendments applied;
- 2.6 pesticide and herbicides applied;
- 2.7 seeding and planting undertaken;
- 2.8 description of native seeds/plants used on reclaimed native prairie lands;

- 2.9 results of germination/growth/production measurements in areas of monoculture plantings and native vegetation;
- 2.10 descriptive maps and photographs;
- 2.11 analysis of successes and failures and related remediation;
- 2.12 comparison of actual reclamation activities to approved plan;
- 2.13 reclamation activities planned for the next year;
- 2.14 any additional relevant information; and
- 2.15 any site specific information as required by approvals.

### **3.0 Application for a Release**

The application will normally require the following information:

- 3.1 Legal description of land parcel including area of parcel.
- 3.2 Mining history:
  - (a) general description, map of mined areas, ramps, box cuts, end cuts, stockpiles, etc.
- 3.3 Pre-mining land use and capability (the following can be taken from an EIS or project proposal):
  - (a) maps of pre-mining land use, soil classifications, land capabilities, and areas of native vegetation including native prairie and wetlands;
  - (b) vegetation inventory on areas of native vegetation; and
  - (c) categories and areas of wetlands.
- 3.4 Reclamation history:
  - (a) soil salvage, stockpiling, leveling, grading, topsoil /coversoil and subsoil replacement;
  - (b) history of revegetation and cropping since reclamation; and
  - (c) success of revegetation i.e. seeding /plantings.
- 3.5 Post-mining land use:
  - (a) map of post-mining land use, limitations, etc.; and
  - (b) areas and description of native prairie, wetlands, and classes of agricultural lands compared to pre-mining areas and characteristics.
- 3.6 Soil characteristic documentation:
  - (a) For agricultural lands, demonstrate, via soil sample results, that final soil quality meets the Poor, Fair or Good criteria in Table 1 and 2 of Appendix C.
- 3.7 Discussion and comparison of pre-mining land capabilities/conditions and post-mining land capabilities/conditions showing the potential for:
  - a) acceptable sustained agricultural productivity under normal farming practices (with conversion to annual cropping with zero tillage only after a considerable period of sustained forage production). The mining company should evaluate its success in developing soils that will have long term productivity similar but perhaps not identical to pre-mine conditions, and that can be sustained by future land owners using the types and quantities of inputs typically used in the region for the chosen land use.
  - b) sustainable native vegetation. The mining company should evaluate its success in creating areas of native vegetation, that have a stable diversity of

species established from the approved seed mix, that can sustain itself without intervention from the company or future land owners.

- c) a diversity of wetlands. Using the Cowardin et al. classification system, the company should evaluate its success in establishing a diversity of wetlands on reclaimed land with total areas similar to pre-mine conditions. Clearly identify and discuss any changes from approved reclamation plans and actual activities.

3.8 Any site specific information required by approvals.

## APPENDIX B

### 1.0 Soil Sampling

This section lists the minimum sampling requirements to document soil characteristics for preparation of a soils report. Detailed soils data may be used to determine existing conditions (e.g. in preparation of environmental impact statement or project proposal) and condition of land after reclamation (e.g. in preparation of an application for a release). In some situations, post reclamation soil results may be compared to pre-mining conditions to show that reclamation goals have been achieved. A biologist or soils specialist who has experience in the successful reclamation of soils should provide input into the sampling design and the interpretation of results.

#### 1.1 Soil Sampling Frequency

Generally, soil samples will be taken before mining commences and post reclamation. Additional sampling may occur at any time that supplementary information is required.

#### 1.2 Soil Sampling Requirements

- (a) To be carried out on a "per field" basis:
  - (i) maximum field size to be one quarter section; or
  - (ii) field size and shape dictated by reclamation criteria and time (i.e. reclaimed during same time period and using same criteria).

#### 1.3 Sampling density:

- (a) Select a sampling pattern which covers the whole field
- (b) One sample site / 2 – 2.4 ha (5-6 acres); or
- (c) 30 sample sites/ 65 ha (quarter section); and
- (d) composite the samples to provide 1 to 3 composites of 9 or 10 samples each for analysis at each depth.

#### 1.4 Sample depths:

- (a) 0 cm to base of topsoil or coversoil;
- (b) base of topsoil or coversoil to 60 cm (24 in) (or to base of planned subsoil depth end land use); and
- (c) if spoil (parent material) is likely to become part of reconstructed subsoil, then sample depths may be increased.

#### 1.5 Special attention and more detail may be required in evaluating rare species habitat.

1.6 Sample parameters

Each Sample Site	Composite Topsoil /Coversoil Sample	Composite Subsoil Sample
Location (by visual estimation) Topsoil or Coversoil depth (cm); Subsoil Depth (cm)	pH Salinity (EC) Sodicity (SAR) Texture Moist Consistency Organic Carbon (%) CaCO <sub>3</sub> Equivalent (%)  Stoniness Class	pH Salinity Sodicity Texture Moist Consistency Organic Carbon (%) CaCO <sub>3</sub> Equivalent (%)  Stoniness Class

**2.0 Soils Report**

The soils report should include both raw data and an interpretation of that data. The interpretation should include a complete characterization of the soil associations and related soil horizons in the proposed mining area. The soil quality criteria (Appendix C) should be used in the interpretation of the soils data. The soils report should be used in the development of the reclamation plan, for example, pre-mining conditions, development of soil stripping and replacement plan and post reclamation assessment.

## APPENDIX C

### 1.0 Soil Quality Criteria

The following soil quality criteria tables are adapted from “Soil Quality Criteria Relative to Disturbance and Reclamation” prepared by the Soil Quality Criteria Working Group, Alberta Agriculture, March 1987. In Saskatchewan, for the purpose of these guidelines, the criteria for topsoil are applied to coversoil. For the purpose of these guidelines, coversoil is defined as being the upper soil profiles meeting the criteria for “good”, “fair” or “poor” soil as outlined in Table 1, below, and containing greater than 0.1 percent organic matter.

Three categories of suitability and one category to indicate unsuitable coversoil and subsoil are used. The four categories are as follows:

1. Good (G) – None to slight soil limitations that affect use as a plant growth medium.
2. Fair (F) – Moderate soil limitations that may affect use but which can be overcome by proper planning and good management.
3. Poor (P) – Severe soil limitations that make use questionable. This does not mean the soil cannot be used, but rather careful planning and very good management are required.
4. Unsuitable (U) – Chemical or physical properties of the soil are so severe reclamation would not be economically feasible or in some cases be impossible.

[http://sis.agr.gc.ca/cansis/glossary/texture\\_soil.html](http://sis.agr.gc.ca/cansis/glossary/texture_soil.html)

**stoniness classes** - The classes of stoniness are defined on the basis of the percentage of the land surface occupied by fragments coarser than 15 cm in diameter.

- Stone 0 (nonstony) - there are very few stones (0.01% of surface, stones more than 30 m apart).
- Stones 1 (slightly stony) - some stones are present that hinder cultivation slightly or not at all (0.01 to 0.1% of surface, stones 10 to 30 m apart).
- Stones 2 (moderately stony) - enough stones are present to cause interference with cultivation (0.1 to 3% of surface, stones 2 to 10 m apart).
- Stones 3 (very stony) - there are sufficient stones to handicap cultivation seriously; some clearing is required (3 to 15% of surface, stones 1 to 2 m apart).
- Stones 4 (exceedingly stony) - the stones prevent cultivation until considerable clearing is done (15 to 50% of surface, stones 0.1 to 0.5 m apart).
- Stones 5 (excessively stony) - The land surface is too stony to permit cultivation; it is boulder or stone pavement (more than 50% of the surface, stones less than 0.1 m apart).

#### Soil Texture

FSL – Fine Sandy Loam

L – Loam

SiL – Silty Loam

SCL – Sandy Clay Loam

LS – Loamy Sand

C – Clay

HC – Heavy Clay

VFSL – Very Fine Sandy Loam

SL – Sandy Loam

CL – Clay Loam

SiCL – Silty Clay Loam

SiC – Silty Clay

S – Sand

**Table 1. Criteria for evaluating suitability of topsoil and coversoil**

Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)	6.5 to 7.5	5.5 to 6.4 & 7.6 to 8.4	4.5 to 5.4 & 8.5 to 9.0	<4.5 and >9.0
Salinity (EC) (dS/m)	<2	2 to 4	4 to 8	>8
Sodicity (SAR)	<4	4 to 8	8 to 12	>12 <sup>1</sup>
Saturation (%)	30 to 60	20 to 30, 60 to 80	15 to 20, 80 to 120	<15 and >120
Stoniness Class	S0, S1	S2	S3, S4	S5
Texture	FSL, VFSL, L, SL, SiL	CL, SCL, SiCL	LS, SiC, C <sup>2</sup> , S, HC <sup>3</sup>	n/a
Moist Consistency	Very friable, friable	Loose	Firm, Very firm	Extremely firm
Organic Matter (%)	>2	1 to 2	<1 to 0.1	<0.1
CaCO <sub>3</sub> Equivalent (%)	<2	2 to 20	20 to 70	>70

<sup>1</sup>Materials characterized by a SAR of 12 to 20 may be rated as poor if texture is sandy loam or coarser and saturation % is less than 100.

<sup>2</sup>C – May be upgraded to fair or good in some arid areas.

<sup>3</sup>HC – May be upgraded to fair or good in some arid areas.

**Table 2. Criteria for evaluating suitability of subsoil material.**

Rating/Property	Good (G)	Fair (F)	Poor (P)	Unsuitable (U)
Reaction (pH)	6.5 to 7.5	5.5 to 6.4 & 7.6 to 8.5	4.5 to 5.4 & 8.6 to 9.0	<4.5 and >9.0
Salinity (EC) (dS/m)	<3	3 to 5	5 to 10	>10
Sodicity (SAR)	<4	4 to 8	8 to 12	>12 <sup>1</sup>
Saturation (%)	30 to 60	20 to 30, 60 to 80	15 to 20, 80 to 120	<15 and >120
Stone Content	<3	3 to 25	25 to 50	>50
Texture	FSL, VFSL, L, SL, SiL	CL, SCL, SiCL	S, LS, SiC, C, HC	Bedrock
Moist Consistency	Very friable, friable	Loose, firm	Very firm	Extremely firm
Gypsum CaCO <sub>3</sub> Equivalent (%)	The suitability criteria for sodicity (SAR) may be altered by the presence of high levels of either lime (CaCO <sub>3</sub> ) or gypsum (CaSO <sub>4</sub> ) in excess of other soluble salts.			

<sup>1</sup>Materials characterized by a SAR of 12 to 20 may be rated as poor if texture is sandy loam or coarser and saturation % is less than 100.

## APPENDIX D

### 1.0 Glossary of Terms

**A-horizon:** The surface horizon of a mineral soil having maximum organic accumulation, maximum biological activity and/or eluviation of materials such as organic matter, iron and aluminum oxides and silicate clays.

**Agricultural Cropping:** Annually cropped and/or forages (may include occasional conservation summer fallow).

**Amendments:** Any substance such as lime, sulphur, gypsum, fertilizer and organic materials used to alter the properties of a soil, generally to make it more productive.

**B-horizon:** A soil horizon usually beneath the A-horizon that is characterized by one or both of the following: 1) an accumulation of silicate clays, iron and aluminum oxides, and humus, alone or in combination; 2) a blocky or prismatic structure.

**Biomass:** The amount of living matter in a given area.

**C-horizon:** A soil horizon generally beneath the solum which is relatively little affected by biological activity and pedogenesis, and is lacking properties diagnostic of an A or B horizon. It may or may not be like the material from which the A and B horizons have been formed.

**Class, soil:** A group of soils having a definite range in a particular property such as acidity, degree of slope, texture, structure, land use capability, degree of erosion, or drainage.

**Cover crop:** A close-growing crop grown primarily for the purpose of protecting and improving soil between periods of regular crop production or prior to revegetation on reclaimed land.

**Coversoil:** For the purposes of this guideline, coversoil is defined as being the upper soil profiles meeting the criteria for “good” “fair” or “poor” soil as outlined in Appendix C, Table 1, and containing greater than or equal to 0.1 percent organic matter.

**Ephemeral Wetland:** A wetland that retains water only during or after rainstorms or snow-melt events, but is otherwise dry.

**Erodibility:** A measure of the susceptibility of a soil toward particle detachment and transport by rainfall, runoff or wind.

**Excessive stoniness:** Soils sufficiently stony to hinder tillage, planting and harvesting operations.

**Glycolic soils:** Soil that is developed under wet conditions. It characteristically has low chroma (purity of colour) and prominent mottling.

**Invasive exotic species:** Species that are non-native or alien to the ecosystem under consideration, and whose introduction causes or is likely to cause economic or environmental harm or harm to human health.

**Land Capability Classification:** A grouping of kinds of soil into special units, subclasses and classes according to their capability for a particular purpose. A “use capability classification” may be defined as one based on both physical and economic considerations according to their capabilities for human use, with sufficient detail of categorical definition and cartographic (mapping) expression to indicate differences in use.

**Lime (agricultural):** In strict chemical terms, calcium oxide. In practical terms, it is a material containing the carbonates, oxides and/or hydroxides of calcium and/or magnesium used to neutralize soil acidity.

**Management, soil:** The sum total of all tillage operations, cropping practices, fertilizer, lime, and other treatments conducted on or applied to a soil for the production of plants.

**Native species:** Means a wild species that was not deliberately or accidentally introduced by humans and that:

- (a) is a breeding resident of Saskatchewan; or
- (b) in some manner or degree, exists naturally in Saskatchewan.

**Organic matter:** see soil organic matter.

**Overburden:** The earth, rock and other material that overlie a mineral deposit and which is removed prior to mining.

**Parent material:** The unconsolidated and, more or less, chemically weathered mineral or organic matter from which the solum of the soil is developed by pedogenic processes. This is usually considered the C horizon.

**Pedogenesis:** The natural process of soil formation; adjective: "pedogenic".

**Plow layer:** The soil ordinarily moved in tillage; equivalent to the surface soil.

**Rare species:** Species listed on the "Interim List" prepared by Fish and Wildlife Branch, Saskatchewan Environment, March 2002 (and as periodically updated).

**Reclamation:** Implies that the land will be returned to a condition able to attain a prior approved land use, including a stable ecological state that does not contribute substantially to environmental deterioration and is consistent with surrounding aesthetic values.

**Revegetation:** The establishment of vegetation, which replaces original ground cover following land disturbance.

**Saline soil:** A soil containing sufficient soluble salts to impair its capability for human use.

**Sodicity, soil** – measure of the sodium levels in soil used to determine if soil is sodic.

**Sodic, soil** - soil containing sufficient sodium to interfere with the growth of most crop plants and affect soil structure. Soil having an exchangeable sodium percentage of 15 or more.

**Soil profile:** A vertical section of a soil, which displays all its horizons and its parent material.

**Soil organic matter ("SOM"):** The organic fraction of the soil which includes plant and animal residues at various stages of decomposition, cells and tissues of soil organisms, and substances synthesized by the soil population. The main component of soil organic matter is carbon.

**Solonetzic soils:** A group of soils having surface horizons on varying degrees of friability underlain by dark hard soil, typically with columnar structure. This hard layer is usually highly alkaline.

**Solum:** The upper and most weathered part of the soil profile; the A and B horizons.

**Subsoil:** Soils (including overburden) meeting the criteria in Appendix C, Table 2 of this guideline.

**Topsoil:** For the purposes of this guideline, topsoil is the A-horizon including the layer of organic matter.

**Wetland:** an area of low-lying land, submerged or inundated periodically by fresh or saline water.

## APPENDIX E

### 1.0 Additional Resources

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