

Conservation Assessments in Native Grasslands



Strategic Siting and Pre-Disturbance Site Assessment Methodology
for Industrial Activities in Native Grasslands

ACKNOWLEDGEMENTS

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TABLE OF CONTENTS

Glossary of Terms	1
Preface	5
1. How to Use this Document	7
2. When to Use this Document	9
3. Planning Considerations	10
3.1 Survey Skill Sets.....	10
3.1.1 Soil Assessment Skills	10
3.1.2 Vegetation Assessment Skills.....	10
3.2 Timing	11
3.3 Communication.....	11
4. Key Assessment Components	12
4.1 Landform and Soils	12
4.2 Ecological Sites and Range Sites.....	12
4.3 Plant Community	13
4.4 Range Health Assessment	14
5. Grassland Conservation Assessments	15
6. Strategic Siting Assessment (SSA)	18
6.1 Desktop Review	18
6.1.1 Establishing a Field Verification Area (FVA)	19
6.1.2 Map Scale.....	21
6.1.3 Landform and Ecological/Range Site Preliminary Field Verification Map.....	22
6.2 Field Verification	23
6.2.1 Confirming Ecological/Range Sites by Soils	24
6.2.1.1 Soil Inspection Density and Survey Intensity.....	24
6.2.1.2 Location of Soil Inspections	25
6.2.1.3 Soil Inspection Methods.....	25
6.2.2 Confirming Native Vegetation Components of the FVA.....	26
6.2.2.1 Field Verification Inventory Procedure	26
6.2.2.2 Native Grassland Determination.....	27
7. Pre-Disturbance Site Assessment (PDSA) for Native Grasslands	28

7.1 Pre-Disturbance Site Assessment (PDSA) Area	28
7.2 Pre-Disturbance Preliminary Soil Map	29
7.3 Pre-Disturbance Soil Assessment	30
7.3.1 Soil Inspection Density and Survey Intensity.....	30
7.3.2 Location of Soil Inspections	31
7.3.3 Soil Inspection Methods.....	31
7.4 Pre-disturbance Vegetation Data Collection	32
7.4.1 Plant Community Classification.....	32
7.4.2 Range Health Assessment.....	32
7.4.3 Regulated Weeds and Invasive Species.....	33
8. Reporting	34
8.1 Strategic Siting Assessment (SSA) Reporting.....	34
8.1.1 Landforms/Topography	34
8.1.2 Soil Information.....	35
8.1.3 Vegetation Information.....	35
8.1.4 Evaluation	36
8.2 Pre-Disturbance Site Assessment (PDSA) Reporting	36
8.2.1 Soil.....	36
8.2.2 Vegetation.....	37
8.2.2.1 Ecological/Range Sites and Component Plant Communities	38
8.2.2.2 Regulated Weeds and Invasive Species.....	38
8.2.3 Evaluation	39
9. References.....	40
10. Resources.....	43

Appendices	45
Appendix A – Ecological Site / Range Site Classification Systems.....	45
A.1 Ecosite/Ecosite Phase Determination.....	45
A.2 Range Site / Ecological Range Site Determination.....	46
Appendix B – Soil Information Collection Detail.....	47
B.1 Required for All Soil Inspection Locations.....	47
B.2 Site Assessment (SSA) Soil Data Collection.....	47
B.3 Pre-Disturbance Site Assessment (PDSA) Soil Data Collection.....	48
Appendix C – Vegetation Information Collection Detail.....	50
C.1 Site Assessment (SSA) Vegetation Data Collection.....	50
Foliar Cover	
C.2 Pre-disturbance Site Assessment (PDSA) Vegetation Data Collection.....	54
C.2.1 Range Health Assessment.....	55
C.2.2 Invasive Species and Regulated Weeds Documentation.....	55
C.2.3 Rare Plants Documentation.....	55
Appendix D – Data Collection Forms (Vegetation and Soils).....	56

List of Figures

Figure 1. Natural Subregions of Alberta that Support Native Grasslands..... 8

Figure 2. Conservation Assessment flow Chart to Avoid or Minimize Disturbance in Native Grasslands 17

Figure 3. Field Verification Area..... 20

Figure 4. Range Site Polygon – Native Rangeland..... 22

Figure 5. Range Site Polygon – Native Rangeland/Cropland Mosaic..... 23

Figure C6 Vegetation Sampling Transect 52

Figure C7 Landscape Assessment Photograph..... 53

Figure C8 Oblique Assessment Photograph..... 53

Figure C9 Vertical Assessment Photograph..... 54

List of Tables

Table 1 Target Density and Minimum Required Inspection Sites Based on PDSA Size 30

GLOSSARY OF TERMS

Definitions of key terms have been provided below. Where definitions are referenced from the *Alberta Public Lands Glossary of Terms* (GOA 2017), it is the definitive source as amended periodically.

Alberta Vegetation Inventory (AVI)

A photo-based digital inventory developed to identify the type, extent and conditions of vegetation, where it exists and what changes are occurring within the forested areas of the province.

Deep Soil Inspections

Characterizing and classifying soils to a depth of 100 cm in mineral soils and 160 cm in organic. For the purpose of this assessment these inspection points classify to soil series.

Derived Ecosite Phase (DEP)

A digital and spatial representation of ecological sites and phases in those areas of Alberta with coverage of both AVI and LiDAR.

Desktop Review Area

The extent evaluated prior to a site visit, for the SSA and/or PDSA with existing mapping/inventory sources. The purpose is to determine siting options for the planned footprint. The area by design is large enough to include the maximum allowable movement of the proposed activity on the landscape. The planned footprint includes full development potential, including temporary or permanent access and utility corridors. As well as the area where offsite impacts to vegetation and soils can be anticipated.

Ecological Site/Range Site

Ecological sites are ecological units that develop under similar environmental influences (climate, moisture, nutrient regime). Ecological sites vary in their moisture and nutrient regime and have similar characteristic plants and soils. **Range sites** are determined by examining key attributes of the landscape, soil features and textural groupings along with additive information such as the site's specific environmental factors, specific geographic position within a position within a subregion. Range sites are considered analogous in definition to ecological sites but are specific to the Grassland Natural Region.

Ecological Site Phase (ecosite phase)

An ecological site phase is a subdivision of the ecological site based on the dominant species in the canopy. On lowland, meadow or grassland sites where tree canopy is not present the tallest structural vegetation layer with greater than 5 per cent cover determines the ecological

site phase. Generally, ecological site phases are mappable units and spatial ecological site phase land cover datasets have been developed from AVI (Alberta Vegetation Inventory) (Derived Ecosite Phase (DEP) and PLVI (Primary Land Vegetation Inventory). Ecological site phases have a distinct range in canopy composition, lower strata plant species and pedogenic processes. The ecological site phase has a strong ecological basis and correlates well with forest cover on forest inventory maps.

Field Verification Area (FVA)

Is a subset of the desktop review area and is specific to conducting a SSA. The extent evaluated onsite must uphold the principles outlined within the *Principles for Minimizing Surface Disturbance in Native Grassland* (AEP 2016a) and provide opportunity for modification of the size and location of the disturbance within the review area. The FVA is an onsite assessment and includes determination of the presence of native vegetation components, soil and landform classification as outlined in this document.

Foliar Cover

Foliar cover is where vegetation canopy is estimated with a similar projection of the canopy onto the ground below, but the spaces within the vegetation canopy are subtracted from the estimate.

Grassland Vegetation Inventory (GVI)

Alberta's comprehensive biophysical, anthropogenic and land-use inventory of the province's White Area. GVI is a biophysical and land-use inventory rather than a purely vegetation inventory. It is comprised of ecological range sites based on soils information for areas of native vegetation and general land use for areas of non-native vegetation, namely those associated with agricultural, industrial, and residential developments

Lentic

Standing or very slowly moving water, including potholes, wetlands, and lakes.

Lotic

Flowing water, usually confined by well-defined banks, and include streams and rivers.

Modified grassland

Grassland communities that have been modified to greater than 70 per cent cover of non-native species due to human and/or naturally caused disturbances.

Native grassland

A landscape unit where the vegetation is dominated by grasses, grass like plants, and/or forbs (>50 per cent). For example, if an air photo review shows a unit with 45 per cent scattered woody species canopy cover and 55 per cent grass species canopy cover, it would still be defined as a grassland. For grasslands to be defined as “native”, they must be comprised of greater than 30 per cent foliar cover of native grassland species (GOA, 2017).

Plant community

A grouping of vegetation identifiably different than other types in surrounding areas, and are an expression of the site’s potential.

Plant community may also refer to the plant community as classified and defined in the *Range Plant Community Guides and Health*, where plant communities are a further subdivision of ecological site phase and the lowest taxonomic unit in the classification system. Generally the plant community types are named by combining the name of the dominant plant species in each structural layer (e.g.: White spruce/Horsetail/Moss).

Polygons

Discrete units delineated on the landscape by differences in tone, texture, and pattern, viewable by remote sensing imagery.

Pre-disturbance Site Assessment (PDSA)

The assessment collects detailed soil and vegetation data within the area designated for planned footprint. For the purpose of this document, the data will flag sensitive soils and plant communities and provide pre-disturbance/biophysical data for detailed plans (e.g. public lands supplements, conservation and reclamation type plans) to guide development of reclamation and native plant community restoration outcomes specific to pre-disturbance communities. The data is also used to inform construction and operations planning to mitigate impacts of disturbance on the landscape and enable successful salvage of reclamation material and storage. Where representative, they may also be applicable for use as controls for final reclamation assessments.

Primary Land Vegetation Inventory (PLVI)

A photo-based digital inventory developed to identify the type, extent and conditions of vegetation in the forested and parkland areas of the province of Alberta. This includes portions of both the Green and White areas of the province. Ecological site phase (ecosite phase) is the main level of classification used in PLVI.

Planned footprint

For the purposes of this document, includes the extent of the proposed direct land disturbance, temporary or permanent. It includes all associated or incidental disturbances.

Range Health

Range health references the ability of the rangeland to perform key ecosystem functions and includes the assessment of certain ecological criteria, which indirectly measure ecosystem function and provide a range health rating of healthy, healthy with problems, or unhealthy.

Reclamation Material

Includes all material conserved, salvaged and/or stored for the purpose of reclamation. Including but not limited to organic layers (O layers, L, F, H) vegetation propagules/root mats, A soil horizons, B soil horizons, and coarse woody debris.

Shallow Soil Inspections

Characterizing soils to a total thickness of the solum (topsoil and subsoil) or topsoil plus 30 cm of the subsoil, whichever is less. Completed to verify the mapping unit as it relates to classification of the corresponding deep soil inspection points located in the mapping unit. As well to increase data points for more accurate topsoil and upper subsoil salvage estimates and storage requirements.

Strategic Siting Assessment (SSA)

Inventories and maps ecological/range sites to determine whether the planned footprint has native grassland components and to identify opportunities to avoid and minimize the disturbance to native grasslands.

PREFACE

Conservation Assessments are a long-standing best management practice and/or requirement, depending on industry type. The Conservation and Reclamation Regulation (C&R Regulation) within the Environmental Protection and Enhancement Act (EPEA) requires the conservation and reclamation of specified land. This includes pre-disturbance data collected for landscape, soils and vegetation as part of a regulatory application or a pre-disturbance assessment.

During the development of this document, EPEA's definition of "conservation" was a key contextual element for the document team.

EPEA: Conservation means the management and implementation of an activity with the objective of protecting the essential physical, chemical and biological characteristics of the environment against degradation.

The evolution of reclamation practices over the last decade has emphasized the importance of balancing land-use demands and proactive conservation when planning for successful reclamation outcomes of **native grasslands**, forests, peatlands and mineral wetlands. *The Reclamation Criteria for Wellsites and Associated Facilities* published by land use (AESRD 2010-2015) and the *Alberta Public Lands Glossary of Terms* (GOA, 2017) defines these land uses and discusses the importance of reclaiming them to the highly ecologically valuable pre-disturbance communities. The release of the Public Lands Administration Regulation (PLAR) in 2011, which includes PLAR's definition of equivalent land capability (ELC), reinforces that all crown lands must be reclaimed back to their pre-disturbance community, unless specifically authorized under the Public Lands Act and corresponding regulation. However, without proactive conservation planning, especially on landscapes that are difficult to reclaim, this legislated requirement becomes costly and decreases the technical feasibility of reclaiming to the pre-disturbance community.

The intent of this document is to provide a consistent assessment tool to meet legislative requirements of conservation and reclamation in this province by:

1. Making it applicable across industrial activity types,
2. Utilizing pre-existing and established assessment practices in native grasslands, and;
3. Providing a versatile tool to be used as a best management practice or under any regulatory framework requiring siting or pre-disturbance assessment data.

Although commonalities exist, conservation must be land-use specific. In the most sensitive of landscapes like native grasslands, it is also be plant community specific.

The purpose of this Conservation Assessment methodology is for native grasslands. However, aspects of this document were developed to be non-specific (e.g., soils assessment protocol for the **pre-disturbance site assessment**) to ensure future alignment of Conservation Assessments across native land use types (e.g. forested land, native grasslands). Regulating bodies may use the soils section of the pre-disturbance site assessments (PDSA) across land use types, where policy on pre-disturbance soil assessment does not exist for an activity type.

This document is meant to align and support foundational policy like the Alberta Environment and Parks (AEP) document *Principles for Minimizing Surface Disturbance in Native Grassland – Principles, Guidelines, and Tools for all Industrial Activity in Native Grasslands in the Prairie and Parkland Landscapes of Alberta* (2016a). Ecological/range site, vegetation and soils information collected during conservation assessments in grasslands feeds into decision-making principles and guidelines described within the aforementioned document and are best used in conjunction with each other.

1. HOW TO USE THIS DOCUMENT

This document provides specific methodology for two complementary Conservation Assessments:

- Strategic Siting Assessments (SSA); and,
- Pre-disturbance Site Assessments (PDSA).

These assessments use quantitative measures to promote strategic siting of sites to avoid and minimize surface disturbance on sensitive landscapes. Methodology provided in this document has been designed for native grasslands found in Grassland, Parkland and Montane Natural Subregions (Figure 1).

Native grasslands are identified through the classification of the ecological/range sites, land form, and plant community. For the purpose of this document and the ones referenced below, the term **native grasslands** are those communities composed of 30 per cent or more native species. This threshold, originally outlined in *Rangeland Health Assessment for Grassland, Forest & Tame Pasture* (Adams et. al 2016), is also utilized in the *Reclamation Criteria for Wellsites and Associated Facilities for Native Grasslands* (2013) and the *Alberta Public Lands Glossary of Terms* (2017). This includes upland grasslands and ephemeral drainages with occasional flowing water.

The SSA methodology in this document provides the process to determine whether the plant community is native or non-native, based on the 30 per cent threshold. While the PDSA methodology provides the process to document detailed vegetation and soils data to construct and reclaim in a manner to prevent loss of native grasslands. Vegetation surveying methodology has largely been adapted from Alberta's range inventory procedures. An excellent resource for vegetation survey methodology is the *Range Inventory Manual for Forest Reserve Allotments and Grazing Leases within Rocky Mountain, Foothills, Parkland, and Grassland Natural Regions* (2018).

The *Alberta Public Lands Glossary of Terms* (2017) contains key definitions as it relates to this document and should be referred to when utilizing this document. A supplemental glossary has also been provided at the beginning of this document.

Notes:

1. Areas of standing water classified as lentic wetlands mapped as part of the conservation assessment must be assessed separately as per the *Alberta Wetland Policy* (GOA 2013).
2. The vegetation assessment methodology in this document is not suitable for rare plant surveys. If rare plant surveys are required, methods for conducting rare plant surveys can be found on the Alberta Native Plant Council website.

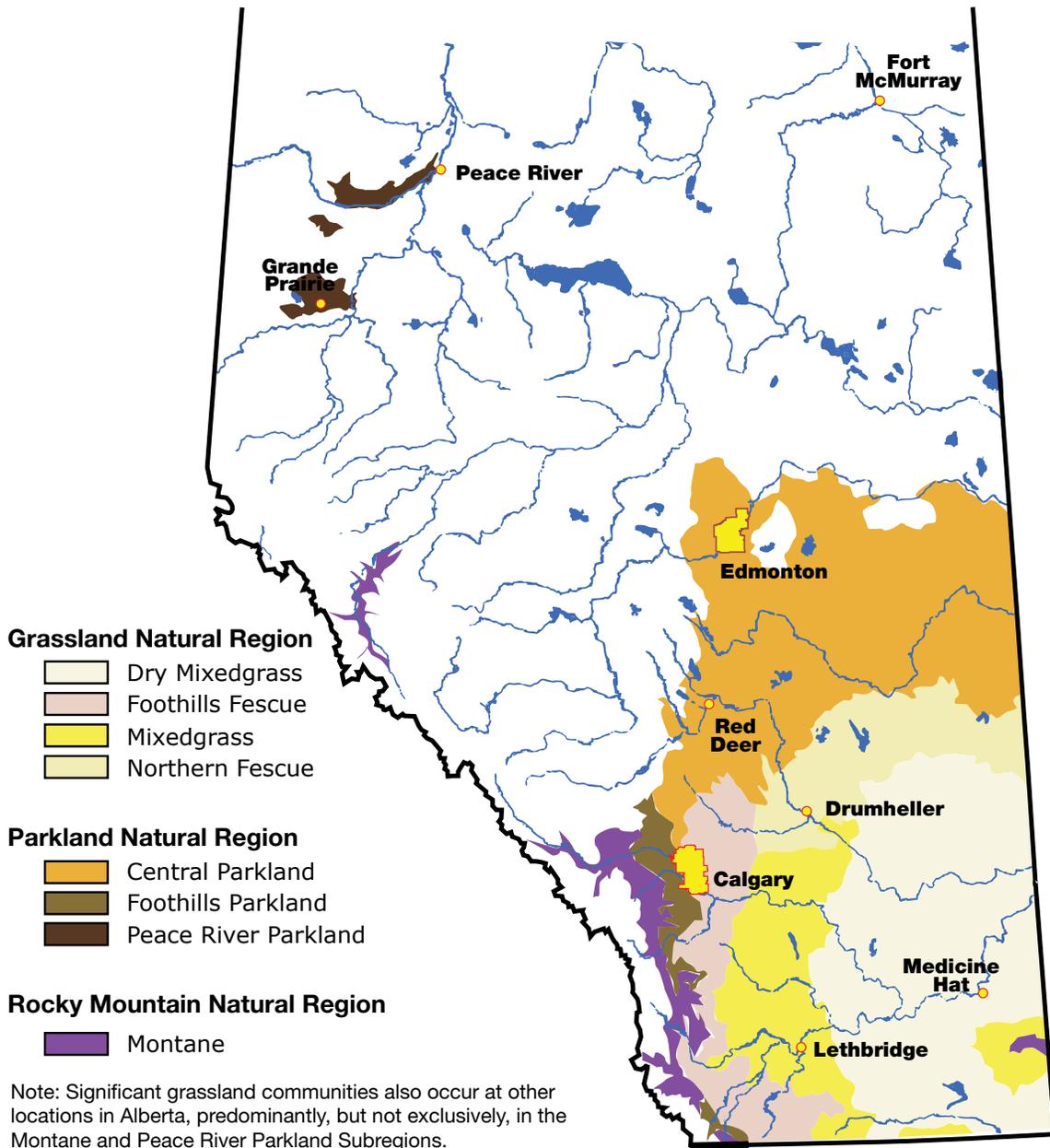


Figure 1. Natural Subregions of Alberta that Support Native Grasslands.

2. WHEN TO USE THIS DOCUMENT

This document is intended to be used during the planning phase of any industrial activity when there is potential to disturb native grasslands or as required by the regulating body or landowner on private or public lands. Examples of applicability of this document include, but are not limited to:

- Pre-disturbance or biophysical assessments required in conservation and reclamation plans and/or similar planning documents, located in potentially native grasslands;
- Pre-disturbance or biophysical soil assessments required in conservation and reclamation plans and/or similar planning documents (e.g. Conservation Operation Reclamation Plans) in any land use type/activity where existing policy direction does not exist;
- Where a Public Lands formal disposition, authorization or approval require pre-disturbance site assessments this document must be followed;
- If an activity falls within the Central Parkland and Northern Fescue sensitivity landscape analysis tool (LAT) layer; and/or
- As a requirement for a non-routine application on public lands at the discretion of the regulating body (e.g.: a non-routine application on the approval standard for minimal disturbance construction)

The SSA and PDSA procedures described in this document are designed to ensure sufficient detail and quality of data to facilitate regulatory approvals. Where existing requirements or methodology existed for PDSA's, this document aligned and only modified where it was required to elaborate or accommodate the land use.

Note:

The requirements outlined in this document do not supersede existing policy or approval requirements. For example, where conservation and reclamation plan requirements stipulate alternate methodology or additional methodology, they are not superseded by this policy.

3. PLANNING CONSIDERATIONS

3.1 Surveyor Skill Sets

At a minimum, an intermediate technical skill level in conducting soil and vegetation assessments, experience conducting field surveys in native grasslands, and experience with classification systems referenced in this manual are needed. Interpretation of and linkages between soil survey mapping, range sites and reference plant communities rely heavily on accuracy of the data collection (McNeil and Craig 2014). Skill set requirements recommended for surveyors are provided below to assist in selection of qualified individuals and promote accurate data collection. This field survey is not suited for junior or entry level staff. Poorly completed, uninformed, and inaccurate field survey results are recognized by reviewers and regulators and can result in delays, audits, or failures of project applications.

3.1.1 Soil Assessment Skills

Competencies needed for soil surveyors completing SSAs and PDSAs include:

- Training and field experience in soil classification to the subgroup level using the *Canadian System of Soil Classification* (SCWG 1998)
- Training and field experience using standard soil assessment methods and equipment
- Familiarity with use and interpretation of applicable inventory databases (e.g. **Grassland Vegetation Inventory**)
- Ability to understand and interpret landscape, soil, parent material, and vegetation relationships
- Familiarity with sensitive landscapes and soils, as well as types of disturbances created by construction practices
- Familiarity with concepts of **ecological site**, **range site**, ecodistrict, and **plant community**

In addition to the above, competencies for soil surveyors completing PDSAs include:

- Training and field experience in soil classification to the series level with guidance from the *Alberta Soil Names File (Generation 3) User's Handbook* (AAFC 2006)
- Training and field experience in soil survey and mapping

3.1.2 Vegetation Assessment Skills

Competencies for vegetation surveyors completing SSAs and PDSAs include:

- Familiarity with and a demonstrated ability to use dichotomous taxonomic keys

- The ability to identify all grass species in the region in a vegetative state and when in flower or seed
- The ability to identify all trees, shrubs and common forbs in vegetative and reproductive states
- The ability to identify all common sedges in a reproductive state
- Familiarity with the concepts of natural subregions, ecological site, range site, ecodistrict, plant communities and succession
- The ability to correctly identify plant communities based on location, soils data and information presented in *Range Plant Community Guides and Range Health Assessment Guidelines* (AESRD 2003-2013)
- Training in range health assessment protocol as outlined in the *Rangeland Health Assessment for Grassland, Forest & Tame Pasture* (Adams et. al 2016)

3.2 Timing

Timing considerations and requirements for soils and vegetation assessments include:

- Soil assessments need to be completed during unfrozen ground conditions
- Soil assessment during adverse weather conditions (e.g. during a significant rain event) are best avoided as they can affect survey time requirements and data quality
- Vegetation and rangeland health assessments must be completed when vegetation is actively growing, approximately between mid-June and mid-September, after new vegetative growth has begun for the season. Appropriate assessment dates within this range may vary in different areas of the province
- Cooperation with livestock producers may also affect timing of survey activities
- Vegetation and rangeland health assessment of grazed pastures are more difficult and may take longer

3.3 Communication

Landowners and land managers may have significant knowledge of the access, soil, vegetation, and weed issues present on their lands. Their perspectives can provide valuable information for SSAs and PDSAs.

4. KEY ASSESSMENT COMPONENTS

Native grasslands are identified through the classification of the land form and soil type, ecological/range sites, and plant community. The health of the native grasslands are measured through the Range Health Assessment outlined below in Section 4.4. These four assessment components are specific to native grassland assessments and are thus considered key assessment components. A brief description and purpose of these assessment components are outlined below.

4.1 Landform and Soils

Assessment of landform and soils across the province follows the inventory protocols for local landforms described in chapter 18 of the Canadian System of Soil Classification, 3rd Edition (SCWG 1998). The classification system is intended to map all landforms, and requires identification of:

- genetic materials (e.g. fluvial, morainal);
- material qualifiers (e.g. gravelly, loamy);
- surface expression/forms (e.g. hummocky, fan);
- slopes;
- modifying processes (e.g. eroded, deflated); and
- qualifying descriptors (e.g. glacial, glaciofluvial) (SCWG 1998).

In native grasslands, assessment of landforms also informs the ecological/range site described below.

4.2 Ecological Sites and Range Sites

The Natural Subregions within the Grassland, Rocky Mountain, Foothills, and Parkland Natural Regions are composed of ecological or range sites. Ecological sites are defined as “a distinctive kind of land with specific physical characteristics that differ from other kinds of land in its ability to produce a distinctive kind and amount of vegetation” (TGUCT 1995).

Terminology used in the *Range Plant Community Guides and Health Assessment Guidelines* (AESRD 2003-2013) differs between Natural Subregions. In the Grassland Natural Region, the term range site is used. Range sites are determined by examining key attributes of the landscape, soil features and textural groupings (Adams et al. 2013). With additive information such as the site’s specific environmental factors, specific geographic position within a position

within a subregion, an ecological range site can be ascertained. This is considered analogous in definition to ecological site. In the Rocky Mountain and Parkland Natural Regions, ecological sites (or ecosites) are defined directly by using similar climatic, moisture, and nutrient regimes derived by parent material, landscape, slope, and aspect (Willoughby et al. 2007).

Upland **site types** in the Grassland Vegetation Inventory (GVI) and **Ecosite phases** within the Primary Land Vegetation Inventory (PLVI) refer to the various ecological sites and range sites. While for the purpose of this document, the four terms (upland site types, ecosite phase (a lower level of ecological site classification), ecological range site and range site) are combined as “**ecological/range site**”. Guidance on determining ecological/range sites is presented in Appendix A.

4.3 Plant Community

The above ecological/range sites in turn are subdivided into plant communities. **Plant communities** are a grouping of vegetation identifiably different than other types in surrounding areas, and are an expression of the site’s potential. For the purpose of the SSA, the term plant community is used only at this general level to determine the native composition of the plant community, not to classify the specific plant community as defined in the *Range Plant Community Guides and Health Assessment Guidelines* (AESRD 2003-2013).

For the purpose of the PDSA, the plant communities need to be defined in an ecological classification system into similar functional units that respond to disturbance in a similar and predictable manner. The success of minimal disturbance construction practices and specific restoration strategies are typically linked to the specific plant community (AEP 2016a). The *Range Plant Community Guides and Health Assessment Guidelines* (AESRD 2003-2013) provide the basis for classification.

Note:

The classification of the plant community as defined in the *Range Plant Community Guides and Health Assessment Guidelines* (AESRD 2003-2013) is a requirement only within the PDSA vegetation assessment.

4.4 Range Health Assessment

The decision on where and how to site an activity may be informed by the range health of the proposed and surrounding area. Range health is an important tool for determining the restoration potential of native grasslands after disturbance. The range health assessment within the context of the Conservation Assessment is a tool to provide:

1. Documentation of a rationale or justification for the location of a site between two native grasslands of differing range health scores during the SSA. Range health assessment is an optional tool in SSA, but may be critical where siting options are limited.
2. Documentation of pre-disturbance range health conditions for final reclamation assessments and comparison to reclamation criteria or performance measures. This is required as part of the PDSA as outlined in Section 7.4.2.

Note:

If range health is determined to be a key factor in the rationale for siting, the documentation required for the vegetation in the SSA is sufficient to be utilized for the purpose of a range health assessment. However, litter quality and quantity are required for all range health assessments as well. Therefore, it is strongly recommended litter samples are collected during the SSA if there is any potential need for range health assessment to site the industrial activity to prevent additional site visits.

5. GRASSLAND CONSERVATION ASSESSMENTS

Native grasslands are considered sensitive lands largely due to their diminishing presence on the landscape and current technical limitations and challenges to their restoration. As *Principles for Minimizing Surface Disturbance in Native Grassland* (2016a) illustrates, conservation for sensitive landscapes involves both planning to avoid as much as possible and operating and reclaiming in a manner to prevent permanent loss of the native grasslands.

Conservation Assessments provide the methodology to identify plant species composition and specific soil parameters to measure the amount and kind of native grasslands present within the **planned footprint** so informed management decisions can be made. The planned footprint includes the extent of the proposed direct land disturbance, temporary or permanent. It includes all associated or incidental disturbances as well.

Conservation Assessments are broken out into two complementary assessments:

1. **Strategic Siting Assessment (SSA):**

The purpose of a SSA is to inventory and map ecological/range sites to determine whether the planned footprint has potential native grassland components and to identify opportunities to avoid and minimize the disturbance to native grasslands.

To determine whether the planned footprint includes native grasslands, the mapping is designed to determine the native species percent composition within the placement of a planned footprint. The SSA can be used to properly determine the amount and kind of native vegetation to meet policy or planning requirements. For example, for projects that fall within the Central Parkland and Northern Fescue Sensitivity LAT geospatial layer; the SSA could confirm whether the project area includes native grasslands and their associated soil type (loamy or sandy). This determines what avoidance and construction practices will be required on public lands within this sensitivity layer.

2. **Pre-disturbance Site Assessment (PDSA):**

If disturbance in native grassland is unavoidable, and the plant community, litter layer, topsoil and/or subsoil may be disturbed at any phase of the activity, a PDSA is completed.

The purpose of the PDSA is to collect detailed soil and vegetation data within the area designated for disturbance. PDSA data will flag sensitive soils and plant communities and provide pre-disturbance/biophysical data for detailed plans (e.g. Public Land Supplements, previously known as Environmental Field Reports, Conservation and Reclamation Plans, Conservation and Reclamation Business Plans, Conservation Operation Reclamation Plans etc.) to guide development of reclamation and native plant community restoration outcomes specific to pre-disturbance range sites. The PDSA data is also used to inform construction and operations planning to mitigate impacts of disturbance on the landscape. Where representative, they may also be applicable for use as controls for final reclamation assessments, as appropriate.

The flowchart in Figure 2 provides an overview of the SSA and PDSA process, and displays a linear progression from the SSA desktop review, field verification, to the PDSA. As the desktop information is correlated with field verification and operational limitations of the activity, the progression through the flowchart may be iterative in application.

Note:

Even where the site has been found not to be native grassland, the PDSA soil assessment may still be required to meet the pre-disturbance requirements of the activity type, typically through a reclamation plan or approval condition.

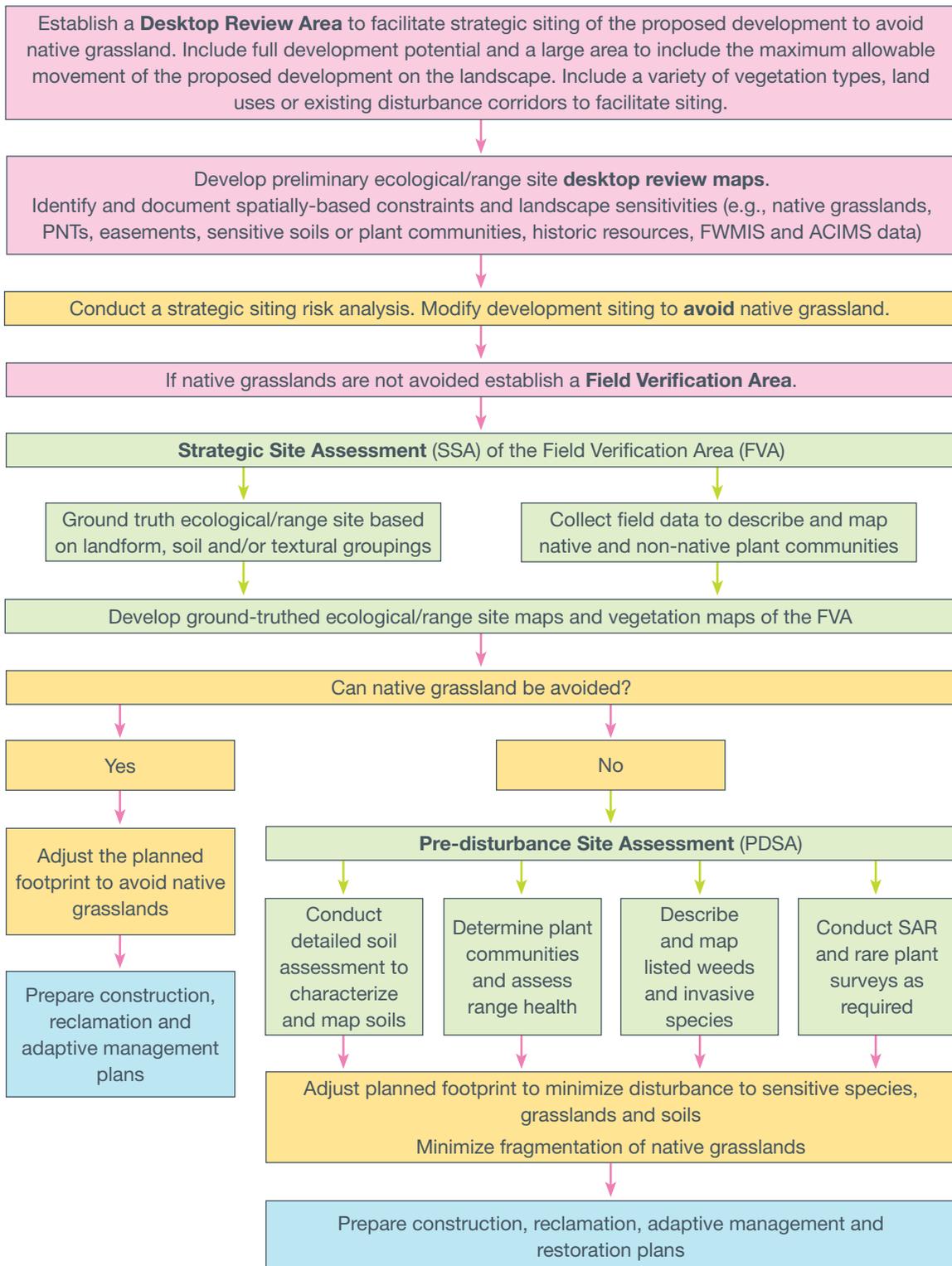


Figure 2. Conservation Assessment flow Chart to Avoid or Minimize Disturbance in Native Grasslands

6. STRATEGIC SITING ASSESSMENT (SSA)

The following sections describe the process for completing Strategic Siting Assessments (SSA) where there is a need to assess the native composition of grasslands and their soil types as outlined within the “How to Use” section of this document (Section 1). Grasslands with different soil types often respond differently to disturbance, therefore knowledge of specific soil metrics is also required.

Once the SSA has been completed, if required, some or all of the information collected through the SSA process can be used to plan for, or support a Pre-Disturbance Site Assessment (PDSA) outlined in Section 7 if required.

Note:

The final product of the SSA is a map of field verified ecological/range sites, grassland composition (percent native and non-native cover) and soil types. The SSA does not require the plant community to be classified as defined in the *Range Plant Community Guides of Alberta*. The final product of the SSA is used to document how siting resulted in avoidance or minimization of disturbance to native grasslands.

It is important that the final map is of the FVA, that includes and goes beyond, the planned footprint area. This will show whether potential indirect impacts may occur to adjacent native grasslands. Less vegetation monitoring will be required where avoidance includes both the planned footprint and directly adjacent lands.

6.1 Desktop Review

The area for the desktop review is established to determine siting options for the planned footprint. The area must be large enough to include the maximum allowable movement of the proposed activity on the landscape. The planned footprint includes full development potential, including temporary or permanent access and utility corridors. As well as the area where offsite impacts to vegetation and soils can be anticipated.

Note:

The area reviewed as part of the desktop review could be much larger than the size of the planned footprint to incorporate a variety of plant community types, land uses, or existing disturbance corridors, in order to assess options for strategic siting (AEP 2016a).

The **desktop review area** is designed to enable the user to uphold the principles of avoiding and minimizing disturbance to native grasslands outlined within *Principles for Minimizing Surface Disturbance in Native Grassland* (AEP 2016a), which are:

1. Avoid native grasslands where possible, especially in critical ecological/range sites identified as extremely difficult to reclaim (ASRD, 2009);
2. Reduce area and impacts of industrial disturbance to the extent possible; and
3. Develop practical methods to facilitate eventual restoration to equivalent land capability of disturbed areas

Below is a list of spatial tools to assist in the desktop review:

- Aerial/Satellite Imagery: Recently acquired (< 2 years) geo/ortho-rectified, this can also include stereo imagery when available.
- Light Detection and Ranging (LiDAR): If available for planned footprint, LiDAR data (or other high resolution data for deriving a Digital Elevation Model), can provide significant value for landscape analysis and interpretation
- Grassland Vegetation Inventory (GVI): If available, GVI for the Grassland Natural Region of Alberta (ASRD and LandWise Inc. 2010)
- **Alberta Vegetation Inventory (AVI)**: AVI available for forested areas of the province. (ASRD 2005)
- Primary Land Vegetation Inventory (PLVI) sporadically available for the Central Parkland Natural Subregion.
- **Derived Ecosite Phase (DEP)** available for areas of Alberta with both AVI and LiDAR coverage
- Agricultural Region of Alberta Soil Inventory Database (AGRASID) (CAESA 1998)
- Higher detailed municipal soils maps LAT geospatial layers for grassland sensitivity

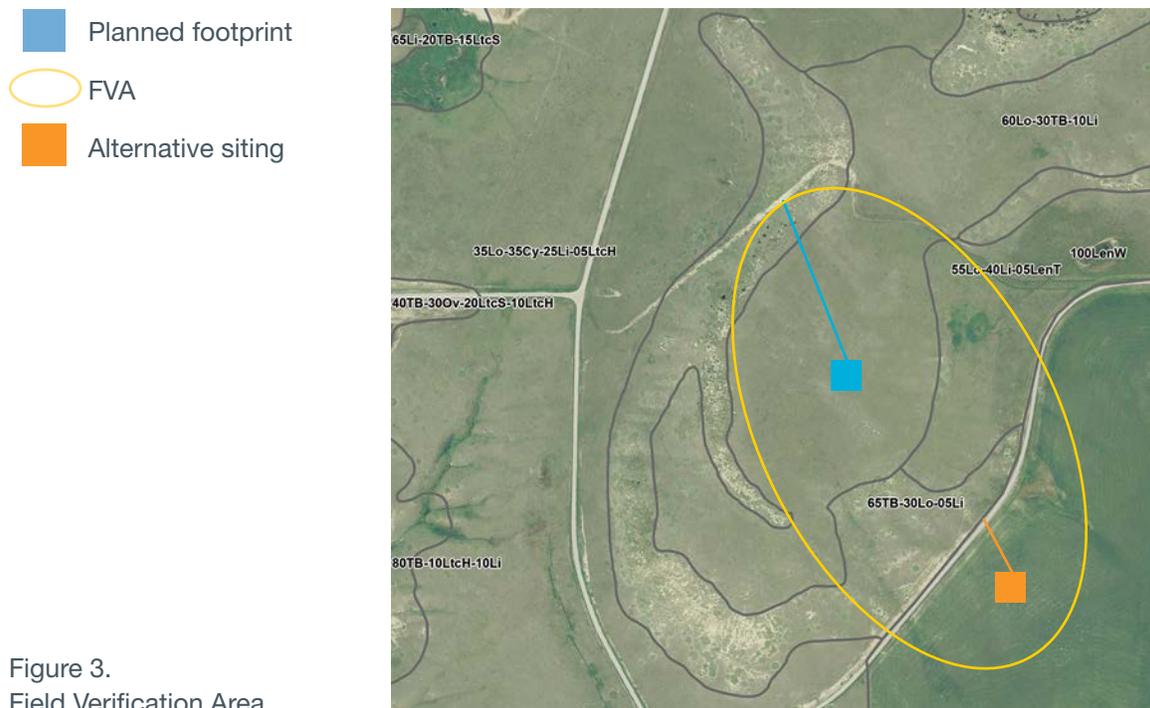
These tools are described in *Principles for Minimizing Surface Disturbance in Native Grassland* (2016a).

6.1.1 Establishing a Field Verification Area (FVA)

Determining the field verification area (FVA) is a subset of the desktop review area and is specific to conducting a SSA. The amount of area chosen for field verification must uphold the principles outlined within the *Principles for Minimizing Surface Disturbance in Native Grassland* (AEP 2016a) and provide opportunity for modification of the size and location of the disturbance within the review area.

Based on the surveyor's experience, a suggested minimum area for FVA is described below. For some areas, the inability to avoid native grasslands may result in an activity not receiving approval, or costly construction and reclamation activities. Therefore, when determining the FVA the surveyor's professional judgment must consider: on site characteristics, allowable movement of the activity, and the sensitivity of native grasslands. This may be an iterative process as outlined in Figure 2.

- 300 m radius beyond the limits of the boundary of the planned footprint for small disturbances like wellsites (e.g.: <1.2 hectare).
- 800-1600 m radius beyond the limits of the boundary of the planned footprint for large disturbances (e.g.: multiple wellsites or wind energy projects).
- Larger FVAs are required for larger disturbances with the ability to site more broadly and/or are more likely to have offsite impacts to surrounding native grassland communities (e.g.: multiple linear features).



Alternative siting of the project is depicted in orange and utilizes cropland rather than native grassland, illustrating the importance of expanding the FVA for the benefit of strategic siting and avoidance of native grasslands.

Note:

Additional direction and requirements on field verification sizing and activity siting may be provided by the regulating body, depending on factors such as the activity type and land type (private, public, parks, Special Areas etc.).

FVAs allow evaluation of the planned footprint, as well as potential alternative locations, and identification of influences from surrounding areas which require consideration during planning to ensure the project is situated in the lowest risk and lowest impact location.

Note:

If the planned footprint can fully avoid areas definitively mapped as native grasslands, FVA areas as large as stated above would **not be required**. Native plant communities directly adjacent to the planned footprint must still be mapped as part of the FVA.

6.1.2 Map Scale

The scale of preliminary maps for field verification will depend upon quality and availability of existing spatial data. Interpretation of imagery and other resources may allow users to modify existing map **polygons** to improve the scale of preliminary maps for field survey stratification and soil/vegetation assessment.

At a minimum, scale of the final map must be consistent with GVI specifications, although depending on the project, more detail may be required. GVI mapping scales are as follows:

- For native upland and modified (non-native) ecological/range sites, polygons are drawn at a scale of between 1:1,000 and 1:7,700 with a minimum polygon size of 2 ha;
- For lentic wetlands and lotic site types (areas with flowing water at some time of the year, e.g. ephemeral drainages), polygons are drawn at a scale of between 1:1,000 and 1:3,000 with a typical minimum polygon size of 1 ha

These scales are designed to display sufficient detail and accuracy within 5 m for uplands and 2 m for lentic and lotic features. While lentic wetlands will be assessed separately, they must be delineated during mapping as part of the SSA. The mapping for the SSA does not supersede the requirements outlined in the *Alberta Wetland Policy*. Where the *Alberta Wetland Policy* (GOA 2013) is more detailed, SSA may utilize those wetland mapping requirements to avoid duplication of surveying.

6.1.3 Landform and Ecological/Range Site Preliminary Field Verification Map

Polygon delineation of the FVA is required to assess the diversity of landform, vegetation, and soil types, in addition to initial stratification of field survey coverage and intensity for the SSA. Typically, polygons are first delineated by vegetation differences in tone, texture, and pattern viewable by remote sensing imagery. These delineations separate different community types. If it is suspected that patterns within a delineated polygon indicate more than one community type that cannot be easily separated, then estimates of their percent area must be attained. Estimates of soil type and ecological/range site for each plant community is also important for initial attribution. Soil type estimates can be collected from AGRASID.

Inventories such as GVI, PLVI, DEP, or AVI provide this initial polygon delineation to create polygons to represent ecological/range sites. If polygons are not available, then delineations must follow GVI specifications (ASRD and LandWise Inc. 2010).

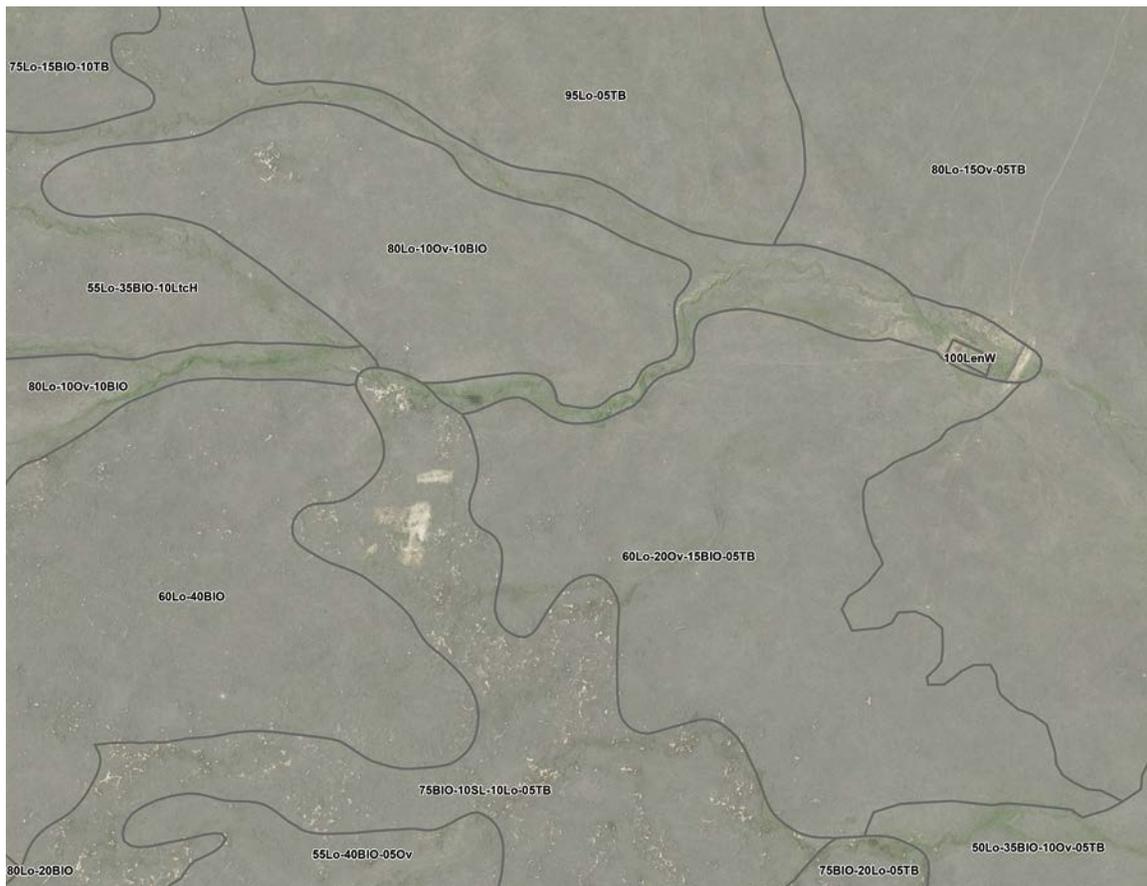


Figure 4. Range Site Polygon – Native Rangeland

Example of basic range site polygon line work using GVI in a native rangeland.



Figure 5. Range Site Polygon – Native Rangeland/Cropland Mosaic

Example of basic range site polygon line work using GVI in a native rangeland/cropland mosaic.

6.2 Field Verification

After the desktop review is completed, and there is still an indication native grasslands are present (siting is not annual crop or confirmed tame pasture), field verification is required. Field verification of ecological/range sites forms the basis to correlate classification and mapping of grassland vegetation communities. Developing an inventory of vegetation communities in the FVA determines whether the proposed disturbance will impact native grasslands and whether there are alternative strategic locations to minimize disturbance to native grasslands.

Note:

Field verification is designed for the SSA to:

1. Confirm the ecological/range sites identified in the desktop review through a soil assessment (Section 6.2.1).
2. Determine whether grassland plant communities are native (composed of 30% or more native species) through a vegetation assessment (Section 6.2.2).

6.2.1 Confirming Ecological/Range Sites by Soils

Ecological/range sites are described based on landscape, landform, soil order and/or soil textural groupings. At each established soil and vegetation inspection location, landform attributes must be recorded.

Critical information to be recorded to document the ecological/range site includes:

- Natural subregion and ecodistrict
- Topography (position, slope class, slope percent [%] and aspect)
- Landform surface expression
- Moisture regime
- Current land use and proposed land uses
- Surface stoniness
- Existing instability, erosion, or modifying features (e.g. gullying)
- Vegetation cover at a landscape scale

Inventory protocols for landforms are described in chapter 18 of the *Canadian System of Soil Classification, 3rd Edition* (SCWG 1998). Landscape descriptions and associated coding used within AGRASID are to be used for consistency (Brierley et al. 1998; Soil Inventory Working Group 1998).

A soil assessment must be completed within the FVA of the SSA, to confirm delineation and characterization of landscape polygons and ecological/range sites on the preliminary landform and ecological site map. The soil assessment will improve accuracy and precision of the established map stratification and classification.

6.2.1.1 Soil Inspection Density and Survey Intensity

The preliminary landform and ecological/range site map will delineate landscape polygons comprised of up to four ecological/range sites. At least one soil inspection must be completed within each ecological/range site occurring within the FVA (includes both linear and non-linear FVAs). Additional soil inspections may be required to confirm reoccurring ecological/range site as professional judgment requires. Additional or alternate ecological/range sites identified while onsite, which were not identified during desktop mapping, must also have a soil inspection.

6.2.1.2 Location of Soil Inspections

Soil inspections are placed in locations which are representative of the ecological/range site. Variable landform features, or suspected ecological/range site existing within the polygon, which were not initially identified by desktop mapping, must also be considered to confirm mapping or identify additional ecological/range site within the FVA.

6.2.1.3 Soil Inspection Methods

The soil inspection must collect sufficient data to confirm ecological/range site type, soil subgroup, and polygon mapping within the FVA of the SSA. During the SSA, surveyors may observe potential sensitive or limiting factors associated with soil. All soil inspection locations must be completed to a minimum depth of:

- 1 meter in mineral soils (1.6 meter in organic soils if encountered) for the purposes of identifying and characterizing ecological/range site type
- Additional soil inspections conducted to delineate ecological/range sites and confirm reoccurring site types are not required to meet minimum depths

If shovel or hand auger refusal is encountered prior to the required depth, documentation of reasons for refusal and depth must be provided. In drier areas of the province, it is recommended, whenever possible, soil assessments be completed during moister times of the year (spring to early summer) prior to soils drying out.

Standardized field assessment methods, definitions, and descriptions must be referenced for classification, soil data collection, and terminology, and are presented within:

- *Canadian System of Soil Classification* (SCWG)
- *The Canada Soil Information System (CANSIS) Manual for Describing Soils in the Field* (ECSS 1982)
- *Alberta Soil Names File (Generation 3) User's Handbook* (AAFC 2006)

An overview of soil characteristics to be recorded at each location is provided in Appendix B. While each characteristic must be assessed at each inspection point, some may not be applicable. A Site Assessment – Soil Description Form for field use is provided within Appendix D.

Other helpful field resources for soil assessment and classification are available and some are listed within Section 10 Resources of this document.

6.2.2 Confirming Native Vegetation Components of the FVA

The preliminary field map provides polygon delineation of plant communities within the FVA. The below field verification inventory procedure and native grassland determination outline how these polygons are field verified for their native species composition.

Note:

Assessments are only required for potential native grasslands within the FVA. This assessment procedure is not intended for tame pasture, perennial or annual crops.

6.2.2.1 Field Verification Inventory Procedure

Field verification includes confirming all the boundaries, plant community compositions, and site attributes of polygons and then surveying each at an appropriate level of detail to determine vegetation composition through rangeland inventory procedures. Levels of assessment complement one another, and are considered hierarchal from high to low level of detail. The inventory procedures and the methodology for determining percent native composition is included in Appendix C – Vegetation Assessment Procedures and additional detailed information on assessment protocol may be found in the Range Inventory Manual for Forest Reserve Allotments and Grazing Leases within Rocky Mountain, Foothills, Parkland, and Grassland Natural Regions (AEP 2018). An overview of the levels are as follows:

1. **Detailed vegetation assessments** are the most comprehensive assessment.

Within the FVA, all plant communities that make up 30% or greater of the polygon area must be represented by at least one detailed assessment that includes a vegetation transect to assess **foliar cover**, groundcover, and bare soil using the Daubenmire Method, and a completed Site and Vegetation Form (detailed in Appendix C - Vegetation Information Collection Detail and Appendix D - Forms). These assessments are located in a representative location within the sample plant community, across a consistent ecological/range site, slope and aspect.

2. **Reconnaissance assessments** link an unconnected polygon to a detailed assessment with the same plant community type.

A reconnaissance assessment is used if similar vegetation occurs on the same ecological/range site as a previous assessed detailed assessment. Similar to detailed assessments, the reconnaissance assessment is established in a representative location. Detailed site and soil information is collected on the appropriate form (Appendix D). The key difference from a detailed assessment is that a transect is **not required**, although a **rapid vegetation assessment** is recommended (detailed in Appendix C).

3. **Visual vegetation assessments** are reserved for small and/or mottled community types that re-occur throughout the FVA but represent only a small portion of the percent area of polygons.

Examples of utilization of visual vegetation assessments:

- Subdominant communities within polygons (30% or less area) that are not a significant portion of the planned footprint, or of significant management concern. (i.e. small shrubby swales identifiably different from the surrounding vegetation, but cover only a small area)
- polygons that contain no vegetative value (e.g. rocks, roads, etc.)

For conservation assessment purposes any reconnaissance or visual assessment that occur in grassland communities must be linked to a detailed assessment. It may not be necessary to have detailed assessments linked to other non-grassland communities (shrublands/forests), although professional judgement for the particular project should be used.

6.2.2.2 Native Grassland Determination

Determining the native vegetation composition of plant communities is completed with the following calculation:

- Calculate total foliar cover of all species
- Calculate total native foliar cover of all native species
- Divide total native foliar cover by total foliar cover
- If result is 30 per cent or greater, the area is deemed to be native grassland
- If the result is less than 30 per cent, the area is deemed to be non-native grassland

$$(\text{Total Native Foliar Cover} / \text{Total Foliar Cover}) * 100 = \% \text{ Native}$$

Note:

Regardless of percent cover, polygons containing native grassland must be linked to a detailed assessment. The required vegetation information collection for each assessment level is provided in Appendix C. Vegetation Description Form for field use is provided with Appendix D.

7. PRE-DISTURBANCE SITE ASSESSMENT (PDSA) FOR NATIVE GRASSLANDS

If, after conducting a SSA, it is determined disturbance of native grasslands is unavoidable, a PDSA is required. PDSA procedures are used to conduct detailed sampling of soils and vegetation associated with the planned footprint. Further detail is required for soil classification and description to soil series level, as well as to correlate soil and vegetation data, and assess characteristics of the plant communities, including range health and listed regulated weeds and invasive species. A PDSA provides insight into restoration risks for the proposed disturbance, including external risks from surrounding areas such as invasive species.

For vegetation and soil assessments the SSA information can be used for the PDSA as long as the transect lies within the area to be disturbed.

Note:

The final product of the PDSA includes:

1. A field verified map of the classified plant communities as classified and defined in *Range Plant Community Guides and Range Health Assessment Guidelines* (AESRD 2003-2013), native composition and range health for the planned footprint.
2. A detailed field verified soils map, to the soil series level, that can be used to conserve topsoil and subsoil.

7.1 Pre-Disturbance Site Assessment (PDSA) Area

The PDSA area is a subset of the desktop review and FVA(s). Like these, the PDSA must uphold the principles outlined within the *Principles for Minimizing Surface Disturbance in Native Grassland* (AEP 2016a) and provide opportunities for minimizing and/or mitigating impacts resulting from the disturbance.

The PDSA area includes:

- temporary and permanent planned footprints;
- associated facilities, access and utility corridors; and
- area(s) where off-site effects to vegetation and/or soils are anticipated.

7.2 Pre-Disturbance Preliminary Soil Map

Prior to commencing field work, a soil map of the planned footprint area must be developed. A preliminary soil map is an essential field tool and informs the final mapping product. Based on soil information reviewed during the desktop review, the planned footprint area is stratified into potential soil map units as per the information collected. For the PDSA, soils must be mapped to the soil series level. The following steps are provided for developing a map for the soil assessment:

- Obtain imagery of the planned footprint area (the base of the desktop review field verification map may be used),
- Overlay the most detailed map of expected soil units. Existing soil maps are available from the Government of Alberta website and AGRASID (ASIC 2001). They are used as a starting point to anticipate soil units within the site, assist in creating a map legend, and identify potential field verification locations. If existing soil maps are unavailable see the below note on soil map development methods.
- Use aerial photograph interpretation (and stereo imagery, satellite imagery and LiDAR, if available) for stratification of additional units or improved delineation accuracy,
- Assign preliminary naming for map units (if applicable), and
- Identify potential soil assessment locations.

Use the most relevant data possible (i.e.: use existing soil surveys over GVI), and refer to the *Soil Mapping System for Canada Guidelines* (MSWG 1981) and the *Soil Survey Handbook* (Alberta Agriculture 1987) for details on standard methods and procedures for soil survey and preparation of maps. The recommended map scale is 1:5000 or greater (i.e.: between 1:1 and 1:5,000), which corresponds to a minimum mappable unit of 0.125 ha (0.5 cm² on the map).

Regardless of how soil map units are initially mapped, the soil data collected will be correlated with vegetation data during PDSA reporting.

Note:

Most grassland areas have been surveyed; however, if historical soil survey information is unavailable for the field assessment area, a new soil survey must be completed as part of the PDSA. Initial desktop mapping will follow the Soil Mapping System for Canada guidelines (Mapping System Working Group, 1981) and the classification system and standard methods described within this document. Stratification may be completed using other available information such as, aerial imagery, geology, landscape, GVI, PLVI and LiDAR information. The Soil Mapping System for Canada (MSWG 1981) and the Soil Survey Handbook (Alberta Agriculture 1987) provide further details on standard methods and procedures for soil survey and preparation of maps.

7.3 Pre-Disturbance Soil Assessment

The purpose of the pre-disturbance soil assessment is to identify soil types and characteristics to the soil series level. The finalized SSA soil map can be a starting point for the field assessment to provide confirmation and/or modification of potential soil map units and improve the scale (as required), accuracy and precision of the established soil unit stratification, classification, and delineation boundaries.

Soil data collected must be sufficient to classify soils to series level. Varying level of detail is required for deep inspection locations versus shallow inspection locations. A list of characteristics to be recorded at each location is provided in Appendix B. A PDSA Soil Description Form for field use is provided with Appendix D.

7.3.1 Soil Inspection Density and Survey Intensity

A minimum number of inspection locations are required based on target densities for both linear and non-linear areas (Table 1). A minimum of one deep inspection location per soil map unit is required. Several shallow inspection locations may be needed within each map unit to accurately identify and map soil map unit boundaries.

Table 1 Target Density and Minimum Required Inspection Sites Based on PDSA Size

Size (ha)	Target Density (ha/inspection site)	Minimum # of sites
1–2	0.2	5
3–6	0.4	8
7–11	0.6	12
12–16	0.8	15
17–23	1.0	17
24–35	1.2	20
36–45	1.4	26
>45	1.6	Calculated at the Target Density
Linear Disturbance <400 m	100 m per inspection site	
Linear Disturbance >400 m	Assess based on soil and management changes (minimum of 4 inspection locations)	

Note: Adapted from Soil Mapping System for Canada (MSWG 1981), *The Soil Survey Handbook* (Agriculture Canada 1987) and the *2010 Reclamation Criteria for Wellsites and Associated Facilities* (AESRD 2010-2015).

Note:

These soil inspection intensities were developed for both native grasslands and forested lands. The inspection intensities were not designed for cultivated lands. For wetlands, the *Alberta Wetland Identification and Delineation Directive* (GoA 2015) must be followed.

7.3.2 Location of Soil Inspections

Soil inspections conducted for map unit descriptions are placed in locations which define the range of soil characteristics of the associations across the landform, the soil units, and inclusions, as applicable. Map unit delineation inspections may be located throughout polygons and near polygon boundaries. Variable features within the area are also considered for assessment, including but not limited to, different topographic positions, aspect, moisture regime, and plant communities to capture potential changes in soil units across the landscape.

7.3.3 Soil Inspection Methods

The soil assessment includes two types of inspection points: deep and shallow. **Deep soil inspections** provide detailed soil description and data for classification, map unit and polygon descriptions, and identification of potential sensitive or limiting factors associated with the soil. **Shallow soil inspections** allow inspectors to confirm classification, check topsoil depths and create more efficient delineation processes and material handling balance for both topsoil and subsoil salvage. The following minimum depths apply:

Deep: 1 meter in mineral soils (1.6 meter in organic soils if encountered) for the purposes of identifying, characterizing and classifying soil. If shovel/auger refusal is encountered prior to the required depth, documentation of reasons for refusal and depth must be provided

Shallow: Complete to the total thickness of the solum (topsoil and subsoil) or topsoil plus 0.3 meter of the subsoil, whichever is less. Additional depth may be required into the subsoil as professional judgement requires to confirm the soil classification/site type. In cases where soils have veneers <1 m thick overlaying till, the inspection must be completed to the depth of the parent material

The exact number of deep versus shallow inspections conducted will depend on the type and scale of existing soil maps, soil and landscape variability, polygon complexity, and surveyor experience and/or familiarity with the area. In relatively uniform landscapes, the minimum number of inspection locations may be sufficient. In variable landscapes, additional shallow or deep inspection locations are typically needed. For example, in a loamy-blowout landscape where solonchic and chernozemic soils occur together, additional detail is needed to accurately map the unit.

A list of characteristics to be recorded at each location is provided in Appendix B. While each characteristic must be assessed at each inspection point, some may not be applicable. A PDSA Soil Description Form for field use is provided with Appendix D. Standardized field assessment methods, definitions, and descriptions must be referenced for classification, soil data collection, and terminology (SCWG 1998; ECSS 1982; AAFC 2006).

7.4 Pre-disturbance Vegetation Data Collection

Vegetation surveys in the SSA field verification are conducted to determine whether grasslands are native. If native grasslands are still in the planned footprint, a detailed assessment is required for each native plant community occurring within the planned footprint. Once a detailed vegetation assessment is completed, this and any soil information collected for the PDSA is also used for the determining the plant community. In addition to determining plant community, range health must be assessed and regulated weeds and invasive species (as defined in the *Weed Control Act*) concerns must be addressed as outlined below.

7.4.1 Plant Community Classification

For the purpose of the PDSA ‘plant community’ refers to the most detailed level of classification as outlined in *Range Plant Community and Range Health Assessment Guidelines* (AESRD 2003-2013). A **plant community** is a grouping of vegetation identifiably different from other types in surrounding areas. They are functional units defined by the ecological characteristics of their ecological/ range site and normally respond to disturbance in similar fashions (Beckingham and Archibald 1996). The soil series identified within the PDSA area provides information to confirm the ecological/ range sites. Appendix A describes how to link soil series to the ecological/range site and ultimately to the plant community. Further detail on classification can be found in the *Range Plant Community and Range Health Assessment Guidelines* (AESRD 2003-2013), where crossover tables have been developed to link soil series with range sites.

7.4.2 Range Health Assessment

Range health assessment must be completed per the *Range Health Assessment for Grassland, Forest and Tame Pasture* (Adams et al. 2016).

Note:

Range health assessment is required for the PDSA vegetation assessment but is an optional tool in SSA.

7.4.3 Regulated Weeds and Invasive Species

The surveyor must confirm whether any non-native species identified in the PDSA area are considered invasive in the natural subregion and/or are regulated weeds (i.e., Prohibited Noxious and Noxious as defined in the *Weed Control Act*). Alberta Agriculture and Forestry (2015) provides more information to identify prohibited noxious and noxious weeds.

Species and their distribution must be identified as specified in the PDSA Vegetation Form. More information on how to assess regulated weeds and invasive species can be found in Adams et al. (2016).

Note:

Reconnaissance and visual assessment methodology is appropriate only for a SSA. Detailed assessments **must** be used for the planned footprint. Data may be used that is collected during the SSA if the transect location falls within the planned footprint.

8. REPORTING

The minimum requirements for SSA and PDSA reporting are outlined below. Field data sheets included in Appendix C and D, list the items that must be reported. Use of these data sheets are recommended. Field data sheet copies and photographs must be provided in report appendices.

Note:

Where the regulating body requires additional information to make a land-use decision, supplemental information requests, deficiency letters or general requests for more information are at the discretion of the regulating body.

8.1 Strategic Siting Assessment (SSA) Reporting

Site assessment reporting requirements include a field-verified landform, ecological/range site map and plant community map as described in Section 6. The map must illustrate classification and distribution of ecological/range sites to GVI specifications at a minimum. Include all components of the planned footprint such as infrastructure, utility and transportation corridors, fences and dugouts, etc. in map.

8.1.1 Landforms/Topography

A summary description of the following information must be presented for each ecological/range site type within the FVA:

- Topography (slope class, slope percent [%] and aspect)
- Landform surface expression
- Surface and subsurface drainage
- Current land use(s)
- Surface stoniness
- Existing instability, erosion, or modifying features (e.g. gullying)

The following information must be shown on a map, or several maps if more appropriate for clarity:

- Landscape polygons with ecological/range site type(s) composition
- Location of planned footprint

- Locations of existing instability, erosion, or gully features
- Current land use and management within the planned footprint

8.1.2 Soil Information

Reporting requirements for soil information collected during the SSA includes:

- Summary of soil related reconnaissance information collected during the desktop review including figures and/or maps as applicable
- Map showing labelled inspection locations correlated to ecological/range site mapping and the location of the planned footprint
- Detailed soil characteristics collected for each inspection point, including classification, ecological/range site, horizon properties (depth, texture, etc.), parent material, etc. (described in Appendix B). These may be provided as a table or appendix

In addition to the data collected, interpretations of characteristics relevant to project siting and avoidance of native grasslands and sensitive areas must be provided. This includes:

- Map showing areas with sensitive ecological/ range sites.
- List and provide descriptions of sensitive areas being avoided. For example, areas with solonetzic blowouts from which it is difficult to effectively salvage topsoil. The reclamation and restoration is challenging.

Resources available for reference with regards to soil disturbance, quality, and suitability evaluation are found within Section 10 Resources.

8.1.3 Vegetation Information

Reporting requirements for vegetation information collected during the SSA includes:

- Correlation of each of the ecological/range sites determined by the landform and soils assessment with vegetation descriptions; and
- Detailed vegetation characteristics for each ecological/range site polygon including dominant species for each ecological/range site, pasture and land use and whether the site is native or non-native.
- Map showing labelled inspection locations correlated to ecological/range site mapping, location of the planned footprint and areas delineated as native or non-native.

8.1.4 Evaluation

The SSA methodology is designed to align with the principles outlined within the *Principles for Minimizing Surface Disturbance in Native Grassland* (AEP 2016a). To support these principles the SSA report includes an evaluation of the range of options for location of the disturbance including but not limited to:

- Are previously disturbed lands located nearby?
- Are non-native or **modified grasslands** present within desktop review area?
- Can the size be reduced or modified to minimize the extent of impact?

8.2 Pre-Disturbance Site Assessment (PDSA) Reporting

PDSA reporting includes data collected during the SSA and the documentation and mapping for the additional soil and vegetation surveys completed. A detailed listing is outline below.

8.2.1 Soil

The PDSA report must provide detailed information on soil types identified during the assessment, location of different soil units, and an indication of how the soil may be impacted by disturbance. The following are required:

- Summary of soil related reconnaissance information collected during the desktop review including figures and/or maps as applicable (from the SSA reporting);
- Map(s) showing soil units and stratification based on field verification with labelled inspection locations and the planned footprint location;
- List and description of each soil unit identified, including: area (in hectares) and soil series within the unit;
- Descriptions summarizing characteristics of each soil series (i.e. average and range of topsoil depths, topsoil and subsoil colour, topsoil and subsoil textures, salinity, structure, consistence, etc. and other series specific characteristics relevant to construction and reclamation). These may be provided as tables or appendices; and,
- Detailed soil data collected for each inspection point, including classification, horizon properties (depth, thickness, texture, etc.), surface and internal drainage (class, mottles, gleying, etc.). These may be provided as tables or appendices.

Maps must include at minimum:

- Map scale;
- Township, ranges and section boundaries and key roadways;
- Symbol descriptions (e.g. roads, township and range lines, section lines, railways, etc.);
- Legend which includes at least: soil series, map units and associated symbols, code descriptions, patterns and/or colours. Map unit descriptions may be provided as a separate table to prevent overcrowding the map.; and
- Sources used for map development.

In addition to the data collected, interpretations of characteristics relevant to disturbance and reclamation planning must be provided. This includes:

- Map showing sensitive soil units and areas;
- List and provide descriptions of sensitive areas being avoided. For example, areas with solonetzic blowouts from which it is difficult to effectively salvage topsoil. The reclamation and restoration is challenging; and
- Correlation of soil information and mapping with vegetation data.

The Resources Section (Section 10) contains references on soil disturbance, quality, and suitability evaluation (Alberta Soils Advisory Committee 1987; Pedocan Land Evaluation 1993; Coote and Pettapiece 1989).

The information provided within the PDSA soil report must be sufficient for users to determine requirements for pre-disturbance, construction and reclamation planning. Operators applying for regulatory approval will use the data and interpretations provided within the PDSA report to develop minimum disturbance strategies and best practices to mitigate impacts to soils associated with native grasslands (AEP 2016a).

8.2.2 Vegetation

In addition to the data collected during the SSA, the PDSA report must provide descriptions of all grassland plant communities their associated range health, regulated weeds and invasive species in the PDSA area. Survey results from SAR or rare plant surveys, if requested, also require reporting. Specific reporting requirements are outlined below.

8.2.2.1 Ecological/Range Sites and Component Plant Communities

The following information must be presented:

- Labelled survey assessment locations displayed on a map
- Ecological/range sites within and adjacent to the PDSA areas displayed on a map (information must be provided for an area of 50–100 m adjacent to the planned footprint and can be based on air photo interpretation and extrapolation of inspection site data; no site inspections are required beyond the PDSA areas)
- Area (hectares) of each ecological/range site in table format
- For each ecological/range site:
 - Correlate soil information collected for the PDSA with component plant communities
 - A list of component plant communities described by their characteristic species composition and code
 - The area of all component plant communities, including native and non-native grassland plant communities, associated with each ecological/range site in table format
- Area of each native plant community that will be disturbed or permanently lost by the activity
- Identification of particular site conditions that may require special consideration; and where appropriate, photographs of each ecological/range site from the on-site assessment

8.2.2.2 Regulated Weeds and Invasive Species

The following information must be presented:

- Maps of locations of noxious and prohibited noxious weeds in the assessment area
- Lists of noxious and prohibited noxious weeds in the assessment area, with descriptions of density and distribution for each species using descriptors on the vegetation assessment form.
- Maps of locations of invasive non-native plants in the assessment area
- Lists of invasive non-native plants in the PDSA area, with descriptions of associated plant communities, density and distribution for each species using

8.2.3 Evaluation

The PDSA evaluation can include a range of components as the regulating body requires. It also includes the evaluation from the SSA, if not previously reported. At a minimum the PDSA report contains an evaluation to determine conservation mitigations for soils and for the plant community(s) that will potentially be affected by the planned footprint. Conservation mitigations are specific to activities phases (planning, construction, operation, closure and reclamation).

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A Soil Mapping System for Canada.

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Agricultural Region of Alberta Soil Inventory Database (AGRASID) [http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag3254](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag3254)

Alberta Conservation Information Management System (ACIMS) Tracking List. (<https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/>)

Alberta Soil Names File (Generation 3) User's Handbook.

([http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag6903](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag6903))

Canadian System of Soil Classification.

(http://sis.agr.gc.ca/cansis/publications/manuals/1998-cssc-ed3/cssc3_manual.pdf)

Canada Soil Information System (CanSIS): Manual for Describing Soils in the Field.

(<http://sis.agr.gc.ca/cansis/publications/manuals/1982-forms/82-52-describing-soils.pdf>)

Field Handbook for the Soils of Western Canada: Section 3 – Soil Profile Description (Watson and Pennock 2016)

Field Manual for Describing Soils, 3rd edition (Ontario Institute of Pedology 1985)

Prohibited Noxious and Noxious Weeds lists ([http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/prm14555](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/prm14555))

Range Plant Community Guides for each Natural Subregion.

(<http://aep.alberta.ca/lands-forests/grazing-range-management/range-plant-community-guides-stocking-rates.aspx>)

Range Health Assessment for Grassland, Forest and Tame Pasture.

(<http://aep.alberta.ca/lands-forests/grazing-range-management/documents/RangelandHealthAssessment-Revised-2009.pdf>)

Range Inventory Manual for Forest Reserve Allotments and Grazing Leases within Rocky Mountain, Foothills, Parkland, and Grassland Natural Regions (AEP, 2018)

Recovery Strategies for Industrial Disturbances in Native Grasslands by Subregion.

<https://foothillsrestorationforum.ca/recovery-strategies/>

Soils Illustrated – Field Descriptions (Watson 2007)

Soil Quality Criteria Relative to Disturbance and Reclamation (Revised) (Alberta Soils Advisory Committee 1987)

Soil Series Information for Reclamation Planning in Alberta (Pedocan Land Evaluation 1993)

Soil Survey Reports by Report Number. ([http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/sag11113](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/sag11113))

Wind Erosion Risk, Alberta (Coote and Pettapiece 1989)

APPENDICES

Appendix A – Ecological Site / Range Site Classification Systems

Two hierarchical classification systems, ecosite and range site, respectively, are used in Alberta to classify plant communities. These are described in greater detail below.

1. In Parkland and Rocky Mountain Natural Regions, landscapes with similar climate, moisture and nutrient regimes are grouped into ecological sites (ecosites). Grassland range sites (analogous to ecosites) are typically associated with subxeric to submesic moisture regimes and a variety of nutrient regimes, from poor to rich. Within the ecosite classification, similar vegetation types are grouped into ecosite phases based on the dominant layer of vegetation.
2. Plant communities in Grassland Natural Regions are classified based on their association with range sites, determined through key attributes of the landscape, soil features and textural groupings within larger mapped ecodistricts.

A.1 Ecosite/Ecosite Phase Determination

1. Consult the edatopic grid for the Natural Subregion the project is within to estimate whether physical conditions that support native grasslands fall into the ecological site description (These area available in a table in the plant community guides).
2. Identify the major soil series (if available) to help assess the nutrient regime of the site. The ecosite may be mapped at a landscape scale in GVI, PLVI or AVI spatial layers if available for the planned footprint. In the field, the soil series and ecosite phase will be confirmed and will help determine which range plant communities that may be found in the project footprint.
3. Refer to the Range Plant Community Table within the *Natural Subregion Plant Community Guide* to identify potential ecosite phases.
4. While at the site, identify the dominant plant species and review descriptions of range plant communities identified in the Range Plant Community Table relevant to the ecosite phase you have determined and find those most closely resembling the sampling site.

A.2 Range Site / Ecological Site Determination

1. Identify the Natural Subregion and Ecodistrict in which the planned footprint is located.
2. Utilize AGRASID to identify major soil series and associated range sites using: “Table: Major Soils and their Associated Range Sites by Ecodistrict or Area” available in each plant community guide. The range site may be mapped at a landscape scale by GVI (called an upland site-type in GVI). In the field, the soil series and range site will be confirmed and then the range site along with the collected plant species composition will help determine which range plant communities may be found in the field assessment area.
3. Find and review the Table: Plant Communities Listed by Ecological Range Site, in the appropriate Range Plant Community Guides and Health Assessment Guidelines (AESRD 2003-2013) which links range site with reference plant communities (or the potential native plant community under light disturbance).
4. Check the table to identify successional and modified communities associated with reference plant communities. This will show the variety of range pant communities potentially present in the planned footprint under different successional trajectories and which can be driven by disturbance, including grazing.
5. While at the site, read through descriptions of range plant communities identified in the tables and find those most closely resembling the plant species composition of the sampling site. If the community does not fit any of the descriptions, it is recorded as conditional and described by its dominant species.

Appendix B – Soil Information Collection Detail

B.1 Required for All Soil Inspection Locations

The following information must be collected for each soil inspection location conducted:

- Location name and coordinates (UTM) Easting, Northing, Zone
- Name of surveyor(s)
- Date of inspection

B.2 Site Assessment (SSA) Soil Data Collection

The following information must be assessed in each Site Assessment soil inspection, in addition to the information required to be collected for all locations outlined above, and recorded in a soil inspection form:

- Elevation
- Soil classification to subgroup (SCWG 1998)
- Ecological/Range site classification
- Landform surface expression
- Moisture and nutrient regimes
- Topography (position, slope class, slope percent [%], aspect)
- Organic horizons and thickness (L, F, H, and O layers if present)
- Soil horizon and profile characteristics associated with ecological/range site determination including:
 - designation (i.e. Ah, Bm, Bnt, etc.)
 - depth (cm)
 - humus form
 - texture
 - coarse fragment content (% total volume)
 - structure
 - consistence
 - degree of effervescence

- evidence of salinity
- mottling, when applicable (matrix and mottle colour, contrast and depth)
- Parent material
- Drainage class
- Depth to bedrock (cm) (if less than 1 m)
- Depth of water table (cm)
- Comments/notes as applicable
- Soil profile and site photographs (minimum one per ecological/range site, include a consistent object in photos for scale, e.g. an extended tape measure)

B.3 Pre-Disturbance Site Assessment (PDSA) Soil Data Collection

Deep Inspection Location

The following information must be assessed in each deep soil inspection, in addition to the information required to be collected for all location outlined above, and recorded in a soil inspection form:

- Soil classification according to the Canadian System of Soil Classification (SWCG 1998)
- Soil series using Alberta Soil Names File (Generation 3) User's Handbook (2006) as a guide (and soil series variation as applicable)
- Organic horizons and thickness (L, F, H, and O layers if present)
- Mineral horizon properties for each horizon as applicable:
 - designation (i.e. Ah, Bm, Bnt, etc.)
 - depth (cm)
 - thickness (cm)
 - texture
 - coarse fragment content (% volume – if relevant for classification include percent for gravel, cobbles, and stones)
 - structure (kind is mandatory, grade and class must only be provided when it is a determining characteristic of the soil classification)
 - consistence (moisture level and plasticity)

- effervescence (carbonates)
- matrix colour (using Munsell colour charts)
- mottling, when applicable (abundance, size, colour, and contrast)
- presence of rooting restrictions
- depth to water table (if applicable)
- Parent material type (can be further described within the horizon comments)
- Drainage characteristics (class, seepage depth and gleyed horizons)
- Moisture and nutrient regimes (where required for ecological/range site classification)
- Evidence of salinity (salt crystals, crusts, etc.)
- Other observations for horizons and/or the general profile such as clay films, precipitates, iron, coal flecks, depth to bedrock, seepage, etc. as applicable.
- Soil profile and site photographs (minimum one per soil series identified, include a consistent object in photos for scale, e.g. an extended tape measure)

Shallow Inspection Location

The following information must be assessed in each shallow soil inspection, in addition to the information required to be collected for all location outlined above, and recorded in a soil inspection form:

- Soil classification according to the Canadian System of Soil Classification (SCWG 1998)
- Designation and depth of topsoil horizons. Where soil inspections are completed deeper than the topsoil to verify the soil classification or where a veneer of <1 m is identified, documentation to the total depth of the inspection point is required.
- Soil horizon characteristics designation, depth, texture, color, coarse fragment content, consistence, rooting restrictions.

Appendix C – Vegetation Information Collection Detail

C.1 Site Assessment (SSA) Vegetation Data Collection

Data Collection for the Site and Vegetation Form

Site and vegetation information must be completed as follows and entered into the site and vegetation form.

- Project identification, agency or company, surveyor
- Date of inspection
- Assessment number
- Site photograph numbers
- Legal land description
- Location coordinates (UTM (easting, northing, zone))
- Natural subregion, ecodistrict
- Elevation, aspect, slope %
- Ecological/range site type
- GVI site type, LAT identification numbers
- Moisture regime - xeric, subxeric, submesic, mesic, subhygric, hygric, subhydric, hydric
- Regional landform - mountains, hills, uplands, midlands, lowlands, valleys
- Local landform - steep slopes, hilly, rolling, hummocky, ridged, plain
- Site position - crest, upper slope, mid-slope, lower slope, terrace, depression, level
- Land use, e.g. oil and gas, industrial, grazing, agriculture, wildland, etc.
- Detailed vegetation assessment
 - Within the polygon, select an area which best represents the targeted plant community and establish a 30-m transect
 - Assess shrubs in a 1-m² plot 10 times along the transect (Figure C7)
 - Assess herbaceous foliar cover, groundcover and bare soil in a Daubenmire frame (0.5 m x 0.2 m) nested in the lower left-hand corner of the 1-m² shrub frame

- Estimate foliar cover to the nearest 1 per cent between 1-10 per cent, the nearest 5 per cent between 10-90 per cent and the nearest 1 per cent between 90-100 per cent. For trace values, use 0.1 per cent.
- Estimate the combined foliar cover of moss and lichens
- Reconnaissance vegetation assessment
 - Within the polygon select an area which best represents the target plant community.
 - Attribute a plant community call, this must be linked to a detailed assessment with the same plant community that is found on the same ecological / range site.
 - A transect is not required, although a **rapid vegetation assessment** is recommended.
- Rapid vegetation assessment
 - Within the polygon record:
- Dominant plant species (three to five species providing the most foliar cover)
- Problem areas, e.g. erosion, gullying, livestock effects
- Visual vegetation assessment
 - Select an area which best represents the target plant community and is appropriate for a visual assessment (eg. small/mottled or of no management concerns/no vegetation cover).
 - Attribute a plant community call.
 - A transect is not required, although a **rapid vegetation assessment** may be employed.
- Plant community estimation can be a code from the Natural Subregion's range community type guide book. If a community type cannot be found in a guide then a conditional call can be used.
 - If the conditional community closely resembles an established community, but either at an earlier seral stage, or disturbed, it can be documented as the established community code with a '_D' or '_S' for disturbed or seral related respectively.
 - If the conditional call is not linked to any established community, the name should be a listing of the dominant 2 or 3 species with "/" dividing life-forms, and "-" dividing species within life-forms.
- Species names and codes
 - Species names must follow the nomenclature found in Flora of Alberta (Moss 1983) until an updated version is published. Scientific names and codes are found in the Range Plant Community Guide for the region (see Resources Section)

- A 7-letter code is used to identify specific species based on the genus (first 4 letters) and species (last 3 letters), e.g. *Festuca campestris* = FESTCAM.
- Unknown species
 - If a vascular plant species cannot be identified in the field, it may be identified by its life form classification; shrub, graminoids, forb
 - If foliar cover is greater than 1 per cent, pictures or a specimen are taken and sent to a specialist for identification
 - Up to three unknown species, representing less than 3 per cent foliar cover are allowed. If more are found, the surveyor must relegate the survey to a more experienced botanist

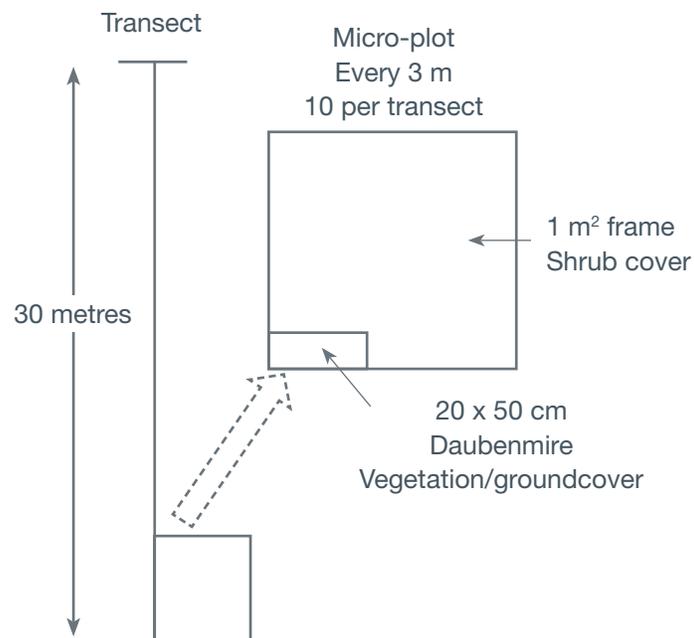


Figure C6. Vegetation Sampling Transect

Diagram not to scale. Includes a nested shrub and Daubenmire frames

Native Grassland Determination

Determining the native vegetation composition of plant communities in question can be done through a simple mathematic exercise.

- Calculate total foliar cover of all species
- Calculate total native foliar cover of all native species

- Divide Total Native Foliar Cover by Total Foliar Cover
- If result is 30 per cent or greater, the area is deemed to be native grassland
- If the result is less than 30 per cent, the area is deemed to be non-native grassland

$$(\text{Total Native Foliar Cover} / \text{Total Foliar Cover}) * 100 = \% \text{ Native}$$

Vegetation Transect Photographs

Three photos are taken to document each 30m vegetation sampling transect:

3m away from the start of the vegetation sampling transect, looking down the transect with a shallow horizon

Figure C7. Landscape Assessment Photograph



1m back from the start of the transect on one knee, looking down the transect with a shallow horizon to get a sense of vegetation height and structure

Figure C8. Oblique Assessment Photograph



Directly downward from a standing position above the first 1m² frame

Figure C9. Vertical Assessment Photograph



Photograph Tips

- Create an assessment photograph label and photograph it at the beginning of each series of photographs.
- In addition, include the assessment label in the photograph of the nested frames.
- Take photographs facing or at an oblique angle to the sun, if possible, to avoid having your shadow in the frame
- For landscape photographs, choose a permanent feature, e.g. distant hillside, utility poles, and place it within the photograph. This can be used to provide reference if the same site is visited again in the future i.e. to gauge restoration progress).
- Include the horizon but minimize the area of the sky, maximize ground coverage
- For subplot photographs, label the photograph with the site and assessment name, and date.

Foliar Cover

C.2 Pre-disturbance Site Assessment (PDSA) Vegetation Data Collection

Pre-disturbance vegetation information must be completed as follows and entered into the Pre-disturbance Site Assessment Vegetation Form.

- Project identification, agency or company, surveyor name
- Date of inspection
- Assessment number

- Legal land description, latitude/longitude (optional)
- Natural Subregion, Ecodistrict
- UTM location - easting, northing, zone
- Ecological/range site type
- Ecological/range site
- Area (hectares) of the site polygon

C.2.1 Range Health Assessment

Range health assessment data collected will be used to calculate the Range Health Score as per the Range Health Worksheets found in Range Health Assessment for Grassland, Forest and Tame Pasture (Adams et al. 2016). This workbook contains detailed instructions and explanations on completing Range Health assessments.

Calculate the range health score for the area using the worksheets and calculations provided in the Range Health Assessment workbook and enter it in the PDSA vegetation form.

C.2.2 Invasive Species and Regulated Weeds Documentation

Invasive species and regulated weeds must be identified throughout the entire site area. Refer to Alberta Agriculture and Forests (2015) for lists of regulated weeds.

- Enter invasive species and regulated weeds - noxious and prohibited noxious
- Determine the density and distribution for each species
- Record the location (UTM) - easting, northing and zone

C.2.3 Rare Plants Documentation

If a rare plant survey is completed it must be attached to the SSA or PDSA.

