PREPARING VARIANCE JUSTIFICATIONS FOR WEEDS AND PROBLEMATIC SPECIES ON WELLSITES AND ASSOCIATED FACILITIES ON FORESTED LAND

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PREFACE

In 2018, the Petroleum Technology Alliance of Canada (PTAC) initiated a multi-stage project on the reclamation certification process for upland sites with vegetation on a trajectory to approximate natural forest vegetation but with one or more reclamation deficiencies according to the Forested Land Criteria. These sites cannot receive a reclamation certificate without additional scrutiny and professional justification under current regulatory criteria and policies. The goal of the overall project was to ensure that decisions made during the reclamation certification process result in the best possible ecological outcome (i.e., net environmental benefit) for these sites and surrounding region.

Several project reports were prepared between 2019 and 2023:

> Tokay, H., C.B. Powter, B. Xu, B. Drozdowski, D. MacKenzie and S. Levy, 2019. *Evaluation of Reclamation Practices on Upland and Peatland Wellsites*. Prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. 221 pp. https://auprf.ptac.org/wp-content/uploads/2021/04/Tokey-at-al.-2019_Evaluation-of-Reclamation-Practices-on-Upland-and-Peatland-Wellsites_Deliverable-1.pdf
>
> Tokay, H., D. MacKenzie, C.B. Powter, B. Drozdowski and K. Renkema, 2020. *Guide to Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities on Forested Land: Case Studies*. Report 18/19 – RRRC-09_6 prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. 104 pp plus appendix. https://auprf.ptac.org/wp-content/uploads/2021/05/Deliverable-6_PTAC18_19-RRRC_09_-Case-Studies_-12-23-2020-DRAFT.pdf
>
> Renkema, K., H. Tokay, D. MacKenzie, B. Drozdowski, N. Shelby-James and C.B. Powter, 2023. *Guide to Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities: Stakeholder Review and Field Verification- 2023 Update*. Prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. Report 20-RRRC-05_4f. 49 pp. https://auprf.ptac.org/wp-content/uploads/2023/03/Upland-Guide-Verification-Summary-Report-2023-Update.pdf
>
> Tokay, H., K. Renkema, D. MacKenzie, C.B. Powter, B, Drozdowski and N. Shelby-James, 2023. *Preparing Variance Justifications for Reclamation Certification of Wellsites and Associated Facilities on Forested Land: 2023 Update*. Prepared for the Petroleum Technology Alliance of Canada, Calgary, Alberta. Report 20-RRRC-05_4g. 70 pp. https://auprf.ptac.org/wp-content/uploads/2023/03/Preparing-Variance-Justifications-2023-Update.pdf

Alberta Environment and Protected Areas asked PTAC and InnoTech Alberta to extract the relevant sections from the 2023 Update (Tokay et al., 2023) to provide specific guidance on applying for a variance for sites that have weeds or problematic species present. This document also reflects recent changes in the Alberta Energy Regulator's variance procedures and provides an example to clarify the definition of Undesireable/Problem Weeds.

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GLOSSARY

Additional Review (OneStop)

Reclamation certificate applications submitted to the Alberta Energy Regulator (AER) through OneStop may go through two levels of review: baseline review and additional review. Applications are sent for additional review if they have unresolved landowner or interest holder complaints, filed statements of concern, requests for variances from the standard criteria that have not been preapproved by the AER, or are more complex. AER staff will undertake a more detailed review of the application, which may include conducting field inspections, before issuing a decision (Alberta Energy Regulator, 2019a). The Forested Land Criteria refers to applications in this stream as non-routine applications (Alberta Environment and Sustainable Resource Development, 2013).

Baseline Review (OneStop)

Reclamation certificate applications submitted to the AER through OneStop may go through two levels of review: baseline review and additional review. The baseline review ensures that the application meet the validation rules (e.g., confirming the well has an abandoned status) and assessment rules (e.g., confirming that there are no outstanding landowner complaints). All applications go through the baseline review, and a notice of application is posted. If no statements of concern are received, then the certificate will be automatically issued (Alberta Energy Regulator, 2019a). The Forested Land Criteria refers to applications in this stream as routine applications (Alberta Environment and Sustainable Resource Development, 2013).

Compatible Species

Seeded species that were part of a seed mix that was appropriate to the time period in which the site was constructed/reclaimed or as outlined in historical agreements with the Land Manager (Alberta Environment and Sustainable Resource Development, 2013).

Control

Refers to information collected off-site against which collected information from a reclaimed site will be compared. The control information is collected off-site from adjacent or representative land (Alberta Environment and Sustainable Resource Development, 2013).

Desirable Species

Desirable species are native species that are appropriate to the representative off-site ecosite based on vegetation assessments at control locations and ecosite guides. Compatible species may be included in the definition of desirable species in some cases depending on the reclamation period of the site (Alberta Environment and Sustainable Resource Development, 2013).

See also Compatible Species.

Deficiency (Reclamation Deficiency)

A feature or parameter that does not meet the Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013).

Ecosystem Function
The interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting, and flammability (Alberta Environment and Sustainable Resource Development, 2013). Conceptually, other forest functions also include providing wildlife habitat, temperature regulation and carbon sequestration.

Equivalent Land Capability
The ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical (Alberta Environment and Sustainable Resource Development, 2013; Government of Alberta, 1993).

Evidence-based Approach
Approach requiring the collection and presentation of concrete evidence as a rationale to justify reclamation deficiencies.

Forested Land
Forested land includes any treed land, whether or not the forest vegetation is utilized for commercial purposes. Treed (bush) land in the White Area (deeded land) that is to be maintained as 'treed' shall meet the Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013).

Forested Land Criteria
The *2010 Reclamation Criteria for Wellsites and Associated Facilities for Forested Lands (Updated July 2013)* (Alberta Environment and Sustainable Resource Development, 2013).

Incompatible Species
Species that are neither desirable species nor compatible species.

See also Desirable Species and Compatible Species.

Invasive Species
The “invasive species” term has not often been formally codified as its usage is broad and subjective and can be used to refer to any number of aggressively colonizing species, particularly those that “displace the original structure of the plant community” (Powter, 2002). The “invasive” label is strongly context-dependent.

See also Problem Introduced Species and Undesirable/Problem Weed.

Land Manager
For Public Lands, this includes the Forest Officer, Lands Officer, Land Management Specialist, and/or Lands Approval Team Lead in Alberta Environment and Parks for a specific Region. For Provincial Parks and Protected Areas, it is an Alberta Environment and Parks staff member from the Parks Division. For Private Lands, this includes the landowner, their designate, or occupant (Alberta Environment and Sustainable Resource Development, 2013).

Native Species
Plant species that are indigenous to the ecosite (Alberta Environment and Sustainable Resource Development, 2013).

A plant species that is part of an area's original flora (Powter, 2002).

Plant species that are listed as native in the *Flora of Alberta: A Manual of Flowering Plants, Conifers, Ferns and Fern Allies Found Growing without Cultivation in the Province of Alberta, Canada* (Moss, 1993).

Natural Recovery Site

Site using a natural recovery strategy for revegetation. Natural recovery is the long term re-establishment of diverse native ecosystems (e.g., forest) by establishment in the short-term of early successional species. This involves revegetation from soil seedbank and/or natural encroachment and no seeding of non-native agronomic species (Alberta Environment and Sustainable Resource Development, 2013).

Net Environmental Benefit

Net environmental benefits are gains in value of environmental services or other ecological properties attained by remediation or [reclamation] minus the value of adverse environmental effects caused by [reclamation] (Efroymson et al., 2004).

Non-native Species

Species that are not native to Alberta.

See also Native Species.

Noxious Weeds

Plant species designated as noxious weeds in the *Weed Control Regulation* (Government of Alberta, 2010). The *Weed Control Regulation* also provides authority for a municipality to designate plants that are not listed as weeds in the *Weed Control Regulation* as noxious weeds. Noxious weeds are problematic to reclamation areas due to their highly aggressive colonization potential, ability to decrease biodiversity, and in some instances the potential to be allelopathic (i.e., inhibit other species from germinating or growing).

OneStop

The online tool used in Alberta to submit reclamation certificate applications for upstream oil and gas sites to the AER.

Problematic Species

An umbrella term used in this report that includes Incompatible Species, Invasive Species, Problem Introduced Species, and Undesirable/Problem Weeds.

Problem Introduced Species

Most often, this label encompasses agronomic species that mount considerable invasion pressure in forested areas. Alberta Environment (2003) defines problem introduced plants as forage plants that were introduced for crop or forage production purposes, and either invade or persist in native plant communities. Examples of plants that have been identified as problematic in the Central Parkland and Foothills regions include, timothy, smooth brome, and reed canary grass (although the latter is a native species, it is used as a forage species).

See also Invasive Species and Undesirable/Problem Weed.

Professional Justification
Explanation of why the site should be permitted to vary from the Forested Land Criteria and still receive certification (Alberta Energy Regulator, 2019a). Typically submitted to the AER with a variance request either in advance of (pre-approved justification) or as part of a reclamation certificate application. Professional justifications should provide a strong rationale as to why the deficiency is not expected to have adverse environmental impacts and how the site will still achieve equivalent land capability and ecosystem function despite not meeting the criteria, accompanied by detailed and comprehensive site-specific supporting information.

Professional Judgment
The application of training, knowledge, and experience in making appropriate decisions.

Reclamation Certification Process
Steps taken to obtain/issue a reclamation certificate for a site including: planning, reclamation, detailed site assessment, variance request, preparation and submission of a reclamation certificate application, application review, inspection and audit (as required), and issuance of a reclamation certificate.

Site (Upland Site)
An upstream oil and gas wellsite and/or associated facilities (e.g., log deck, access road) required to meet Alberta's reclamation criteria to achieve reclamation certification. In this document, the term site is used to refer to a site on forested land (whether in the Green Area or the White Area), or a site to which the Forested Land Criteria applies, on which the well has been properly and fully abandoned, and where contamination is absent or has been remediated (risk managed sites are out of scope). Furthermore, a site in this document has one or more reclamation deficiencies as per the Forested Land Criteria, but additional reclamation activities to correct these deficiencies would damage the developing forest ecosystem on the site (or its associated access road) to the extent that the impacts outweigh benefits.

Undesirable/Problem Weed
The "undesirable/problem weeds" category, as with other weed labels, is context-dependent and based on the reclamation area's location, the species in question, the native plant community, and historical management practices. In the context of reclaiming a forested ecosystem, if an invading species is not listed as a prohibited noxious or noxious weed and is not agronomic in nature then the species can be considered "undesirable", or a problem weed (sweet clover is a forested land example). Specific counties or regions can consider species to be undesirable/problematic weeds, even if they are not listed as noxious or prohibited noxious in legislation. Relevant native plant community guides and local authorities can be consulted to understand if the species of concern is labeled as undesirable in a specific area.

See also Invasive Species and Problem Introduced Species.

Variance (Criteria Variance)
A deviation from the standard criteria or assessment process described in the relevant wellsite criteria document which must be approved by the AER. The term variance is used in SED 002 (Alberta Energy Regulator, 2019a) but not in the Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013). A variance request containing a professional justification must be submitted to the AER to obtain a variance.

Variance Request

A formal request submitted to the AER for a deviation from the standard criteria or assessment process described in the Forested Land Criteria. A variance request must contain a professional justification. For sites that require a variance request, the application process is termed a "non-routine application" or "additional review" (unless pre-approval is obtained).

See also Additional Review.

Vegetation Override

A specific type of variance to the wellsite certification criteria, where reasonable forest cover (i.e., amount, species, and distribution) is present, and where additional activities required to meet the conditions described in the criteria pose a risk to existing ecosystem function (Alberta Environment and Sustainable Resource Development, 2013). The term vegetation override is used in the Forested Land Criteria but not in SED 002 (Alberta Energy Regulator, 2019a).

ACRONYMS

The following acronyms are used in this report or the cited references.

AEPA	Alberta Environment and Protected Areas
AER	Alberta Energy Regulator
AUPRF	Alberta Upstream Petroleum Research Fund
EPEA	*Environmental Protection and Enhancement Act*
CAT	Combined Assessment Tool
DSA	Detailed Site Assessment
LSD	Legal Subdivision
PTAC	Petroleum Technology Alliance Canada
RCV	Reclamation Certificate Variance
RoO	Record of Observations
SED	Specified Enactment Direction

1.0 INTRODUCTION

1.1 PURPOSE

This document was developed to support preparation of complete and comprehensive variance requests[1] for upland wellsites to allow for consistent decisions that result in the best possible ecological outcome during the reclamation certificate application process. Nonetheless, **variances are to remain the exception and not the rule**. This document is not intended to encourage or promote the use of variances to avoid conducting reclamation activities or to justify poor reclamation practices. Operators should conduct timely reclamation rather than waiting for conditions to develop on-site that could be used to justify deficiencies.

This document applies solely to forested upstream oil and gas wellsites (and associated facilities) that have vegetation on a trajectory to approximate natural forest vegetation but that have weeds or problematic species present[2] resulting in a reclamation deficiency according to Alberta's Forested Land Criteria (Alberta Environment and Sustainable Resource Development, 2013a).[3] The vegetation on the sites can originate through a planned natural recovery revegetation strategy or in combination with planting.

During the reclamation certification process, the main question that arises with these sites is whether to:

- disturb existing vegetation to modify deficient features to meet reclamation criteria; or
- certify these sites without removing existing vegetation and re-starting the traditional reclamation process.

It is recognized that in certain instances, sites with weeds or problematic species present can be on a trajectory towards developing a sustainable plant community and having equivalent land capability. Managing these species or removing the existing vegetation and re-starting reclamation to address the deficiency, can have unintended negative outcomes such as damaging desirable species or sensitive soils and creating access for third-party recreational use. However, in the long-term, re-starting the traditional reclamation process could allow the site to provide more diverse, abundant, and resilient ecological services and pose less of a risk to future land users.

Based on current regulatory guidance (Forested Land Criteria and *Specified Enactment Direction (SED) 002: Application Submission Requirements and Guidance for Reclamation Certificates for Well Sites and Associated Facilities* (Alberta Energy Regulator, 2019a)), sites that do not meet the Forested Land Criteria can still receive a reclamation certificate if:

- equivalent land capability is demonstrated, and

[1] See the Glossary for definitions of terms used in this report.
[2] See (Tokay et al., 2023) for information on variances for other deficiencies.
[3] Citations for government documents will be provided the first time the document is referenced but will not be repeated each subsequent time the document is mentioned as they are cited frequently in this report.

- a comprehensive description of the site is presented to the AER.

The AER's *Submitting Reclamation Certificate Variances* (RCV's) guidance document provides information on how to submit a variance request through OneStop (Alberta Energy Regulator, 2022). The contents of this document are intended to assist practitioners in providing robust professional justifications for RCV submissions.

To support preparation of complete and comprehensive variance requests this document includes the following information:

- The reclamation certificate application process (Section 2.0).
- General considerations before proceeding with a variance request (Section 3.0)
- Formulation of a justification (i.e., what information and what level of detail to provide) (Section 4.0).
- Detailed information for variances when weeds or problematic species are present (Section 5.0).
- References and relevant information to support justifications (Section 6.0).
- Example variance justification form based on the document (Appendix A).

1.2 CAVEATS

The following caveats must be recognized before using this document:

- Variance requests should be avoided by using all possible reclamation techniques to meet Forested Land Criteria.
- Following this document does not guarantee approval of variance requests as approvals are made on a site-by-site basis and there may be additional regional considerations.
- Information from this document must not be copied and pasted to populate a variance justification form – site-specific information is required.
- This document does not contain regulatory guidance; however, it has been developed based on feedback from the AER and Alberta Environment and Protected Areas (AEPA).
- This document does not replace SED 002, which provides the current reclamation certificate application submission requirements and guidelines.
- This document applies to all sites constructed/reclaimed during any timeframe as all sites can be eligible for a variance. However, the expectation is that the need for variances should be reduced for sites constructed and reclaimed after June 2007 as reclamation practices are expected to have improved with the updated Criteria.
- This document does not apply to contaminated sites that cannot be certified through the *Contaminated Sites Policy Framework* (Alberta Environment and Sustainable Resource Development, 2014).

2.0 RECLAMATION CERTIFICATE APPLICATION PROCESS OVERVIEW

2.1 RECLAMATION CERTIFICATE APPLICATION SUBMISSION

A site becomes eligible for a reclamation certificate when it meets all the Forested Land Criteria for reclamation. At this time, reclamation certificate applications are submitted to the AER for approval, following the procedures described in SED 002.

Sites that do not meet all the Forested Land Criteria may still be eligible for a reclamation certificate. According to SED 002:

> *A reclamation certificate application that includes a variance request in response to assessment parameters failing to meet the applicable criteria or guidelines may still be submitted if the application is accompanied by professional justification.*

The AER is entirely responsible for making decisions regarding certification, including those sites which require professional justification for a variance request[4]. Variance requests can be submitted to the AER in two ways (Alberta Energy Regulator, 2019a):

- **Option 1**: the variance request can be submitted to the AER for pre-approval prior to submitting the reclamation certificate application – a signed document confirming pre-approval is then submitted with the reclamation certificate application.
- **Option 2**: the variance request can be submitted with the reclamation certificate application.

The option selected to submit a variance request has implications for the review stream that the application is subject to within the AER's online application submission system (OneStop); submitted applications may be subject to two levels of review (review streams) (Alberta Energy Regulator, 2019a):

- Baseline review – certificates are automatically issued if the online tool verifies all validation and assessment rules have been met and no statements of concern have been received. Option 1 applications go through this stream. The Forested Land Criteria refers to applications in this stream as routine applications.
- Additional review – more detailed review of the application by AER staff before the certificate is issued. Option 2 applications go through this stream. The Forested Land Criteria refers to applications in this stream as non-routine applications.

Figure 1 presents a flow chart for proceeding through the application process for sites that require a variance.

NOTE: Separate RCV applications must be submitted for each public lands disposition type associated with the wellsite (e.g., access road, pad, pipeline) or associated assets that do not have a stand-alone disposition (e.g., remote sump, campsite, log deck).

[4] Sites that require a land use change (i.e., a change in the assessment criteria used) have additional approval requirements; these sites are beyond the scope of this document.

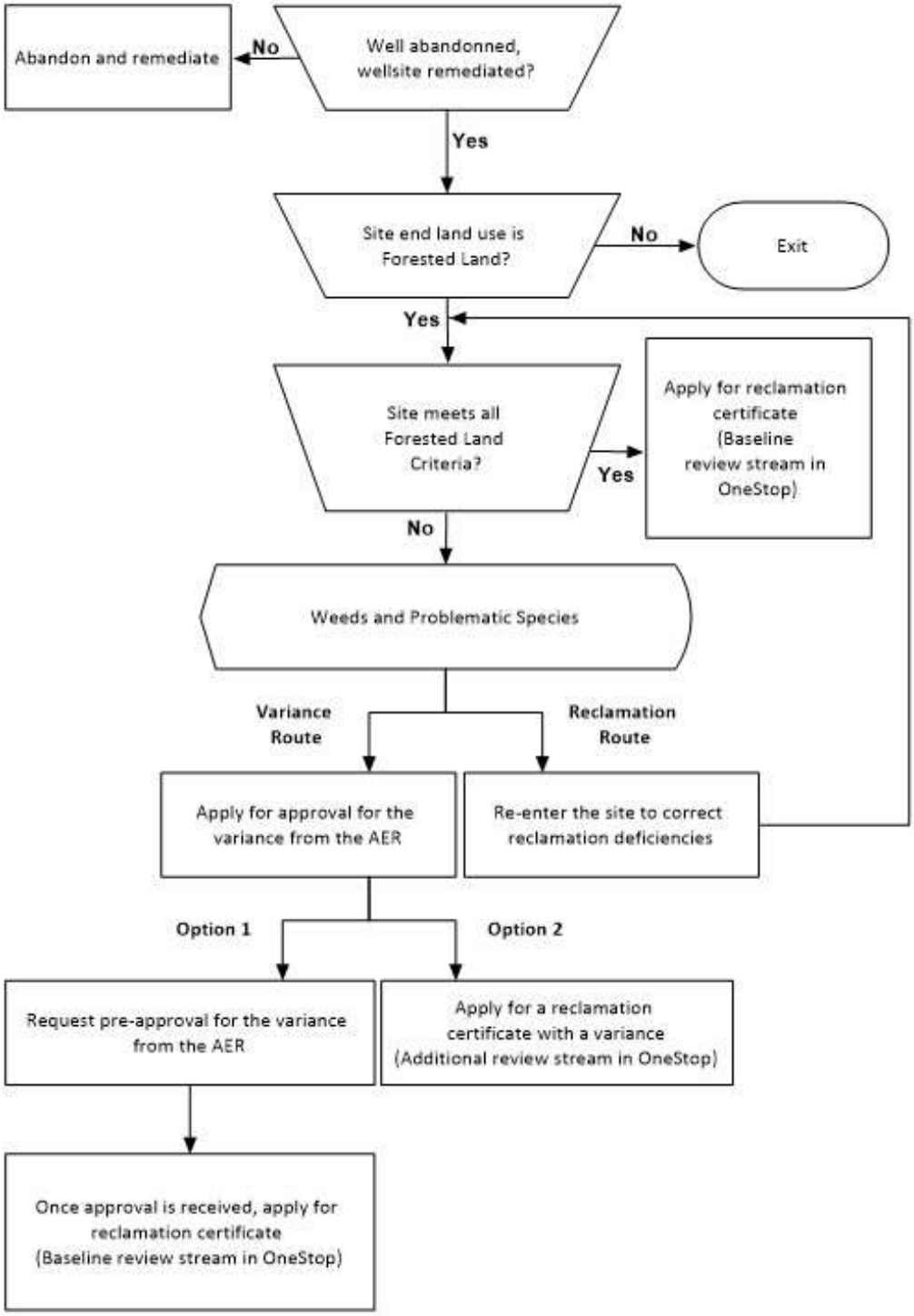

Figure 1. Reclamation certification application process.

2.2 PROFESSIONAL JUSTIFICATION FOR VARIANCE REQUESTS

Professional judgement is used to determine whether a site that does not meet the Forested Land Criteria is eligible for a variance, or whether additional reclamation work is required to correct reclamation deficiencies[5]. Professional justifications submitted with a variance request must include a "rationale for [the] decision, supported by acceptable references" (Alberta Energy Regulator, 2019a)[6].

There are terminology differences between the Forested Land Criteria and SED 002 with regards to variances that create potential for confusion. SED 002 uses the term *variance* to refer to formal approval for deviations from the standard criteria, but this term is not used in the Forested Land Criteria. Instead, the Forested Land Criteria use the term *vegetation override* (see quote below) to describe a specific situation where the criteria may not be met, as follows; this term is not used in the SED 002:

> *Where reasonable forest cover (i.e., amount, species, and distribution) is present, and where additional activities required to meet the conditions described in these criteria pose a risk to existing ecosystem function, a vegetation override may be appropriate. Equivalent capability for forested landscapes must be demonstrated.*

A vegetation override is just one type of variance. At this time, several different types of variances related to weeds and problematic species can be selected for forested sites in OneStop (AER, 2019b):

- Incompatible vegetation – Noxious weeds.
- Incompatible vegetation – Invasive species.
- Incompatible vegetation – Problem introduced species.
- Incompatible vegetation – Undesirable/problem weeds.

[5] Professional judgement is also used when adjacent lands cannot be used as representative controls for the assessment (e.g., in situations where access to off-site areas was restricted or representative controls were not available).

[6] SED 002 also recommends that "operators should first discuss options with the AER prior to conducting the detailed site assessment."

3.0 CONSIDERATIONS PRIOR TO PROCEEDING WITH A VARIANCE REQUEST

3.1 ALTERNATIVES TO A VARIANCE REQUEST

Prior to proceeding with a variance request, all reclamation techniques that could be used to remedy the deficiency must be considered. Techniques can range from fully redisturbing and reclaiming a site to low-impact methods that may fully or partially remedy the deficiency. To make a final decision, the net environmental benefit of each technique should be compared to leaving the deficiency "as-is". A variance request should only be made if the net-environmental benefit of a variance-request out-weighs all other options. For sites with multiple deficiencies, practitioners should consider the cumulative effects of these deficiencies on net-environmental benefit.

Net environmental benefits can be defined as gains in value of environmental services or other ecological properties attained by reclamation minus the value of adverse environmental effects caused by reclamation (Efroymson et al., 2004) (i.e., the reclamation results in the best possible ecological outcome). Net environmental gains should be considered at a decade to century timeframe. Information to quantitively assess the gains and losses associated with reclamation techniques to determine the net environmental benefit is currently limited, but reasonable qualitative estimates can be made.

Gains in environmental services could include:

- Increased biodiversity.
- Increased cover of native understory vegetation.
- Faster or more sustainable tree growth.
- Improved wildlife habitat.
- Greater traditional use opportunities.
- Reduction or removal of problematic species.
- Reduced risk of wildfire.

Access to the site to control weeds could result in:

- Damage to existing vegetation on the access road.
- Rutting and compaction.
- Re-opening of access to recreational users, resulting in increased frequency of disturbance and third-party impacts on the site.
- Additional weed establishment due to weed seeds brought in on equipment or soil disturbance.

Use of herbicides to control weeds may also have negative impacts, including potential elimination or harm to desirable species (Schoonmaker et al. 2018; Small et al. 2018).

3.2 EQUIVALENT LAND CAPABILITY

Equivalent land capability must be demonstrated for a variance request to be considered. If equivalent land capability cannot be demonstrated, all site deficiencies must be remedied. Equivalent land capability is defined in the Forested Land Criteria as:

> *The ability of the land to support various land uses after conservation and reclamation is similar to the ability that existed prior to an activity being conducted on the land, but that the individual land uses will not necessarily be identical.*

Ultimately, if there is no land use change, what this means is re-creating landscape, soil and vegetation conditions that will result in future forested ecosystem functions and land uses that may include wildlife utilization and habitat, recreational and traditional uses, and/or commercial forestry.

Ecosystem function is defined in the Forested Land Criteria as "the interactions between organisms and the physical environment, such as nutrient cycling, soil development, water budgeting, and flammability[7]." Conceptually, other forest functions also include providing wildlife habitat, temperature regulation and carbon sequestration. Forest ecosystems are made up of several structural vegetation layers, most notably the overstory tree canopy and a variety of understory strata (e.g., shrubs, herbaceous plants, mosses, lichens). Biodiversity in these layers and the interactions between vegetation layers and the forest soils they are supported by allow forests to be self-sustaining and resilient to stressors and disturbance (Pyper et al., 2013), both of which are cornerstones of functional ecosystems.

Equivalent land capability can be demonstrated by:

- meeting or exceeding the Forested Land Criteria,
- being comparable to pre-disturbance conditions, or condition in the surrounding area,
- providing annual monitoring data with a trend/trajectory towards a functional ecosystem,
- proving that the landscape and soil are suitable for supporting ecosystem function, and/or
- proving that the deficiency does not cause long-term impacts to ecosystem function.

[7] Ecosystem function is considered a component of equivalent land capability, but the concept of equivalent land capability is broader. Ecosystem function represents the current ecological state of the site while equivalent land capability incorporates current, future, and alternate land uses.

4.0 PREPARING PROFESSIONAL JUSTIFICATIONS

If a variance will result in the best ecological outcome and the site has equivalent land capability, the request, including a complete and comprehensive professional justification, can be prepared and submitted to the AER for approval. **Following the recommendations in this report will not guarantee approval by the AER; the AER will make the final decision for each variance request.**

This section outlines the content that a professional justification should include and discusses additional data collection that may be required. Information specific to weeds and problematic species can be found in Section 5.

4.1 DEVELOPING A PROFESSIONAL JUSTIFICATION

According to SED 002:

> *an operator may provide justification as to why a site should be permitted to vary from the criteria and still receive certification. […]. If a variance is being requested, the operator must provide the rationale for its decision, supported by acceptable references.*

Professional justifications should be developed using an evidence-based approach and contain detailed and comprehensive site-specific supporting information. Justifications should include:

- relevant background information,
- rationale or evidence that a variance request will result in the best ecological outcome,
- explanation of why the deficiency is not expected to have adverse environmental impacts, and
- demonstration of equivalent land capability and ecosystem function despite not meeting the Forested Land Criteria.

As discussed in Section 2.1, operators have the option to submit a justification for pre-approval prior to submitting a reclamation certificate application (Option 1), or they can submit the justification with the reclamation certificate application (Option 2). A justification form is available for use as part of the Combined Assessment Tool (CAT) and Record of Observations (RoO) (Alberta Energy Regulator, 2019c) used for a detailed site assessment (DSA). However, this form is not ideal for use as part of a pre-approval request for a variance because it does not include background site history and ecological information. The form presented in Appendix A is proposed as a standardized form for submitting variance requests. It includes an optional section for pre-approval requests in which background information can be provided.

The form in Appendix A details the comprehensive information that should be included in a justification. The first page of the form can be repeated for each facility, and text boxes can be expanded to include

additional information. If a section is “Not applicable”, the professional should provide an explanation of why it is “Not Applicable”. The following describes the sections of the form and the information to include:

- Facility(ies)
    - Include separate pages for each facility. In some instances, two or more facilities that are in close proximity and have the same deficiency could be grouped to avoid redundancy; however, information should not be generalized.
- Deficiency Type(s)
    - This report deals specifically with weeds or problematic species present; however, the form may be used for sites with multiple deficiencies. All the deficiencies that occur on the site must be listed in this section, as the combined impacts of all deficiencies must be weighed together to determine if any one deficiency can receive a variance. Submission of a variance request for a site that has already received a variance for one deficiency is discouraged.
- Description of the Deficiency
    - The description of the deficiency should be as detailed as possible. Data from multiple years is encouraged to show trends over time.
    - Describe when the deficiency was identified (or why the deficiency may not have been identified) and why it wasn’t and corrected previously. Include information on any attempts to correct the deficiency in the section labelled “Actions Taken to Address Deficiency”.
- Pre-existing Conditions and Pre-disturbance Biophysical Information
    - Review information from pre-disturbance assessments, environmental field reports or other documents, if available. Historical aerial imagery could provide coarse scale information if other sources of information are lacking.
    - Summarize and interpret this data to determine if the pre-disturbance conditions may have contributed to the deficiency and/or demonstrate how the pre-disturbance conditions were equivalent to the reclaimed conditions.
- Surrounding Area – Land Use(s) and Biophysical Information
    - Review information on the current and historical land uses and biophysical conditions from field assessment data, historical aerial imagery, provincial databases, or other sources.
    - Summarize and interpret this data to determine if the surrounding land use may have contributed to the deficiency and/or demonstrate there are conditions comparable to the deficiency in the surrounding area (natural analogs).
    - Provide the locations and sizes of any natural analogs and include photographs.
    - Provide the names and distances to nearby populated areas (if relevant).

- Construction/Reclamation Limitations
    - Summarize information on the site's history of construction and initial reclamation and determine if there were any factors during construction and initial reclamation that may have caused the deficiency.
- Actions Taken to Address Deficiency
    - Summarize any work completed to address the deficiency in part or in full (e.g., hand picking, herbicide application).
    - Describe the outcome of this work.
- Alternatives to Justification Considered
    - List the possible techniques that could be used to remedy the deficiency.
    - Describe why leaving the deficiency "as-is" will result in the best ecological outcome (net-environmental benefit).
- Annual Monitoring Results and Current Site Conditions
    - Summarize the results of annual monitoring (e.g., detailed site assessment(s)) and describe the historical trajectory of the site and current state of the site.
- Limitations or Hazards Caused by Deficiency
    - List and describe the probability (i.e., likelihood of occurrence) and severity (i.e., consequences of occurrence) of any risks that not remedying the deficiency could cause to future land users and wildlife (including risk of wildfire).
    - Describe any steps taken to limit the risk.
- Rationale for Variance
    - Summarize information from the previous sections of the justification form to explain why:
        - the site still meets equivalent land capability and is on a trajectory towards a forested ecosystem even with the deficiency left in place, and
        - leaving the deficiency "as-is" results in the best possible ecological outcome (i.e., environmental cost-benefits analysis).
    - Include data from the DSA to support explanations.
    - Include additional supporting information (refer to Section 4.2 and Appendix A).
    - When justifying multiple deficiencies, do not provide contradictory evidence; a statement that supports one deficiency should not be disproven in the arguments for another deficiency.
    - Support the rationale with relevant literature (Section 6.1).

The following information should also be attached to support the justification:

- Photographs of the deficiency and for each facility.

- Site diagram (including overlapping dispositions).
- Survey plans.
- DSA, including CAT and RoO datasheets and any supporting reports.
- Aerial photos.
- Construction records.
- Pre-disturbance biophysical information.
- Any other relevant information.

Background information that should be included if the variance justification form is not accompanied by a CAT and RoO includes:

- Site overview, ecological and land use information, and any overlapping dispositions.
- Facility location and size.
- Site history (dates and descriptions of activities and conditions).

4.2 ADDITIONAL DATA COLLECTION

When weeds or problematic species are present on-site, additional data collection during site assessment is beneficial to develop more in-depth professional justifications for variance requests. Additional data collection helps to provide improved context for the reclamation goals than may be provided by the normal number of control points or other data requirements in the Forested Land Criteria. Recommended data to collect beyond the data collected in the DSA could include the following, as applicable for the site:

- Species, location, number of plants and patch size for each patch of noxious weeds, invasive species, problem introduced species and undesirable/problem weeds on-site and off-site.
- Percent cover of noxious weeds, invasive species, problem introduced species and undesirable/problem weeds by species (either in each grid or on the site as a whole).
- On-site tree data to support mean annual increment assessment (as per the *Regeneration Standards of Alberta*; Alberta Agriculture and Forestry, 2018).
- Off-site ecosite phase and photographs.
- Evidence of ATV/UTV/snowmobile/light vehicle trails on-site and on the access road, including dimensions, location (e.g., sketch, coordinates) and photographs.
- Evidence of wildlife use of the site, including descriptions, locations (e.g., sketch, coordinates) and photographs.

5.0 WEEDS AND PROBLEMATIC SPECIES

In addition to the more well-known noxious weeds (*Weed Control Regulation*; Government of Alberta, 2010), there are three other classifications of weeds that are used in OneStop to describe problematic vegetation (Alberta Energy Regulator, 2019b):

- Incompatible vegetation – noxious weeds.
- Incompatible vegetation – invasive species.
- Incompatible vegetation – problem introduced species.
- Incompatible vegetation – undesirable/problem weeds.

Sites with prohibited noxious weeds (as per Schedule 1 of the *Weed Control Regulation*) are not eligible for a variance and cannot be certified.

Interpretation of the terms "invasive species," "problem introduced species," and/or "undesirable/problem weed" depends largely on the situational context of the reclamation area, its surrounding vegetation and land use, site history, natural region and subregion, previous management actions, and the species of concern. Noxious weeds, however, are a unique category in that they are defined by legislation (*Weed Control Regulation*). The other three terms were derived from previous provincial government guidance documents. Relevant literature and guidance documents pertaining to the natural subregion, county, or plant communities in question should be consulted to aid in the determination (refer to Section 6.1). Ultimately the onus is on the reclamation practitioner applying for the variance to conduct due diligence to understand if and how problematic vegetation may be classified in terms of these definitions.

All four categories of species can be problematic to reclamation areas due to their highly aggressive colonization potential, ability to decrease biodiversity, and in some instances the potential to be allelopathic (i.e., inhibit other species from germinating or growing). Problematic species can compete with desirable vegetation onsite and slow vegetation recovery to targeted forest ecosystems and have the potential to spread off-site into adjacent undisturbed areas, necessitating control. Problematic vegetation species of any of the four categories should not be included in the RoO as desirable species cover, unless they can be considered compatible species as defined in the Forested Land Criteria.

Noxious weeds

The *Weed Control Regulation* lists the plant species that are designated as noxious weeds in Alberta. The *Weed Control Regulation* also provides authority for a municipality to designate plants that are not listed as weeds in the *Weed Control Regulation* as noxious weeds (and to change the designation of noxious weeds to prohibited noxious weeds).

Invasive species

The "invasive species" term has not often been formally codified as its usage is broad and subjective and can refer to any number of non-native aggressively colonizing species, particularly those that "displace the original structure of the plant community" (Powter, 2002). Practitioners should conduct due diligence

in preparing their professional justification for a variance request to understand if a species of concern may be considered an invasive in the specific region and plant community.

Problem Introduced Species

Most often, this label encompasses agronomic species that mount considerable invasion pressure in forested areas. Alberta Environment (2003) defines problem introduced plants as forage plants that were introduced for crop or forage production purposes, and either invade or persist in native plant communities. Examples of plants that have been identified as problematic in the Central Parkland and Foothills regions include alsike clover, timothy, smooth brome, and reed canary grass (although the latter is a native species, it is used as a forage species).

Undesirable/Problem Weeds

In the context of reclaiming a forested ecosystem, if an invading species is not listed as a prohibited noxious or noxious weed and is not agronomic in nature then the species can be considered an undesirable/problem weed (sweet clover is a forested land example). Specific counties or regions can consider species to be undesirable/problem weeds, even if they are not listed as noxious or prohibited noxious in legislation. Practitioners are encouraged to consult relevant native plant community guides, as well as speak to local authorities, weed inspectors or public land managers to understand if the species of concern is labeled as undesirable in the area that they are seeking to reclaim.

5.1 CURRENT FORESTED LAND CRITERIA

For noxious weeds, both the requirements of the Forested Land Criteria (Section 10.4) and the *Weed Control Act* (Government of Alberta, 2008) must be met:

- Noxious weeds must be controlled on-site.
- Noxious weed ratings[1] on-site must be comparable to those off-site: the average rating on-site cannot be greater than the average rating off-site, and the difference in the average ratings between on-site and off-site must be <0. For example, if one off-site assessment point has a noxious weeds rating of 4, there could be noxious weeds present on-site but these must have ratings <4.

Note that the *Weed Control Act* defines "control" differently than "destroy,":

> 1(c)[2] "control" means
>
> (i) to inhibit the growth or spread, or
>
> (ii) to destroy;
>
> (d) "destroy" means
>
> (i) to kill all growing parts, or
>
> (ii) to render reproductive mechanisms non-viable.

[1] Ratings are used in the Forested Land Criteria to assess various parameters, including noxious and other weeds.
[2] Numbers and letters appearing at the start of the excerpt refer to a specific section of the referenced legislation.

For undesirable/problem weeds, the following conditions must be met, as per Section 10.4 of the Forested Land Criteria:

- Undesirable plants must be controlled so that they do not impede operability, management, or the functioning of the native plant community.
- Undesirable plants should not require a change in management practice on-site compared to off-site.
- There cannot be a difference >2 ratings categories between the lowest control rating and the lowest rating at any assessment point on the lease. The difference in average ratings between on-site and off-site must be <0.30 (or 0.15, depending on sample intensity).

The Forested Land Criteria provides an additional list of conditions that, if all are met, can allow a site to pass the assessment and the application can be submitted through the baseline review process, even if the site does not meet the previously stated criteria for noxious weeds or other undesirable species categories:

- The site is on Public Lands (excluding Provincial Parks and Protected Areas).
- The site has met Criteria for all other parameters being assessed.
- The site fails the comparison for controlled[3] and/or undesirable problem weeds that are resulting from a single source of weeds from off-site.

It these conditions are met, the application must include data, photos, historical weed management and supporting information clearly indicating that the weeds are from an offsite location that is not owned or managed by the same operator.

5.2 CONSIDERATIONS FOR A VARIANCE REQUEST

If the site does not meet the Forested Land Criteria, and/or the three additional conditions specified in the Criteria, the site may be eligible for a variance to allow weeds or problematic species to be left in place without further reclamation, if the site has the following characteristics:

1. The site is passing the Forested Land Criteria for vegetation (excluding weeds), which should be an indicator that the site is on a trajectory towards native species dominance:
   - If a Natural Recovery Site (regardless of reclamation date): A minimum of 25% canopy cover of herbaceous species; and a minimum 25% canopy cover of woody species or a minimum stem count of 5/10 m^2 plot (i.e., 5,000 stems/ha), and the plants are healthy.
   - If a Planted Site: A minimum of 25% canopy cover of herbaceous species; and a minimum 25% canopy cover of woody species or a minimum stem count of 2/10 m^2 plot (i.e., 2,000 stems/ha), and the plants are healthy.

[3] While the Forested Land Criteria uses the term “controlled” weeds in this clause rather than “noxious” weeds, the application of this clause to noxious weeds is implied.

2. **Either**

- The growth and spread of weeds are inhibited (as per the definition of control noted above). The following factors can be used to make this determination, keeping in mind that control does not require complete elimination:
    - Spread of weeds is considered inhibited if their abundance on-site is decreasing over time. Data from multiple assessments is needed to demonstrate trends in abundance over time.
    - Distribution of weeds and native vegetation on-site.
        - Weed populations are less likely to grow and spread if the plants on-site are present as scattered individuals among native vegetation, forming only small patches (<4 m^2). Weeds are also easier to control if the plants that are present on-site are not flowering and appear to have reduced vigour (e.g., leaves appear limp and/or reduced in size).
        - When native vegetation completely covers the site and there are no sparse or bare patches to provide a receptive seed bed for weeds to establish, the likelihood of weed populations colonizing and spreading on-site is reduced (Haeussler et al., 1999; Sumners and Archibold, 2007), likely by the competitive pressure exerted by the native vegetation.
    - Movement of noxious weeds into off-site areas.
        - If there is evidence of the noxious weed population moving from the site into adjacent off-site areas, the growth and spread of noxious weeds is not considered to be inhibited. Literature has shown that non-native and invasive plants (i.e., noxious weeds) have typically not been observed, or have been found in low numbers, more than 20 to 30 m from boreal forest edges, suggesting that weed growth and development is not supported by the mature forested environment (Small et al., 2018).
        - Noxious weed populations located on or near linear features are considered more likely to spread (especially to non-forested areas) and are more difficult to justify leaving them in place.
    - Potential for third party activity to spread the weeds from the site to off-site areas.
        - If there is no evidence of third-party activity in and around the site, the potential for the spread of the noxious weed into off-site areas is reduced.

Or

- The source of weeds is shown to be third-party activity[4]. Weeds can be the result of third-party impacts if:
    - Weeds are present on a nearby public highway, on an access road on the way to the site or on other facilities that share the same access route (unless the source is a wellsite or access road that is owned by the same entity as the site seeking the variance), and there is a vector that could spread the weeds to the site (wind, water, animals, humans, etc.). Wind dispersal distances of species such as perennial sow-thistle and Canada thistle have been recorded in the literature as approximately 10 m (Becker et al., 2008; Moore, 1975; Sheldon and Burrows, 1973); however, helicopters can create wind currents that may spread these species further than reported in the literature, in addition to acting as a vector between sites in and of themselves.
    - Grazing activity is occurring on-site or nearby (e.g., within 100 m), acting as an ongoing source of weeds.
    - There is evidence of third-party or recreational traffic (e.g., ATV/UTV tracks) on the site which has resulted in the introduction of weeds.

If third-party sources of weeds are not being controlled (whether due to unsuccessful past treatments or through lack of control efforts) it would be extremely difficult for the operator to reduce the impacts and the spread of the weeds onto the site seeking certification.

If the site is eligible for a variance for problematic species one of the following categories are used in OneStop:

- Incompatible vegetation – Noxious weeds.
- Incompatible vegetation – Invasive species.
- Incompatible vegetation – Problem introduced species.
- Incompatible vegetation – Undesirable/problem weeds.

5.3 ADDITIONAL CONSIDERATIONS

Additional considerations for requesting/approving a variance include:

- Whether the cover of weeds is expected to out-compete or adversely affect the growth and development of desirable native vegetation. The phenology and ecology of the invading weed species affects its potential to impact the ability of a developing forest environment to meet equivalent land capability (refer to *Optimizing Weed Control for Progressive Reclamation:*

[4] Third-party impacts are defined in the Terms and Acronyms section of this document. Further discussion of what constitutes third-party activity and the operator's responsibilities are described in the *Conservation and Reclamation Information Letter: Third Party Impact on Reclamation* (Alberta Environment, 1997).

Literature Review (Small et al., 2018) and associated references for a discussion of the nature of weed growth in forested ecosystems). There are three questions to consider:

1. Will the species adversely affect the growth and development of a forest canopy through aggressive growth and shading?
2. Is the species known to have allelopathic properties that inhibit germination of forest understory species?
3. What is the shade tolerance profile for the species – will it die off when shaded by a canopy?

For example, perennial sow-thistle and scentless chamomile are aggressive, shade-intolerant species that can quickly colonize large areas of land, despite herbicide application and other control efforts. However, these species are not known to suppress growth of tree seedlings or understory shrubs (MacFarlane, 2003, cited in Langor et al., 2014). Although they are strong colonizers, they will eventually be outcompeted by the developing forest canopy of the reclamation area (Small et al., 2018). Conversely, species that grow very tall and in dense patches (such as white sweet clover, although not a noxious weed) show real potential to suppress growth of planted tree or shrub seedlings and therefore affect achieving equivalent land capability. Meeting target (planting) densities for woody species and abundance criteria for herbaceous species are both evidence that forest development would not be impeded by a problematic species invasion.

- Previous weed control on the site that demonstrates proactive efforts on the part of the operator to control weeds.
- Negative consequences of continued weed control.
    - Damage and mortality of desirable native vegetation from herbicide overspray, particularly when broadcast spraying.
    - Impacts to ecological recovery. Direct effects of herbicide include the reduction in cover and species richness of non-target vegetation species, impacts to soil microbial communities, and potential toxic effects to wildlife. The removal of native forbs, shrubs or trees impacts the composition, structure and function of the plant community and can alter the successional pathway of the site as a whole, which then has impacts on wildlife forage, habitat provision and biodiversity (Alberta Sustainable Resource Development, 2004; Helander et al., 2012; Miller and Miller, 2004).
    - Damage caused by repeated re-entry to the site to conduct weed control.
    - Risk of continual spreading of weed seeds via equipment used to access the site and conduct weed control.

5.4 KNOWLEDGE GAPS

There are a few species that are designated as noxious weeds or undesirable/problem weeds that likely will not impede forest development or the establishment of equivalent land capability. These are weeds,

such as scentless chamomile or perennial sow-thistle, that are not shade tolerant and do not grow thick enough to out-compete woody stems (Schoonmaker et al. 2018; Small et al. 2018). However, there are knowledge gaps surrounding the interaction and growth dynamics between these types of weeds and the developing forest on reclamation areas. Weed control is often heavily prescribed for all noxious weeds across the province, although the establishing forest canopy may act as a significant deterrent to weed invasion itself.

5.5 CHECKLIST OF KEY FACTORS FOR WEEDS AND PROBLEMATIC SPECIES

Requirements and Factors to Consider for Weeds and Problematic Species Deficiency

- ☐ Site history (dates and descriptions of activities and conditions)
- ☐ On-site vegetation (cover, density of woody plants, presence of sparse or bare areas)
- ☐ Trends over time
- ☐ Distribution of the weed population and native vegetation on-site
- ☐ Movement of noxious weeds into off-site areas
- ☐ Third party activity
  - ☐ As a dispersal agent of noxious weeds
  - ☐ As a source of weeds
- ☐ Problematic species, phenology, and ecology
- ☐ Impacts of weeds on on-site vegetation and ecosystem development
- ☐ Site and soil conditions
- ☐ Previous weed control on the site
- ☐ Negative consequences of continued weed control
- ☐ Damage to the access road required to access the site to conduct weed control

6.0 REFERENCES

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6.1 ADDITIONAL READING

The following is a list of references, sorted by category, that may be helpful in understanding forest ecology and in justifying reclamation deficiencies from an ecological perspective.

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