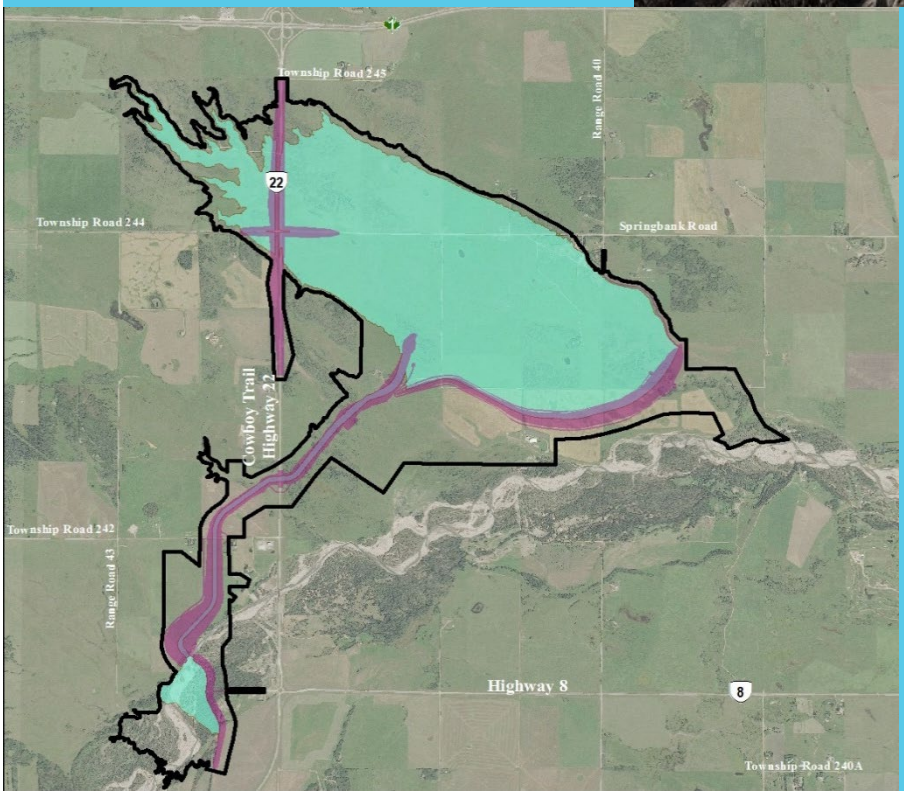
Springbank Off-stream Reservoir Project

Environmental Monitoring Report



Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan

January 2022

Alberta

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

January 2022

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Abbreviations

ACIMS	Alberta Conservation Information Management System
AISC	Alberta Invasive Species Council
AEP	Alberta Environment and Parks
CEAA	Canadian Environmental Assessment Agency
ECO	Environmental Construction Operations
EIA	environmental impact assessment
ESRD	Environment and Sustainable Resource Development
GoA	Government of Alberta
IAAC	Impact Assessment Agency of Canada
LAA	local assessment area
LUA	land use area
NRCB	Natural Resource Conservation Board
PDA	Project development area
PLS	pure live seed
RAA	regional assessment area
SAR	species at risk
SOMC	species of management concern
SR1	Springbank Off-stream Reservoir Project
SSRP	South Saskatchewan Regional Plan
TLRU	traditional land and resource use
TUA	traditional use area

TUS	traditional use study
URW	utility right of way
USDA	United State Department of Agriculture
WAIR	wetland assessment and impact report

1.0 INTRODUCTION

This document describes the Vegetation and Wetland Mitigation, Revegetation and Monitoring Plan (Vegetation Plan) for construction and operation of the Springbank Off-stream Reservoir Project (SR1, the Project). Project construction and operations are expected to affect vegetation, wetland abundance, and diversity. The Vegetation Plan details mitigation measures and revegetation prescriptions for reducing effects and supporting land use, and monitoring of effectiveness. The Vegetation Plan is current as of January 2022 and is subject to change.

Alberta Transportation developed a draft Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan which outlines key mitigations and monitoring commitments during construction, dry and flood operations and was shared with Piikani Nation, Ermineskin Cree Nation, Foothills Ojibway Society, Ktunaxa Nation Council, Métis Nation of Alberta Region 3, Montana First Nation, and Samson Cree Nation on April 20, 2020 for review and feedback. This draft Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan was also shared with Blood Tribe/Kainai, Siksika Nation, Stoney Nakoda Nations, and Louis Bull Tribe on May 6, 2020 and Tsuut'ina Nation on July 16, 2020. Alberta Transportation also offered funding to Indigenous groups to provide written feedback and offered multiple opportunities to provide oral feedback, including group meetings in the fall of September 2020 and individual meetings to discuss. The Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan has been finalized following the NRCB and IAAC decisions and conditions, and has taken into account any feedback received from Indigenous groups.

Alberta Transportation will be responsible for implementation of the Vegetation Plan during Project construction and for a period of three years post-construction (herein referred to as post-construction). Following post-construction, Alberta Environment and Parks (AEP) will be responsible for implementing the Vegetation Plan during dry operations, and both flood and post-flood operation phases of the Project.

1.1 PLAN OBJECTIVES

The objectives of the Vegetation Plan, through all phases of the Project, are to control erosion and dust, limit weed abundance and support establishment of desirable plant species. Achieving these objectives will support preferred end land uses, including wildlife and traditional use, and limit potential adverse effects to surrounding lands.

2.0 REGULATIONS, APPROVALS AND GUIDELINES

The Project was subject to approval under various provincial and federal regulations and regulations relevant to vegetation and wetlands are provided in Appendix A. Alberta Transportation has prepared the Plan to meet Impact Agency of Canada (IAAC) and Natural Resource Conservation Board (NRCB) approval conditions and current regulatory guidance and guidelines for vegetation, wetland and weed monitoring. In addition, the Plan has been prepared to meet NRCB approval condition 10 as described in approval NR 2021-01. The approval conditions as defined by IAAC and NRCB are provided in Table 2.1. Commitments made by Alberta Transportation related to vegetation, wetland and weeds throughout the regulatory approvals process have been considered.

Table 2.1 Summary of Approval Conditions for Vegetation, Wetland and Soils

Project Phase	Reference	Approval Condition
Construction	IAAC Condition 3.5	The Proponent shall inspect all vehicles machinery and construction equipment before it enters the project development area for the presence of invasive alien species and noxious weeds, taking into account Alberta's Decontamination protocol for work in or near water: quick reference guide. The Proponent shall remove all invasive alien species or noxious weeds found on any machinery or equipment before it enters the project development area.
Construction	IAAC Condition 4.2	The Proponent shall give preference to the use of existing access roads and disturbed areas for temporary workspaces and transportation activities over building new access roads and temporary workspace in undisturbed areas, and shall revegetate any area where native vegetation was removed for temporary workspace.
Construction	IAAC Condition 5.6	The Proponent shall implement the Designated Project in a manner that avoids adverse environmental effects of the Designated Project on wetlands and wetland functions. To avoid adverse effects, the Proponent shall maintain wetlands and their functions over minimizing adverse effects on wetlands and their functions. When the loss of wetlands and their functions cannot be avoided, the Proponent shall mitigate the adverse effects on wetlands and their functions instead of compensating for affected wetlands and their functions.
Construction	IAAC Condition 5.7	In the case of the adverse environmental effects of the Designated Project on wetlands and their functions located in the project development area that cannot be avoided or mitigated pursuant to condition 5.6, the Proponent shall develop, in consultation with Indigenous groups, Environment and Climate Change Canada and other relevant authorities, and taking into account the Alberta Wetland Policy, a wetland replacement plan to compensate for the loss of wetlands and their functions.

Table 2.1 Summary of Approval Conditions for Vegetation, Wetland and Soils

Project Phase	Reference	Approval Condition
Construction	IAAC Condition 5.8	The Proponent shall direct during construction any drainage pathway, constructed or modified as part of the Designated Project, away from wetlands and shall identify prior to construction wetlands where drainage pathway should not be directed during operation. The Proponent shall provide a map of the wetlands to be avoided to the Agency prior to construction.
Construction	IAAC Condition 8.1	The Proponent shall undertake, in consultation with Indigenous groups and relevant authorities, progressive reclamation of areas disturbed by the Designated Project, including bank and riparian areas. In doing so, the Proponent shall: • identify agronomic plant species and plant species native to the regional assessment area to use for revegetation, including plant species suitable as habitat for migratory birds and native seed mix suitable for wetlands; • revegetate the portions of the diversion channel excavated through soil and the earthen dam embankment free of rip rap; • reclaim non-native plant areas to equivalent baseline land functions after construction and during post flood operation; and • reclaim the surface drainage patterns of the area after construction.
Construction	IAAC Condition 8.2	The Proponent shall manage noxious weeds and invasive alien species as necessary to promote successful revegetation that includes traditional plant establishment and growth. In doing so, the Proponent shall not use herbicide within 30 metres of wetlands and waterbodies in the project development area.
Operations	IAAC Condition 8.13	The Proponent shall develop, prior to operation, and in consultation with Indigenous groups, a follow-up program to verify the accuracy of the environmental assessment as it pertains to natural re-vegetation of the drained reservoir during post-flood operation. As part of the development of the follow-up program, the Proponent shall identify objectives that shall be used by the Proponent to evaluate the success of re-vegetation. The Proponent shall implement the follow-up program during operation. As part of the implementation of the follow-up program, the Proponent shall: • monitor the composition and abundance of natural re-vegetation occurring in the drained reservoir, for the first 12 months of post-flood operation; and • develop and implement additional mitigation measures if the results of the monitoring referred to in condition 8.13.1 demonstrate that additional mitigation measures are required to promote successful re-vegetation of the drained reservoir. As part of these measures, the Proponent shall mitigate wind erosion through measures such as hydroseeding or the application of a tackifier.

Table 2.1 Summary of Approval Conditions for Vegetation, Wetland and Soils

Project Phase	Reference	Approval Condition
Construction	IAAC Condition 8.14	The Proponent shall develop, prior to construction and in consultation with Indigenous groups, a follow-up program to verify the accuracy of the environmental assessment and to determine the effectiveness of mitigation measures as it pertains to the adverse environmental effects of the Designated Project on the current use of lands and resources for traditional purposes. The proponent shall implement the follow-up program during all phases of the Designated Project to monitor: • the effectiveness of progressive reclamation Note: Currently under development with Land Use Advisory Group
Construction	IAAC Condition 9.8	The Proponent shall strip and stockpile topsoil during construction and shall prevent mixing of topsoil with other soil horizons. The Proponent shall replace the topsoil during progressive reclamation pursuant to condition 8.1.
Construction	NRCB Condition 9	The Operator shall: a) extend monitoring of revegetated areas from 18 months to a minimum of two full growing seasons following seeding, and b) assess the extent and species mix of trees and shrubs that are likely to be lost in the more frequently inundated areas and implement replacement plantings at higher elevations within the reservoir or along the perimeter, to the satisfaction of Alberta Environment and Parks.
NOTE: Approval conditions listed are provided in the NRCB Board Decision (June 22, 2021) and SR1 Decision Statement Issued under Section 54 of the *Canadian Environmental Assessment Act, 2012* (July 8, 2021)		

3.0 RESPONSIBILITIES AND REPORTING REQUIREMENTS

Alberta Transportation will be responsible for implementation of the Plan during Project construction post-construction. After that, AEP will implement the Plan during both flood and dry-operations phases of the Project. In the event that the Project operates during the post-construction period, responsibility for implementing this plan will transfer and remain with AEP.

In compliance with IAAC approval condition 2.11, Alberta Transportation or AEP (depending on the project phase) will prepare an annual report (irrespective of whether the Project operates or not) summarizing the monitoring results, which will be provided to IAAC and the First Nation Land Use Committee by October 31 of the reporting year to which the annual report applies. IAAC has defined the reporting year as July 1 of the calendar year to June 30 of the subsequent calendar year (definition 1.32). The annual report, including a plain language executive summary in both official languages, will be made publicly available to Indigenous groups and public stakeholders no later than October 31 following the reporting year to which the annual report applies (IAAC approval condition 2.13). Indigenous groups, the First Nation Land Use Advisory Committee and the Agency will be notified of the annual reports within 48 hours of their publication (IAAC approval condition 2.14). The annual reports will be available for 15 years following their publication (IAAC approval condition 2.14).

In compliance with NRCB approval condition 10, Alberta Transportation will make the Plan easily accessible to the public, subject to privacy protection requirements and to the satisfaction of AEP.

4.0 INDIGENOUS AND PUBLIC STAKEHOLDER FEEDBACK

4.1 FEEDBACK RECEIVED

Since completion of the EIA, additional feedback on vegetation and wetlands was received from Indigenous groups, stakeholders and the public, and through supplemental regulatory information requests and the Project approval hearing. Additional feedback included:

- inclusion of sheep fescue (*Festuca ovina*) and Duhurian wildrye (*Elymus dahuricus*) in preliminary agronomic seed mix. Concern species can be invasive.
- abundance of wheatgrasses (Elymus spp. and Agropyron spp.) in preliminary native seed mix. Concern species could outcompete other native plants and alter wildlife habitat and use.
- inclusion of traditional use plants in seed mixes. Request for addition of traditional use plants in native seed mixes.
- prevention and control of weeds. Concern for potential weed spread beyond PDA due to movement of equipment and creation of new disturbance during construction, and presence of bare ground following flood events.
- ability to revegetate sediment in the reservoir following flood events and potential dust exposure due to exposed soils. Concern that sediment will not support vegetation growth and adjacent landowners will be exposed to elevated dust levels.
- management of woody debris following flood events. Concern trees and shrubs killed by flooding will increase wildfire risk for PDA and surrounding lands.

Alberta Transportation has considered the feedback while preparing the Plan. The Plan includes additional seed mixes, evaluation of traditional use plants available for seeding, expanded weed management measures, and debris management.

5.0 PROJECT DESCRIPTION

The Project consists of the construction and operation of an off-stream reservoir to divert and retain a portion of Elbow River flows during a flood. The diverted water will be released back to Elbow River in a controlled manner after the flows in Elbow River decrease sufficiently to accommodate the release of water from the reservoir. The reservoir will not hold a permanent pool of water.

5.1 PROJECT COMPONENTS

The primary Project components are:

- a diversion structure on the main channel and floodplain of Elbow River
- a diversion channel to transport diverted floodwater from Elbow River to the off-stream reservoir
- a dam to temporarily retain the diverted floodwater in the reservoir
- a low-level outlet in the dam to return retained water through the existing unnamed creek and back to the river when AEP Operations determines conditions are appropriate.

5.2 PROJECT PHASES

5.2.1 Construction

The Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood event) after two years of construction and be completely constructed (able to accommodate the design flood) after three years of construction.

5.2.2 Dry Operations

Dry operations refers to post-construction and Project operation between floods. During dry operation, the diversion inlet gates will close and the service spillway gates will open. The outlet structure will remain open to carry the flow of the unnamed creek over which the dam will be built. The outlet gate system and its operation will be checked according to a routine maintenance schedule to be developed by AEP Operations.

The associated access roads, emergency spillway and reservoir will be inspected at the same time and repaired, if necessary. The maintenance schedule will also include inspections of the diversion structure and the river channel upstream of it, the maintenance building, the floodplain berm, and the auxiliary spillway. Repairs and debris management will be completed as necessary.

5.2.3 Flood Operations

AEP Operations will be in communication with the City of Calgary Glenmore Dam operators in advance of and during the flood season each year. The need for flood operations will be determined through this communication, which will be informed by forecasted and measured flows on Elbow River at the diversion structure and upstream. AEP Operations staff, in communication with the City of Calgary Glenmore dam operators, will decide on when to open the diversion gates to commence partial diversion of flood water into the off-stream reservoir. Operational information will be shared with the City of Calgary.

5.2.4 Post-Flood Operations

During post-flood operations, the diversion inlet gates are closed and the service spillway gates are open (lowered to the river bed). The gates of the outlet structure would be opened to allow the floodwater retained in the reservoir to drain through the low-level outlet into the unnamed creek and then into Elbow River. The outlet structure gates at the base of the reservoir will remain open after the reservoir has drained.

6.0 MITIGATION AND MANAGEMENT

Alberta Transportation will implement mitigation measures prior to the initiation of any ground disturbance activities. Mitigation will be continued during construction and post-construction, and through dry operations and post-flood operations. Vegetation management techniques will also be implemented to reduce the potential for undesired establishment and spread of weeds and unregulated alien invasive plants, control dust emissions and reduce the potential for wildfire.

6.1 CONSTRUCTION

The objectives of the construction mitigation measures are to properly identify sensitive vegetation and wetland features (e.g., native grassland, rare plants) and avoid or reduce potential Project effects from ground disturbance and weed introduction or spread. Key mitigation measures that will be implemented are listed in Table 6.1. The Environmental Monitor (or designate) will follow established industry best management practices and will evaluate effectiveness of mitigation during and following the construction phase. Key monitoring issues will include erosion and sediment control, management of regulated weeds, and revegetation success.

Table 6.1 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in landscape diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Construction activities will be restricted to the approved construction footprint.
Change in community diversity	• Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing	• Construction activities will be restricted to the approved construction footprint.

Table 6.1 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in community diversity (cont'd)	• Indirect alteration of native communities, including riparian lands and ecological communities of management concern from the introduction or establishment of regulated weeds and invasive species or deposition of dust	• Cover crop seed mixture will be applied to assist in weed and erosion control on exposed soils where warranted. • All equipment will arrive at the Project site clean and free of soil and vegetative debris. • Topsoil and subsoil piles will be monitored for weed growth during construction and implement corrective measures (e.g., spraying, mowing, hand-pulling) to avoid growth and establishment of regulated weeds. • Only Certified No.1 seed will be used unless Certified No. 1 seed is not available for selected reclamation species (i.e., native species). • For control of weeds, a licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010).
Change in species diversity	• Direct loss of a plant SOMC or traditional use plant species of due to vegetation clearing	• Construction activities will be restricted to the approved construction footprint. • Offer to conduct field visit with Indigenous groups prior to construction to identify priority areas for harvest of traditional plants. Visit will be coordinated by Alberta Transportation.
Change in species diversity	• Direct loss of a plant SOMC or traditional use plant species of due to vegetation clearing	• Provide opportunities for harvesting of medicinal and culturally significant traditional use plants prior to clearing. • Where possible, temporary workspaces and access roads will be in areas that avoid wildlife features and native vegetation (e.g., shrubland, treed areas, wetlands). • Potential contaminant-related effects will be mitigated through road water runoff management, implementing a spill response plan, using appropriate sediment and erosion control measures, limiting the use of herbicides and fertilizers in the dry reservoir and near water bodies, and using non-toxic biodegradable hydraulic fluids in equipment for any required instream works.
	• Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds	• Cover crop seed mixture will be applied to assist in weed and erosion control on exposed soils where warranted. • Herbicide will not be applied within 30 m of plant species or ecological communities of management concern, wetland or waterbody. Spot spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas. • A licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010).

Table 6.1 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in wetland function	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or deposition of dust • Direct loss or alteration of surface or groundwater flow patterns	• Reduce the removal of vegetation in wetlands to the extent possible • Where possible, conduct ground level cutting/mowing/mulching of wetland vegetation instead of grubbing. • Where applicable, in areas not impacted by the permanent Project footprint, if ground conditions are encountered that create potential for rutting, admixing or compaction, reduce ground disturbance by using a protective layer such as matting or biodegradable geotextile and clay ramps or other approved materials between wetland root/seed bed and construction equipment. • Erosion and sediment will be managed utilizing Alberta Transportation's Erosion and Sediment Control Manual. An appropriate native seed mix that is suitable for wetlands will be used to reclaim wetland areas.
	• Indirect loss or alteration of wetland area or wetland type because of vegetation clearing and ground disturbance • Indirect alteration of surface and groundwater flow patterns	• Where possible, grading/drainage will be directed away from wetlands. • Where there are permanent or temporary access roads, cross drainage will be maintained to allow water to move freely from one side of the road to the other. • All equipment servicing activities with potential for spills will be conducted in a designated area and in a manner to protect the environment.. These activities will not be done within 100 m of rivers, streams, and waterbodies.

6.2 POST-CONSTRUCTION

The objectives of the three-year post-construction mitigation measures are to avoid and reduce potential Project effects to vegetation and wetlands following ground disturbance and support vegetation establishment. Key mitigation measures that would be implemented are listed in Table 6.2.

Table 6.2 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in landscape diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Not applicable. No vegetation clearing planned.
Change in Community Diversity	• Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing	• All equipment will arrive at the Project site clean and free of soil and vegetative debris. • Erosion and sediment control measures will be monitored and repaired as needed. • Native areas disturbed by the Project will be reseeded using an Alberta Transportation native seed mix customized for the Project. Roots will be retained in topsoil salvaged from cleared native areas and used to assist with revegetation. • Vegetation cover establishment will be monitored, and areas of poor cover re-seeded as needed. • Temporary work spaces will be reclaimed incorporating input on native species to be used from Indigenous groups.
	• Indirect alteration of native communities, including riparian lands and ecological communities of management concern from the introduction or establishment of regulated weeds and invasive species or deposition of dust	• Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the Alberta *Weed Control Act* and associated regulations. • A licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the *Code of Practice for Pesticides* (Government of Alberta 2010).
Change in Species Diversity	• Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds	• Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the Alberta *Weed Control Act* and associated regulations. • A licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the *Code of Practice for Pesticides* (Government of Alberta 2010).

Table 6.2 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in Wetland Function	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or deposition of dust • Direct loss or alteration of surface or groundwater flow patterns	• Erosion and sediment control measures will be monitored and repaired as needed. • Areas of rutting, admixing or compaction, will be recontoured and seeded with an appropriate wetland seed mix (e.g., Custom Mix 1, Table 9.3).
	• Indirect loss or alteration of wetland area or wetland type because of vegetation clearing and ground disturbance • Indirect alteration of surface and groundwater flow patterns	• Erosion and sediment control measures will be monitored weekly and repaired as needed. • Areas where there may be topsoil/subsoil rutting, admixing or compaction, will be recontoured to match surrounding topography and seeded with an appropriate wetland seed mix (this would occur where topsoil/subsoil has not been cleared). • Vegetation cover establishment will be monitored, and areas of poor cover re-seeded as needed.

6.3 DRY OPERATIONS

Mitigation measures during dry operations will be limited to noxious and prohibited noxious weed management and monitoring. The PDA will be periodically inspected for weeds and non-native invasive plants. Weed species will be controlled as identified in the Alberta *Weed Control Act* and associated regulations. Non-native invasive species will be managed to limit interference with land use objectives. No further vegetation management will be conducted in the PDA during dry operations.

Weed and non-native invasive plant control methods will follow guidelines provided in Section 7.0, Weed Management Plan.

6.4 POST-FLOOD OPERATIONS

The objectives of post-flood operation mitigation measures are to avoid and reduce potential Project effects to vegetation and wetlands following flooding and post-flood sedimentation and support vegetation establishment in effected areas. Post-flood mitigation measures are guided by the proposed end land uses. Key mitigation measures that will be implemented are listed in Table 6.3. Measures include control of weeds and non-native invasive species, erosion and dust, and debris management.

Weed and non-native invasive plant control methods will follow guidelines in Section 7.0, Weed Management Plan. See Section 8.0, Erosion and Sediment Management, for erosion and dust control measures. Debris potentially blocking drainage channels in the reservoir will be moved to maintain Project operation. Woody debris will be left in the reservoir, including standing dead trees and shrubs.

Table 6.3 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Flood

Potential Effect	Effect Pathway	Mitigation Measure
Change in landscape diversity	• Fragmentation of native plant community patches arising from native vegetation clearing	• Not applicable. No clearing will occur
Change in Community Diversity	• Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing	• All equipment will arrive at the Project site clean and free of soil and vegetative debris. • Vegetation cover establishment will be monitored, and areas of poor cover will be seeded and/or re-seeded as needed. • Areas of sediment deposition where wind erosion may be an issue may be hydroseeded with native plant species and a tackifier to reduce erosion. • Erosion and sediment control measures will be monitored and repaired as needed. •
	• Indirect alteration of native communities, including riparian lands and ecological communities of management concern from the introduction or establishment of regulated weeds and invasive species or deposition of dust	• Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the Alberta Weed Control Act and associated regulations. • A licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010).
Change in Species Diversity	• Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds	• Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the Alberta Weed Control Act and associated regulations. • A licensed industrial pesticide applicator will select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010).

Table 6.3 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Flood

Potential Effect	Effect Pathway	Mitigation Measure
Change in Wetland Function	• Direct loss or alteration of wetland area or change in wetland type from vegetation clearing or deposition of dust • Direct loss or alteration of surface or groundwater flow patterns	• Erosion and sediment control measures will be monitored weekly and repaired as needed. • Where movement of sediment within the reservoir is required to maintain hydrological function of water control components, graded soil material will be directed away from adjacent wetlands. • Areas where there may be topsoil/subsoil rutting, admixing or compaction, will be recontoured and seeded with an appropriate wetland seed mix.
Change in Wetland Function (cont'd)	• Indirect loss or alteration of wetland area or wetland type because of vegetation clearing and ground disturbance • Indirect alteration of surface and groundwater flow patterns	• Erosion and sediment control measures will be monitored and repaired as needed. • Where movement of sediment within the reservoir is required to maintain hydrological function of the water control components, graded soil material will be directed away from adjacent wetlands. • Areas of rutting, admixing or compaction, will be recontoured to match surrounding topography and seeded with an appropriate wetland seed mix (this would occur where topsoil/subsoil has not been cleared). • Vegetation cover establishment will be monitored, and areas of poor cover re-seeded as needed.

7.0 WEED MANAGEMENT PLAN

Six noxious weeds (Table 7.1) and 21 non-native potentially invasive alien plant species (Appendix B) were observed in the PDA during EIA surveys (Volume 3A, Section 10.2.2.3 of the EIA). Noxious weeds are widely distributed and were observed in most of the PDA (Figure 7-1). No prohibited noxious weeds were observed in the PDA. Noxious weeds and alien invasive species can outcompete native plants, and change water and nutrient availability (Alberta Invasive Species Council [AISC] 2014a, b, c, d, e and f), undermining revegetation efforts, and damaging existing vegetation communities, wildlife habitat and human use of the PDA and surrounding lands. None of the alien invasive plant species observed in the PDA are suggested for regulation under Alberta's *Weed Control Act*; however, they can outcompete native species and may interfere with Project revegetation efforts in agronomic and native areas of the PDA (Figure 7-2).

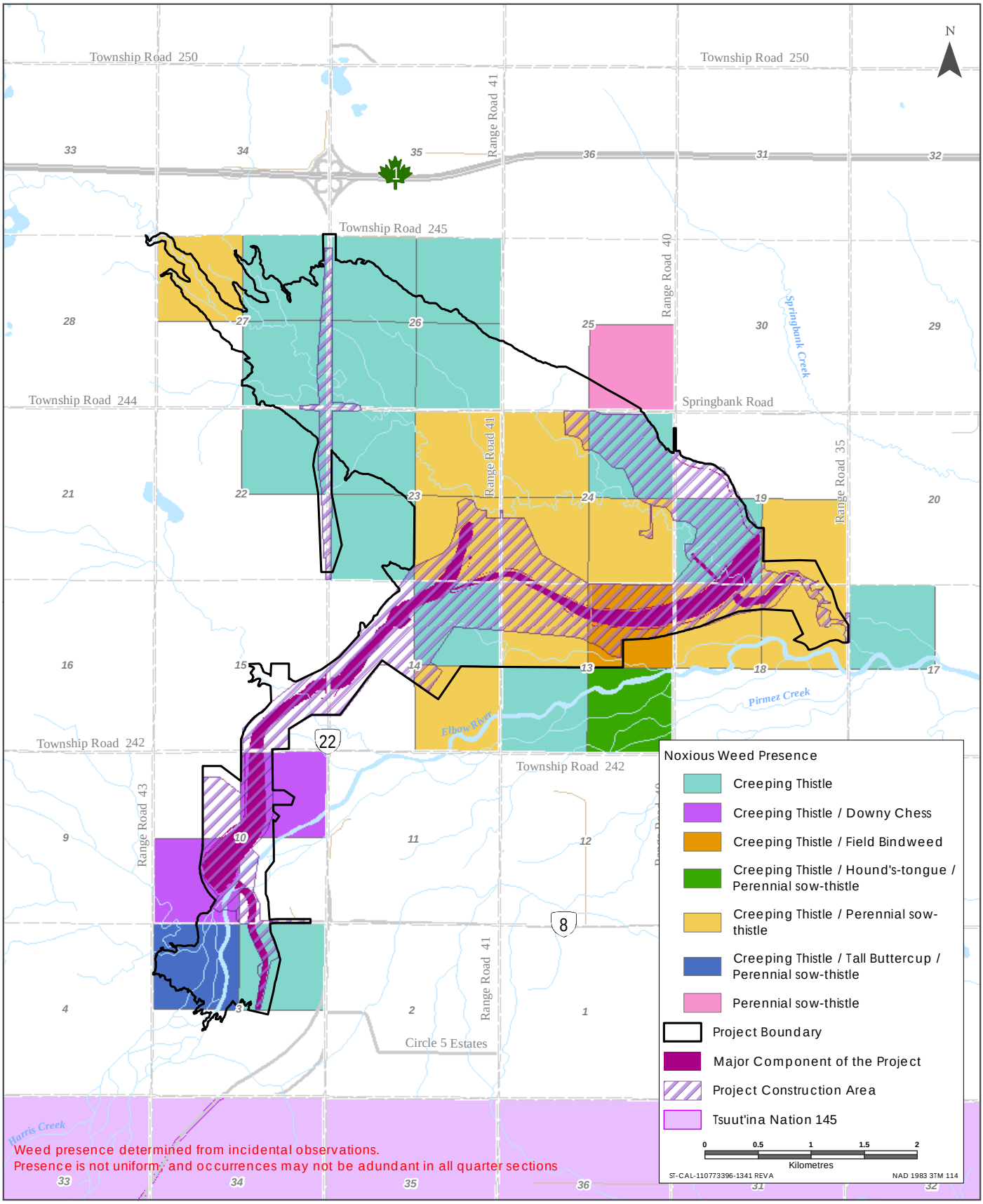
Creeping thistle, field bindweed and perennial sow thistle observed in the PDA can establish extensive root systems in a matter of months and regrow from roots (i.e., rhizomes) that remain underground (AISC 2014a, b and c). Once established, these species require an integrated management plan using multiple control options over several years to achieve effective control (DeKeyser et al. 2010; Jacobs et al. 2006). For example, creeping thistle roots can spread horizontally up to 4.5 meters and vertically down to 6 meters and can access water and nutrients well below the roots of many native plants (AISC 2014a). The lateral roots of field bindweed can extend 60 m outward within the top 30-40 cm of soil (AISC 2014b). Rhizomatous species such as these are not well controlled by cultivation as the root fragments produced will develop into new plants; however, properly timed mechanical control can be effective.

During construction and post-flood operations, Alberta Transportation and AEP will pro-actively manage the PDA to limit opportunities for weed and alien invasive plant establishment and promptly control weeds to limit spread to neighboring properties. Control of alien invasive species will focus on alien invasive forbs in agronomic areas of the PDA as the alien invasive grasses are commonly seeded for agronomic use (AISC 2021; DeMaere et al. 2012) and are currently abundant in tame grassland in the PDA. Alien invasive forbs and grasses will be controlled in native areas of the PDA (Figure 7-2). In addition to the alien invasive species observed in the PDA, non-native species commonly a concern for agriculture that may emerge, such as lamb's-quarters (*Chenopodium album*), wild buckwheat (*Fallopia convolvulus*), summer-cypress (*Kochia scoparia*) and stinkweed (*Thlaspi arvense*), will also be targeted for control if observed. Weeds will be controlled or removed from the PDA, except those lands still privately held under URW, following the Alberta *Weed Act* regulations. Landowners of private land held under URW will be responsible for controlling or removing weeds as per the Alberta Weed Act Regulations Annual alien invasive plants can help protect seedlings by improving moisture conditions and providing shade. These plants will not be targeted for control in the PDA provided the abundance is not interfering with desired plant establishment and growth.

Table 7.1 Noxious Weeds Observed in the PDA

Scientific Name	Common Name	Propagation[a]	Life Cycle	Abundance					Number of Occurrences Intersecting Construction Footprint	Spatial Distribution
				# Observations	Average Cover (%)	Minimum Cover (%)	Maximum Cover (%)	Standard Deviation (%)		
Cirsium arvense	creeping thistle	rhizomes, root fragments, seeds	perennial	59	1.7	0.1	10.0	2.4	21 (diversion channel, highway, off-stream dam, diversion channel, access road)	NE-03-24-04-W5; NE-10-24-04-W5; NE-13-24-04-W5; NE-14-24-04-W5; NE-18-24-03-W5; NE-22-24-04-W5; NE-23-24-04-W5; NE-24-24-04-W5; NE-26-24-04-W5; NE-27-24-04-W5; NW-03-24-04-W5; NW-13-24-04-W5; NW-17-24-03-W5; NW-18-24-03-W5; NW-23-24-04-W5; NW-24-24-04-W5; NW-26-24-04-W5; NW-27-24-04-W5; SE-13-24-04-W5; SE-14-24-04-W5; SE-19-24-03-W5; SE-23-24-04-W5; SE-24-24-04-W5; SE-26-24-04-W5; SE-27-24-04-W5; SW-10-24-04-W5; SW-13-24-04-W5; SW-19-24-03-W5; SW-23-24-04-W5; SW-24-24-04-W5; SW-26-24-04-W5
Bromus tectorum	downy brome	seed	annual	3	1.4	0.1	2.0	1.1	3 (diversion channel)	SW-10-24-04-W5; NE-10-24-04-W5
Convolvulus arvensis	field bindweed	rhizomes, root fragments, seeds	perennial	1	0.3	0.3	0.3	N/A	1 (off-stream dam)	NE-13-24-04-W5
Cynoglossum officianale	hound's tongue	seed	biennial	1	0.1	0.1	0.1	N/A	0	SE-13-24-04-W5
Ranunculus acris	tall buttercup	seed	perennial	1	3.0	3.0	3.0	N/A	0	NW-03-24-04-W5
Sonchus arvensis	perennial sow thistle	rhizomes, root fragments, seeds	perennial	15	2.7	0.1	15	4.0	2 (temporary workspace, off-stream dam access road)	NE-18-24-03-W5; NE-23-24-04-W5; NW-03-24-04-W5; NW-13-24-04-W5; NW-18-42-03-W5; NW-24-24-04-W5; NW-27-24-04-W5; SE-13-24-04-W5; SE-14-24-04-W5; SE-19-24-03-W5; SE-23-24-04-W5; SE-24-24-04-W5; SE-2W5-24-04-W5; SW-24-24-04-W5

NOTE:
[a] Alberta Invasive Species Council 2014



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

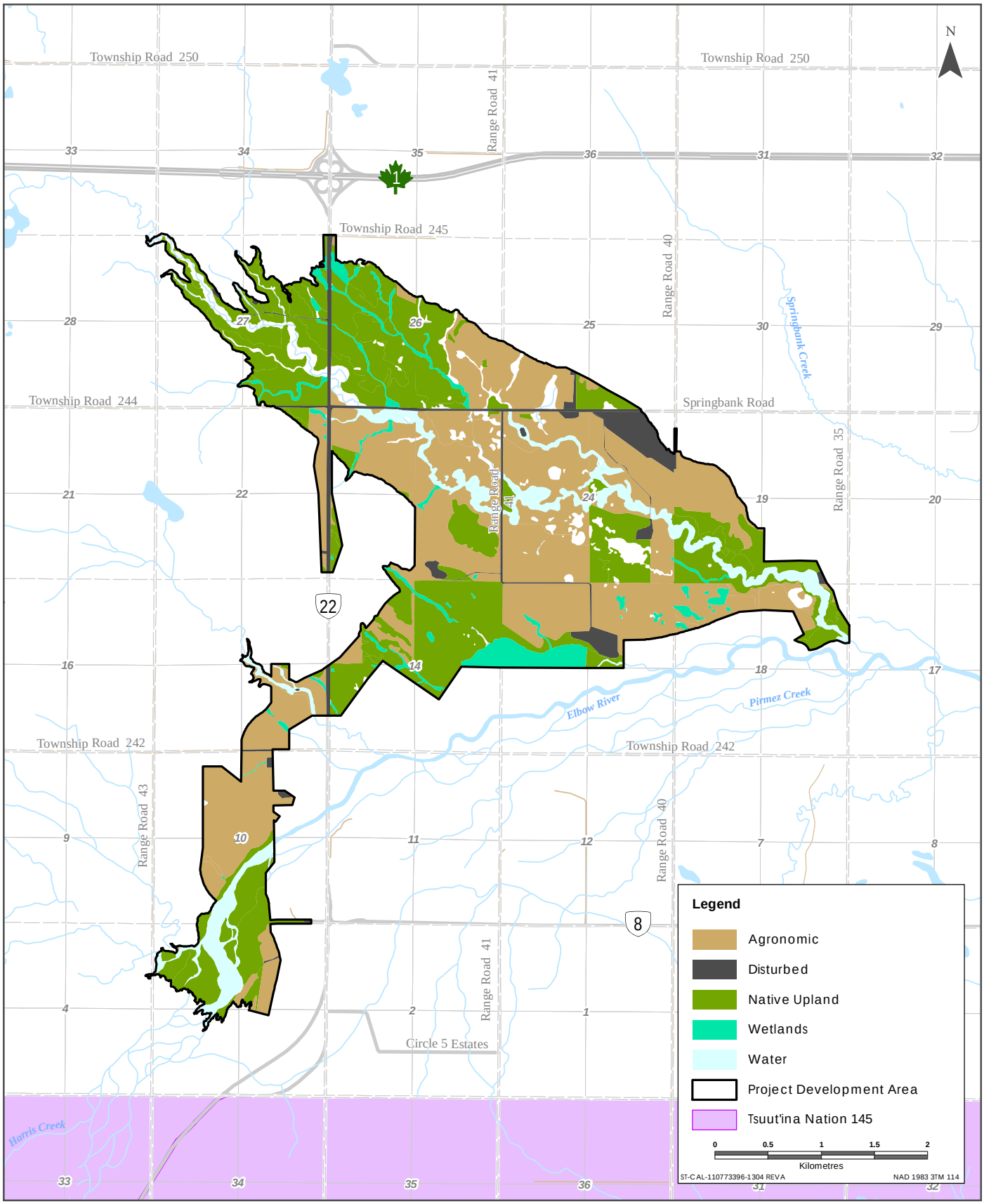
1/19/2022

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Noxious Weed Presence

Figure 7-1



Sources: Base Data - Government of Canada. Thematic Data - Government of Alberta

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

11/8/2021

Land Cover Types in the PDA

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT

Figure 7-2

An integrated weed management plan using multiple prevention and control methods applied over multiple seasons will be used to manage weeds and alien invasive plant species in the reservoir and at flood control structures. Multiple control methods will improve control effectiveness (AISC 2014a, b, c, d, e and f; Jacobs et al. 2006; Grekul and Bork 2007), improve revegetation success, and help meet provincial regulatory requirements.

7.1 PREVENTION

Preventing the introduction, spread, or re-introduction of weeds and alien invasive plant species is the most efficient and cost-effective method of controlling weeds and alien invasive plants.

During construction, the contractor will implement controlled entry/exit points where vehicle and equipment inspection and cleaning will occur. At these designated controlled entry/exit points, vehicles and equipment will be inspected and cleaned of soil and any plant material prior to entering or leaving the PDA. Only clean vehicles and equipment free of soil and plant material will be allowed in the PDA or allowed to leave the PDA. Vehicles and equipment not free of soil and plant material shall either be turned away from the construction area or cleaned at the Contractor provided station.

Inspection and cleaning stations will be established in areas lacking designated weeds and alien invasive species. Any weeds and alien invasive species not present because of agricultural land use identified at designated inspection and cleaning stations will be destroyed prior to site use. Sites will be regularly inspected by an independent Environmental Monitor during construction and weed control and removal conducted as needed. Weeds along travel routes will be controlled or removed prior to route use. Routes will be regularly inspected for weeds during construction and control conducted as needed. Aggregate should be sourced from a provider practicing good weed control, such as regular monitoring and removal of plants prior to flowering. Locations in which aggregate is used on the Project will be monitored for weed establishment and control conducted as needed.

During dry operations and post-flood, all vehicles and equipment will be inspected for obvious accumulation of dirt or vegetation debris and cleaned, when necessary..

The following measures will also be used at the inspection and cleaning sites during construction:

- Runoff debris from washing stations shall be contained within the inspection and cleaning area with vehicle wash water either allowed to infiltrate or disposed of offsite at an approved facility.
- At the end of use, soil and aggregate within the inspection and isolation station shall be stripped, removed from the PDA, and disposed of offsite at an approved facility.

Appropriate cleaning methods will include one or more of the following:

- **Pressure air/ steam cleaning**: high pressure air or steam cleaning until no visible soil or plant material remains. This approach will limit ground wetting and reduces the risk of recontamination from mud under vehicles.
- **Pressure washing**: high pressure water cleaning until no visible soil or plant material remains. Used wash water will be contained and managed to prevent re-contaminating vehicles and equipment.
- **Manual cleaning:** brooms or brushes used to physically remove soil. Recommended for frozen conditions, or lightly soiled vehicles, equipment, tools and clothing.

The Alberta Clubroot Management Plan (Alberta Clubroot Management Committee 2014) will be reviewed and recommended sanitation measures, including items identified above, implemented prior to accessing agricultural fields and areas recently converted to tame grassland dominated by agronomic plants intersected by the Project.

7.2 CONTROL

Weed control will follow Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 01391 – Environmental Protection*. Accepted methods will be used as needed during construction, dry operations, and post-flood operations and will be guided by the weed and alien invasive plant species biology, site conditions (e.g., amount of plant cover, whether areas are native or agronomic, and revegetation plans). Alien invasive plants currently present in native areas and alien invasive forbs in agronomic areas within the PDA will also be managed following the weed management plan (Table 7.2). See Figure 7-2 for locations of native and agronomic land cover.

Control and prevention of the introduction and spread of weeds and alien invasive plants will be evaluated on a site-specific basis. A combination of the following weed and alien invasive plant control methods are recommended:

- mechanical control, such as mowing (preferred, if timed correctly prior to seed set)
- hand-picking and disposal (preferred, although labour-intensive, it may be the best option for steeper slopes or other challenging sites)
- chemical control, such as targeted herbicide application, in accordance with IAAC Condition 8.2
- cultural control of weeds (i.e., seeding of competitive species)

Control will be conducted until selected weed control targets are achieved (Table 7.4, Table 11.1, and Table 11.2) and as required following site monitoring periods.

A weed survey of construction areas prior to construction (or shortly following plant emergence after the start of construction) will be done by the independent Environmental Monitor to confirm the current extent of noxious weeds in areas of planned disturbance so management activities can be appropriately planned, and control measures implemented prior to ground disturbance or active weed growth. Additional inspections and control will be done throughout construction, post-construction, dry operations, and post-flooding. See Section 7.3 Site Inspection and Maintenance for additional details for site inspection and control timing.

Table 7.2 Noxious Weed and Alien Species Control Activities and Timing

Timing	Target Area	Primary Control Activity	Target Species
Construction			
Starting early spring and ongoing as required (late May until mid-September)	Entire PDA (where deemed necessary)	Mechanical control (mowing)	creeping thistle
			perennial sow thistle
			hound's tongue
			tall buttercup
Starting early spring and ongoing as required (late May until mid-September)	Targeted species populations	Mechanical control (hand pulling)	downy brome
			field bindweed
			hound's tongue
			tall buttercup
Spring, summer, early fall until 2-3 weeks prior to seeding (June until 2-3 weeks prior to seeding)	Targeted species populations	Broadcast or targeted herbicide application[b]	creeping thistle
			perennial sow thistle
Post-Construction (three-year) and Dry Operations			
Fall	Entire Project area (where deemed necessary)	Competitive re-seeding	noxious weeds and alien invasive species[a]
Twice annually during the growing season (early June to mid-September), for 5 years post-construction, or until revegetation targets are achieved	Targeted species populations	Mechanical control (mowing)	creeping thistle
			perennial sow thistle
			hound's tongue
			tall buttercup
			field bindweed
			hound's tongue
			tall buttercup
Ongoing, as required	Where required	Broadcast or targeted herbicide application[b]	noxious weeds[c]

Table 7.2 Noxious Weed and Alien Species Control Activities and Timing

Timing	Target Area	Primary Control Activity	Target Species
Post Flood			
Starting early spring and ongoing as required until mid-September in year of flood following release of flood waters and area is safe to access	Entire Project area	Mechanical control Broadcast or targeted herbicide application[b]	noxious weeds and alien invasive species[1] prohibited noxious weeds[c]
Twice annually during the growing season (early June to mid-September), for 5 years post-flood reclamation, or until revegetation targets are achieved	Entire Project area	Competitive re-seeding Mechanical control (mowing)	noxious weeds and alien invasive species[a]
	Where required	Broadcast or targeted herbicide application[b]	prohibited noxious weeds[c]
Ongoing, as required	Where required	Broadcast or targeted herbicide application[b]	noxious weeds and alien invasive species[a]

NOTES:

[a] Alien invasive forbs are to be controlled in agronomic areas. Alien invasive grasses and forbs are to be controlled in native areas.

[b] Broadcast herbicide application should be limited to abundant dense weed occurrences (e.g., several patches or continuous uniform occurrences) where possible to reduce damage to desired vegetation (IAAC approval condition 8.2).

[c] No prohibited noxious weeds have been observed in the PDA but may establish in time or following disturbance, including flooding.

7.2.1 Mechanical Control

Several courses of mechanical control, mowing or hand pulling, may be conducted over the growing season (late May to mid-September) during construction and post-construction with control targeting noxious weeds before seed dispersal (Table 7.3). Mowing creeping thistle and perennial sow thistle populations once to twice monthly is recommended (AISC 2014a and c). All cut material should be removed from the site following mowing to avoid spreading seed. Mechanical control should be repeated throughout the growing season as required to control noxious weeds. Each mowing activity should consider the stage of growth and blooming of the targeted noxious weeds at the time of the activity to limit seed spread. Control is best conducted prior to seed development.

In addition to mowing, hound's tongue and tall buttercup plants can be removed by hand. Hand pulling only is recommended for field bindweed as mowing is not effective (AISC 2014b). Hand pulling may be done throughout the growing season and at regular intervals between the flowering and seed maturation period, which can extend from May to September (AISC 2014b, d, e and f; Royer and Dickinson 2007). As much of the below-ground root system as possible should be removed, plants bagged and disposed at an approved landfill. Protective clothing such as gloves and long sleeves should be worn when handling tall buttercup as the plant contains an irritating oil that can cause blistering and redness of the skin (AISC 2014f). Plant removal methods for individual weed occurrences will be identified by a Professional Agrologist prior to control.

Table 7.3 Recommended Mechanical Control Actions

Scientific Name	Common Name	Action	Timing	Frequency
Cirsium arvense	creeping thistle	Mowing	Late May to mid-September	As determined by professional biologist or agrologist in consultation with AEP
Bromus tectorum	downy brome	Mowing[a]	Late May to mid-October	As determined by professional biologist or agrologist in consultation with AEP
Convolvulus arvensis	field bindweed	Hand-pulling	Late May to mid-September	As determined by professional biologist or agrologist in consultation with AEP
Cynoglossum officianale	hound's tongue	Mowing or Hand-pulling[b]	Late May to mid-September	As determined by professional biologist or agrologist in consultation with AEP
Ranunculus acris	tall buttercup	Mowing or Hand-pulling[c]	Late May to mid-September	As determined by professional biologist or agrologist in consultation with AEP
Sonchus arvensis	perennial sow thistle	Mowing	Late May to mid-September	As determined by professional biologist or agrologist in consultation with AEP

NOTES:

[a] Smooth brome should be cut at approximately 4 cm above the soil surface (Stacey et al. 2005).

[b] In loose soil, hand-pulling is effective; in harder soils, cut as close to soil level as possible (AISC 2014e).

[c] Mowing prior to seed set is essential; small infestations can be hand-pulled (AISC 2014f).

7.2.2 Herbicide Control

Herbicide application may be necessary and more effective than mowing or cultivation if weeds are abundant and widespread, particularly for creeping thistle and perennial sow thistle (Table 7.2). Herbicide treatments that can reach the roots are cost effective, efficient, and suitable for species that are difficult to control mechanically (i.e., propagate by roots and rhizomes). Each herbicide application should be coordinated to follow 2-3 weeks after mechanical control, if required, and removal of mowed material to improve uptake of herbicide by new plant growth. Plants must be actively growing when herbicides are applied (Throckmorton 2010; United States Department of Agriculture [USDA] 2015). Herbicides are available to treat all of the weeds observed in the PDA (Alberta Agriculture and Forestry 2011, 2012, AISC. 2014b, AISC. 2014c, AISC. 2014f, Upadhyaya et al. 1988).

If the use of herbicides is deemed necessary, a licensed industrial pesticide applicator will select and apply all herbicides. Herbicide application will be in compliance with the weed control plan, and the *Environmental Code of Practice for Pesticides* (GoA 2010). Broad spray herbicide application will be a last resort as it may kill desirable plants and deter traditional land use. Following seeding, broadcast spraying should be avoided to minimize the possibility of spray drift and unintentional damage to native plants. A wick or hand applicator will be evaluated for herbicide application following re-seeding, including cover crops, where mowing is not effective. Herbicide will not be broad sprayed within 30 m of plant species or ecological communities of management concern, wetlands or waterbodies. Application in these areas, if needed, should be done by spot spraying or wicking. Mowing or hand picking are the preferred control methods within 30 m of plant species and ecological communities of management concern, wetlands and waterbodies. Herbicides will not be applied within 30 m of traditional plant collection locations identified by affected Indigenous group during the pre-construction site visit. Weeds in this buffer will be controlled by mowing, hand pulling or competitive seeding.

Dead vegetation due to herbicide application can be left on site provided the plants do not have allelopathic properties. Perennial sow thistle (Sonchus arvensis) has been shown to have allelopathic effects on other plants (Bashir et al. 2018) and dead plant parts of this plant should be removed from the PDA following control treatment. Retained dead vegetation of other weeds could contribute organic matter to the soil and inhibit seed germination by reducing bare ground, provided the plants do not contain mature or nearly mature seeds.

7.2.3 Cultural Control

Cultural control (e.g., competitive seeding or grazing) may also be used to help control and limit weed abundance in the PDA. Cultural controls, combined with other measures, reduce available space, moisture and nutrients for weeds and alter species competition (USDA 2008, Lancaster et al 2018). General seeding and establishment of vegetation cover and supplemental seeding in areas of weed and alien invasive plant removal will be done following construction, and during dry operations and post-flood as needed. Alberta Transportation

and/or AEP will pro-actively seed areas of sediment, including a cover crop if needed, to reduce opportunities for weed establishment and the need for broad herbicide application. Where used, the cover crop will be seeded as soon as possible. This will give a competitive edge to desired species and will reduce weed growth.

Grazing permits may be issued, on an as required basis, for pasture land within designated zones by AEP, with input from the First Nation Land Use Advisory Committee. Land use, such as grazing, will help control weed abundance by maintaining healthy plant community conditions (e.g., reducing litter) and reduce the risk of wildfire. Weed management and fire control will vary among years and therefore grazing stocking rates and grazing areas will be determined on an annual basis; stocking rates will consider manure production rates and effects to water quality. Grazing permits will be issued by AEP (the operator) on an as required basis; grazing may not be necessary every year. Animals used for grazing will not be left in the reservoir year-round. If a grazing permit is issued, animals will be brought in after the flood period when it is deemed safe by AEP (the operator) and removed before the following years' flood period.

7.3 SITE INSPECTION AND MAINTANENCE

Weed and alien invasive species inspections will be conducted during construction at the following intervals:

- Entry and exit inspection/cleaning sites – minimum of bi-weekly during the growing season (i.e., May – September)
- Active construction footprint – minimum of bi-weekly during the growing season
- PDA outside of active construction footprint – minimum of twice per year in the growing season

Topsoil and subsoil piles will be monitored for weed growth during construction and corrective measures (e.g., spraying, mowing, hand-pulling) implemented to avoid growth and establishment of regulated weeds. Topsoil and subsoil piles will be pro-actively seeded or covered to limit opportunities for weed establishment. Reclaimed areas will be reassessed in the spring of the following year and additional weed control conducted where control targets have not been met. Bare areas will be re-vegetated to help limit weed establishment.

During dry operations, weed inspections will be conducted at a minimum of twice per year during the growing season (i.e., May – September). Post-flood, weed inspections will be done a minimum of bi-weekly in the growing season following flood release of flood waters. Weed inspections will be done a minimum of twice annually during the growing season after the first year post flood until revegetation targets are achieved. If weed and alien invasive species abundance targets are not met by the designated timelines (see Table 11.1 and Table 11.2), additional control inspection will be conducted. Remaining un-flooded areas will be inspected for weeds twice per growing season post-flood.

Minimum weed and alien invasive species abundance targets for construction, dry operations and post-flood are provided in Table 7.4. Weeds were frequently observed in the PDA (Table 7.1) and full removal may not be possible. Full removal could interfere with other land uses, particularly harvesting of traditional plants. Alberta Transportation and AEP are working with Rocky View County to determine suitable long-term weed and alien invasive species abundance targets and best management approaches may be adjusted. AEP will consult further with Rocky View County, and Alberta Agriculture, Food and Rural Development, prior to dry operations and following flood events.

Maintenance will include limiting litter accumulation (e.g., grazing), revegetation of areas with poor vegetation cover and additional weed control measures.

Table 7.4 Weed Management Targets

Attribute	Minimum Target	Timeframe
Noxious weed abundance	No prohibited noxious species present	All years post-seeding
	Noxious weed cover is 10% or less, and density distribution[a] is level 1, 2 or 3	Year 3 post-seeding
Alien invasive species abundance	Less than 10% total cover of alien invasive grasses and forb species in native areas, and less than 10% total cover of alien invasive forbs in agronomic areas.	Year 3 post-seeding

NOTES:

[a] See Appendix C for density distribution definitions.

8.0 EROSION AND SEDIMENT MANAGEMENT

8.1 CONSTRUCTION

8.1.1 Erosion and Dust Control

Construction may cause changes in terrain stability as well as soil quality and quantity. Terrain stability is associated with quantity in terms of wind and water erosion. The quality of soil may be affected by admixing, compaction and rutting during construction.

Where required, areas of exposed soil will be protected from wind and water erosion during construction using a combination of the following mitigation measures:

- Installing silt fencing
- Spraying erodible areas with water to stabilize the surface
- Spraying erodible areas with a tackifying agent
- Texturing slopes to reduce water velocity

Areas more susceptible to wind and water erosion (e.g., slopes and drainage courses) will be identified prior to vegetation clearing and construction. Areas of exposed soils will be regularly inspected, and mitigation measures repaired and supplemented as needed. Areas will be graded to direct drainage away from wetlands, to the degree possible. Reclaimed areas will be re-contoured to match surrounding topography and revegetated. Areas of vegetation removal will be revegetated following construction and physical mitigation measures such as silt fencing maintained until vegetation has established. Cover crops will be used to help control erosion while areas disturbed by construction are revegetated.

Proper soil handling can preserve soil quality. Soil handling should take place when the ground surface is dry and trafficable (i.e., dry or frozen) to reduce the potential for admixing, compaction and/or rutting that might result in adverse effects on soil quality (AEP 1998).

If fill from the diversion channel does not have the volume required for construction of Project components, Alberta Transportation has identified a borrow source in sections 19-024-03-W5M and 240-024-04W5N. Prior to excavation of the borrow pit, a soil and vegetation survey must be completed according to guidelines provided in Alberta Transportation Pre-Disturbance Assessment Guide for Borrow Excavations (Alberta Transportation 2013). The guidelines provide information into the number of soil inspection sites required, soil information to be collected and vegetation details to be recorded.

8.1.2 Shelter Belts

If requested by directly adjacent landowners, trees or shelter belts may be planted along properties (residences) directly adjacent to the PDA. Agriculture and Agri-Food Canada design guidelines (2010) will be used for shelter belt placement and spacing. Species planted will be locally sourced and native to southern Alberta.

8.2 POST-FLOOD

Following release of water from the reservoir, AEP will access the site and inspect post-flood conditions in the reservoir to determine needed actions to manage deposited sediment and maintain integrity of reservoir operations. AEP's immediate focus will be on the safety of workers and the public as well as the integrity of reservoir operations. At the same time, AEP will begin evaluating erosion control and stabilization requirements, and will begin planning revegetation activities. Erosion control, stabilization and revegetation activities will commence once safe to do so and will continue as needed to manage fugitive dust and support revegetation.

Sediment cleanup will only involve moving sediment and debris within the reservoir to maintain water flow and allow proper functioning during future operations. Sediment and debris that would affect operation of the diversion structure will be removed.

Sediment will be evaluated for potential contaminants, erosion, and dust. A risk analysis will be conducted of areas with sediment and management actions selected.

8.2.1 Erosion and Dust Control

The reservoir will be visually inspected for erosion concerns at safely accessible access points while flood waters are released and in greater detail following complete release of water from the reservoir. Erosion and stabilization activities will commence once identified areas of concern can be safely accessed. Access in areas of low trafficability could be improved through the use of walking, all-terrain vehicles or low ground pressure wheeled or tracked vehicles, and use of soil moisture probes or protective ground matting where needed.

Following management and repairs of major project components, areas of higher erosion potential in the reservoir will be inspected and stabilized, Areas of higher potential include:

- sandy and clay soils
- areas of low vegetation cover
- areas along drainage courses

Areas with evidence of soil movement or low vegetation cover at risk of erosion by air or water may be repaired or stabilized using one of the following techniques:

- tackifier
- cover crop
- soil amendments
- revegetation
- soil roughening

The soil surface may also be roughened (e.g., ripping or listing) if other control options are not feasible for managing wind erosion (i.e., conditions are too dry or wet to establish a cover crop or desired agronomic or native seed mix). Roughening the soil surface reduces dust emissions and soil loss by reducing the ability of wind to move soil particles (GoA ND). Soil amendments should be used for spot treatments and tackifier, cover crops and desired seed mixes applied for larger areas. Tackifier effectiveness will be regularly assessed and reapplied where needed.

Areas too large for tackifier application or areas of bare soil that cannot be seeded prior to the fall following a flood event should be roughened. Roughing should be done to either expose soils less prone to erosion, such as non-erodible clods, or create ridges that disrupt air movement.

Roughening strips should run perpendicular to the prevailing wind direction, which are generally westerly to northwesterly, with roughening starting on the upwind side of the reservoir, Strips should be about 5 m apart and resulting ridges equaling 25-30 cm in height.

Straw crimping may be used to help maintain the roughened surface and further protect against wind erosion. Straw should be shredded and hairpinned with a disk to anchor against wind loss. Straw should be applied at 2-4 tonnes/ha. Straw used for crimping must be tested for weeds prior to use. Weed free straw should be used whenever possible.

Physical erosion control measures such as silt fences and straw wattles may also be used to control erosion. Physical erosion control measures will be regularly inspected,, repaired or replaced as needed and left in place until sufficient vegetation cover establishes to control erosion.

See Section 9.0 for seed application and soil treatments for site revegetation requirements, including cover crop application.

Areas may be left without repair or stabilization in consideration of the following criteria:

- no signs of erosion (e.g., rills or other active soil movement) are present
- area has established vegetation cover at a level suitable for managing erosion, or needed cover is likely to establish within the current growing season
- deposited sediment is thin and is not impeding vegetation growth
- weed and alien invasive species cover is below minimum target (see Table 7.4)

Within days of the reservoir emptying, an air monitoring station will be installed along the PDA boundary to monitor ambient dust concentrations. Details on air quality monitoring are presented in the Air Quality Monitoring Plan for the Project.

9.0 REVEGETATION

Areas disturbed by construction, including soil stockpiles, will be pro-actively revegetated. Vegetation cover in temporary workspaces will be evaluated at the completion of use and actively revegetated if cover is below desired targets (see Section 9.1). Areas not meeting vegetation targets will be seeded using conventional methods (e.g., drill seed, hydroseed, or broadcast) as determined by the Environmental Monitor.

Following reservoir flood operation and draining of flood waters, affected areas will be inspected, repaired, and revegetated as needed. Inspection and monitoring will consist of two phases: initial monitoring and establishment and maintenance monitoring. The following process will be used to identify if revegetation is needed and where:

1. Initial Monitoring
    a. no active revegetation – areas have needed cover or are likely to achieve needed cover in one growing season (seeds germinating and appear healthy), no signs of erosion, weeds below targets, deposited sediment is thin or does not appear to be impeding desired vegetation growth.
    b. stabilize and repair areas (e.g., seed application with tackifier, weed control) – erosion is evident (rills, active soil movement), weed cover is above targets.
    c. Where appropriate, harrow, fertilize and apply seed to promote re-vegetation – areas of sediment impeding vegetation growth (e.g., surface crust, poor nutrient status)
2. Establishment and Maintenance Monitoring
    a. no active revegetation – areas have appropriate cover (living and non-living [i.e., litter]) and desired diversity for the monitoring period (i.e., time since reclamation), no signs of erosion, weed cover is below target.
    b. stabilize and repair areas (e.g., seed application with tackifier, weed control) – erosion is evident (rills, active soil movement), weed cover is above targets.
    c. fertilize and apply seed to promote re-vegetation – areas not achieving desired cover (living and non-living) and desired diversity for the monitoring period. The need for soil amendments and fertilizer will be determined following soil recommendations from the Soil Quality Working Group (1987). To determine if fertilizer or soil amendments are required, soil can be sampled and sent to a lab for analysis and compared to criteria in Table 6 in the Soil Quality Criteria Relative to Disturbance and Reclamation (Soil Quality Working Group 1987) which provides criteria for soil quality (i.e., pH, salinity, organic carbon). Alternately, soil samples may be sent to an appropriate commercial laboratory (such as ALS Laboratory Group, Down To Earth Labs, AGAT Labs), tested and recommended fertilizer and soil amendments rates obtained. Soil sampling will be approved by a Professional Agrologist if testing is conducted.

9.1 TARGETS AND GOALS

Revegetation of areas disturbed by the Project is guided by the proposed end land use for the site (see Section 1.0). Ideally, and to the degree practical, the goal of revegetation is the establishment of self-sustaining vegetation cover consisting of desired agronomic or native species that are compatible with the vegetation of land adjacent to the PDA. Revegetation will take place initially post-construction and will also be evaluated post-flood.

Areas of the PDA disturbed by construction or flooding will be reclaimed to either agronomic or native cover depending on pre-disturbance conditions and location. Desired revegetation types per feature are identified in Table 9.1. The Vegetation Plan does not target the re-establishment of existing conditions or restoration of native communities. Attempts will be made to return native vegetation areas affected by the Project to native vegetation, but possibly with different plant composition. Restoration is not proposed for all Project affected native areas, including fescue grassland, as efforts would be lost with future flood events.

Vegetation establishment, plant diversity, weed abundance and litter accumulation will be the focus of monitoring with the following specific targets:

1. Native communities temporarily affected (see Figure 7-2 for locations of native communities):
    a. Revegetated area is dominated by native plant species and ground cover of each seeded species is within 10% of desired cover. Total vegetation cover is 40% or greater[1].
    b. No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and do not account for more than 10% % of the total vegetation cover.
    c. Litter cover is similar to adjacent undisturbed areas of the target community type and signs of erosion are not present
2. Previously disturbed (e.g., industrial, transportation and rural residential land unit types,) agricultural lands (e.g., annual crop, hayland, tame grassland) temporarily affected:
    a. Total vegetation cover is 60% or greater
    b. No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and do not account for more than 5% of the total vegetation cover
    c. Litter cover is similar to adjacent previously disturbed areas and signs of erosion are not present

[1] NOTE: Native plant percent cover target reduced from draft Plan following further review of pre-disturbance data and incorporation of litter quality and quantity targets.

3. Permanent Project disturbance (i.e., off-stream dam, floodplain berm:
    a. Vegetation cover equals 80% or greater
    b. No signs of erosion
    c. No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and does not account for more than 5% of the total vegetation cover

Table 9.1 Project Features and Revegetation

Disturbance Type	Feature	Native Species	Agronomic Species	Wetland Species	Trees and Shrubs	Cover Crop[a]
Temporary[b]	Access roads	√	√	√	√	√
	Laydown areas	√	√	-	-	√
	Soil stockpiles	-	√	-	-	√
	Borrow areas	-	√	√	√	√
	Portion of Highway 22[c]	-	√	-		√
	Portion of Elbow River diversion channel and floodplain berm[d]	-	√	-	-	√
Permanent Project Components	Access roads[e,f]	-	-	-	-	-
	Diversion structure[g]	-	√	-	-	√
	Floodplain berm[g]	-	√	-	-	√
	Diversion channel	-	√	-	-	√
	Emergency spillway[f]	-	-	-	-	-
	Off-stream dam[h]	-	√	-	-	√
Off-Stream Reservoir	Post-construction and post-flooding	√	√	√	√	

NOTES:

[a] Cover crops may be sown to stabilize soil and reduce erosion prior to seeding with target species.

[b] Temporary disturbances will occur at various times during Project construction and will be progressively reclaimed once no longer required to support the project construction.

[c] The replaced portion of Highway 22. Once the new lanes of Highway 22 are in service, the existing lanes that have been replaced will be closed and decommissioned

[d] The channel and berm are required for a temporary diversion of the Elbow River and floodplain berm to allow construction of the service spillway. The channel will be restored to its original location and the berm removed once construction of the service spillway is complete.

[e] Permanent access roads are adjacent to the diversion channel, on the berm and adjacent to the inlet.

[f] No revegetation is planned for this permanent feature.

[g] The Diversion Structure will be partially revegetated to agronomics while some parts will remain as an unvegetated permanent riprap structure

[h] No trees or shrubs are to be planted on the floodplain berm or the off-stream dam due to dam safety rules

Disturbed areas will be monitored for a minimum of two years post-construction and a minimum of two to five years post-flooding. Monitoring will continue if targets are not achieved, or conditions are not reasonably stable by the end of the minimum monitoring period. See Section 10.0 for further monitoring details and reclamation progress targets.

AT and AEP will continue working with Rocky View County to determine best management practices for weeds, including noxious weed abundance. Targets may be revised based on site conditions and discussions with the County and Alberta Agriculture, Food and Rural Development.

9.2 SOIL PREPARATION

9.2.1 Project Construction Areas

Site preparation will follow the specifications specifically created for SR1 based on Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 02930 – Soil Erosion Protection and Section 02910 - Topsoil Placement*. After rough grading of permanent features, areas where soil replacement has been completed will be de-compacted prior to revegetation, as directed by the environmental inspector. Where cultivation is deemed appropriate, cultivating in two passes at 90 degrees to each other to a depth of 20 cm to 25 cm is typically sufficient to break up any hardpan layer that would impede root penetration and moisture movement. Topsoil and, where applicable, subsoil that has been salvaged and stockpiled during construction will be replaced on the site prior to de-compaction. Subsoil and topsoil that was salvaged from a temporary disturbance area (e.g., the construction laydown areas) will be replaced in the same area. Where topsoil or subsoil salvage volumes are in excess of the replacement needs, the surplus will be applied to any areas where it might improve the potential for revegetation success. One example is the south-facing slope of the dam where an additional 10 cm of soil replacement has been prescribed to improve the likelihood of vegetation establishment. South-facing slopes receive more solar insolation than north-facing slopes, tending to increase evapotranspiration and cause these locations to be drier. Increasing the depth of the topsoil/upper lift should provide more soil moisture holding capacity to support revegetation.

After the subsoil and topsoil replacement operations are finished, the surface will be track-packed to stabilize it before seeding. Any erosion issues identified will follow Alberta Transportation Erosion and Sediment Control Manual (2011 to limit the potential for erosion.

9.2.2 Off-Stream Reservoir and Post-Flood Sediment

Site preparation in the off-stream reservoir may occur post-flood and will depend on the trafficability, soil moisture conditions and the texture and depth of sediment deposition. If soil conditions are appropriate, soil preparation may not be required. If required, site preparation will be progressive as soil and sediment dry and trafficability across the off-stream reservoir increases. Access in areas of low trafficability could be improved through the use of all-terrain vehicles or low ground pressure wheeled or tracked vehicles, and use of soil moisture probes or protective ground matting where needed.

Once sediment or soil is trafficable, soil preparation methods for seeding may include harrowing and cultivating, and soil amendments such as fertilizer, biochar, or compost. Soil amendments such as fertilizer, biochar or compost may be required in sediment with low organic matter or low fertility.. Harrowing will be considered in areas where surficial vegetation debris would impede seeding.

9.3 SEEDING

Areas disturbed by project construction or flooding that are not likely to naturally revegetate within a single growing season, or are at risk of erosion, weed establishment or invasion by alien invasive plants will be seeded using one of the Project recommended seed mixes. Seed mix composition may need adjustment depending on seed availability and will be made in consultation with a qualified professional. Seed mixes will be adjusted while balancing need for vegetative cover, suppressing weed establishment and managing surrounding undisturbed areas. Species used will also be based on availability of required quantities.

Potential tree and shrub planting will be evaluated as per NRCB approval condition 9b, in areas of higher elevation less likely to flood and around the PDA perimeter, with trees and shrubs planted where appropriate to replace areas lost from Project flood operation. Other native plants, including traditionally used plants, are expected to naturally disperse to Project disturbed areas over time, however, plant abundance may differ from existing conditions.

9.3.1 Seed Mix Selection

9.3.1.1 Native Seed Mixes

Native areas disturbed by temporary Project activities will be revegetated using Alberta Transportation Design Bulletin No. 25, Grass Seed Mixtures Used on Highway and Bridge Projects (Alberta Infrastructure and Transportation 2005) for Seed Mix Zone 6 (Table 9.2) or one of the suggested custom mixes (Table 9.3 and Table 9.4). The mix for zone 6 has been used on recent Alberta Transportation projects near SR1, including the intersection of Highway 1 and Highway 22 and the Ring Road (Stoney Trail).

Custom native mix 1 is intended for use on lower wet topographic positions (Table 9.3) in fine textured soils (e.g., clays and silts). Reclaimed wetland areas will be monitored following reseeding and areas not meeting revegetation targets will be evaluated for re-seeding or live plugs.

Custom native mix 2 is intended for use on drier topographic positions with coarse soils (e.g., sand) or of thin soils (Table 9.4). These custom native seed mixes incorporate native plant species typical of transitional or successionally earlier grassland communities such as FPA4 (Foothills rough fescue – western porcupine grass [*Festuca campestris - Hesperostipa curtiseta*]) and FPA13 (Foothills rough fescue – Richardson's needlegrass [*Festuca campestris – Achnatherum richardsonii*]) of the Foothills Parkland (DeMaere et al. 2012) and should support later establishment of successionally mature communities.

Table 9.2 Alberta Infrastructure and Transportation Recommended Native Seed Mix

Common Name	Scientific Name	% Pure Live Seed (PLS) by Dry Weight
Slender Wheatgrass	*Elymus trachycaulum*	30
Smooth Wildrye	*Elymus glaucus*	20
Northern Wheatgrass	*Agropyron dasystachyum*	10
Tickle Grass	*Agrostis scabra*	10
Fringed Brome[a]	*Bromus ciliatus*	10
Tufted Hairgrass	*Deschampsia cespitosa*	10
Foothills Rough Fescue	*Festuca campestris*	10
NOTE: [a] Fringed Brome shall be coated		

Table 9.3 Custom Native Seed Mix 1 – Fine Textured Soils in Wet Topographic Positions

Common Name	Scientific Name	% PLS by Dry Weight
Smooth Wildrye	*Elymus glaucus*	30
Bluejoint	*Calamagrostis canadensis*	12
Tickle Grass	*Agrostis scabra*	8
Fringed Brome[a]	*Bromus ciliatus*	20
Tufted Hairgrass	*Deschampsia cespitosa*	10
Fowl Bluegrass	*Poa palustris*	20
NOTE: [a] Fringed Brome shall be coated		

Table 9.4 Custom Native Seed Mix 2 – Coarse Textured Soils in Dry Topographic Positions or Thin Soils

Common Name	Scientific Name	% PLS by Dry Weight
Slender wheatgrass	*Elymus trachycaulus*	20
Smooth Wildrye	*Elymus glaucus*	20
Parry's oat grass	*Danthonia parryi*	5
Fringed Brome[a]	*Bromus ciliatus*	10
Idaho fescue	*Festuca idahoensis*	15
Foothills rough fescue	*Festuca campestris*	10
Western porcupine grass	*Hesperostipa curtiseta*	20
NOTES: [a] Fringed Brome shall be coated		

Alterations will be made to these native seed mixes in consideration of site-specific conditions of vegetation communities and input from Indigenous groups as to species that are culturally important to them. Variations will support diversification of vegetation communities, traditional use, and wildlife habitat. Additional seed mixes will be guided by species composition of representative community types for the Foothills Parkland Natural Subregion (DeMaere et al. 2012) occurring in the PDA. AEP guidelines, such as Revegetation using Native Plant Materials Guidelines for Industrial Development Sites (AEP 2003), will also be used. Plant species currently included in the species mix may be substituted for the following native species:

- pine grass (*Calamagrostis rubescens*)
- Richardson's needlegrass (*Achnatherum richardsonii*)
- hairy wild rye (*Leymus innovatus*)

These grass species are dominant components of upland community types occurring in the PDA. Traditionally used forbs and shrubs could also potentially be included if requested by Indigenous groups.

Commercially available native seeds will be obtained from southern Alberta suppliers where possible and potential seed collection from the PDA will be evaluated. Preference will also be given to seed produced from southern Alberta stock. If seed produced from southern Alberta stock is not available, characteristics of the source stock will be evaluated for suitability and if needed an alternative species will be used. As considerable notification is required for procurement of seed and living material, seed supply contracts will be negotiated shortly after release of flood waters following Project operation.

9.3.1.2 Traditional Use Plants

Of the 77 traditional use plants identified in the EIA and in the Project-specific traditional use studies submitted following the March 2018 EIA filing, 41 were observed in the PDA, of which 39 are typically available as seed and may be suitable for revegetation, including 16 forb, two graminoid, 14 shrub, and five tree species (Table 9.5) (AMEC Earth & Environmental 2009, AMEC Earth & Environmental 2010, MacPherson Leslie & Tyerman LLP Lawyers 2011, Enbridge 2012, Trans Mountain Pipeline ULC 2013, National Energy Board 2015, Riversdale Resources 2015, Tsuut'ina Nation 2016 and Energy East Pipeline Ltd. 2016).

Traditionally used forbs will be used in combination with the native seed mixes to increase species diversity, help outcompete non-native species and weeds, and support traditional land use. Increased forb abundance is following natural disturbance (Henrichs 1997) and their use will mimic natural recovery. Trees and shrubs will be planted in higher topographic locations less likely to flood and around the PDA perimeter, where appropriate, to replace areas lost during Project flood operation.

Forb seeding will be staged to occur after initial native grass seeding and after weed control measures have been applied. Desired species used for revegetation will be finalized following discussions with Indigenous groups (see Table 9.5 for the list of traditional use plants available for seeding). Some of the traditional use plants can be aggressive competitors (e.g., yarrow [*Achillea* spp.], cattail [*Typha latifolia*]) and will be seeded in a lower cover, if selected for use.

Table 9.5 Traditional Use Plant Species Available for Seeding

Traditionally Used Name[a]	Scientific Name[b]	Growth Form[c]	Life Span[c]	Growth Rate[c]	Observed in PDA[d]
yarrow	*Achillea* spp.	forb	perennial	moderate	✓
onion (wild, prairie)	*Allium cernuum*	forb	perennial	-	✓
saskatoon berry	*Amelanchier alnifolia*	shrub	perennial	moderate	✓
sweetgrass	*Anthoxanthum hirtum*	graminoid	perennial	unknown	-
bearberry, kinnikinnick	*Arctostaphylos uva-ursi*	shrub	perennial	moderate	✓
sage (bush, prairie)	*Artemisia* spp.	shrub, forb	perennial	slow to rapid	✓
white birch	*Betula occidentalis*	tree	perennial	rapid	✓
paintbrush flower	*Castilleja* spp.	subshrub	perennial	rapid	✓
fireweed	*Chamerion* spp.	forb	perennial	rapid	✓

Table 9.5 Traditional Use Plant Species Available for Seeding

Traditionally Used Name[a]	Scientific Name[b]	Growth Form[c]	Life Span[c]	Growth Rate[c]	Observed in PDA[d]
bunchberry	*Cornus canadensis*	forb	perennial	slow	✓
red osier dogwood, nipiswasiskwatew	*Cornus stolonifera*	shrub	perennial	moderate	✓
Shooting star	*Dodecatheon* spp.	forb	perennial	unknown	✓
silverberry, wolf willow, white sage berry	*Elaeagnus commutata*	shrub	perennial	rapid	✓
wheat	*Elymus* spp.	graminoid	perennial	moderate to rapid	✓
strawberry	*Fragaria virginiana*	forb	perennial	-	✓
norther beadstraw	*Galium boreale*	forb	perennial	moderate	✓
old-man's whiskers	*Galium triflorum*	forb	perennial	moderate	✓
juniper (ground, berry)	*Juniperus* spp.	shrub	perennial	slow to moderate	✓
cohosh, honeysuckle	*Lonicera* spp.	shrub	perennial	rapid	✓
mint, peppermint, wild mint	*Mentha arvensis*	forb	perennial	moderate	✓
bergamont	*Monarda fistulosa*	forb	perennial	moderate	-
spruce	*Picea* spp.	tree	perennial	slow	✓
pine (lodgepole)	*Pinus contorta*	tree	perennial	rapid	-
cottonwood, black cottonwood, poplar	*Populus* spp.	tree	perennial	rapid	✓
aspen	*Populus tremuloides*	tree	perennial	rapid	✓
pin cherry	*Prunus pensylvanica*	shrub	perennial	rapid	-
chokecherry	*Prunus virginiana*	shrub	perennial	rapid	✓
northern gooseberry	*Ribes oxyacanthoides*	shrub	perennial	-	✓
currant	*Ribes* spp.	shrub	perennial	moderate to rapid	✓

Table 9.5 Traditional Use Plant Species Available for Seeding

Traditionally Used Name[a]	Scientific Name[b]	Growth Form[c]	Life Span[c]	Growth Rate[c]	Observed in PDA[d]
wild rose	*Rosa* spp.	shrub, forb	perennial	rapid	✓
wild raspberry	*Rubus idaeus*	shrub	perennial	rapid	✓
cloudberry, dewberry	*Rubus pubescens*	forb	perennial	unknown	✓
western dock	*Rumex occidentalis*	forb	perennial	unknown	✓
willow	*Salix* spp.	shrub	perennial	moderate to rapid	✓
soapberry, hoshum	*Shepherdia canadensis*	shrub	perennial	rapid	✓
goldenrod	*Solidago* spp.	forb	perennial	moderate to rapid	✓
smooth blue aster	*Symphyotricum laeve*	forb	perennial	unknown	✓
alsike clover	*Trifolium hybridum*	forb	annual/perennial	rapid	✓
red clover	*Trifolium pratense*	forb	biennial/perennial	rapid	✓
cattail	*Typha latifolia*	forb	perennial	rapid	✓
stinging nettle	*Urtica dioica*	forb	perennial	unknown	✓
cranberry	*Viburnum opulus*	shrub	perennial	slow	-

NOTES:

[a] Traditional names are those listed in Project-specific Traditional Use Studies as well as in the following sources (AMEC Earth & Environmental 2009, AMEC Earth & Environmental 2010, MacPherson Leslie & Tyerman LLP Lawyers 2011, Enbridge 2012, Trans Mountain Pipeline ULC 2013, National Energy Board 2015, Riversdale Resources 2015, Tsuut'ina Nation 2016 and Energy East Pipeline Ltd. 2016) that have the potential to occur within the RAA.

[b] Scientific names are inferred based on Moss 1983, Marles et al. 2000, Royer and Dickenson 2006 and professional judgement

[c] USDA (2020).

[d] EIA Volume 3A Section 10.2.2.3 Table 10.7

Commercial availability determined from Alberta Native Plant Council (2021).

Alberta Transportation has provided opportunities for Indigenous groups to relocate and harvest medicinal and ceremonial plants prior to construction. Alberta Transportation will notify Indigenous groups regarding project activities and schedules, including provision of Project maps and design components, and discuss key traditional harvesting periods prior to construction.

9.3.1.3 Agronomic Seed Mixes

Disturbed land units (e.g., industrial facilities, transportation and rural residential land unit types) and agricultural cover types that are disturbed by the Project will be reclaimed using a variation of Alberta Transportation's agronomic seed mix (Table 9.6). These land units are predicted to become tame grassland dominated by non-native agronomic plants.

Table 9.6 Alberta Infrastructure and Transportation Recommended Agronomic Seed Mix

Common Name	Scientific Name	% PLS by Dry Weight (%)
Pubescent Wheat Grass	*Agropyron trichophorum*	35
Slender wheatgrass[a]	*Elymus trachycaulus*	10
Idaho fescue[b]	*Festuca idahoensis*	45
Perennial Ryegrass	*Lolium perenne*	10

NOTES:

[s] Replaces Dahurian wildrye (*Elymus dahuricus*) to address concerns from neighbouring residents. Percent dry weight reduced due to greater seeds per pound and longer life span compared to Dahurian wildrye.

[b] Replaces sheep fescue (*Festuca ovina*) to address concerns from neighbouring residents. Percent dry weight increased due to slower growth rate and less seeds per pound compared to sheep fescue.

Consideration might also be given to planting trees and shrubs on some of the reclaimed sites if it will not interfere with the operational requirements of the Project and is consistent with the end land use objectives. Certain areas of riprap, such as the headcut prevention section adjacent to the floodplain berm, are to be planted with willow cuttings or nursery stock to provide a robust, erosion resistant surface cover. Temporarily disturbed erosion-prone areas and riparian areas will be seeded with a native seed mix (Table 9.2 or suitable variation) or the agronomic mix (Table 9.6) depending on surrounding site conditions. The agronomic mix is intended for Project disturbances in agricultural areas, hayland, tame grassland, and stream banks and approach slopes with abundant weeds. These species were selected due to their ability to establish rapidly on a wide range of soil types, root structure or leaf abundance, competitive ability, and varying life expectancy.

All seed mixes will be tested for purity, viability and weed presence prior to seeding.

9.3.1.4 Cover Crop

Wherever possible, cover crops should be seeded as soon as possible. This will give a competitive edge to desired species and may out-complete weed growth. Cover crops establish quickly (4-6 weeks) on a variety of textures. They stabilize soils and improve soil quality. Cover crops in the area are typically annual rye or barley. Cover crops may be seeded at a rate of 3-5 kg/ha or at a rate approved by a Professional Agrologist and Alberta Transportation or AEP. Cover crops should be cut prior to seed head development and may be co-seeded with native or agronomic seeding.

9.3.2 Seed Application Methods

The Project area has multiple features on different landscapes with different construction timing and revegetation (seeding) requirements. The type of seeding that will take place will depend on the timing of seeding (soil moisture conditions), the size of the disturbance and the location of the disturbance. Options for seeding methods include: hydroseeding, broadcast seeding and conventional agricultural seeding such as zero till direct drilling. Seeding will be carried out using methods appropriate for the location, as determined by Alberta Transportation or Alberta Environment and Parks.

A cover crop will be used in combination with the planned native and agronomic seed mixes. Supplemental seeding in areas of weed removal should be done via drill seeder, by hand or via belly-grinder.

Prior to seed application, all dead plant material (e.g., leaf litter, thatch) and small debris will be removed or worked into the soil surface layer to provide sufficient seed-to-soil contact and improve seed germination. All areas to receive seed should be free of ruts, trench settling. The upper surface of topsoil (minimum top 50 mm) should be loosened and rough to increase seed-to-soil contact and improve seed germination.

9.3.2.1 Construction

Drill Seed

In areas of direct Project construction, where drill seeding is deemed appropriate, seed application will follow the specs specifically designed for SR1 which are based on Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 02924 – Drill Seeding*. Drill seeding will occur on prepared surfaces that are free of frost and standing water. Seed must be uniformly distributed at the specified application rate and seed must be placed in the soil and covered to a depth of 20 mm to 40 mm.

On slopes, seeding will be oriented crosswise to the slope and not following the slope unless Surface Tracking is immediately provided to eliminate surface runoff potential. Fertilizer may be applied only if the seed drill is equipped to side band. Where seeding adjoins existing vegetation, overlap the seeding application at least 300 mm into adjacent vegetated areas.

Seeding will not occur on hardened, crusted or rutted soil and seeding will not cause soil displacement of erosion.

Broadcast Seeding

Broadcast seeding will be used in areas that are inaccessible to drill seeding equipment. If broadcast seeding is the best option, a cyclone seeder or hand applied methods will spread seed. The applicator must provide a means to verify the quantity of seed and fertilizer either by weight or volume measurement. After broadcast seeding, harrow the seeded area to provide a soil cover between 20 mm and 40 mm over the seeds and surface track the seeded area no more than two times. Surface Tracking follows Alberta Transportation's Best Management Practice #34(a-c) of the Field Guide for Erosion and Sediment Control (2011).

Hydroseeding

Hydroseeding will be guided by SR1 specs based on *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 02924 Hydroseeding.* Hydroseeding must use water that is free of impurities that would inhibit or adversely affect germination and growth of seed. If hydro-mulch is used, it must be a wood or wood cellulose fiber mulch that is 100% biodegradable, compatible with the environment, free of growth and germination inhibiting factors, free of weeds and other deleterious matter. Tackifier must be a polymer or resin tackifier, for use with mulch, capable of joining mulch particles together and secures the mulch to the ground. Hydro-mulch and tackifier must not create an impervious seal that prevents moisture from reaching the underlying soil.

Hydroseeding native seed may result in lower success rates due to poorer seed soil contact.

9.3.2.2 Post-Flood

The Off-stream reservoir has approximately 19 quarter sections that may be flooded and require revegetation during a design flood. In areas where sedimentation is less than 3 cm, natural regeneration is expected. In areas where sedimentation is between 3-10 cm deep, there may be effects to seed germination, however, most plant species at baseline conditions are expected to survive. Where deposition is between 10 cm to 100 cm, site preparation may be required to prepare for seeding. Revegetation will be primarily through conventional direct drill seeding unless there are accessibility problems. Hydroseeding may be used in areas of low trafficability, erosion, and dust concerns. Additional seeding may be required if hydroseeding is used for native areas.

9.3.3 Timing

Depending on soil moisture conditions, seeding cover crops is the best option in summer post-flood, as the soil may not have enough moisture going into fall to support agronomic and native plant species. In late fall and under dry soil conditions, agronomics and native seed may be sown where it will lie dormant over winter and germinate under spring moisture conditions. Many seeds of native species, including traditional use plants, require cold stratification that comes with a fall planting.

Supplemental seeding may be needed if warm temperatures are experienced during the winter and seeds break dormancy. If seeding cannot be completed prior to snowfall, seeding can occur in the following spring immediately after ground thaw (April-early May). Supplemental seeding will also be considered if vegetation targets are not being met and will be done following weed control that causes bare ground.

10.0 WETLAND REPLACEMENT PLAN

A wetland and ephemeral water body assessment and impact report (WAIR) was completed for the Project to support compliance with the Alberta *Water Act*. The WAIR was prepared following the Alberta Wetland Policy (Government of Alberta [GoA] 2013) and directives published on the Alberta Wetland Policy Implementation web page (GoA 2019a) and includes effects for Project construction, including permanent and temporary disturbances and from Project operations. Unavoidable wetland effects from temporary construction (e.g., workspace, soil stockpiles) will be reclaimed following construction. Permanent effects from construction features (e.g., dam, diversion channel) and from Project operations will be replaced off-site with an in-lieu fee payment to the Government of Alberta in accordance with the Alberta Wetland Mitigation Directive (GoA 2017).

The WAIR will be made available to Environment and Climate Change Canada (ECCC) and Indigenous groups when finalized.

11.0 MONITORING

Monitoring of Project effects on vegetation and wetlands will be implemented to determine the effectiveness of mitigation measures to address changes to the vegetation and wetlands, achievement of revegetation goals, and define additional actions that may be needed if mitigation measures are not effective. Upland areas will be monitored for a minimum of two years following construction. Post construction wetland monitoring will be conducted of areas partially lost or intersected by temporary activities and not included in the replacement plan. Wetland areas will be evaluated during three monitoring events over a five-year period (i.e., year one, three, and five post construction). Monitoring during dry operations will be limited to weed inspection and control and will be managed by AEP. Post flood operations and reclamation will also be managed by AEP and will include evaluation of sediment management, dust control, weed control and reclamation. Project upland areas affected by flooding will be monitored for two to five years post flood reclamation with monitoring done at three time intervals (i.e., year one, three and five post reclamation) if monitoring is needed for five years. Wetlands not previously included in a replacement plan and intersected by flood waters will be monitored at three time periods for five years post flood (i.e., year one, three, and five post reclamation Areas not achieving end goal key performance indicators (i.e., year five) will continue to be monitored until indicators are achieved or a replacement plan provided. Reclaimed native grassland areas are expected to establish within three years, possibly sooner depending on the duration of flooding, flood extent and sediment depth, however, reclaimed areas may resemble early seral communities for 10 to 12 years or more. Native prairie vegetation growth is expected to follow a trajectory of early seral species establishing first moving to late seral species as time goes by (Lancaster et al. 2014). Alberta Transportation recognizes that recovery can take many years but will monitor revegetation and adaptively manage as required. Adaptive management may include application of soil amendments, supplemental seeding, development, and application of additional seed mixes, or planting live plants.

Site conditions will be assessed in two main phases: initial monitoring/assessment (short-term), establishment and maintenance monitoring (long-term). Initial monitoring will evaluate soil compaction, soil chemistry and nutrient status (e.g., pH, electrical conductivity, sodium absorption), seedling vigour, ground cover, weed presence, and evidence of erosion. Initial monitoring will begin once flood affected areas can be safely accessed. Establishment and maintenance monitoring will evaluate trends in vegetation growth, cover and diversity, litter accumulation, weed abundance, and evidence of erosion. Establishment and maintenance monitoring will begin following stabilization of site conditions and application of mitigation measures, such as erosion control and seeding.

All monitoring activities will be supervised and approved by a qualified vegetation biologist or agrologist.

11.1 METHODS

11.1.1 Post-Construction

Following construction, monitoring will be focused on assessing the rate of establishment of a healthy vegetation cover, and rapid assessment and mitigation of soil erosion. An inspection of seeding during the month of May of the calendar year following initial seeding will be conducted. Any required reseeding will be completed prior to June 15 of that year. This date will be extended if weather conditions prior to June 15 are not suitable for reseeding work.

Post-construction and operation monitoring activities will be stratified based on the major categories identified in Table 9.1. Initial sampling locations will be selected prior to monitoring, although locations may be modified based on specific conditions observed in the field.

Vegetation cover, species composition, litter accumulation, weed abundance, and signs of erosion will be assessed following construction, and post-flood, as part of establishment and maintenance monitoring. Depending on the extent of revegetation, all areas or a subsample will be assessed. At each assessment location, vegetation cover of all vascular plant species, total ground cover of vascular plants, non-vascular plants, litter, surface water and bare ground will be recorded. Cover and height of each shrub species will also be recorded if present. Photographs and spatial coordinates of each plot will be recorded. Photographs showing general site conditions will also be taken at fixed locations.

11.1.2 Post-Flood

Following post-flood reclamation, monitoring of flood water affected areas will initially be focused on rapid assessment and mitigation of potential soil erosion, weed abundance, and assessing the rate of establishment of a healthy vegetation cover. Initial monitoring will occur every 3-4 weeks until the end of the growing season following a flood.

Establishment and maintenance monitoring will begin the growing season after completion of post-flood reclamation, including assessment of wetland not previously included in a replacement plan. Depending on the extent of post-flood revegetation, all upland areas or a subsample will be assessed. All flood affected wetlands not previously included in a replacement plan will be assessed. At each assessment location, vegetation cover will be recorded including all vascular plant species and associated species cover, total ground cover of vascular plants, non-vascular plants, litter, surface water and bare ground. Cover and height of each shrub species will also be recorded if present. Water depth and chemistry will also be recorded at assessed wetlands, and wetland extent delineated. Photographs and spatial coordinates of each plot will be recorded. Photographs showing general site conditions will also be taken at fixed locations.

Establishment and maintenance monitoring will be done once annually during the growing season for the duration of the monitoring period (i.e., minimum of two years). Conditions will be assessed between late July to late August when plants are actively growing and vegetative and reproductive features helpful for positive species identification are present.

11.2 KEY PERFORMANCE INDICATORS

In addition to the overall Vegetation Plan reclamation targets and goals identified in Section 9.1, reclamation performance progress indicators have been developed for native areas (Table 11.1) and agronomic areas (Table 11.2). These key performance indicators were developed using the Range Plant Communities and Range Health Assessment Guidelines for the Foothills Parkland Subregion of Alberta (DeMaere et al. 2012) and Rangeland Health Assessment for Grassland, Forest and Tame Pasture (Adams et al. 2016) and will help identify if reclamation is progressing as desired. The indicators will be used for post construction and post-flood reclamation assessment.

Table 11.1 Monitoring Period Performance Indicators – Native Vegetation

Attribute	Time Period Post-Reclamation				Potential Adaptive Management Measures
	Year 1[a]	Year 2	Year 3	Year 5[b]	
Plant Vigour	• ≤25% of plants are wilted or have signs of disease[c]	• ≤20% of plants are wilted or have signs of disease	• ≤15% of plants are wilted or have signs of disease	• No signs of poor plant health or disease (e.g., wilted leaves, necrosis, infected seed heads)	• Evaluate soil conditions and apply amendments where needed
Plant Ground Cover	• ≥25%[d]	• ≥30%	• ≥35%	• ≥40% and greater than or equal to cover observed in year three	• Evaluate soil conditions and apply amendments where needed • Re-seed
Litter Quality	N/A	• Accumulation present	• Clear evidence of accumulation, including standing dead and fallen material	• Clear evidence of accumulation and decomposition, including standing dead and variably decomposed fallen material	• Evaluate soil conditions and apply amendments where needed
Litter Quantity	N/A	N/A	• ≥175 lb/ac (196 kg/ha)[e] • Litter somewhat patchy to uniform across site	• ≥325 lb/ac (364 kg/ha) • Litter more or less uniform across site	• Evaluate soil conditions and apply amendments where needed • Re-seed
Plant Diversity	• ≥90% of seeded species are present	• Native plants are the dominant cover • Traditional use plants included in seed mix are present • Non-native perennial plants occupy ≤5% of total cover	• Seeded plant abundance is within 25% of species cover in seed mix • Traditional use plants included in seed mix are within 25% of cover in seed mix • Non-native perennial plants occupy ≤5% of total cover	• All dominant and indicator plants of corresponding mid-seral native community are present • More than one community structural layer is present (e.g., tall grasses and medium grasses and forbs) • Percent cover of all species is at or below natural levels and unlikely to abnormally dominate the site and reduce diversity to less than the number of species in seed mix • Traditional use plants are present in levels supporting Indigenous use • Non-native plants occupy ≤5% of total cover can cover has been stable or decreasing over monitoring period.	• Re-seed with modified seed mix • Control plants that might be limiting establishment of desired species • Plant plugs of desired missing plant species to assist establishment • Conduct additional control of alien invasive plants
Weed Abundance	• No prohibited noxious weeds present • Noxious weed abundance is similar to surrounding undisturbed area or less than 15% • Annual weed/alien invasive plant abundance not interfering with desired plant development (i.e., not out shading plants)	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 10% • Annual weed/alien invasive abundance/distribution ≤ class 8 (few patches and sporadically occurring plants)	• No prohibited noxious weeds present • Noxious weed abundance is similar to surrounding undisturbed area or less than 10% • Annual weed/alien invasive plant abundance/distribution ≤ class 8 (few patches and sporadically occurring plants)	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 5% • Annual weed/alien invasive abundance/distribution ≤ class 2 (few sporadically occurring plants)	• Conduct additional mechanical or chemical weed control • Re-seed to increase competition with weeds and alien invasive plants and reduce opportunities for establishment

Table 11.1 Monitoring Period Performance Indicators – Native Vegetation

Attribute	Time Period Post-Reclamation				Potential Adaptive Management Measures
	Year 1[a]	Year 2	Year 3	Year 5[b]	
Erosion/Soil Movement	• Some evidence of soil movement, but flow patterns are short and shallow	• Some evidence of soil movement, but flow patterns are short and shallow	• No sign of soil movement	• No sign of soil movement	• Re-install or add erosion control measures • Re-seed to improve ground cover
Wetland Function	• Wetland plants are dominant in mapped wetland areas • No evidence of artificial drainage or flooding	• N/A	• Boundary of retained wetland area is maintained or has increased • Wetland plants are dominant in mapped wetland areas • Flooding level and plant composition aligns with pre-construction wetland class or higher class	• Flooding level and plant composition aligns with pre-construction wetland class or higher class • ABWRET-A results indicate wetland is of equal or greater value	• Re-seed or plant wetland areas using live plugs • Provide wetland replacement for lost wetland area

NOTES:
[a] Initial monitoring phase
[b] Year Five performance indicators align with final targets (see Section 9.1).
[c] If area is seeded.
[d] Assessed in late summer. Areas selected for seeding if percent cover target not achieved.
[e] Healthy with problem lower level for thin break soils in the Foothills Parkland Natural Subregion (Adams et al. 2016).

Table 11.2 Monitoring Period Performance Indicators – Agronomic Vegetation

Attribute	Time Period Post-Reclamation				Potential Adaptive Management Measures
	Year 1[a]	Year 2	Year 3	Year 5[b]	
Plant Vigour	• ≤25% of plants are wilted or have signs of disease	• ≤20% of plants are wilted or have signs of disease	• ≤15% of plants are wilted or have signs of disease	• No signs of poor plant health or disease (e.g., wilted leaves, necrosis, infected seed heads)	• Evaluate soil conditions and apply amendments where needed
Plant Cover	• ≥30%[c]	• ≥40%	• ≥45%	• ≥60% and greater than or equal to cover observed in year three	• Evaluate soil conditions and apply amendments where needed • Re-seed
Litter Quality	N/A	• Accumulation present	• Clear evidence of accumulation, including standing dead and fallen material	• Clear evidence of accumulation and decomposition, including standing dead and variably decomposed fallen material	• Evaluate soil conditions and apply amendments where needed
Litter Quantity	N/A	N/A	• ≥250 lb/ac (278 kg/ha)[d] Litter somewhat patchy to uniform across site	• ≥450 lb/ac (504 kg/ha) • Litter more or less uniform across site	• Evaluate soil conditions and apply amendments where needed • Re-seed
Plant Diversity	• ≥90% of seeded species are present	• Seeded plants are the dominant cover	• Seeded plant abundance is within 25% of desired species cover of plants in seed mix	• All dominant and indicator plants of corresponding mid-seral native community are present • More than one community structural layer is present (e.g., tall grasses and medium grasses and forbs) • Percent cover of all species is at or below natural levels and unlikely to abnormally dominate the site and reduce diversity to less than the number of species in seed mix	• Re-seed with modified seed mix • Control plants that might be limiting establishment of desired species • Plant plugs of desired missing plant species to assist establishment • Conduct additional control of alien invasive plants
Weed Abundance	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 15% • Annual weed/alien invasive plant abundance not interfering with desired plant development (i.e., not out shading plants)	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 10% • Annual weed/alien invasive abundance/distribution ≤ class 8 (few patches and sporadically occurring plants)	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 10% • Annual weed/alien invasive abundance/distribution ≤ class 8 (few patches and sporadically occurring plants)	• No prohibited noxious weeds present • Noxious weed abundance similar to surrounding undisturbed area or less than 5% • Annual weed/alien invasive plant abundance/distribution ≤ class 2 (few sporadically occurring plants)	• Conduct additional mechanical or chemical weed control • Re-seed to increase competition with weeds and alien invasive plants and reduce opportunities for establishment

Table 11.2 Monitoring Period Performance Indicators – Agronomic Vegetation

Attribute	Time Period Post-Reclamation				Potential Adaptive Management Measures
	Year 1[a]	Year 2	Year 3	Year 5[b]	
Erosion/Soil Movement	• Some evidence of soil movement, but flow patterns are short and shallow	• Some evidence of soil movement, but flow patterns are short and shallow	• No sign of soil movement	• No sign of soil movement	• Re-install or add erosion control measures • Re-seed to improve ground cover

NOTES:

[a] Initial monitoring phase

[b] Year Five performance indicators align with final targets (see Section 9.1). Monitoring will be stopped if final targets are achieved in year two following revegetation.

[c] Healthy with problem lower level for thin break soils in the Foothills Parkland Natural Subregion (Adams et al. 2016).

12.0 ADAPTIVE MANAGEMENT

Adaptive management is a systematic process for continually improving management policies and practices by learning from the outcomes of operational programs (Walters 1986; Walters and Holling 1990). An adaptive management approach will be applied to the revegetation program. If selected targets and goals are not achieved in the specified time frame for a land use area, potential reasons will be evaluated and the need for further mitigation (e.g., weed control) or revegetation measures (e.g., supplemental seeding) determined. Results of each revegetation event will be assessed, and effectiveness of measures evaluated. This information will help inform future revegetation activities and guide adjustments in revegetation measures (e.g., alternate seed mixes, further site preparation, change is seed application). Evaluation details and a plan for further mitigation or revegetation will be documented in monitoring reports.

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APPENDICES

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
VEGETATION AND WETLAND MITIGATION, MONITORING AND REVEGETATION PLAN

Appendix A LEGISLATION WITH REGULATORY AUTHORITY OVER VEGETATION AND WETLANDS

Table A.1 Legislation with Regulatory Authority over Vegetation and Wetlands Relevant to the Project

Legislation	Regulatory Agency	Resource
Canadian Environmental Assessment Act, 2012	Impact Assessment Agency of Canada	Environmental protection and public interest
Water Act	Alberta Environment and Parks	Waterbodies, wetlands and aquatic environments
Weed Control Act	Alberta Environment and Parks	Regulated weeds

Appendix B WEEDS AND ALIEN INVASIVE PLANTS OBSERVED IN THE PDA

Table B.1 Listed Weeds and Alien Invasive Plants Observed in the PDA

Plant Form	Scientific Name (ITIS) [a]	Common Name (ACIMS) [b]	ACIMS Rank [b]	Tracked/ Watched (ACIMS) [b]	Native/Exotic (ACIMS) [b]	Alberta General Status [c]	Weed Rank[d]	Non-Native Invasive Species Listing[e]
Forb	*Artemisia absinthium*	absinthe wormwood	SNA	-	Exotic	-	-	AISC 2017
Forb	*Carum carvi*	caraway	SNA	-	Exotic	-	-	AISC 2017
Forb	*Chenopodium album*	lamb's-quarters	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Cirsium arvense*	creeping thistle	SNA	-	Exotic	-	Noxious	ANPC 2018
Forb	*Convolvulus arvensis*	field bindweed	SNA	-	Exotic	-	Noxious	ANPC 2018
Forb	*Crepis tectorum*	annual hawk's-beard	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Cynoglossum officinale*	hound's-tongue	SNA	-	Exotic	-	Noxious	ANPC 2018
Forb	*Descurainia sophia*	flixweed	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Erucastrum gallicum*	dog mustard	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Galeopsis tetrahit*	hemp-nettle	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Lappula squarrosa*	bluebur	S5	-	Native	-	-	ANPC 2018
Forb	*Medicago sativa*	alfalfa	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Plantago major*	common plantain	SNA	-	Exotic	-	-	ANPC 2018

Table B.1 Listed Weeds and Alien Invasive Plants Observed in the PDA

Plant Form	Scientific Name (ITIS) [a]	Common Name (ACIMS) [b]	ACIMS Rank [b]	Tracked/ Watched (ACIMS) [b]	Native/Exotic (ACIMS) [b]	Alberta General Status [c]	Weed Rank[d]	Non-Native Invasive Species Listing[e]
Forb	*Ranunculus acris*	tall buttercup	SNA	-	Exotic	-	Noxious	ANPC 2018
Forb	*Rumex crispus*	curled dock	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Silene cserei*	smooth catchfly	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Sonchus arvensis*	perennial sow-thistle	SNA	-	Exotic	-	Noxious	ANPC 2018
Forb	*Taraxacum officinale*	common dandelion	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Thlaspi arvense*	stinkweed	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Tragopogon dubius*	common goat's-beard	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Trifolium hybridum*	alsike clover	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Trifolium pratense*	red clover	SNA	-	Exotic	-	-	ANPC 2018
Forb	*Trifolium repens*	white clover	SNA	-	Exotic	-	-	ANPC 2018
Graminoid	*Agrostis stolonifera*	redtop	SNA	-	Exotic	Exotic	-	ANPC 2018
Graminoid	*Bromus inermis*	smooth brome	SNA	-	Exotic	-	-	ANPC 2018
Graminoid	*Bromus tectorum*	downy chess	SNA	-	Exotic	-	Noxious	ANPC 2018
Graminoid	*Dactylis glomerata*	orchard grass	SNA	-	Exotic	-	-	ANPC 2018

Table B.1 Listed Weeds and Alien Invasive Plants Observed in the PDA

Plant Form	Scientific Name (ITIS) [a]	Common Name (ACIMS) [b]	ACIMS Rank [b]	Tracked/ Watched (ACIMS) [b]	Native/Exotic (ACIMS) [b]	Alberta General Status [c]	Weed Rank[d]	Non-Native Invasive Species Listing[e]
Graminoid	*Phalaris arundinacea*	reed canary grass	S5	-	Native	-	-	ANPC 2018
Graminoid	*Phleum pratense*	timothy	SNA	-	Exotic	-	-	ANPC 2018

NOTES:

- means the species is not designated

None of the species listed in this table are listed by COSEWIC or SARA (Government of Canada 2016)

ANPC 2018 Alien invasive list includes plants that are native to Alberta. Plants native to Alberta are not considered alien invasive species for the purpose of this plan with the exception of reed canary grass as an aggressive non-native type is present in Alberta.

SOURCES:

[a] Integrated Taxonomic Information System 2016

[b] ACIMS 2016

[c] Alberta Environment and Sustainable Resource Development 2012

[d] Alberta Weed Act Regulation

[e] ANPC (Alberta Native Plant Council [2018]) and AISC (Alberta Invasive Species Council [2021])

Appendix C WEED DENSITY DISTRIBUTION RATINGS

Table C.1 Weed Density Distribution Ratings

Class	Abundance Description
0	None
1	Rare
2	A few sporadically occurring individual plants
3	A single patch
4	A single patch plus a few sporadically occurring plants
5	Several sporadically occurring plants
6	A single patch plus several sporadically occurring plants
7	A few patches
8	A few patches plus several sporadically occurring plants
9	Several well spaced patches
10	Continuous uniform occurrences of well spaced plants
11	Continuous occurrence of plants with a few gaps in the distribution
12	Continuous dense occurrence of plants
13	Continuous occurrence of plants with a distinct linear edge in the polygon
SOURCE: Reproduced from Adams et al. (2016).	