

**ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
RESPONSE TO CEEA INFORMATION REQUEST PACKAGE 2, AUGUST 20, 2018**

Appendix IR19-1 Draft Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan
May 2019

**APPENDIX IR19-1 DRAFT VEGETATION AND WETLAND
MITIGATION, MONITORING AND
REVEGETATION PLAN**

**ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT
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Appendix IR19-1 Draft Vegetation and Wetland Mitigation, Monitoring and Revegetation Plan
May 2019

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



Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

May 2019

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Abbreviations

ACIMS	Alberta Conservation Information Management System
AEP	Alberta Environment and Parks
CEAA	Canadian Environmental Assessment Agency
ECO	Environmental Construction Operations
ESRD	Environment and Sustainable Resource Development
LAA	local assessment area
PDA	Project development area
RAA	regional assessment area
SAR	species at risk
SOMC	species of management concern
SSRP	South Saskatchewan Regional Plan
TLRU	traditional land and resource use
TUA	traditional use area
TUS	Traditional Use Study

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Introduction
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1.0 INTRODUCTION

This document describes the draft Vegetation and Wetland Mitigation, Revegetation and Monitoring Plan (Vegetation Plan) for construction and operation of the Springbank Off-stream Reservoir Project (the Project) as Project construction and operations are expected to affect vegetation, wetland abundance, and diversity.

This draft Vegetation Plan is based on assumed regulatory requirements for approvals and authorizations specific to the Project; however, additional explicit monitoring details will be determined after approval conditions are provided.

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Approval Conditions
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2.0 APPROVAL CONDITIONS

The approval process for the Project will be two-fold. First, the overall Project requires approval by Alberta Environment and Parks (AEP) and the Canadian Environmental Assessment Agency (CEA Agency). Second, the Project will require approvals and authorizations for specific project components prior to construction and operation after the overall Project is approved (e.g., *Water Act* for loss or alteration of wetlands).

Each approval and authorization will include conditions so the Project complies with relevant regulatory obligations (e.g., the Project mitigation must comply with the *Water Act* approval requirements). Monitoring plan components were selected to demonstrate the Project's conformance with these requirements. Additional approval conditions may apply and will be determined through the regulatory authorization process. The relevant regulatory authority of different legislative bodies listed in Table 2-1.

Table 2-1 Legislation with Regulatory Authority over Vegetation and Wetlands Relevant to the Project

Legislation	Regulatory Agency	Resource
<i>Alberta Environmental Protection and Enhancement Act</i>	Alberta Environment and Parks	Environmental protection and public interest
<i>Canadian Environmental Assessment Act</i>	Canadian Environmental Assessment Agency (Environment and Climate Change)	Environmental protection and public interest
<i>Alberta Water Act</i>	Alberta Environment and Parks	Waterbodies, wetlands and aquatic environments
<i>Alberta Public Lands Act</i>	Alberta Public Lands	Crown claimable land including waterbodies within bed and shore
<i>Alberta Weed Control Act</i>	Alberta Environment and Parks	Regulated weeds

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2.1 PROVINCIAL AGENCY RESPONSIBILITIES AND REPORTING REQUIREMENTS

2.1.1 Construction and Dry Operations

Alberta Transportation will be responsible for final development of the Vegetation Plan and implementation during the construction phase and for a period of three years post-construction during the dry operations phase of the Project. After that, AEP will implement the Vegetation Plan during dry operations. The reporting requirements (i.e., number of reports, timing) will be determined following Project approval.

2.1.2 Flood and Post-Flood Operations

AEP will be responsible for implementing the Vegetation Plan during both flood and post-flood operation phases of the Project. The reporting requirements (i.e., number of reports, timing) will be determined following Project approval.

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Regulatory, Indigenous and Public Stakeholder Input
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3.0 REGULATORY, INDIGENOUS AND PUBLIC STAKEHOLDER INPUT

Engagement with stakeholders, including landowners, municipalities, infrastructure companies and others has been ongoing since the fall of 2014. Alberta Transportation’s engagement with Indigenous groups also began in 2014 and with the five Treaty 7 First Nations in accordance with The Government of Alberta’s Guidelines on Consultation with First Nations on Land and Natural Resource Management (2014) and the First Nation Consultation Plan approved by the Aboriginal Consultation Office (ACO).

3.1 GROUPS ENGAGED

Table 3-1 lists the Indigenous groups that have been engaged on the Project.

Table 3-1 Indigenous Groups Identified for Engagement

Indigenous Group or Organization	Distance from Project
Treaty 7 Nations	
Tsuut’ina Nation	619 m
Stoney Nakoda Nations (Bears paw First Nation, Chiniki First Nation, and Wesley First Nation)	28 km
Siksika Nation	78 km
Piikani Nation	144 km
Kainai First Nation (Blood Tribe)	170 km
Treaty 6 Nations	
Ermineskin Cree Nation	204 km
Louis Bull Tribe	207 km
Montana First Nation	194 km
Samson Cree Nation	198 km
Other	
Foothills Ojibway	No Reserve
Ktunaxa Nation	180 km
Métis Nation of Alberta, Region 3	N/A
Métis Nation British Columbia	N/A

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3.1.1 Issues Identified

Issues, concerns and recommendations related to effects of the Project on vegetation and wetlands were reported by Indigenous groups through the Indigenous engagement program.

Engagement with the Indigenous groups potentially affected by the Project is ongoing and will continue as the Project progresses. Alberta Transportation will review Traditional Use Study (TUS) reports as they are made available by Indigenous groups. Relevant traditional land and resource use (TLRU) information, concerns, and recommendations received after the EIA was filed will be used for project planning and implementation purposes, where applicable.

Generally, issues and concerns related to effects from the Project on vegetation and wetlands, as reported by Indigenous groups through the review of Project-specific and publicly-available TLRU information, include:

- effects on traditional use of plants for harvesting and medicinal use
- loss of wetland area
- effects on sensitive ecosystems
- effects on wetland function
- tree removal

3.1.2 Economic Opportunities

Alberta Transportation is committed to Indigenous participation in the Project including training, employment and contracting opportunities. Alberta Transportation is preparing an “Indigenous Participation Plan” for the Project. The goal of this Plan is to create training and contracting opportunities with interested Indigenous groups potentially affected by the Project. Alberta Transportation aims to obtain Indigenous comment and feedback on the draft Plan, the final draft of which will identify how that feedback has been incorporated, as appropriate.

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Project Description
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4.0 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.

4.1 PROJECT COMPONENTS

The primary Project components are:

- a diversion structure on the main channel and floodplain of Elbow River
- a diversion channel to transport partially diverted floodwater into 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.

4.2 PROJECT PHASES

4.2.1 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. Project construction may be continuous (24 hours per day), weather conditions permitting.

4.2.2 Dry Operations

Dry operation refers to 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.

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4.2.3 Flood Operations

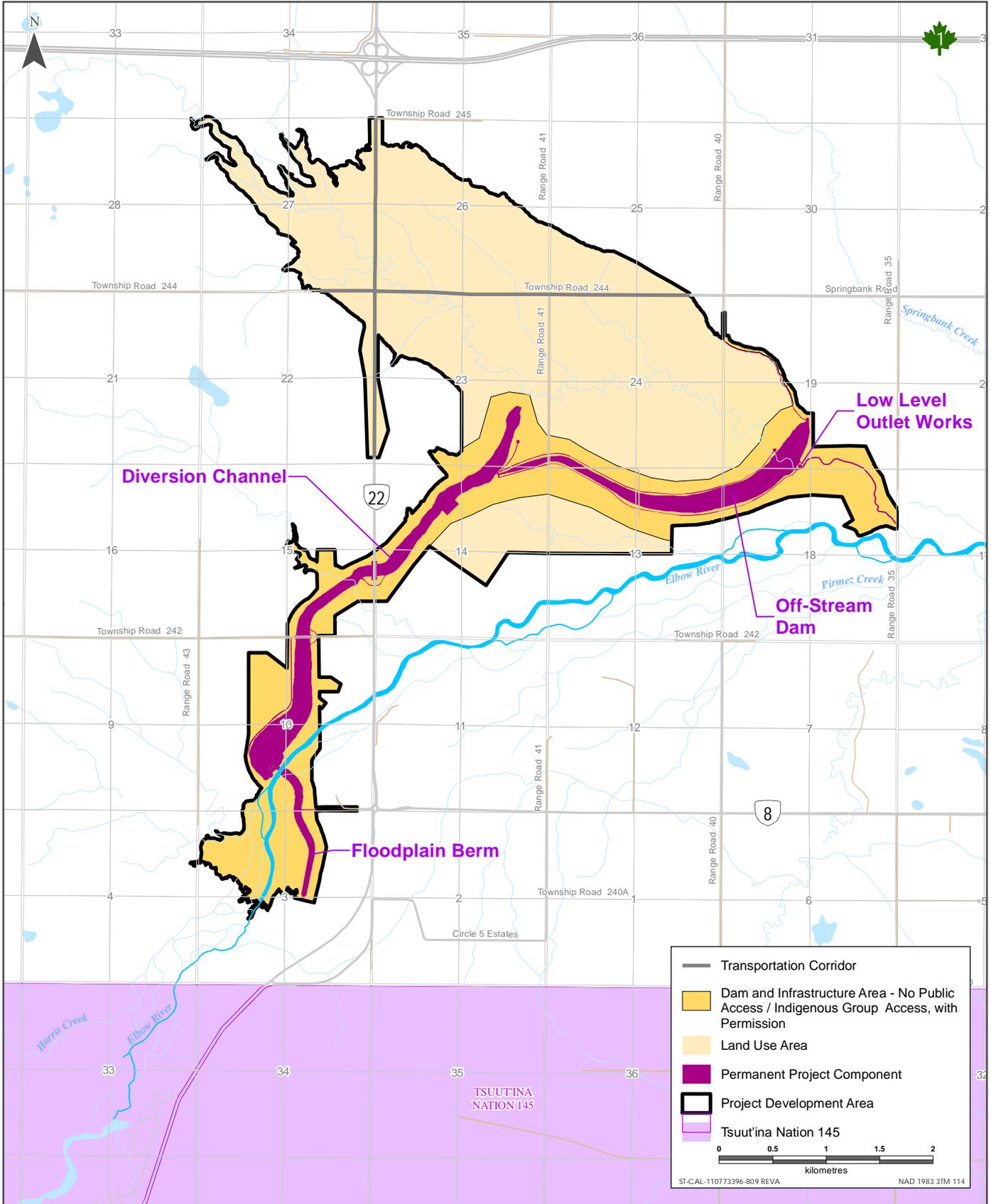
AEP Operations will be in communication with the City of Calgary Glenmore Dam operators in advance of and during the flood season each year. The need for flood operations will be determined through this communication, which will be informed by forecasted and measured flows on Elbow River at the diversion 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.

4.2.4 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.

4.3 PREFERRED END LAND USE

Since filing the ELI, a draft post-construction land use document for the Project has been created. This document provides the draft principles of future land use for the Project, which was developed through the engagement process and includes feedback received by First Nations and stakeholders. The principles apply to the land use area (LUA) outlined in yellow in Figure 4-1. The primary use of all lands within the PDA, including the LUA, is for flood mitigation. In light of the primary use, the safety of anyone with access or land users will be an overriding factor.



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

Land Use Area within the PDA



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Vegetation and Wetland Overview
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5.0 VEGETATION AND WETLAND OVERVIEW

The following sections provide a summary of baseline vegetation and wetland conditions and potential Project effects. See Volume 3A, Section 10 for further detail.

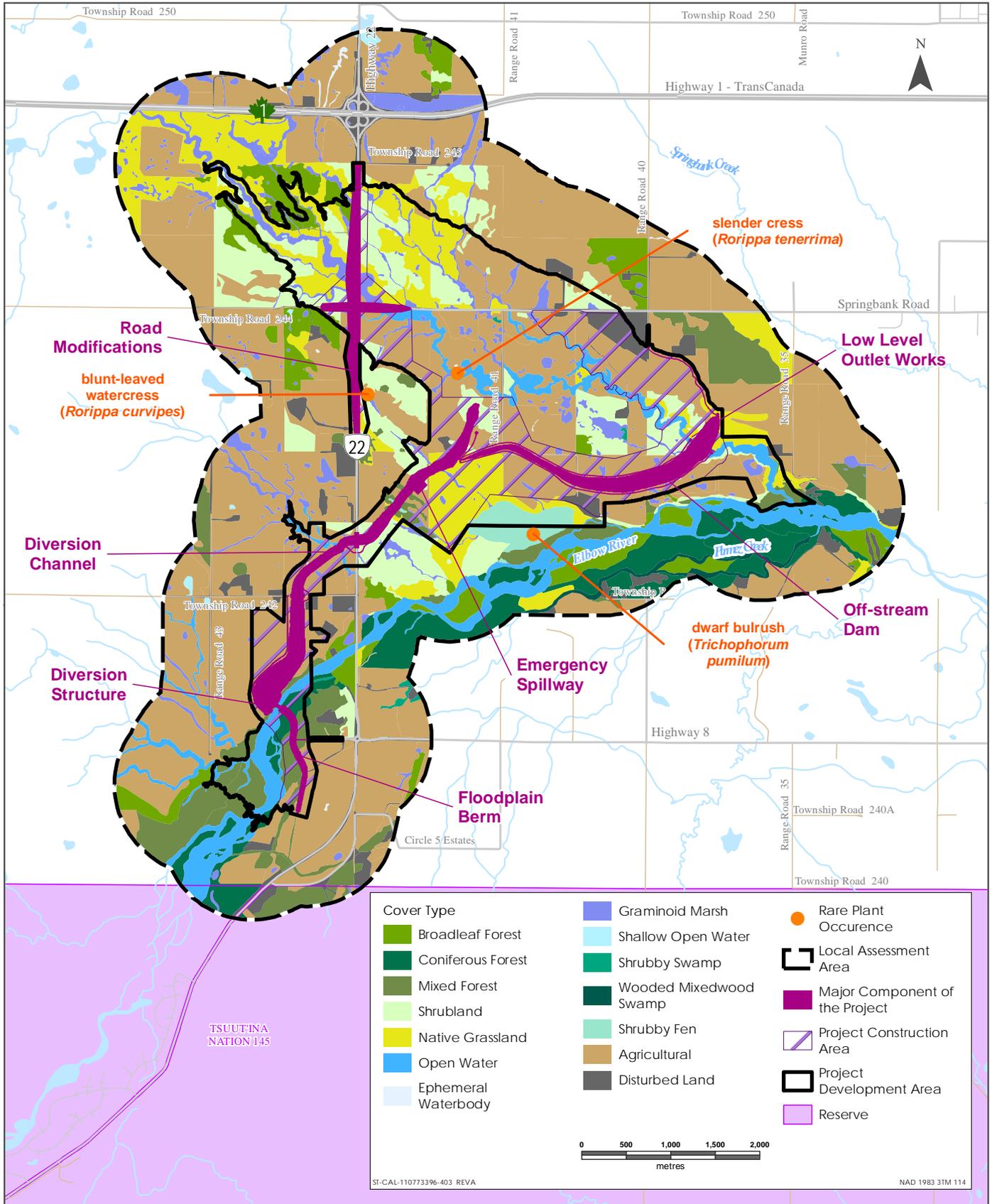
5.1 BASELINE CONDITIONS

The vegetation LAA occurs in the Foothills Parkland natural subregion in Alberta, which is characterized by rolling topography with hills and comprised of rough fescue grasslands, willow shrublands, and aspen woodlands (Natural Regions Committee 2006). The vegetation LAA is largely composed of agricultural land (48.3%), with annual crop and tame pasture being the dominant land cover types (Figure 5-1). The most common native land cover types within the LAA are forested areas (16.3%), native grasslands (8.7%) and shrublands (8.4%). Forested areas are largely restricted to areas bordering Elbow River and large patches near the intersection of Range Road 40 and Springbank Road, and west of Highway 22 near Township Road 244, with mixed forest the most common type.

Native grassland is largely ecosite phase c1 – rough fescue (382 ha, 7.9% of the LAA) and shrubland areas are mostly beaked willow (*Salix bebbiana*) f3 ecosite phase (309 ha, 6.4% of the LAA). Native grassland and shrublands are more common in the northwest portion of the LAA, particularly bordering Highway 22 and near Highway 1, and east of Highway 22 on the north side of Elbow River (Volume 3A, Section 10.2.2.2 of the EIA).

Wetlands occupy 6.4% of the LAA and seasonal graminoid marsh (102.7 ha, 2.1% of the LAA) is the most common type, followed by temporary graminoid marsh (92.9 ha, 1.9% of the LAA). The remaining wetland types each occupy less than 1% of the LAA and consist mainly of moderate-rich shrubby fen (42.6 ha), semi-permanent graminoid marsh (34.7 ha) and seasonal wooded mixedwood swamp (20.3 ha) wetlands. Wetlands are widely dispersed in the LAA, but most occur along drainages and adjacent to Elbow River. A large temporary graminoid marsh wetland occurs just north of Highway 1; however, most graminoid marshes are small scattered ponds with an average size of 0.68 ha, occurring mainly in agriculture land. Many of the wetlands provide habitat for native plants and wildlife, as well as groundwater recharge/discharge, water storage and sediment retention. Additionally, the shrubby fen wetland that is located north of Elbow River in the southern portion of the PDA also sequesters carbon.

Surveys of the PDA were conducted in June, July and August 2016 and a total of 313 plant species, including three species of management concern (SOMC), 41 traditional use plant species or genus, and six listed weed species, were recorded. No rare ecological communities were recorded.



Sources: Base Data - Government of Alberta, Government of Canada, Thematic Data - Stantec Ltd.

Vegetation and Wetlands in the Local Study Area



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5.2 POTENTIAL PROJECT EFFECTS

The components and activities that may interact with vegetation and wetlands during construction are:

- clearing
- channel excavation
- dam and berm construction
- lay down areas
- borrow extraction
- reclamation

During dry operations and post-flood operations, there is potential for maintenance activities to interact with vegetation and wetlands.

5.2.1 Change in Landscape Diversity

Temporary disturbance from Project construction and permanent Project components will result in native vegetation clearing. Temporary disturbances to native vegetation cover types will be seeded with an approved native seed mix. This would result in an increase in native grassland cover type patch area and a decrease in patch edge length. In areas where trees and shrubs were present prior to disturbance, native trees and shrubs should naturally reestablish over time in reclaimed native upland areas; however, for the dry operations phase it is assumed these areas would become native grassland.

5.2.2 Change in Community Diversity

Temporary clearing of vegetation is expected to remove 223 ha of upland and 29.5 ha of wetland during the construction phase. Permanent disturbances will affect 107.1 ha, mainly areas of agricultural land cover types including annual crop and hayland, and native shrubland. All temporarily disturbed upland ecosites would be reclaimed using an approved custom seed mix, and wetlands would be recontoured and seeded with an approved custom native wetland seed mix. As a result of reclamation, it is anticipated there will be an increase in native grassland cover types (95.4 ha), and a reduction in broadleaf forest (3.0 ha), coniferous forest (11.0 ha), mixed forest (34.9 ha) and shrubland (83.5 ha) cover types during the dry operations phase. Increased dust deposition is anticipated during construction; however, it is expected dust would be removed soon after construction by precipitation. No vegetation and wetland land cover types are completely lost, and no lasting effects on vegetation and wetlands are anticipated. Regulated weeds and non-native invasive species were recorded at most survey sites and were abundant when observed. The seeds of these regulated weed species would remain in the seedbank in stockpiled material and are anticipated to persist following construction. Weed control is discussed below.

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Approximately 234.2 ha (41% of the PDA) of upland in the reservoir would be inundated by a design flood. Flooded upland forest types and shrubland cover types are expected to become modified grassland ecosites with similar soil moisture and nutrient regimes following a design flood. After water is released from the reservoir and soil moisture levels return to baseline conditions (see Volume 3B, Section 9.2.3.3 of the EIA for the predicted timeline), surviving plant propagules (e.g., stem and root segments, seeds, rhizomes) and seeds blown-in from surrounding areas would likely begin to grow and recolonize the area. A design flood would inundate, in the reservoir, approximately 450.4 ha (55% of the PDA) of agricultural and disturbed land and 70.3 ha (9% of the PDA) of wetlands; little effect is expected in these areas due to the dominance of non-native plants species and flood tolerant species already existing in those locations.

Sediment resulting from the design flood would cover 375.4 ha of the reservoir. Most of the post-flood sediment deposition would be to 1 cm to 3 cm deep (193 ha, 51%) followed by areas with 10 cm to 100 cm deep (105 ha, 28%) sediment deposition; 41 ha (11%) would be covered by more than 100 cm and 37 ha (10%). Wang et al. (2013) found that sedimentation of less than 3 cm did not significantly affect germination rates in wetland plant communities. Therefore, no effect is expected on the 18.3 ha of wetland plant communities that would be covered by less than 3 cm of sediment, though minor effects to germination of annuals may still occur (Volume 3B, Section 10.2.2.3, Table 10-11 of the EIA). Information on the effect of post-flood sedimentation on the germination of upland plant species is not available in the literature; however, the effect of sediment on germination is presumed to be similar for upland and wetland plant species because it is known that changes to the microsite in which a seed settles affects the probability of seed germination, seedling emergence, and survival. Sediment deposition between 10 cm and 100 cm would result in mortality of species in the herb and short shrub strata, but species in the tall shrub and tree strata would likely survive (Kui and Stella 2016). Loss of species in the short shrub and herb strata would eventually be replaced through recruitment from surrounding areas.

Effects on ecological communities of management concern are not expected because rare ecological communities were not identified from a review of Alberta Conservation Information Management System (ACIMS) records (ACIMS 2016a) or during field surveys of the PDA.

5.2.3 Change in Species Diversity

Effects on plant SOMC from vegetation clearing are not expected because none were observed in the project construction area. Effects on plant SOMC may still occur as unidentified plant SOMC may be present, including slender cress, blunt-leaved water cress and dwarf bulrush observed during rare plant surveys of the PDA outside the project component footprint.

All plant SOMC occurrences occur outside the spatial extent (in the reservoir) of the 1:10 year flood and one occurrence of slender cress (*Rorippa tenerrima*), an S3 tracked species (ACIMS 2016a), was observed within the extent of both the 1:100 year and the design floods in the

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reservoir. Should a design flood occur, it is predicted 1 cm to 3 cm of post-flood sedimentation would cover the slender cress location. Although slender cress can be found in upland or wetland habitats (Kershaw et al. 2001), it is not tolerant of submerged environments (Flora of North America 2017); therefore, it is unlikely to survive the design flood (estimated flooded duration of 41.7 days). There is a lack of information in the literature on the germination and growth requirements of this species; however, it is known that this species is generally found in moist to wet soil conditions (Kershaw et al. 2001). It is unknown if seeds present in the seedbank would survive prolonged submersion as would occur during the design flood and germinate after soil moisture has returned to baseline conditions (See Volume 3B Section 9.2.3.3 of the EIA for predicted timeline). The plant is assumed lost from the PDA.

The 41 species used for traditional purposes, observed in the PDA, are generally common and widespread species that are generally ranked S5 (ACIMS 2016b). No community type supporting traditional use plants would be lost from the PDA and no plant species used for traditional purposes would be lost from the LAA.

Through the Indigenous engagement program for the Project, Ermineskin Cree Nation, Louis Bull Tribe, Stoney Nakoda Nations, Kainai First Nation, Piikani Nation and Tsuut'ina Nation have expressed concern regarding the potential for the Project to affect wetlands and riparian areas, and how these impacts would affect harvesting of traditional use plants. Project construction would reduce riparian area and potentially reduce wetland area or alter wetland conditions. However, effects would be low in magnitude because changes in community abundance would be limited to temporary disturbances and in the immediate area of the dam, diversion channel and diversion structure.

Many of the plant species potentially used for traditional purposes (Volume 3A, Table 10-7 of the EIA) are upland species and likely do not have adaptations to survive prolonged flooded conditions. It is likely, should a 1:10 year, 1:100 year or design flood occur, there would be mortality of traditional plant use species found in upland plant communities. Because these species are common and widespread, it is likely that reestablishment of these species would occur by natural recruitment over time. Therefore, permanent loss of traditional plant use species is not anticipated.

5.2.4 Change in Wetland Function

Wetland ecological function (i.e., wildlife habitat and plant diversity) would be altered due to vegetation clearing for permanent components. Dry operations would result in the loss of 16% (8 ha) of the estimated high value wetland area and 36.1 % (13 ha) of moderate value wetland area (Volume 3A, Section 10.4.5, Table 10-13 of the EIA). Because no wetland cover types are lost due to project construction, measurable changes to groundwater recharge and discharge, water storage, sediment retention and carbon sequestration are not expected.

Water Act approval will be obtained for disturbances to wetlands prior to construction.

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The duration of inundation in the reservoir, including holding time and time to drain, from the 1:10 year flood is predicted to be 73 days. This is likely to alter wetland function (i.e., habitat, biogeochemistry and hydrology); however, the extent of the 1:10 year flood is predicted to only affect a small area (21.4 ha including 1.1 ha of wetland). Should a 1:10 year flood occur, 0.1 ha (1%) of high value and 0.1 ha (2%) of moderate value wetland area would be temporarily affected in the PDA.

The duration of inundation in the reservoir from a 1:100 year flood is predicted to be 82 days and covers approximately 40 times more wetland area than a 1:10 year flood (481 ha including 42.2 ha of wetland).

Inundation in the reservoir due to a design flood would last for 58 days and temporarily affect 816 ha with 70.3 ha of wetland inundated. During a design flood, 3.7 ha in the reservoir (86%) of high value, 7.1 ha (83%) of moderate value, 1.2 ha (51%) of moderately low value wetland area in the PDA would be temporarily affected. Wetland functions of habitat, plant and wildlife, and hydrology would likely be reduced in these areas as plant composition may be altered and cover reduced, at least for one growing season. Lower class marsh and swamp wetlands would be flooded for a duration and depth beyond natural variation, likely a few weeks (Stewart and Kantrud 1971; ESRD 2015). Biogeochemistry may also be altered, but positively due to increased nutrient input from river sediment and debris. Deposition of sediment is likely to alter wetland topography, resulting in changes to surface flow and alteration of wetland basin shape and depth. Together, these changes could result in a reduction of 1.4 ha in the reservoir (33%) of high value, 3.4 ha (40%) of moderate value and 0.04 ha (2%) of moderately low value wetland area in the LAA and result in altered surface flow patterns.

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Mitigation
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6.0 MITIGATION

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.

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 would be implemented are listed in Table 6-1. The environmental inspector (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 and management of regulated weeds.

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	<ul style="list-style-type: none"> Fragmentation of native plant community patches arising from native vegetation clearing 	<ul style="list-style-type: none"> Construction activities will be restricted to the approved construction footprint.
Change in community diversity	<ul style="list-style-type: none"> Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing 	<ul style="list-style-type: none"> Construction activities will be restricted to the approved construction footprint.

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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)	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 be contracted to 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	<ul style="list-style-type: none"> Direct loss of a plant SOMC or traditional use plant species of due to vegetation clearing 	<ul style="list-style-type: none"> Construction activities will be restricted to the approved construction footprint. Conduct field visit with Indigenous Elders prior to construction to identify priority areas for harvest of traditional plants
Change in species diversity	<ul style="list-style-type: none"> Direct loss of a plant SOMC or traditional use plant species of due to vegetation clearing 	<ul style="list-style-type: none"> Allow 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.
	<ul style="list-style-type: none"> Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds 	<ul style="list-style-type: none"> 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 be contracted to select and apply all herbicide in compliance with the procedures as outlined in the Code of Practice for Pesticides (Government of Alberta 2010).

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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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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. • A site-specific erosion and sediment control plan will be developed in accordance with 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.
	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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.

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6.2 POST-CONSTRUCTION

The objectives of the 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	<ul style="list-style-type: none"> Fragmentation of native plant community patches arising from native vegetation clearing 	<ul style="list-style-type: none"> Construction activities will be restricted to the approved construction footprint.
Change in Community Diversity	<ul style="list-style-type: none"> Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing 	<ul style="list-style-type: none"> 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 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.
	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the <i>Alberta Weed Control Act</i> and associated regulations. A licensed industrial pesticide applicator will be contracted to select and apply all herbicide in compliance with the procedures as outlined in the <i>Code of Practice for Pesticides</i> (Government of Alberta 2010).
Change in Species Diversity	<ul style="list-style-type: none"> Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds 	<ul style="list-style-type: none"> Disturbed areas will be monitored for noxious and prohibited noxious weeds and species controlled as identified in the <i>Alberta Weed Control Act</i> and associated regulations. A licensed industrial pesticide applicator will be contracted to select and apply all herbicide in compliance with the procedures as outlined in the <i>Code of Practice for Pesticides</i> (Government of Alberta 2010).

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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	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • 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.
	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Erosion and sediment control measures will be monitored weekly and repaired as needed. • Areas of rutting, admixing or compaction, will be recontoured to match surrounding topography and seeded with an appropriate wetland seed mix. • 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 monitoring. Species will be controlled as identified in the *Alberta Weed Control Act* and associated regulations. No further vegetation management will be conducted in the PDA during dry operations.

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 would be implemented are listed in Table 6-3.

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Table 6-3 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in landscape diversity	<ul style="list-style-type: none"> Fragmentation of native plant community patches arising from native vegetation clearing 	<ul style="list-style-type: none"> Restrict activities to the reservoir area.
Change in Community Diversity	<ul style="list-style-type: none"> Direct loss or alteration of native vegetation communities, including riparian lands and ecological communities of management concern arising from native vegetation clearing 	<ul style="list-style-type: none"> All equipment will arrive at the Project site clean and free of soil and vegetative debris. Areas of sediment deposition where wind erosion may be an issue may be hydroseeded with native plant species and a tackifier to reduce erosion. An operation and maintenance plan for the reservoir will be developed that would include sediment stabilization and debris management. Erosion and sediment control measures will be monitored and repaired as needed. Vegetation cover establishment will be monitored, and areas of poor cover re-seeded as needed.
	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> 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 be contracted to 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	<ul style="list-style-type: none"> Indirect effects on plant SOMC or traditional use plant species from herbicide application to control the spread of regulated weeds 	<ul style="list-style-type: none"> 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 be contracted to 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 Wetland Function	<ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Erosion and sediment control measures will be monitored weekly and repaired as needed. Where sediment moving within the reservoir is required to maintain hydrological function of water control components, graded soil material will be directed away from adjacent wetlands. Areas of rutting, admixing or compaction, will be recontoured and seeded with an appropriate wetland seed mix.

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Table 6-3 Key Mitigation Measures to Reduce Potential Effects on Vegetation and Wetlands – Post-Construction

Potential Effect	Effect Pathway	Mitigation Measure
Change in Wetland Function (cont'd)	<ul style="list-style-type: none"> • 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 	<ul style="list-style-type: none"> • Erosion and sediment control measures will be monitored and repaired as needed. • Where sediment moving 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. • Vegetation cover establishment will be monitored, and areas of poor cover re-seeded as needed.

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7.0 REVEGETATION

Revegetation of areas disturbed by the Project is guided by the proposed end land use for the site (see Section 4.3 for details). This includes temporary disturbances, such as contractor laydown areas, permanent project components, and the off-stream reservoir.

7.1 TARGETS AND GOALS

The goal of revegetation, through all phases of the Project, is to control erosion and dust, limit weed abundance and to support establishment of desirable plant species. Vegetation establishment, plant diversity and litter accumulation will be the focus of monitoring with the following specific targets.

For native communities temporarily affected:

- Revegetated area is dominated by native plant species and cover of each seeded species is within 10% of desired cover. Total vegetation cover is 60% or greater.
- No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and do not account for more than 25% of the total vegetation cover
- Litter cover is similar to adjacent undisturbed areas of the target community type and signs of erosion are not present

For previously disturbed lands (e.g., industrial, transportation and rural residential land unit types, agricultural cover types) temporarily affected:

- Total vegetation cover is 60% or greater
- No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and do not account for more than 25% of the total vegetation cover
- Litter cover is similar to adjacent previously disturbed areas and signs of erosion are not present

For permanent Project disturbance:

- Vegetation cover equals 80% or greater
- No signs of erosion
- No prohibited noxious weeds present. Noxious weed abundance is equivalent or lower than surrounding undisturbed areas and does not account for more than 25% of the total vegetation cover



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7.2 SEED MIX SELECTION

Native areas disturbed by temporary Project activities will be revegetated using the Alberta Transportation Design Bulletin No. 25, Grass Seed Mixtures Used on Highway and Bridge Projects (AIT 2005) for Seed Mix Zone 6 – Lower Foothills (Table 7-1) or a suitable variation.

Table 7-1 Alberta Infrastructure and Transportation Recommended Native Seed Mix for Lower Foothills¹

Common Name	Latin Name	% by Dry Weight
Slender Wheatgrass	<i>Elymus trachycaulum</i>	30
Smooth Wildrye	<i>Elymus glaucus</i>	20
Northern Wheatgrass	<i>Agropyron dasystachyum</i>	10
Tickle Grass	<i>Agrostis scabra</i>	10
Fringed Brome ²	<i>Bromus ciliatus</i>	10
Tufted Hairgrass	<i>Deschampsia cespitosa</i>	10
Foothills Rough Fescue	<i>Festuca campestris</i>	10
NOTES: ¹ see also Brett and Young 2017 ² Fringed Brome shall be coated		

Alterations will be made to the Alberta Transportation custom native seed mix 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 and 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 and pre-disturbance PDA survey information. 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 (*Stipa richardsonii*)
- Idaho fescue (*Festuca idahoensis*)
- hairy wild rye (*Leymus innovatus*)

These grass species are dominant components of upland community types occurring in the PDA. Traditionally used forbs and shrubs will also be included with species following feedback from Indigenous groups.

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A seed mix is not proposed for temporarily affected wetland areas because most weeds in Alberta, including species observed during field surveys, are not tolerant of periodic flooding and anoxic soils, and are not likely to increase to unacceptable percentages in wetter wetlands. The seed mix in Table 7-1 may be applied to wetland edges to provide initial coverage and reduce weed establishment in temporarily wetted areas. Native plants of more seasonally to semi-permanently wetted areas will be left to naturally establish.

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 Alberta transportations agronomic seed mix and are predicted to become tame pasture (Table 7-2).

Table 7-2 Alberta Infrastructure and Transportation Recommended Agronomic Seed Mix

Common Name	Latin Name	% by Dry Weight
pubescent wheat grass ¹	<i>Agropyron trichophorum</i>	40
Dahurian wildrye ¹	<i>Elymus dahuricus</i>	22
sheep fescue ²	<i>Festuca ovina</i>	30
perennial ryegrass	<i>Lolium perenne</i>	8
NOTES: ¹ Although short-lived, species provides high initial cover helping limit soil erosion and weed establishment. ² May be substituted with Idaho fescue (<i>Festuca idahoensis</i>) depending on potential grazing pressure and seed availability.		

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 7-1 or suitable variation) or the agronomic mix (Table 7-2) depending on surrounding site conditions. The agronomic mix is intended for Project disturbances in agricultural areas, hayland, tame pasture, 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. Seed certificates of authenticity will be obtained to verify the seed composition and purity of the seed mix.

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7.3 SITE PREPARATION

Site preparation will follow 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. Typically, cultivating in two passes at 90 degrees to each other to a depth of 20 cm to 25 cm is 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 (2011), which will contain erosion control measures and monitoring to limit the potential for erosion.

Areas targeting native vegetation establishment will not be fertilized. Disturbed areas to be revegetated with non-native vegetation may be fertilized, depending on vegetation establishment and growth.

7.4 SEED APPLICATION

Seed application will follow Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 02924 – Drill Seeding*. Seeding will be carried out using methods appropriate for the location, as determined by the environmental inspector and may include:

- drill seeding
- Broad-cast seeding
- hydro-seeding

Seeding will be targeted for early spring or late fall. Watering may be required if implemented during late spring or summer.

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7.5 WEED CONTROL

Weed control will follow Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects, Section 01391 – Environmental Protection*. During construction, the contractor will implement appropriate weed-control measures consistent with accepted weed management practices.

Control and prevention of the spread of prohibited noxious and noxious weeds will be evaluated on a site-specific basis and will incorporate the following practices and methods:

- 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)
- cultural control of weeds (i.e., seeding of competitive species)

If the use of herbicides is deemed necessary, a licensed industrial pesticide applicator will be contracted to select and apply all herbicide application will be in compliance with the weed control plan, and the *Environmental Code of Practice for Pesticides* (GoA 2010).

Control will be conducted until selected target weed control are achieved and as required following site monitoring periods.

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8.0 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. Monitoring during construction will be the responsibility of the contractor and included as part of the Project-specific *Environmental Construction and Operations Plan (ECO Plan) Framework* (Alberta Transportation 2017).

8.1 METHODS

Shortly after 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. Complete any required reseeding work 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. If revegetation is required following major flood events, monitoring will also be conducted following post-flood revegetation activities.

Post-construction and operation monitoring activities will be stratified based on the major categories identified in Section 7.1. Initial sampling locations will be selected prior to monitoring, although locations may be modified based specific conditions in the field.

Vegetation cover, species composition, litter accumulation and weed abundance will be assessed following construction and post-flood. Depending on the extent of revegetation, all areas or a subsample 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. Photographs and spatial coordinates of each plot will also be recorded. Photographs showing general site conditions will be taken at fixed locations.

8.2 REPORTING

A report detailing the results of monitoring events will be provided to AEP by December 31 of the monitoring year. This information will also be made available to interested Indigenous groups and public stakeholders. The report will evaluate reclamation progress in the context of the targets and goals outlined in Section 7.1.

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9.0 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 in seed application). Evaluation details and a plan for further mitigation or revegetation will be documented in monitoring reports.

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