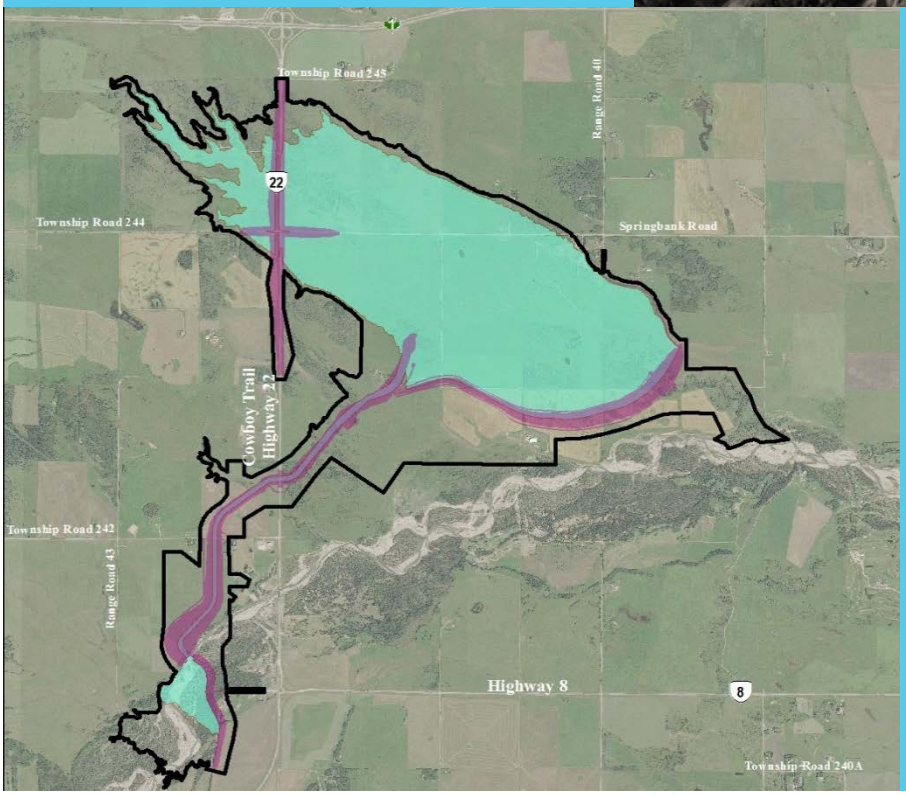
Springbank Off-stream Reservoir Project

Projet de réservoir hors cours d'eau de Springbank

Environmental Impact Assessment
Étude d'impact environnemental



EIS Summary
Résumé de l'EIE

March 2018
Mars 2018

Alberta Transportation

SPRINGBANK OFF-STREAM RESERVOIR PROJECT
Environmental Impact Assessment

EIS Summary

Prepared for:
Alberta Transportation

Prepared by:
Stantec Consulting Ltd.

March 2018

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Abbreviations

AAAQO	Alberta Ambient Air Quality Objectives
AAD	annualized average damage
ACB	articulated concrete block
ACO	Aboriginal Consultation Office
ACT	Alberta Culture and Tourism
AEP	Alberta Environment and Parks
AVC	animal-vehicle collision
BGL	below ground level
CAAQS	Canadian ambient air quality standards
CAC	Criteria Air Contaminant
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEA Agency	Canadian Environmental Assessment Agency
CIE	Commission Internationale de L'Éclairage
CO	carbon monoxide
COPC	chemicals of potential concern
COPD	chronic obstructive pulmonary disease
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CRA	Commercial, recreational and Aboriginal
DEP	diesel exhaust particulate
DFO	Fisheries and Oceans Canada

ECCC	Environment and Climate Change Canada
ECO	Environmental Construction Operations
ECO Plan	Environmental Construction Operations Plan
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMS	Environmental Management System
ER	exposure ratio
FWMIS	Fisheries and Wildlife Management Information System
GDP	gross domestic product
GHG	greenhouse gas
GOA	Government of Alberta
HHRA	Human Health Risk Assessment
HPV	high vapour pressure
HRIA	Historical Resources Impact Assessment
IDC	initial design concept
IHDA	Interactive Health Data Application
ILCR	Incremental Lifetime Cancer Risk
KSO	Kainai Consultation Office
KWBZ	key wildlife biodiversity zone
LAA	Local Assessment Area
LCC	land capability
LPV	low vapour pressure
MDP	Municipal Development Plan

MGA	*Municipal Government Act*
MLS	Multiple Listing Service
MNL	mitigation noise level
NAICS	North American Industry Classification System
NGTL	NOVA Gas Transmission Ltd.
NO_2	nitrogen dioxide
NPA	*Navigation Protection Act*
NRCB	Natural Resources Conservation Board
OHV	off-highway vehicle
PAH	polycyclic aromatic hydrocarbon
PDA	Project Development Area
pH	potential of hydrogen
PIL	Project Inclusion List
PM	particulate matter
PMF	Probable Maximum Flood
PRA	Public Recreation Area
QAES	Qualified Aquatic Environmental Specialist
RAA	Regional Assessment Area
RAP	restricted activity period
RCC	roller compacted concrete
RCMP	Royal Canadian Mounted Police
ROW	right-of-way
SARA	*Species at Risk Act*

SCO	Siksika Consultation Office
SO_2	sulphur dioxide
SOMC	species of management concern
TAS	traffic accommodation strategies
the Project	Springbank Off-stream Reservoir Project
TLRU	traditional land and resource use
total suspended particles	total suspended particles
TRV	toxicological reference value
TUS	traditional use study
VC	valued component
VOC	volatile organic compound

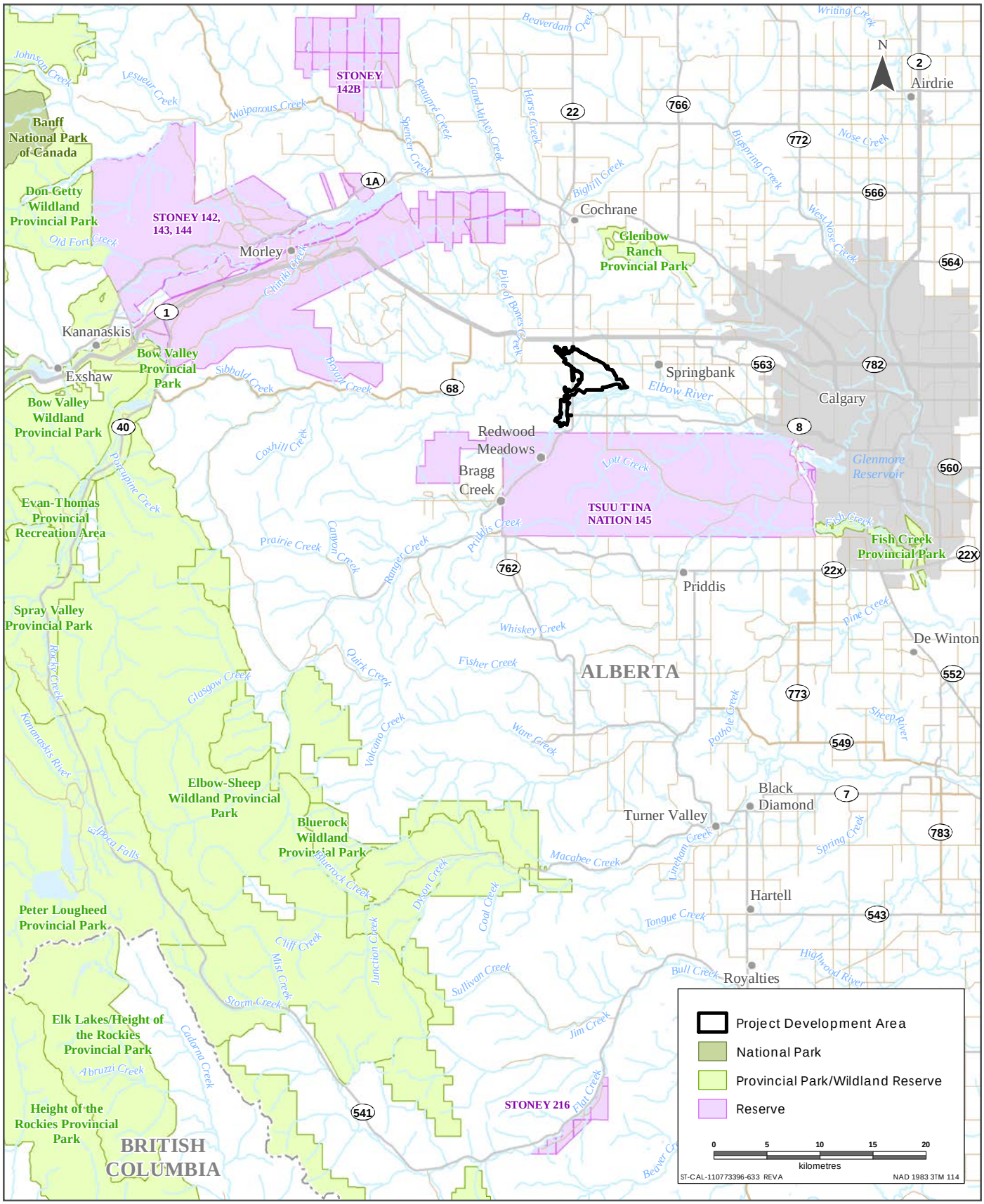
1.0 INTRODUCTION AND ENVIRONMENTAL ASSESSMENT CONTEXT

The Elbow River flood of 2013 was a devastating event socially and economically. That event had an estimated peak flow of 1,240 m^3/s, a 7-day volume of 149,600,000 m^3 and is estimated to be slightly greater than a 1:200 year flood. A study by IBI Group estimates that up to $1.5 billion is at risk due to flooding of the Elbow River during a future flood of the same magnitude without flood protection.

To help reduce the effects of future extreme floods on infrastructure, water courses and people in the City of Calgary and downstream communities, Alberta Transportation is applying to the Alberta Natural Resources Conservation Board (NRCB) for approval to construct and operate the Springbank Off-stream Reservoir Project (the Project), located approximately 15 km west of Calgary in Rocky View County (Figure 1-1). Alberta Transportation is also applying to the Canadian Environmental Assessment Agency (CEA Agency) for approval by the federal Minister of Environment and Climate Change. Alberta Transportation will hold all approvals for the Project until construction completion. Approvals will transfer to Alberta Environment and Parks (AEP) for operation and maintenance of the Project.

The purpose of the Project is to help reduce the effects of future extreme floods on infrastructure, watercourses, and people in the City of Calgary and downstream communities.

Subject to regulatory approvals, the Project is scheduled to be functionally operational (able to accommodate a 1:100 year flood) for floods starting in the spring of 2021, and be completely constructed (able to accommodate the design flood) for the spring of 2022. Any delay in Project approval or land acquisition beyond the end of 2018 will delay the construction of the Project and the ability to mitigate floods in 2021 or beyond.



Sources: Base Data - ESRI, Natural Earth. Thematic Data - ERBC

Springbank Off-stream Reservoir Project Location

2.0 REGULATORY SETTING

2.1 PROVINCIAL REGULATORY REQUIREMENTS

2.1.1 Provincial Environmental Impact Assessment Requirements

The Project requires an Environmental Impact Assessment (EIA) under the *Alberta Environmental Protection and Enhancement Act*. Alberta Environment and Parks (AEP) (formerly Alberta Environment and Sustainable Resource Development) issued final Terms of Reference for the EIA on February 5, 2015.

2.1.1.1 Other Provincial Regulatory Approval Requirements

The Project will be subject to other provincial approval or notification requirements as listed in Table 2-1.

Table 2-1 Provincial Approvals or Notifications Required for the Project

Legislation	Applicable Section (s)	Resources Protected/Managed	Type of Activity	Responsible Agency	Project Phase	Project Component
Natural Resources Conservation Board Act	*Section 5* Approval of the Project to construct and operate a water management project	Is the project in the public interest for Alberta	Water Management Project	Natural Resources Conservation Board	All phases	All Project components
Historical Resources Act	*Section 37(1)* Archaeological and Palaeontological Research Permit *Historical Resources Act* Clearance	Archaeological, palaeontological, historical and cultural resources	Any surficial disturbance that could affect archaeological or palaeontological resource	Alberta Culture and Tourism	Construction	All Project components

Table 2-1 Provincial Approvals or Notifications Required for the Project

Legislation	Applicable Section (s)	Resources Protected/Managed	Type of Activity	Responsible Agency	Project Phase	Project Component
Water Act	Part 4, Division 1 Section 36(1) Approval for works that may change the location of water or direction of water flow Approval to disturb or modify a wetland. Approval for works that affect the aquatic environment. Part 4, Division 2, Section 62(1) Temporary Diversion Licence.	Waterbodies, including wetlands. Aquatic environment	Activity with the potential to cause an effect to the aquatic environment requires a *Water Act* Approval, with the exception of activities exempted from requiring an Approval in the Water (Ministerial) Regulation. Also includes Wetland disturbance & compensation permitting. Licence to take "small" volumes of water from a surface water body (i.e. water for dust control).	AEP	Construction and Post-flood	All Project components
Fisheries Act	Section 13 Fish Research Licence (FRL)	Conservation of stocks and fish capture methods.	Application is required to conduct fish rescue activities before and during instream work.	AEP	Construction and Post-flood	Project components that require potential fish handling, instream isolation, or fish rescues.

2.1.1.2 Other Applicable Provincial Regulatory Requirements

Other applicable provincial environmental legislation that could directly affect Project activities is listed in Table 2-2.

Table 2-2 Other Applicable Requirements for the Project

Legislation	Resources Protected/Managed	Issuing Agency	Project Phase	Project Components
Soil Conservation Act	Requires measures to prevent soil loss or deterioration or to mitigate the same where it has occurred,	AEP	Construction	Diversion channel and dam
Weed Control Act	Requires landowners or occupants to destroy occurrences of plants listed as prohibited noxious upon discovery and control populations of plants listed as noxious to prevent the spread of those species.	AEP	Construction, Dry and Post-flood	Diversion channel and dam
Wildlife Act	Wildlife species (and their residences) listed on the *Wildlife Act* as endangered or threated are protected from disturbance and destruction.	AEP	Construction, dry and post-flood operations	All Project components

2.1.1.3 Relevant Provincial Policies, Agreements and Plans

Land use plans and guidelines pertinent to the Project are:

- the Alberta Land Use Framework, which describes an approach to managing land and natural resources in a manner that would achieve Alberta's long-term economic, environmental and social goals
- the South Saskatchewan Regional Plan (SSRP) (part of the Alberta Land Use Framework), which defines a long-term vision for the region and includes supporting a growing population through economic diversification

2.2 FEDERAL REGULATORY REQUIREMENTS

2.2.1 Federal Regulatory Requirements

2.2.1.1 Federal Environmental Impact Assessment Requirements

In April 2016, Alberta Transportation submitted a Project Description under the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) to the federal government, and on August10, 2016 the CEA Agency issued *Guidelines for Preparation of an Environmental Impact Statement under the Act*. Other Federal Regulatory Requirements.

Other federal environmental legislation applicable to Project activities is listed in Table 2-3.

Table 2-3 Federal Legislation Applicable to the Project

Legislation	Applicable Section	Resources Protected/Managed	Type of Activity	Responsible Agency	Project Phase	Project Component
Navigation Protection Act	Approval under Section 5 (assessment by Minister), 15 (Obstructions), and 28 (Regulations and Orders)	For any works built or placed in, on, over, under, through, or across a navigable water	Activity or physical structure that impedes navigation.	Transport Canada	All phases	Diversion structure
Fisheries Act	Authorization under Section 35(2) (Serious Harm to Fish)	Commercial, recreational and Aboriginal (CRA) fisheries, fish that support a CRA fishery and their habitat	The *Fisheries Act* includes prohibitions against causing "serious harm" to CRA fish and fish which may support such a fishery. In addition to provisions for flow, fish passage and deleterious substances.	Fisheries and Oceans Canada (DFO)	Construction and Post-flood operations	Diversion structure, outlet and dam
Migratory Birds Convention Act	Section 5 (prohibitions) and 6.1 (regulations)	Migratory birds populations, individuals, and their nests within Canada	Migratory bird species listed on the Migratory Birds Convention Act and their nests are protected from disturbance and destruction.	Environment Canada	Construction, and Post-flood operations	All project components
Species at Risk Act	Section 32, 33 (general prohibitions) and 73,74 (agreements and permits)	Wildlife and plant species at risk	Protection under SARA applies to wildlife and plant species listed in Schedule 1 of SARA. It is prohibited to kill, harm, harass, capture or take individual species at risk, or damage or destroy their residences.	Environment Canada	Construction, and Post-flood operations	All project components

Migratory Birds Convention Act

The purpose of the *Migratory Birds Convention Act is to* protect and conserve migratory bird populations and individuals and their nests within Canada. Section 6.1 of the Migratory Birds Regulations states that without a permit, the disturbance, destruction, or removal of a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird, or possession of a migratory bird, carcass, skin, nest, or egg of a migratory bird are prohibited. Potential effects on migratory birds may occur during the construction and post-flood phases so a permit may be required for this phase of the Project. The *Migratory Birds Convention Act* would be most applicable legislation during the construction phase for clearing activities and diversion channel excavation.

Species at Risk Act

The purposes of the *Species at Risk Act* (SARA*)* are to prevent Canadian wildlife species from becoming extirpated or extinct, to provide for the recovery of endangered or threatened species, and encourage the management of other species to prevent them from becoming at risk. To achieve this mandate, SARA has a recovery planning process and provides prohibitions to protect species, the residences of their individuals, and any part of their critical habitat.

SARA provides regulatory protection and includes prohibitions against the killing, harming, harassment, capture, or taking of species listed as extirpated, endangered, or threatened. The damage and destruction of residence are prohibited under the Act.

The Minister of Environment and Climate Change or Fisheries and Oceans Canada (DFO) can authorize, through a SARA permit, an activity that would otherwise violate the *SARA* prohibitions with the flexibility afforded in Section 73 of SARA. Furthermore, Section 74 states that an authorization issued by the Minister under another Act of Parliament has the same effect as *SARA* permit, which means that a Paragraph 35(2)(b) *Fisheries Act* Authorization can also act as a *SARA* permit.

However, certain conditions must be met prior to the issuance of a SARA permit. The Minister must be of the opinion that the activity (Subsection 73(2)):

- is scientific research relating to the conservation of the species and conducted by qualified persons
- benefits the species or is required to enhance its chance of survival in the wild or
- affects on the species is incidental to the carrying out of the activity.

As well, the Minister must be of the opinion that (Subsection 73(3)):

- all reasonable alternatives to the activity that would reduce the impact on the species have been considered and the best solution has been adopted;
- all feasible measures will be taken to minimize the impact of the activity on the species or its critical habitat or the residences of its individuals; and
- the activity will not jeopardize the survival or recovery of the species.

Additionally, Subsections 73(4) and (5) of SARA require that DFO consult with wildlife management boards or Indian bands if the activity affects species found in land claim settlement areas or reserves prior to permit issuance.

SARA would apply through all phases of the Project and components, but fish, wildlife and vegetation species would be most vulnerable to effects during the construction phase and draining of the reservoir following a flood.

Navigation Protection Act

One function of the *Navigation Protection Act* (NPA) is to allow for approved works that interfere with the public right of navigation to be completed. The NPA provides a List of Scheduled Waters, which includes waterways that support busy commercial or recreation-related navigation. Works that will substantially interfere with navigation on scheduled waters require notice of the proposal to the Minister, as per Section 5(1) of the NPA. The Elbow River is not on the List of Scheduled Waters; however, the public right to navigate applies to all navigable watercourses, including non-scheduled waters. The *NPA* includes an opt-in provision that allows the owners of works in non-Scheduled navigable waters to ask for a review under the *NPA*, which, once approved, allows works that interfere with navigation to be sanctioned under the *NPA*.

Transport Canada's amended Minor Works Order includes a list of designated works that may proceed on Scheduled waterways without a Notice to the Minister. The Works Order includes pipelines buried under the bed of navigable water.

The NPA would be applicable during all phases of the Project but navigation would be most likely to be affected during the construction phase for work in the Elbow River on the diversion structure.

2.3 MUNICIPAL REGULATORY REQUIREMENTS

Development in the project area is regulated by zoning and development permit requirements administered by Rocky View County under Sec 619(1) of the *Municipal Government Act*. A licence, permit, approval or other authorization granted by AEP or the NRCB prevails over any municipal development plan, area structure plan, land use bylaw or development decision by a development authority.

The Project is in Rocky View County, Alberta (the Municipal District of Rocky View No. 44 became Rocky View County in June 2009).

3.0 PROJECT OVERVIEW

The Project is located 15 km west of Calgary in Rocky View County in the Province of Alberta (Township 24, Range 04/03 W5M) (Figure 1-1). The Project is predominately situated on private land that has been used for ranching and agriculture since the late 1800s. There are also several acreages and commercial developments within the Project area. There is a small portion of the Project that is located on Crown land; it includes rights-of-way (ROWs) for roads and road allowances and the bed and banks of the Elbow River and its tributaries.

The relief within the project area is approximately 70 m with an average elevation of 1200 m. The physiography is defined as sloping lower foothills and hummocky uplands, all of which is heavily dissected by intermittent streams. Till soils dominate the landscape with significant lacustrine materials in valleys defined by outcrops of the Brazeau, Coalspur and Paskapoo bedrock formations. Quaternary soils are predominantly black chernozems, some dark grey chernozems while wetlands are mainly gleysols.

Aspen forests dominate the sub-region but are largely absent in the Project Development Area (PDA), while stands of conifers are present in the Elbow River floodplain. Some areas of dense tall willow are in lowlands and northerly slopes, while grasslands dominate the natural landscape and are more common on southerly slopes.

The location of the Project is determined by the capacity requirement for the off-stream reservoir. The natural basin of the Unnamed Creek that will be used for the reservoir is the only one of sufficient size to meet flood management requirements when dammed in the designed facility configuration.

The northwest and southeast corner points of the Project Area are as follows:

- NW: -34703.218 E, 5660917.356 N
- SE: -27570.395 E, 5652979.442 N
- NW: 51° 5’ 0.33” N, -114° 29’ 43.09” W
- SE: 51° 0’ 44.84” N, -114° 23’ 34.44” W

Coordinate values are in 3TM NAD83.

The Project Area would cover all or part of the following:

- NW-17-24-3-W5M
- N-18-24-3-W5M
- SE -19-24-3-W5M
- SW -19-24-3-W5M
- NW -19-24-3-W5M
- 3-24-4-W5M
- NE-4-24-4-W5M
- 10-24-4-W5M
- 13-24-4-W5M
- 14-24-4-W5M
- E-15-24-4-W5M
- NE-22-24-4-W5M
- 23-24-4-W5M
- 24-24-4-W5M
- S-25-24-4-W5M
- 26-24-4-W5M
- 27-24-4-W5M
- NE-28-24-4-W5M
- S-34-24-4-W5M

The off-stream reservoir would work in tandem with the Glenmore Reservoir and will store water only when flood levels in the Elbow River exceed 160 m^3/s and flow downstream of the Glenmore Reservoir is expected to exceed 170 m^3/s. The Project has the capacity to divert up to 600 m^3/s of flow from the Elbow River to the off-stream reservoir, which can hold 77,771,000 m^3 of water as active flood storage. Flows more than the diversion capacity will pass the diversion structure and be stored within Glenmore Reservoir, up to its allocated flood storage capacity of 10,000,000 m^3. The total storage capacity of 87,771,000 m^3 provided by the system (i.e. the off-stream reservoir and the Glenmore Reservoir) exceeds the amount of water that overtopped Glenmore Dam during the 2013 flood and caused damage from overland flooding downstream.

There are no plans to expand the Project or to decommission it in the foreseeable future. No additional, alternative or modified uses, objectives or applications of the Project have been identified.

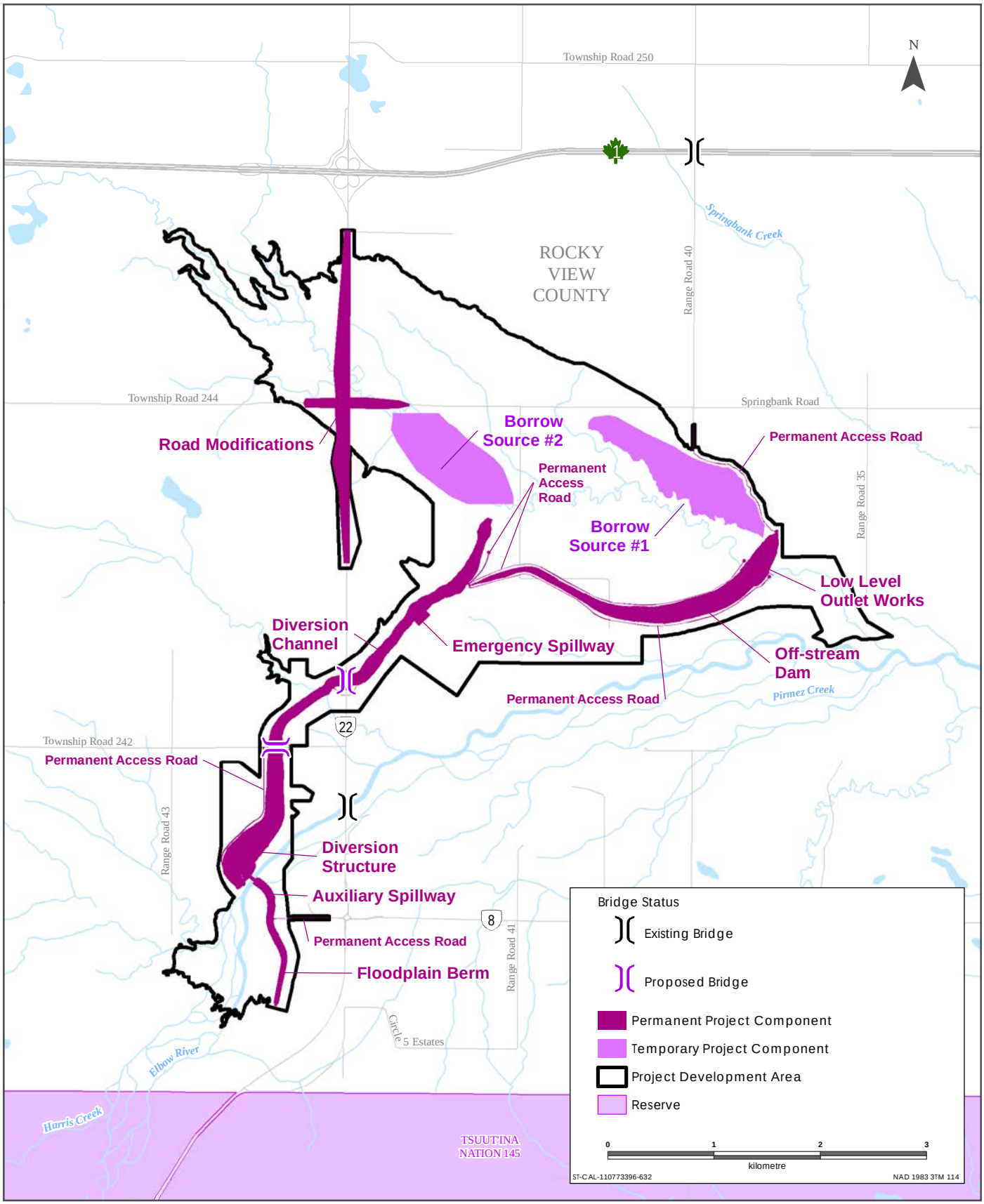
3.1 PROJECT COMPONENTS

The primary Project components include:

- a diversion structure on the main channel and floodplain of the Elbow River
- a diversion channel to transport diverted floodwater into the reservoir
- a dam to temporarily contain the diverted floodwater
- a low-level outlet in the dam to return the stored water back to the river after the flood subsides through an existing unnamed creek channel.

These primary components are described further in the following sections, and shown in Figure 3-1 Construction of the primary components requires other project infrastructure including:

- new roadworks and bridges
- utility relocations



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Main Components of the Project

Stantec

The Project is designed to mitigate potential flood damage to the City of Calgary and downstream communities, including the northeast corner of the Tsuut'ina Reserve. It will not mitigate potential flood damage to Bragg Creek and Redwood Meadows, which are located on the Elbow River upstream of the diversion point. Bank protection and dikes have been proposed for protection of Bragg Creek and these are waiting approval by AEP and DFO. The provincial government has provided funding to Redwood Meadows for flood protection.

3.1.1 Diversion System

The diversion system consists of four main elements:

- diversion inlet: The diversion inlet is a gated concrete structure that controls the diversion of river water into the diversion channel during flood events. It is located at the entrance to the diversion channel on the north bank of the Elbow River
- service spillway: The service spillway is a gated concrete structure located in the Elbow River channel adjacent to the diversion inlet
- floodplain berm: The floodplain berm is located on the south floodplain of the Elbow River. In concert with the auxiliary spillway, it acts to constrain flow in the Elbow River and direct it to the diversion structure.
- auxiliary spillway: The auxiliary spillway is dam safety component that is reserved to convey excess flood flow without overtopping failure, or circumvention of the floodplain berm. The auxiliary spillway spans the 214 m between the floodplain berm and the service spillway.

3.1.2 Diversion Channel

The diversion channel carries floodwater from the diversion inlet to the off-stream reservoir. The channel is 4,700 m long with a bottom width of 22 m, 4H:1V side slopes and a slope that varies from 0.1% to 0.2%. At the design maximum flow of 600 m^3/s, the required channel depth is 8.3 m, allowing for a maximum height of 6.4 m for floodwater and a minimum of 1.9 m of freeboard (room between the water and the top of the channel wall). The downstream 700 m of the channel gradually flares out to a width of 150 m and is protected from head cut by riprap and a grade control structure where it enters the reservoir.

3.1.3 Emergency Spillway

The emergency spillway is a concrete structure approximately 135 m long that permits unregulated overflow first to a graded outlet channel and then overland to the Elbow River. The spillway has a crest at the reservoir full service elevation of 1,210.75 m and a discharge capacity of 354 m^3/s at 1.25 m of head. It is located on the east side of the diversion channel

approximately 1,300 m upstream of the off-stream reservoir and is designed to operate during a probable maximum flood when:

- the diversion inlet gates jam in the open position and cannot be closed and
- the capacity of the reservoir is exhausted

The purpose of the emergency spillway is to prevent the stored water from overtopping the reservoir and instead release it in a controlled manner over the bedrock and return it to the Elbow River.

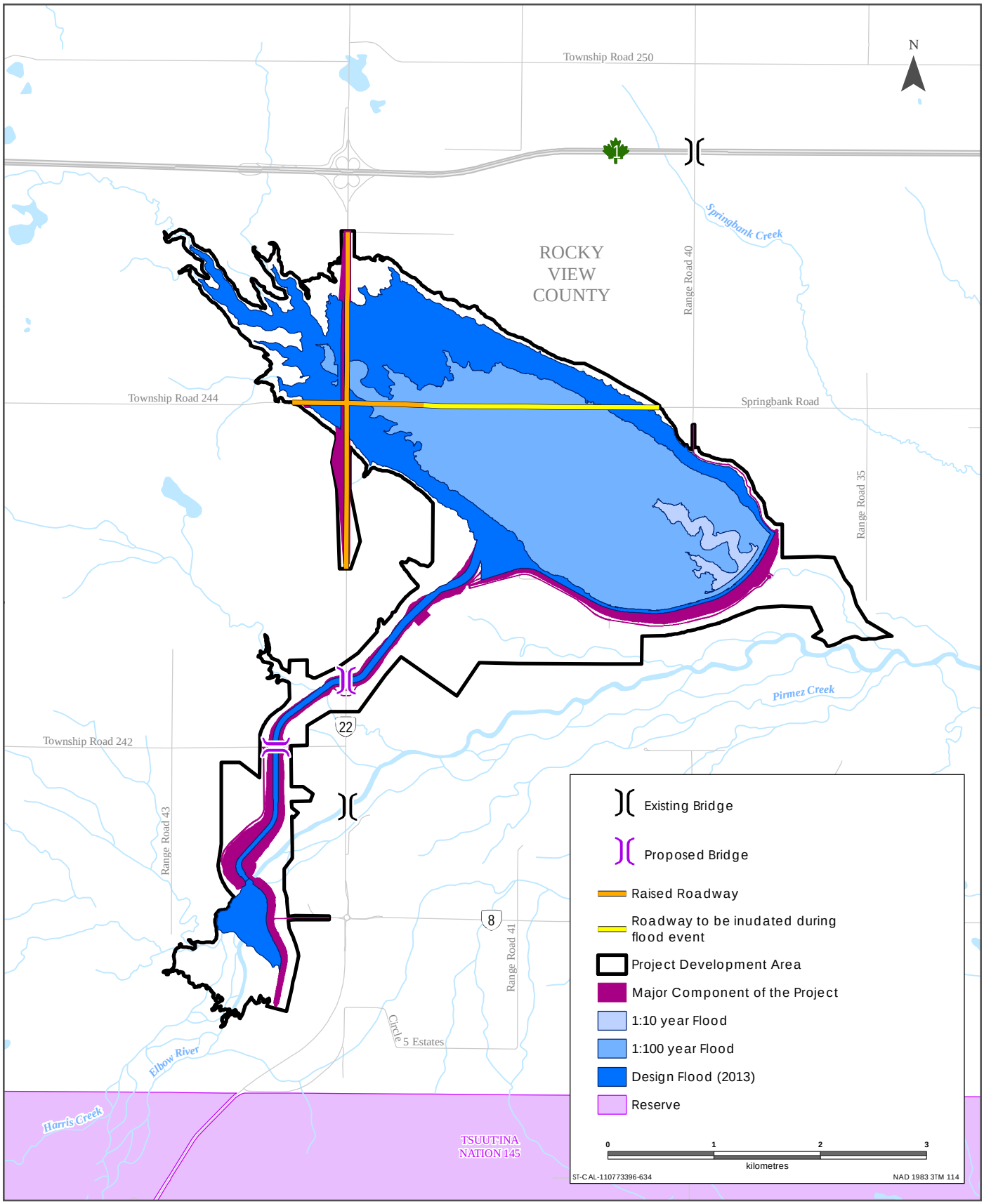
3.1.4 Off-Stream Reservoir and Dam

The off-stream reservoir uses existing topography to provide a basin within which diverted floodwater can be stored. Three flood scenarios were examined: a 1:10 year, 1:100 year and the 2013 flood. The Project has been designed to capture the 2013 flood, which had an estimated peak flow of 1,240 m^3/s, a 7-day volume of 149,600,000 m^3. Table 3-1 shows the reservoir storage volume, area flooded, and filling times for the three flood events. Residence time and release time are values assumed for the EIA, based on modelling results. Actual residence time and release rates will vary depending on conditions downstream post flood, performance of the dam while storing water, and other factors. Figure 3-2 shows the areas covered by the three flood scenarios.

Table 3-1 Reservoir Volumes, Area and Floodwater Times

Flood Magnitude	Storage Volume Used (dam^3)	Area of Reservoir Flooded (ha)	Duration of Diversion (days)	Residence Time in Reservoir (days)	Release Time (days)
1:10 year	500	60	0.38	43	30
1:100 year	30,100	500	1.8	43	39
2013 flood	77,800	730	3.75	20	38

The off-stream storage dam is a clay-cored earth embankment that would temporarily impound diverted floodwaters. The dam would be constructed of material excavated from the diversion channel, supplemented if necessary by borrow material. The dam has been designed in accordance with Canadian Dam Association (CDA) and Alberta Dam and Canal Safety Guidelines.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Flood Scenarios

Stantec

3.1.5 Low-Level Outlet

The low-level outlet is a gated concrete structure near the east end of the dam embankment that controls discharge of the floodwaters into an existing unnamed creek and back into the Elbow River. The outlet channel would be graded downstream of the low-level outlet works to convey the discharge away from the toe of the dam into the existing natural stream which flows to the Elbow River.

3.1.6 Access and Utilities

To maintain access to the area during flood events, road upgrades and new bridges would be required. Highway 22 will be raised above the reservoir design flood level and Springbank road will be raised to permit an at-grade intersection with raised Highway 22. In the event of Springbank road being inundated during a flood, traffic would be detoured north along Range Road 40. Figure 3-3 presents the preferred road network for the Project.

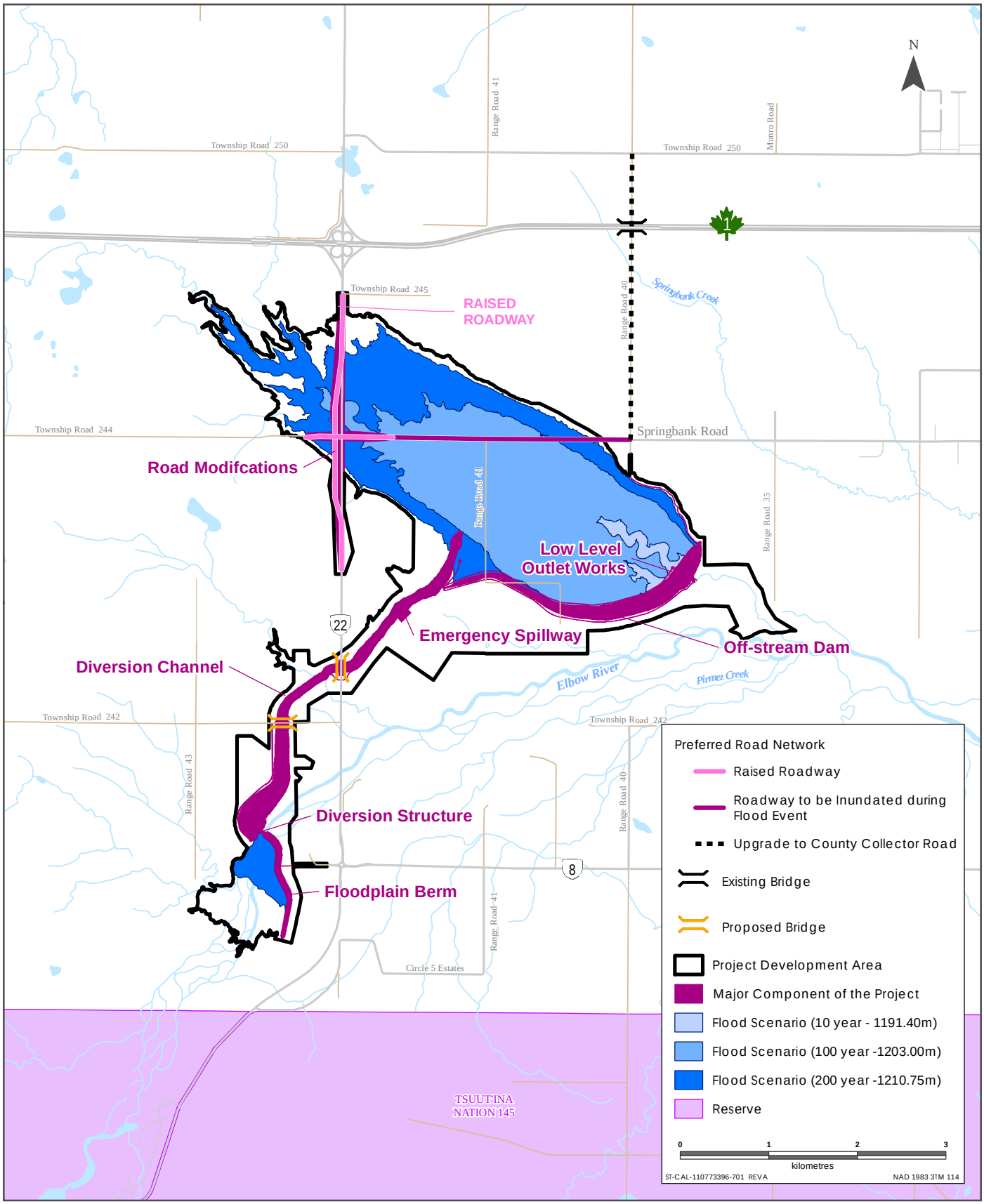
The following access roads will be required for on-going infrastructure operation and maintenance:

- along the crest of the floodplain berm and an access spur down the river side of the berm to the active floodplain, with access from Highway 22 along a provincial easement
- short ramp leading north from the diversion structure, on the west side of the diversion channel
- along the east side of the diversion channel from the diversion structure to the west end of the off-stream dam, incorporating crossings of Township Road 242 and Highway 22
- three access paths leading from the diversion channel access road at the west end of the dam: paths on the inner and outer bases of the dam to the low-level outlet works and a road along the dam crest to a turnaround at the east end
- an unpaved north emergency access around the reservoir perimeter connecting the east end of the dam with Springbank Road

All permanent access roads for the Project will be gated with swing gates and vehicle access will be limited to AEP operations and maintenance.

Pipelines, power lines and telephone and internet lines that cross the project facilities will need to be relocated. Alberta Transportation has been in discussions with the owners of these facilities who will be responsible for the relocations.

Oil and gas pipelines operated by four companies (TransCanada Pipelines Ltd., Pengrowth Energy Corp., Veresen Inc., and Plains Midstream Canada) are in the diversion channel, dam, and reservoir areas.



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

Preferred SR1 Road Network

Stantec

AltaLink operates a transmission line that crosses the diversion channel. Power pole locations would be adjusted to permit a clear span over the channel. Electricity distribution in the area is supplied by Fortis as overhead power lines with primary lines running along Springbank Road and down the Highway 22 corridor. The ultimate plan for Fortis infrastructure is dependent on land acquisition and which customers they will need to continue to serve if the Project is approved.

Telephone and internet cables owned by Telus run through the reservoir area with their main cable running down the northern ditch line of Springbank Road. Discussions with Telus to date acknowledge that basic waterproofing of the existing infrastructure is not feasible given the serviceable depths of reservoir over the lines; and that a sealed conduit may be warranted. Lines that currently run down road ditch lines will likely be moved to the realigned ditch lines and services re-connected. At crossings of the diversion channel the lines are to run through conduits in the bridges. The ultimate plans for Telus infrastructure are dependent on land acquisition and which customers they will need to continue service to once the project is in place.

3.2 PROJECT CONSTRUCTION

At present, the Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood event) for floods in the spring of 2021, and be completely constructed (able to accommodate the design flood) for the spring of 2022. Any delay in Project approval or land acquisition beyond the end of 2018 will delay the construction of the Project and the ability to mitigate flood events in 2021 or beyond.

Project construction would be continuous (24 hours per day), weather conditions permitting. Portable light plants (nine at three different locations) are assumed to operate 12 hours per day to provide night time illumination for construction. Power for construction activities would be supplied by diesel engines in vehicles and equipment. Electrical energy would be supplied by portable diesel generators.

Environmental protection would be managed during construction through Alberta Transportation's Environmental Construction Operations (ECO) Plan process (ECO Plan). An ECO Plan is a project-specific contractor's plan to identify and mitigate the environmental effects that might result from construction-related activities and ensure compliance with applicable guidelines, regulatory requirements and proponent commitments. Other Alberta Transportation guidance documents that apply to the project deals specifically with erosion and sediment control, and have been implemented throughout the valued components (VCs) assessments proposed mitigation measures in Section 6.0.

3.2.1 Waste Management Plan

Waste disposal during construction will be the responsibility of construction contractors and would follow these guidelines:

- Waste streams will be disposed of according to the applicable provisions of the Waste Control Regulation and its associated codes of practice and the requirement for each waste classification outlined in the Alberta User Guide for Waste Managers.
- Solid waste will be either recycled or disposed of through licensed companies at licensed facilities.
- Excavated rock and soil materials that are unsuitable for construction uses would be hauled to a designated spoil location within the Project limits.
- The construction contractor's ECO Plan will include a waste management plan.

3.2.2 Hazardous Materials Management

Hazardous materials management during construction would be the responsibility of construction contractors and would follow these guidelines:

- Hazardous materials will be transported to and from the site, labelled, handled, used and stored in accordance with regulatory requirements.
- Fuel and other hazardous materials will be stored at least 30 m from any waterbody.
- Fuel tanks and other containers of hazardous liquids will be stored in secondary containment having 110% of the capacity of the largest vessel inside the containment.
- Liquid fuel and propane tanks will have "no smoking" signage.
- Spill kits will be on site, in construction vehicles and in fuel and service vehicles.
- Leaks and spills will immediately be contained, cleaned up and reported in accordance with regulatory requirements.
- Waste hazardous materials, including spill wastes, will be removed from site and disposed in accordance with regulatory requirements.
- Copies of tipping fee receipts and manifests will be retained on site to verify legal disposal of hazardous wastes.
- Spill sites will be cleaned in accordance with regulatory requirements.

3.2.3 Water Management Plan

The main objective of the Project is to manage flood flow and lessen their impact on life and property downstream. This water management plan's objective to achieve this and maintain or improve the quality of water that comes into contact with Project components during each project phase, and minimize adverse effects to fish and fish habitat. This water management plan proposes to achieve this by complying with regulations, and guidelines by implementing mitigation and monitoring programs to minimize project effects.

During construction, environmental protection will be managed through Alberta Transportation's ECO Plan process.

No active water management is required during dry operation. Water from the ephemeral creeks that are bisected by the diversion channel (and adjacent drainage) will be collected in the diversion channel and drained to the Unnamed Tributary which conveys it through the low-level outlet and to the Elbow River. Grading design will allow for positive drainage within the project site directing flows into proposed infrastructure or existing drainage ditches.

In the event that maintenance or repairs require work in water, the care of water as described in the construction phase would apply.

During flood conditions, a portion of the Elbow River is diverted down the diversion channel to be retained in the reservoir. Local drainage will continue to flow into the diversion channel, reservoir, or existing drainage ditches. The amount of inflow into the reservoir from the Elbow River will be controlled through different gate settings at the diversion structure. An emergency spillway is located along the diversion channel to prevent overfilling of the reservoir.

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

3.3 DRY OPERATION

Dry operation refers to project operation between floods. During dry operation, the diversion inlet gates would be closed, and the service spillway gates would be open (lowered). The gate system and its operation would be checked according to a routine maintenance schedule to be developed by AEP. The maintenance schedule would 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 removal would be completed as necessary.

Surface runoff from storms or melting snow, as well as streamflow from watercourses intersected by the diversion channel, would flow into the diversion channel and travel to the reservoir. Between floods, the dam embankment, associated access roads and low- level outlet works also would be inspected for damage on a regular schedule to be determined by AEP, and repairs would be carried out if necessary

3.4 FLOOD AND POST-FLOOD OPERATIONS

The Project is expected to begin diversion of flood waters when flows in the Elbow River exceed 160 m^3/s. At that flow level, the service spillway gates would be raised to create a backwater upstream of the diversion structure, the diversion inlet gates would be opened, and excess flood flow would begin to divert into the diversion channel to be stored in the off-stream reservoir. The diversion inlet and service spillway gates would be operated and monitored from the adjacent control building, which would be staffed continuously during diversion of flood events.

The maximum rate of diversion is 600 m^3/s and when incoming flows on the Elbow River are between 160 m^3/s and 760 m^3/s, a flow of 160 m^3/s would be allowed downstream through the service spillway. When inflows from the Elbow River exceed 760 m^3/s, the excess flow would be allowed downstream through the service spillway, while maintaining a constant diversion rate of 600 m^3/s until the reservoir is full, then the inlet gates will close.

During post-flood operations, the diversion inlet gates would be closed, and the service spillway gates would be opened (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 outlet channel and then into Elbow River The outlet structure gates would remain open after the reservoir has drained.

3.5 PROJECT DECOMMISSIONING

The Elbow River will continue to pose a threat of flooding indefinitely. Accordingly, there are no plans to decommission the Project.

After the new raised lanes of Highway 22 are in operation, the parallel section of the existing highway will no longer be needed and will be decommissioned. Also to be decommissioned after construction is complete are:

- the borrow site in the reservoir
- construction access roads that are not needed for operations
- the temporary channel used for the diversion of the Elbow River

The decommissioned infrastructure would undergo surface preparation, topsoil replacement and revegetation to meet AEP reclamation requirements.

3.6 PROJECT JUSTIFICATION AND ALTERNATIVES CONSIDERED

The Elbow River flood of 2013 was a devastating event socially and economically. That flood had an estimated peak flow of 1,240 m^3/s, a 7-day volume of 149,600,000 m^3 and is estimated to be slightly greater than a 1:200-year event. A study by IBI Group estimates that up to $1.5 billion is at risk due to flooding of the Elbow River during a future flood of the same magnitude without flood protection.

The terms of reference for the environmental assessment from AEP and the guidelines from the CEA Agency both require that alternatives to the Project be described. In accordance with Part 2, Section 2.2. of the CEAA EIS Guidelines for the Project, alternative means of carrying out the project that are technically and economically feasible need to be identified. Consideration of alternative means have been addressed following guidance in the Agency's Operational Policy statement on this subject – Addressing "Purpose of" and "Alternative Means" under the *Canadian Environmental Assessment Act, 2012*.

The environmental team worked with the engineering team throughout Project and environmental protection is a component of the Project design. Although engineering (including feasibility), and economic considerations were the prime factor in choosing many of the alternatives, environmental considerations drove some of them.

An alternative means evaluation was completed for the following Project components:

- Project location
- diversion system
  - location (including diversion channel)

  - service spillway
  - auxiliary spillway
- emergency spillway
- off-stream dam location
- low-level outlet channel
- realignments and modifications of public roads

3.6.1 Project Location Alternatives

Following the floods of June 2013, the Government of Alberta (GOA) set up the Southern Alberta Flood Recovery Task Force. Five potential locations for flood mitigation measures on the Elbow River were identified, as follows:

- a dry dam on Quirk Creek near the upper reaches of the Elbow River: The Quirk Creek option was dismissed due to slope stability concerns.
- a dry dam on Canyon Creek, also near the upper reaches of the Elbow River: The Canyon Creek option was dismissed because the volume was too small for the amount required for flood mitigation.
- an underground diversion tunnel running east from Glenmore Reservoir and discharging into the Bow River: The Glenmore Reservoir diversion tunnel has a positive benefit/cost ratio in only two of the four scenarios considered, and it has a lower benefit/cost ratio than either the Project or MC1 in all four of the scenarios. Consequently, the diversion tunnel was rejected from further consideration.
- an earth fill dam built on the main channel of the Elbow River near its confluence with McLean Creek and spanning the Elbow River valley (MC1 Option): which was ultimately dismissed, due to a variety of concerns, described in Table 3-2.
- an off-stream reservoir at Springbank Road (SR1, or the Project): recommended in combination with local mitigation for Bragg Creek and Redwood Meadows, over the MC1 Option.

Table 3-2 Comparison of the Project (SR1) and the MC1 Option

Category	Comparisons
Project Effectiveness	• The Project is more effective than MC1 because it is further downstream and has a larger catchment area. It can respond to rainstorms occurring over a significantly larger area than MC1 by also managing water entering the Elbow River downstream of the MC1 Option. • The Project is significantly less affected by sedimentation. The amount of large sediment that the Elbow River carried in 2013 is a key factor in supporting off-stream storage. • MC1 is on-stream, closer to the mountains, and is more likely to trap rocks and trees, putting the structure and its operation at risk. • Through the design of the SR1 diversion structure, it is possible to look at ways to reduce the impact of sediment on the dam itself. • SR1 is closer to Calgary and is more accessible. This means that dam operations are more robust, as emergency access to the dam is less likely to be hampered by damage to access roads.
Environmental Impacts	• The environmental reviews undertaken have consistently described the MC1 proposal as fundamentally more ecologically sensitive to disturbance than SR1. • The Elbow Valley is home to a number of species at risk or concern, including grizzly bears, harlequin ducks, bull trout, westslope cutthroat trout, and wolverine. • The Project leaves the river as a more natural system. • The construction of MC1 would permanently alter fish habitat and interfere with fish spawning. • MC1 would require the removal of trees and vegetation in the reservoir, and would irreparably alter the habitat for wildlife and fish population. • Deltares noted that “From an environmental point of view, SR1 leaves the river as a more natural system.” • Since SR1 is an off-stream project, less in-stream work will be required during its construction.

Table 3-2 Comparison of the Project (SR1) and the MC1 Option

Category	Comparisons
Construction and Operation Risks	• Deltares indicates that fewer construction risks makes SR1 the preferred project. • SR1 is less subject to the risks of flooding and consequent threat of catastrophic failure during construction when compared to MC1, which involves building a dam in the river itself. Further, should MC1 fail during construction, the communities of Bragg Creek and Redwood Meadows would be subject to severe damage from debris from the partially built dam. • SR1 is estimated to require less time to build than MC1 because it is less subject to construction windows required by environmental concerns. • MC1 is an on-stream dam and would be constrained by construction windows which limit when work can happen in the river. • There is a greater risk of cost increases associated with MC1 because of the complex engineering required, the on-stream nature of the dam, the comparatively limited access to the site, and the more difficult geology. • The approval process for MC1 has a higher risk of delays to address mitigation of environmental impacts, and it is possible the project would not receive approval at all. • MC1 is less accessible and more remote than the Project, potentially making on-site response to emergencies more challenging. • Potential debris flows during a flood are more likely at MC1 and could threaten the structure.
Social and Recreational Value	• MC1 would have a direct negative impact on the recreational and social values in the area it affects. • AMEC notes that "current users appear to place a high social value on the area in its present state." • The areas is the single access point for one of the most heavily used recreational areas in Kananaskis Country with an estimated half a million visitors annually. • The area includes the primary access to the McLean Creek Off-Highway Vehicle Zone, Moose Mountain Downhill Biking and secondary access to the West Bragg Creek trails, the Elbow River camping and trailhead facilities, and numerous sight-seeing and day use facilities such as "Elbow Falls". • Other outdoor recreational opportunities and experiences include cross-country skiing, snowshoeing, hiking, camping, equestrian riding, off-highway vehicle (OHV) use, backpacking, rafting, fishing, hunting, canoeing, kayaking, and paddle boarding.

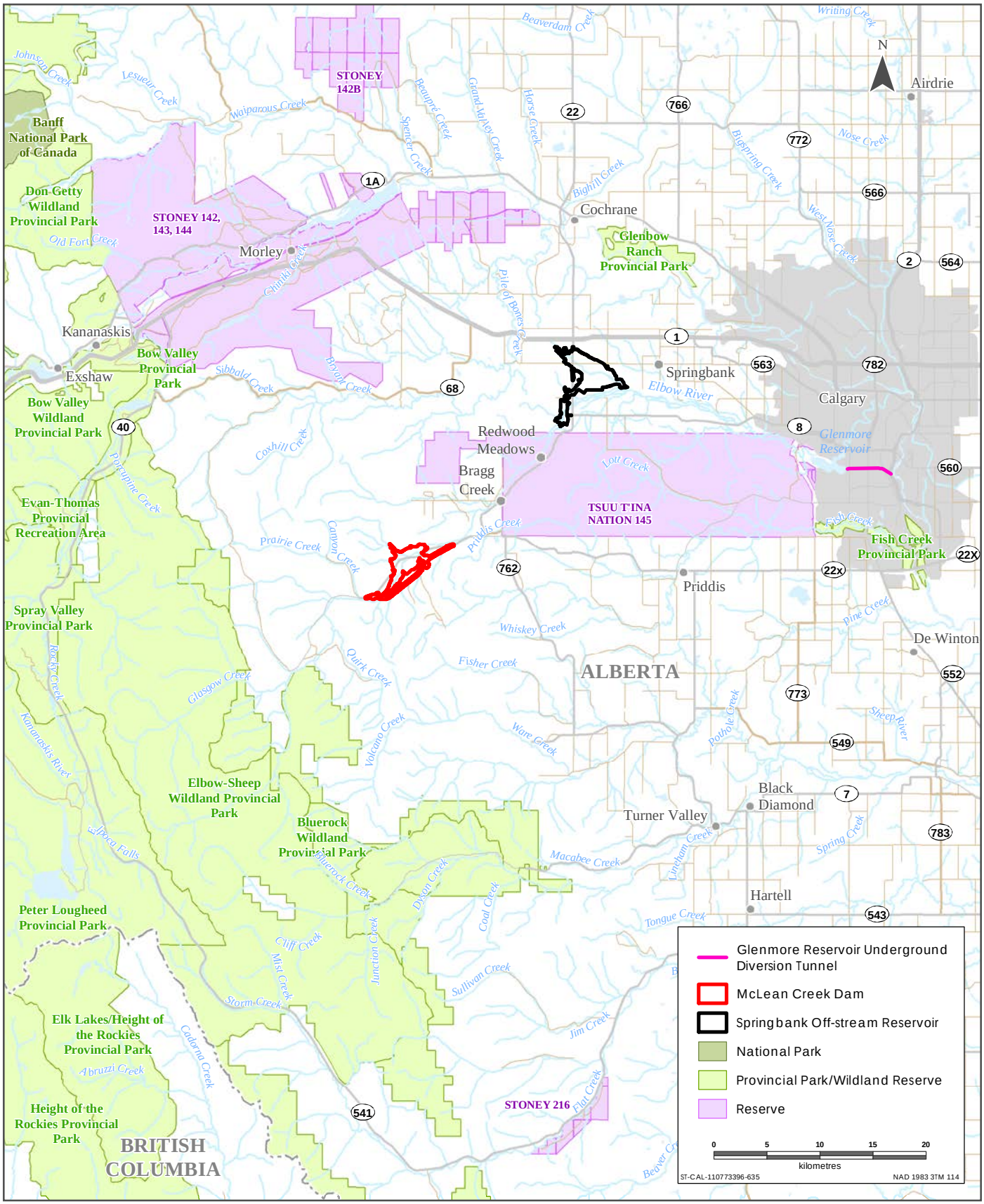
Table 3-2 Comparison of the Project (SR1) and the MC1 Option

Category	Comparisons
Social and Recreational Value (cont'd)	• The recreation sites and parks in the Elbow Valley that are directly affected by the MC1 proposal are: – Gooseberry Public Recreation Area (PRA) including the campground (83 sites) and Elbow Visitor Centre; – McLean Creek PRA and OHV zone, including day use, campground (170 sites) and concession; – Elbow River PRA including Allen Bill Day Use, River Cove Group Camp, Paddy's Flats campground (98 sites) and Group Camp Area, Station Flats Staging Area and Elbow Ranger Station. • There were 17 special events permitted in the Elbow Valley parks from May 1, 2015 to October 15, 2015. • SR1 affects grazing areas and ranch lands for a small number of Albertans. This will have an impact as these are legacy ranching families with a strong stewardship ethic.
Commercial and Tourism Values	• From commercial and tourism value perspective, SR1 is the preferred project. • The McLean access point is one of the main arteries into the recreational area. • In 2014, there were 107 Commercial Guiding and Outfitting Permits representing over 40 different commercial companies involved in over 20 different activities.
Construction Cost Estimates	• SR1 is the preferred project because it is less expensive and therefore has a more favourable benefit/cost ratio. • The cost referred to in the Deltares report say it includes funding for mitigation in Bragg Creek and Redwood Meadows, but it doesn't include the latest cost estimates required to provide the necessary level of flood protection. • The actual amount for the project (earmarked for SR1 and upstream mitigation) is $297 million. This figure remains cheaper than MC1 and provides protection against the same level of cost damage. Therefore, SR1 still provides the better benefit/cost ratio. • The initial cost estimates are susceptible to change but the cost-escalation risk for MC1 is higher than for SR1. • Deltares recommended that compensating landowners after flood events should be considered because it could be less costly than buying the land.

Table 3-2 Comparison of the Project (SR1) and the MC1 Option

Category	Comparisons
Construction Timelines	• It is expected that SR1 will take less time to construct than MC1. • AMEC notes that 'Special measures would be required for winter construction, including heating and hoarding for concrete, and the continuous 24-hour per day earthfill operations" should rapid year-round construction proceed. Such measures would also affect the cost of construction. • An additional concern with respect to the construction time of the MC1 project is the uncertainty around identified zones of "moderate and high archaeological potential". Projects unable to avoid damage to historical resources require an "extended regulatory timeline…including restrictions on winter fieldwork". • With reference to MC1, AMEC notes that "The EIA process (preparation and review) combined with the NRCB process…could take between 2 and 5+ years for these types of projects. Some projects have taken longer." Note that this time would be in addition to the time required for construction.
Conclusions	• Deltares agreed with previous assessments that the Project, combined with local mitigation at Bragg Creek and Redwood Meadows, is less expensive, more environmentally friendly, can be delivered on a shorter timeline, and presents less risk during construction than MC1. • There is also a clear recognition that SR1 would capture a storm surge that entered a much wider area of the basin offering better protection for the City of Calgary over the long term. • The off-stream design of the Project better handles sedimentation and is more cost effective than MC1. • The complexity and remote location of MC1 comes with an inherently higher risk of escalating construction costs. Deltares highlighted the potential risk of a major flood during the construction phase. • Overall, the assessment and scoring for SR1 are considerably more favourable than for the proposed MC1. When social and recreational values enter into the equation the evidence is overwhelmingly in favour of the social good created by the SR1 project from a cost, environmental and risk basis.
SOURCE: AEP 2015	

The Government of Alberta formally announced on October 26, 2015 that it would proceed with entering the Springbank Off-stream Reservoir Project into the regulatory process.



Sources: Base Data - ESRI, Natural Earth. Thematic Data - ERBC, Opus International Consultants Limited,

Project Alternatives for Elbow River Flood Protection in the Calgary Area

3.6.2 Project Design Alternatives

An alternative means evaluation was completed for the following Project components:

- Project location
- diversion system
  - location
  - service spillway
  - auxiliary spillway
- emergency spillway
- off-stream dam location
- low-level outlet channel
- realignments and modifications of public roads

3.6.2.1 Diversion System

Location Alternatives

Two locations for the diversion system were considered: the initial design concept (IDC) from the AMEC 2014 report, and an alternate location, approximately 400 m upstream of the IDC site. The IDC diversion channel location was chosen as the preferred division system location for the following reasons:

- The IDC diversion channel location is shorter than the upstream location, which reduces the area of disturbance and land requirements.
- Less vegetation and wildlife habitat loss would occur with the IDC location compared to the upstream location.
- the upstream location is approximately $5-$15 million more expensive than the IDC location and provides limited advantages to diversion structure operations.

Service Spillway

Three potential gate types were considered for the service spillway:

- radial gate (underflow gate which draws water from the bottom of the water column)
- bottom hinged steel ‘flap’ gate with top mounted hydraulic cylinders (overflow gate which draws water from the top of the water column)
- Obermeyer crest gate (overflow gate)

An Obermeyer crest gate was the preferred alternative for the service spillway. Overflow gates provide better forebay water level control than underflow gates and are superior in debris passage. Further, overflow gates are able to open without power permitting river flows to pass in the event of a dam safety issue. In comparison to steel flap gates, Obermeyer crest gates provide further benefits including lower cost, ease of installation and modular design.

Auxiliary Spillway

Three alternatives for the auxiliary spillway were considered prior to the selection of the proposed design:

- an earth embankment with an articulated concrete block (ACB) overlay
- an earth embankment with a roller compacted concrete (RCC) overlay, and
- an RCC with an earthen overlay

An auxiliary spillway consisting of an ACB or RCC overlay would result in a surface composed of concrete blocks or compacted concrete, either of which would result in difficulties for ungulate movement over the structure. The chosen alternative of an RCC base overlain by topsoil is more conducive to ungulate movement and is $2 million less expensive than having a RCC overlay.

3.6.2.2 Emergency Spillway Alternatives

Three alternative spillway locations (Alternate Location 1, 2, and 3) were considered, shown on Figure 3-5, within the off-stream storage dam embankment.

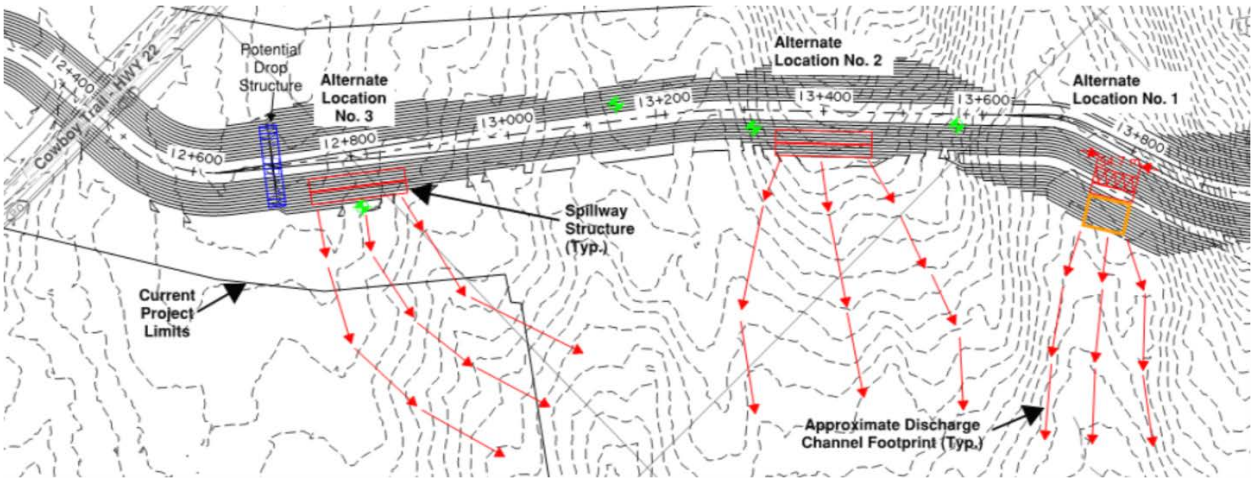


Figure 3-5 Three Proposed Alternate Spillway Locations

Alternate Location 1 would be located primarily over existing till and clay and fill material that has a relatively high potential for head-cutting. The outlet channel for locations 2 and 3 would primarily be placed over existing bedrock. The bedrock is more durable than the native till and clay materials, thereby being less susceptible to erosion and head-cutting.

Alternate Location 3 is located outside the environmental assessment area and current project limits. Additionally, an approximate 1 m drop structure in the diversion channel would be required to lower the diversion channel to prevent premature discharge over the spillway.

The emergency spillway location alternatives affect the soil, vegetation, wildlife and land use valued components. Location 1 has the greatest erosion potential of the three alternatives, which could affect soil conditions, vegetation and wildlife habitat. Locations 2 and 3 require a greater channel width than Location 1. This would affect land use and also the extent of vegetation communities and wildlife habitat disturbed in the channel footprint. Location 3, with its position outside the PDA would affect the area of land disturbance and associated disturbance on vegetation and wetlands.

Based on engineering considerations, Location 2 was deemed the most appropriate location for the emergency spillway, because of the more stable bedrock materials present and particularly because of the diversion channel drop structure that would be required at Location 3. Environmentally, although both Location 2 and 3 are in bedrock, offering less potential for erosion, Location 2 offers the advantage over Location 3 of being within the PDA and not requiring an expansion of the PDA and further land use disturbance.

3.6.2.3 Off-stream Dam Location Alternatives

The IDC, developed by AMEC, included a provision of 41,200 dam^3 of flood storage for protection up to the 1:100 flood annual exceedance probability flood event. The dam toe of the IDC was approximately 300 m away from the top of bank of the Elbow River at its closest location.

In April 2015, Stantec submitted the Conceptual Design Update Memorandum that included provision of 70,200 dam^3 of storage for flood mitigation up to the 2013 flood event. This increased storage volume was achieved in part by moving the dam further downstream (southeast) to within approximately 100 m of the top of Elbow River north bank.

Studies on the location of the dam in the conceptual design update included a review of general site considerations, river bank erosion rate, and geotechnical considerations.

Stantec proposed three preliminary alternatives for the dam toe location:

- dam toe in conceptual design location, monitor
- dam toe in conceptual design location, bank toe stabilization
- dam relocated upstream

These location alternatives were intended to mitigate geotechnical stability and river instability risks.

Alternative 1 – Dam Toe in Conceptual Design Location, Monitor

A conservative average erosion rate of 1.0 m/year results in an unacceptable factor of safety in approximately 50 years. A single large-scale event, like the 2013 flood, is not likely to result in more than 10 m of erosion, based on review of recent aerial photography and river alignments. The slow rate and timescale for this erosional process to occur are such that they would allow the implementation of slope stabilization, river training structures, as discussed below as Alternative 2, or other corrective actions when routine dam inspections indicate the erosion is threatening slope stability.

Alternative 2 – Dam toe in Conceptual Design Location, Bank Toe Stabilization

Two conceptual options were developed that would mitigate erosion at the toe of the terrace from the Elbow River.

Option 1 is the construction of groynes as river training structures. Groynes are long projections of earth or rock fill that can be used to effectively 'push' the river away from areas of high erosion potential. The proposed groynes are comprised of vegetated earth fill with a Class II riprap cap on their ends and a self-launching apron for scour protection. A *Fisheries Act* authorization and *Water Act* approval would be required for the implementation of the groynes.

Option 2 is the construction of a terrace with riprap facing. This concept uses an assumed 10 m wide vegetated bench. As with Option 1, this option would require *Fisheries Act* authorization, *Water Act* approval and a disposition licence of occupation for any portions that encroach on the bed and shore of the Elbow River, or any other portions of Crown land. The riprap would not be expected to affect the common right to navigation.

Alternative 3 – Relocate the Dam Upstream

The third alternative for addressing bank erosion risks is to relocate the dam approximately 100 m upstream from the conceptual design location, moving it approximately 200 m from the top of bank of the Elbow River at its closest location. Relocation of the dam further upstream would have a relatively small effect on reservoir storage, requiring a pool elevation increase of 0.3 m.

Alternatives 1 and 3 would contain work within the existing project boundary. No new properties would need to be acquired as a part of these proposed alternatives. Alternative 2 involves proposed work exceeding the current project boundary.

The dam toe location alternatives all have the potential to affect the soil, hydrology, water quality, aquatic resources and land use components. Alternatives 1 and 2 would require instream work to mitigate erosion issues. Work in the Elbow River offers the potential destruction of fish habitat and fish mortality. The use of groynes would disrupt flow patterns in the river. The constructed terrace and riprap facing has less hydraulic impact than groynes and is less aggressive a diversion of the river channel; however, the use of riprap results in a loss of shade and feeding areas in the aquatic environment and causes effects on wildlife passage. Alternative 2 would affect the land use component because mitigation measures would extend outside of the existing PDA. Alternative 3 would not require instream work.

Alternative 2 is $3.4 to $7.2 million more expensive than Alternative 1, while Alternative 3 is $615,000 more expensive. Given the better geotechnical conditions (less toe erosion potential from the river), the elimination of the need of instream work and the ability for the dam to remain in the existing PDA, Alternative 3 was chosen as the preferred alternative for the dam location.

3.6.2.4 Low-level Outlet Channel Alternatives

Two alternatives were considered for the outlet channel:

- upsizing the existing stream to convey to peak design flow to the Elbow River
- delay reshaping the channel until it is absolutely necessary

The existing stream is undersized to handle the design peak discharge and, therefore, it would likely erode and scour during high discharges from the low-level outlet works. If high flows were discharged to the outlet channel, a substantive amount of maintenance would be anticipated to restore the stream to its existing condition.

Upsizing the existing stream during the Project construction phase would result in reshaping the channel, likely to the size of a design flood event. This would include the addition of armouring of the channel and would affect the aquatic ecosystem of the stream, including any fish habitat. The riparian conditions along the stream would be altered with the likely removal of vegetation paralleling the stream. The upsizing would involve instream work and offer the potential for erosion of sediment into the stream and downstream to the Elbow River.

If stream maintenance were to be postponed until a large flood had occurred and the extent of stream damage following reservoir draining had been evaluated, effects to the stream and adjacent environment may be less extensive that those for a design flood event.

The choice was made to delay maintenance on the channel until such a time as it may be required.

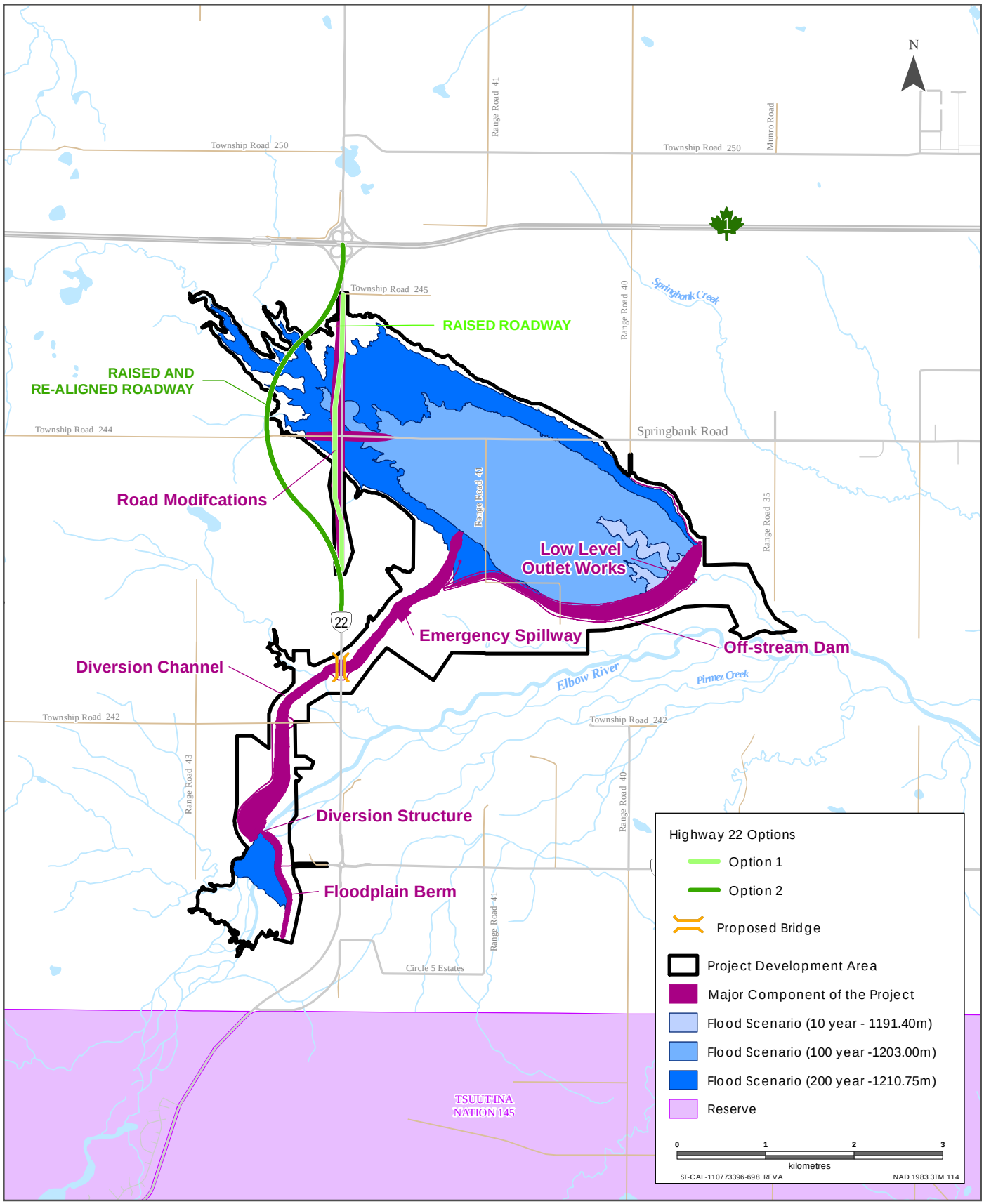
3.6.3 Alternatives to the Realignment and Modifications to Public Roads

In order to protect existing roadways in the PDA, improvements such as relocation, raising the vertical profile, or a combination of the two are required. In addition to the roadway improvements, bridges are required over the diversion channel. The roads that are affected are:

- Highway 22
- Springbank Road/Township Road 244
- Township Road 242

Evaluation of the road network options were completed for Highway 22 (see Figure 3-6), Springbank Road and Township Road 242, shown on Figure 3-7 and Figure 3-8, respectively. The evaluations considered:

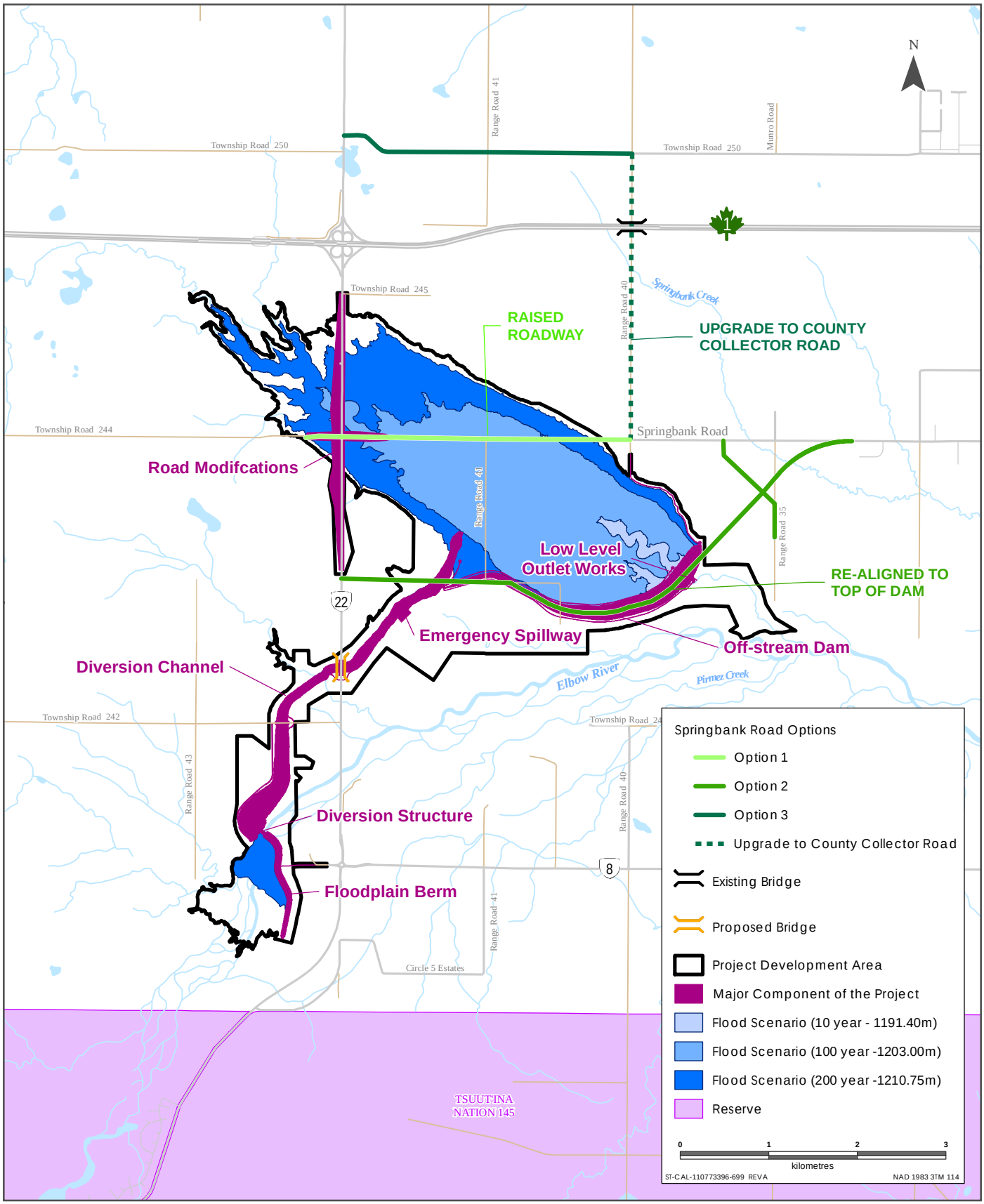
- construction cost
- environmental constraints
- historical resources constraints
- effects on existing developments
- flood effects on the road infrastructure and remediation requirements
- future access management affect
- road user cost
- travel distance



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

Highway 22 Options

Stantec



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

Springbank Road Options

Stantec

3.6.3.1 Design Options for Highway 22

Highway 22 passes through the western end of the reservoir and, at its existing elevation, would be inundated during the design flood as well as during some lesser flood events. Initially three design options were considered for protecting Highway 22, but one – realigning Highway 22 and relocating the Highway 1/22 interchange to the west, outside the influence of the flood area – was eliminated from consideration because of the increased cost to construct a new Highway 1/22 interchange and the additional right-of-way required. The remaining two design options are shown on Figure 3-6 and described below.

Design Option 1 raises Highway 22 above the reservoir design flood level in the location of the future southbound lanes (twinning to the west side). The design elevation allows 0.5 m for freeboard and 1.0 m for the pavement structure depth above design flood level, which results in an embankment height of approximately 5 m at the Springbank Road intersection. The length of the raised roadway is approximately 1,800 m. Culverts in the raised road embankment are sized at 3.67 m to facilitate filling and draining of the reservoir during a flood event. In order to maintain traffic operations along Highway 22 during construction of the new lanes, this design option proposes shifting the new lanes west to avoid affecting traffic on the existing highway.

After the new lanes are opened, the former Highway 22 alignment would be decommissioned. Design Option 1 is the preferred Highway 22 option.

Design Option 2 realigns Highway 22 in a loop to the west. As in Option 1, the highway is raised above the reservoir design elevation.

Design Option 1 is the preferred alternative because of its smaller footprint and lower cost.

3.6.3.2 Design Options for Springbank Road/Township Road 244

Springbank Road is located east of Highway 22 and is a paved east–west regional collector road that provides access to existing properties and future development in the area. West of Highway 22, Township Road 244 is a gravel collector roadway. The existing Springbank Road would be affected by the design flood levels. The three roadway design options are shown on Figure 3-7 and described below.

Design Option 1 raises Springbank Road above the 2013 flood level to maintain traffic during a flood event. Difficulties with this option include:

- The road embankment would be classified as a dam under the Dam and Canal Safety Guidelines, leading to higher engineering, construction, safety, maintenance, and licensing costs than for a typical roadway.

- With a maximum roadway embankment of 16 m, this option requires more than 2,000,000 m^3 of fill. Sourcing this much dam-quality material would be challenging, and hauling it would be costly.
- The embankment would span 3.5 km to a maximum height of 16 m and width of 80 m, which would create an obtrusive visual legacy.

Design Option 2 maintains existing Springbank Road except for the modifications necessary to permit an at-grade intersection with raised Highway 22. Raising the road grade at this intersection permit access to Township Road 244 during the design flood, but a portion of Springbank Road would be submerged. In that circumstance, traffic would be detoured north on Range Road 40, under the existing Highway 1 underpass, then west on Township Road 250 to Highway 22. Range Road 40, currently a two-lane gravel road, would be upgraded to a county collector roadway. Design Option 2 is the preferred option for Springbank Road.

Design Option 3 leaves the existing roadway near Range Road 35 and realigns Springbank Road on top of the dam, with a connection to Highway 22, 1,600 m south of the existing Springbank Road intersection. This option requires a bridge crossing over the diversion channel.

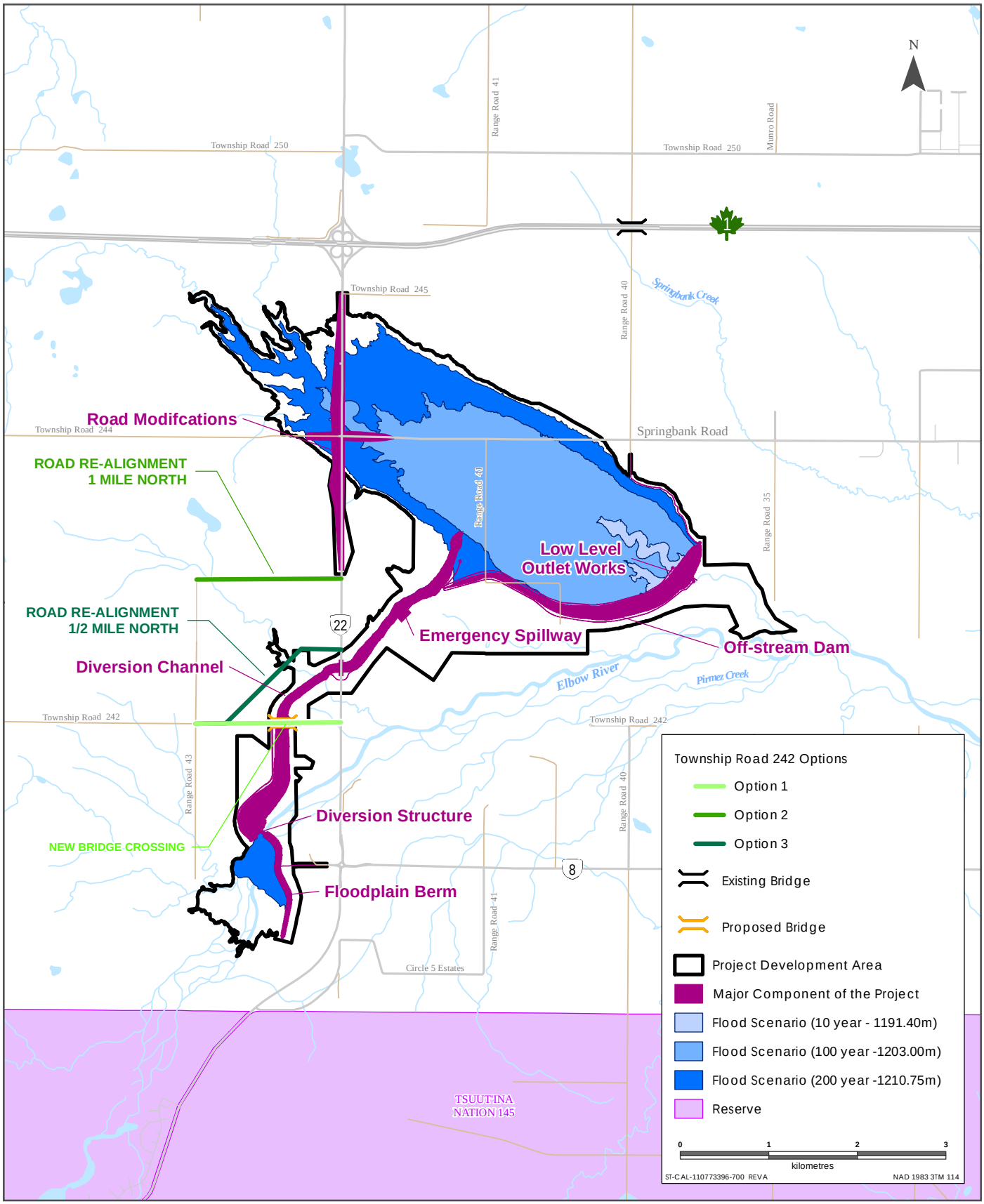
Design Option 2 is the preferred alternative. It avoids the creation of a new dam because of the embankment required (Option 1) or the construction of a new road that would be used only during large floods (Option 3), and is the least expensive.

3.6.3.3 Design Options for Township Road 242

Township Road 242, west of Highway 22, is a two-lane roadway that serves the Copithorne gravel pit and a small number of country residential dwellings. Township Road 242 is not in the reservoir but does intersect the diversion channel. Three roadway options are shown in Figure 3-8 and described below.

- Design Option 1 maintains the existing Township Road 242 alignment, but with a bridge crossing over the diversion channel.
- Design Option 2 realigns Township Road 242 using Range Road 43, approximately 1,600 m north of the existing intersection of Highway 22 and Township Road 242. This option eliminates the need for a bridge crossing over the diversion channel.
- Design Option 3 realigns Township Road 242 to connect with Highway 22 approximately 800 m north of the existing intersection of Highway 22 and Township Road 242. This option also eliminates the need for a bridge crossing over the channel diversion.

Design Option 1 is the preferred option for Township Road 242. It provides the least disruption to the existing travel distance and the least requirement for new road construction.



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

Township Road 242 Options

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4.0 PUBLIC ENGAGEMENT PROGRAM SUMMARY

Alberta Transportation has completed engagement in support of the Project beginning in November 2014. These engagement activities have included Project notification, meetings with landowners and with stakeholders, open houses, and other activities. Alberta Transportation also conducted three facilitated presentations to affected landowners, ten public Open Houses, over 40 meetings with affected landowners and organized stakeholder groups (including Bow River Basin Council, Elbow River Watershed Partnership, Alberta Environment and Parks Water Collaborative, the Calgary River Communities Action Group, Calgary Regional Partnership, Western Irrigation District and affected industry and utilities), and ongoing meetings with Rocky View County and City of Calgary administration.

Issues, concerns and recommendations related to the Project were raised by stakeholders and public during engagement activities. Responses and outcomes to the issues, concerns and recommendations are provided in Attachment A.

Engagement with stakeholders, including landowners, municipalities, infrastructure companies and others identified interested groups will continue as the Project planning progresses. Alberta Transportation is committed to providing Project information to the public as the design becomes approved.

5.0 INDIGENOUS ENGAGEMENT PROGRAM SUMMARY

Alberta Transportation's engagement with Indigenous groups began in 2014 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). The Treaty 7 First Nations identified for consultation are:

- Kainai First Nation (Blood Tribe)
- Piikani Nation
- Siksika Nation
- Stoney Nakoda Nations (Bearspaw First Nation, Chiniki First Nation and Wesley First Nation)
- Tsuut'ina Nation

The Treaty 7 First Nations were provided with Project information, and the opportunity to provide information regarding current use, to conduct site visits in the PDA and to conduct a traditional use study (TUS).

In June 2016, an additional eight Indigenous communities and organizations were identified for engagement in the CEAA Guidelines for the Project. Project information was sent to these additional communities and organizations and they were provided with the opportunity to provide information regarding current use, to conduct site visits in the PDA and to conduct TUS CEAA identified the following Indigenous groups for engagement:

- Ermineskin Cree Nation
- Foothills Ojibway
- Ktunaxa Nation
- Louis Bull Tribe
- Montana First Nation
- Samson Cree Nation

CEAA also identified two Métis organizations for engagement:

- Métis Nation of Alberta, Region 3
- Métis Nation British Columbia

When contacted, Ktunaxa Nation has stated that the Nation would not be participating in the engagement activities for the Project and would not be engaging with Alberta Transportation further on the Project. In accordance with the CEA Agency Guidelines for the Project, Ktunaxa Nation has been included in the description of existing conditions; however, no assessment of potential effects on Ktunaxa Nation on TLRU is provided.

Indigenous Engagement Program Summary
March 2018

Alberta Transportation's engagement with Siksika Nation, Kainai Nation, Piikani Nation, Tsuut'ina Nation, and Stoney Nakoda Nations began in 2014 and has included sharing of Project information and updates, on-going communication about the Project, face-to-face meetings, facilitation of site visits, and funding for Project-specific TUS. Through the Indigenous engagement program for the Project Alberta Transportation has provided the Treaty 7 First Nations with the opportunity to provide their views on the environmental effects of the Project and information used for describing and assessing effects on Indigenous peoples, and activities upon which Aboriginal and Treaty rights depend. This has been accomplished through providing information on the EIA and regulatory requirements to Indigenous groups.

Alberta Transportation's engagement with Ermineskin Cree Nation, Foothills Ojibway, Ktunaxa Nation, Louis Bull Tribe, Montana First Nation, Samson Cree Nation, Métis Nation of Alberta, Region 3, and Métis Nation British Columbia began in 2016. Engagement with these Indigenous groups has included letter notification about the Project and an invitation to participate in a dialogue to discuss any project-related issues, or concerns. In addition, Alberta Transportation has held meetings to discuss the Project with Samson Cree Nation, Montana First Nation, Louis Bull Tribe and Métis Nation of Alberta Region 3.

Alberta Transportation also funded TUS for all of the Treaty 7 First Nations for the Project. As of March 16, 2018, Alberta Transportation received the following TUS reports:

- Kainai Consultation Office (KCO) and Siksika Consultation Office (SCO). 2017. Springbank Off-stream Reservoir (SR-1) KCO and SCO TUS Research Study, Alberta Bow and Elbow River Flood Prevention and Mitigation Project: Joint Kainai & Siksika Interim Report. (March 9, 2017)
- Piikani Nation. No date. *Piikani report on Proposed Springbank Reservoir and Dam*. Prepared for Piikani Consultation by William Big Bull, Piikani Nation.
- Draft TUS report from the Tsuut'ina Nation. However, permission to use the information in the report in this assessment had not been received as of March 16, 2018.

Additional TUS reports are anticipated from Stoney Nakoda Nations, Louis Bull Tribe and Métis Nation of Alberta – Region 3, but have not been received by Alberta Transportation as of March 2018. Alberta Transportation will review 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 has been filed will be used for project planning and implementation purposes, where applicable.

Issues, concerns and recommendations related to effects of the Project were reported by Indigenous groups through the Indigenous engagement program. Responses and outcomes to the issues, concerns and recommendations are provided in Attachment B. Engagement with the Indigenous groups potentially impacted by the Project is ongoing.

6.0 SUMMARY OF ENVIRONMENTAL EFFECTS ASSESSMENT

Valued components (VCs) on which to base the assessment of environmental effects of the Project were selected with consideration of the AEP Terms of Reference, the CEA Agency Guidelines, issues identified through public and Indigenous consultation and the professional experience of the EIA team. Fifteen VCs were chosen for the assessment:

- air quality and climate
- acoustic environment
- hydrogeology
- hydrology
- surface water quality
- aquatic ecology
- terrain and soils
- vegetation and wetland
- wildlife and biodiversity
- land use and management
- historical resources
- traditional land and resource use
- public health
- infrastructure and services
- economy and employment

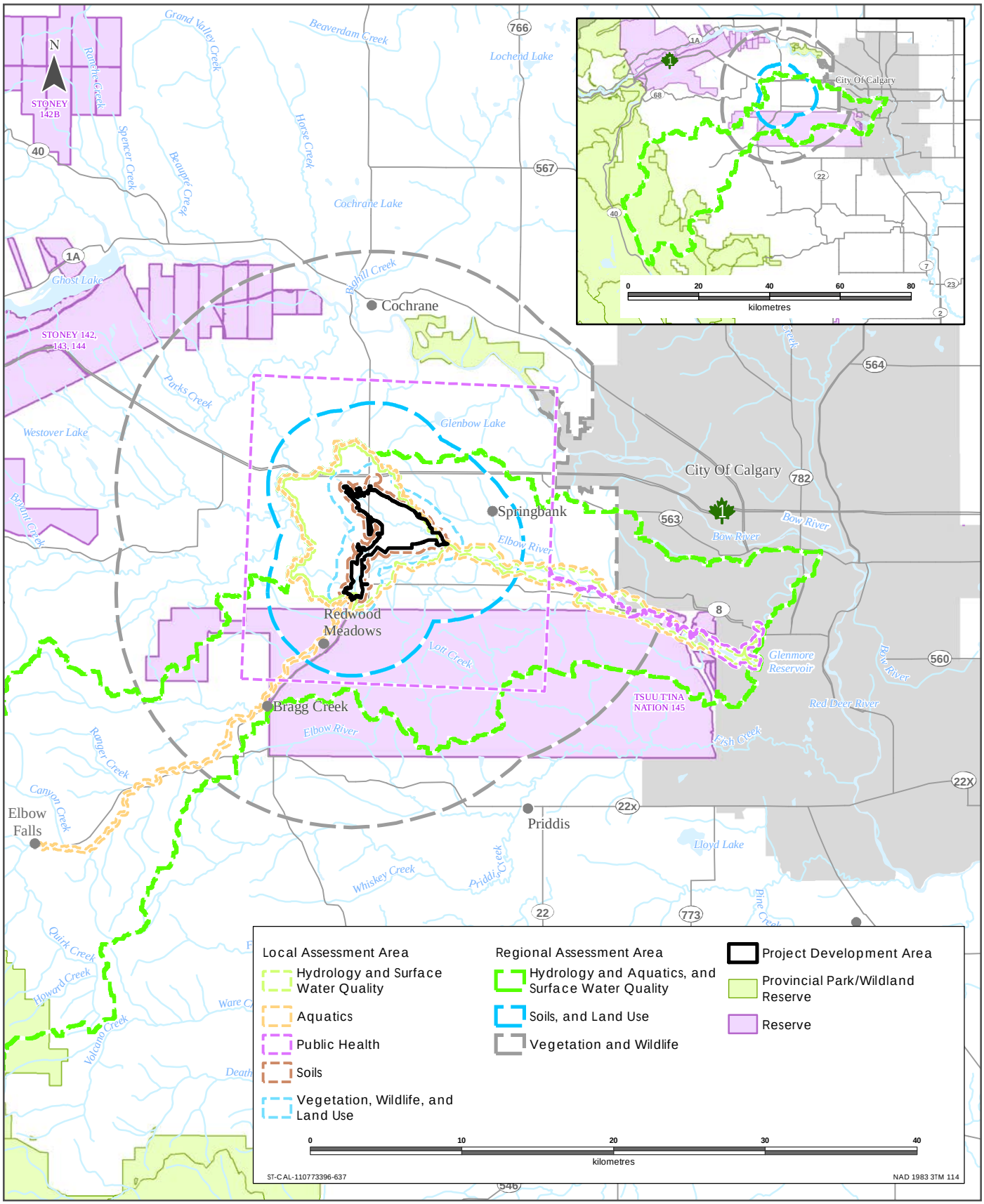
Sections 6.1 through 6.15 summarize the environmental effects on the VCs. Effects were assessed for three cases: the base case (existing environment), the application case (Project effects) and the planned development case (cumulative effects).

The assessment looked at effects in three spatial areas: the PDA (the Project footprint), a Local Assessment Area (LAA - includes the PDA and adjacent areas where environmental effects may reasonably be expected to occur; specific to each VC), and a Regional Assessment Area (RAA– includes the PDA and LAA and is the area where the Project's environmental effects may interact or accumulate with the environmental effects of other projects or activities; specific to each VC). Assessment areas are shown in Figure 6-1 and Figure 6-2.

Effects were assessed under four phases: a construction phase, a dry operations phase (during which there would be no water in the reservoir), a flood phase (which included the diversion of water into the reservoir and its draining back to the Elbow River) and a post-flood phase (which included clean up immediately following a flood phase).

The effects of the Project on federal lands are summarized in Section 6.16; effects of accidents and malfunctions from the Project are summarized in Section 6.17 effects of the environment on the Project are summarized in Section 6.18.

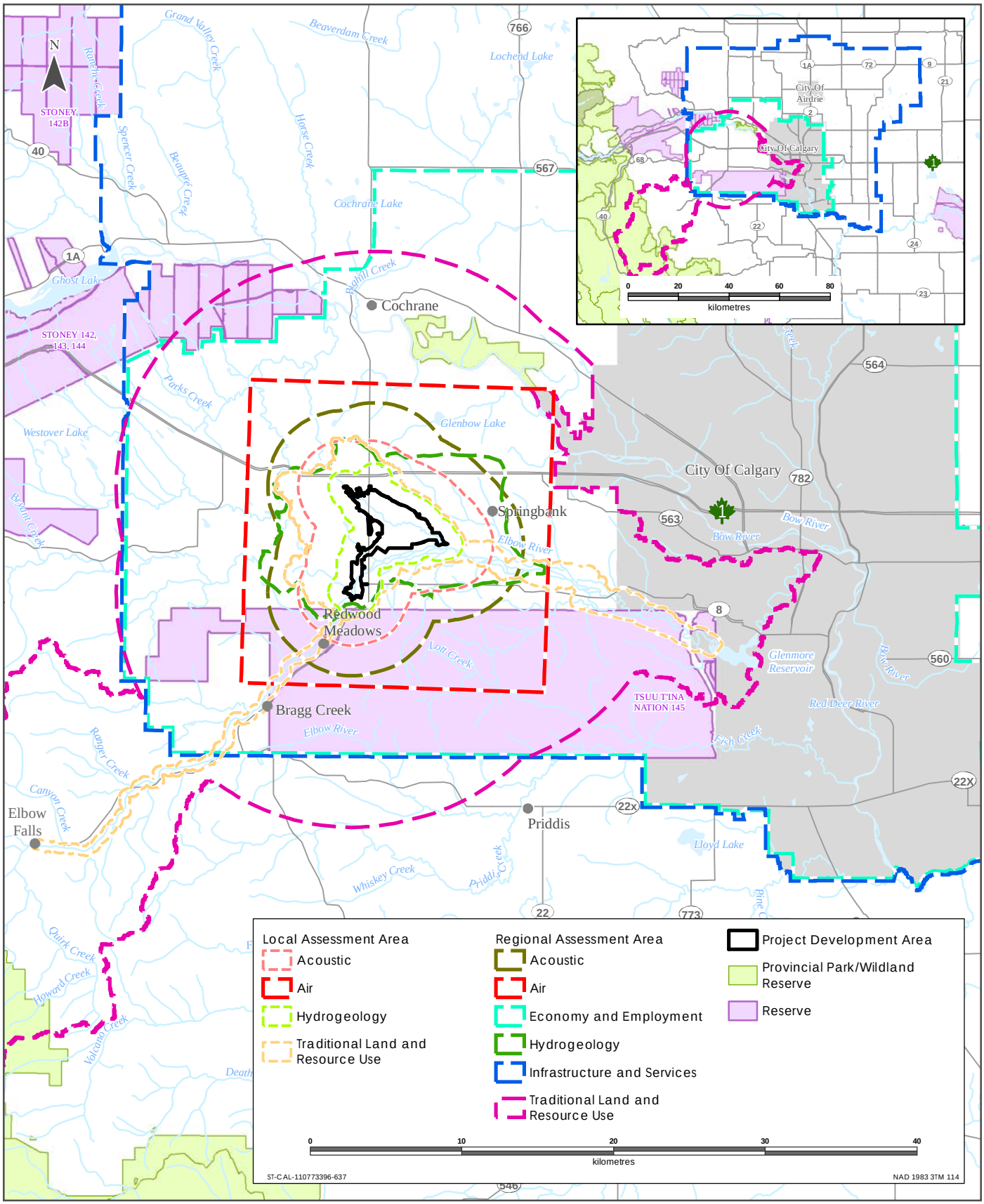
Cumulative effects, the effects of the Project with effects from other projects and activities, were assessed where the effects of other projects and activities overlapped with those of the Project, either spatially or temporally. Cumulative effects of past and current projects and activities form part of the existing conditions (base case) for each VC. Cumulative effects are discussed in Section 7.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Assessment Areas (Part 1)

Stantec



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Assessment Areas (Part 2)

Stantec

6.1 AIR QUALITY AND CLIMATE ENVIRONMENT

6.1.1 Description of the Baseline Conditions

6.1.1.1 Climate and Meteorology

The average monthly temperature is 22.2°C while the average monthly minimum temperature is -14.2°C. Most precipitation tends to occur in the May to September period, with the high value occurring in June. The greatest recorded extreme daily rainfall event was 128.4 mm and occurred in June, this value was greater than the average rainfall amount of 106.7 mm for that month. The highest extreme daily snowfall event, 30.0 cm, occurred in March. Rainfall can occur more than 25% of the days during the May to August period. The ground is snow-covered in the November to March period with average depths of 4 to 8 cm. The maximum hourly wind speeds range from 61 km/h to 76 km/h, and these events occur most frequently from the west. The maximum recorded wind gust speed is 120 km/h (occurring January 1997). Most frequent winds come from the northwest and west.

6.1.1.2 Ambient Air Quality

Due to proximity of farms and/or ranch yards, a particulate matter (PM) monitoring program was conducted for $PM_{2.5}$, total suspended particles (TSP) and dustfall. Results from the monitoring program indicate that $PM_{2.5}$, and TSP concentrations are well below the Alberta Ambient Air Quality Objectives (AAAQO) and the average and individual dustfall measurements are less than the AAAQO.

To provide a more robust definition of the background ambient air quality conditions the results from the 10-week local PM monitoring program were combined with published ambient air quality data from regional (more distant) air quality monitoring stations with longer records. Background air quality of Criteria Air Contaminant (CACs) gases, volatile organic compounds (VOCs), particles, Polycyclic aromatic hydrocarbons (PAHs) and metals were reviewed. The selected background concentrations range from 0.005 to 51 percent of the regulatory criteria. Out of the 35 substance/averaging period combinations, ten background values are more than 10% of the criteria, and five are more than 25% of the criteria.

6.1.1.3 Ambient Light

Existing light monitoring, conducted in January 2017, measured incident light and light trespass. Based on the ambient light levels (both sky glow and light trespass), the LAA is considered a rural environmental zone. Light trespass measurements were well within the CIE (Commission Internationale de L'Éclairage) guidelines for light trespass in rural/suburban/urban areas. Sky glow measurements are consistent for an urban environment due to combined light emissions from nearby urban areas.

6.1.1.4 Greenhouse Gases

The latest year for which greenhouse gas (GHG) data has been published is 2014. The provincial and national GHG emissions are 274,000 Mt and 732,000 Mt. Alberta GHG emissions accounted for 37.4% of the national GHG emissions.

6.1.2 Effects on the Environment

6.1.2.1 Construction and Dry Operations

Change to the Environment

Air Quality

The main sources of air emissions due to the Project are vehicle exhaust and fugitive emissions during Project construction. As these emissions result from ground based sources, the greatest air quality changes due to these emissions occur inside and near the PDA, decreasing to Base Case levels with increasing distance from the PDA. The main finding is the potential for TSP and $PM_{2.5}$ concentrations to be greater than the regulatory criteria outside the PDA.

Ambient Light

Nighttime light levels (light trespass and glare) due to Project construction would remain below CIE guidelines for a rural area and sky glow levels would not be expected to increase.

Greenhouse Gases

Construction GHG emissions are conservatively estimated to be 84,970 tonnes CO_2e over the entire construction period. If all Project construction emissions were assumed to be emitted over one year, the magnitude of emissions represent 0.03% of 2014 provincial emissions and 0.01% of 2014 national emissions.

Carbon Sequestration Capacity

The bottom and slopes of the diversion channel would be re-vegetated, thereby restoring the carbon sequestration capacity to a level that would be comparable to the pre-construction condition. During construction and dry operations, the area that is expected to undergo a permanent land use change is the concrete diversion structure and its area is estimated to be 0.36 hectares. Given the small area that is to undergo a permanent land use change during construction and dry operations, the change in carbon sequestration capacity in the PDA is expected to be very small.

Mitigation Measures

Air Quality

The following mitigation options would be planned for the management of combustion emissions (i.e., construction vehicles) during the construction phase:

- One-way traffic flows on Highway 22 and Springbank Road, to accommodate construction activities that may result in traffic line-ups and idling, will be limited to the extent possible.
- Project construction vehicles will be required to meet current emission control standards.
- Engines and exhaust systems will be properly maintained. Equipment, including construction equipment, that shows excessive emissions of exhaust gases will not be operated until corrective repairs or adjustments are made.
- The concentration of sulphur in diesel fuel shall not exceed15 mg/kg.
- Construction vehicle idling times will be reduced to the extent possible.
- Cold starts will be limited to the extent possible to reduce emissions.

The following mitigation measures would be planned for the management of fugitive dust emissions during the construction phase:

- Dust generating construction activities will be suspended during periods of excessive winds.
- During dry periods, water will be applied to haul roads and/or disturbed areas to mitigate dust emissions. The application of water will be limited to non-freezing temperatures to prevent icing that can present a safety hazard. Repeated watering several times a day may be required, depending on surface and meteorological conditions.
- Chemical dust suppressants will be applied to haul roads as an alternative option to watering on an as-needed basis during high wind conditions or if PM concentrations are in exceedance of the Alberta Air Quality Objectives and if an increase of watering is determined ineffective or unfeasible at the time.
- In the event of trackout and carryout of soils occurs, road cleaning will be conducted by manually picking up and sweeping material or by using rotary or vacuum street cleaning vehicles.
- Disturbed surfaces will be revegetated promptly following construction to prevent wind erosion and to control dust.
- Surfaces of temporary soil and overburden stockpiles will be stabilized during extended periods between usage, by means of vegetating or covering the exposed surfaces.
- Silt fences and other erosion control methods such as mulching and application of tackifiers will be used to prevent soil loss from soil stockpiles due to wind erosion.

Ambient Light

Mobile lighting is required to provide a secure and safe working environment. To limit potential effects from the use of the mobile lighting on light trespass, glare, and sky glow, the following mitigation measures would be employed:

- Lights will be positioned so that the luminaires can be pointed downward with no more than a 10º tilt from the horizontal, so that only the working area is illuminated.
- As much as is possible, lighting will be located such that unavoidable light spill off the working area is not directed toward receptors outside the PDA.
- Lighting will be located so that the lights are not directed toward oncoming traffic on nearby roads on or off site because of the objectionable nuisance and safety hazard this may present.
- Lights will be designed to avoid excessive use of the mobile flood lighting units and reduce potential effects by turning off lighting when they are not required; this would also conserve fuel.
- Lighting design guidelines and the lighting requirements for workspaces as enforced by Labour Canada will be adhered to.
- Occupational Health and Safety Part 12 General Safety Precautions – Lighting will be complied with.

Greenhouse Gases

The mitigation measures associated with ambient air quality to reduce combustion emissions are also applicable to the mitigation of GHG emissions because combustion sources account for virtually all the GHG emissions associated with the construction phase.

Residual Effects and their Significance

The Project is in an area that has existing air emissions and light sources. The Project is expected to increase predicted ambient concentrations and dustfall, light trespass and glare, and greenhouse gas emissions within the LAA.

As noted above, the main finding of the assessment is the potential for TSP and $PM_{2.5}$ concentrations to be greater than the regulatory criteria outside the PDA. Predicted concentrations that are greater than the applicable ambient air quality criteria, in themselves, do not imply that the effect on ambient air quality is significant. Dispersion models often produce results that are conservative (i.e., they overpredict concentrations). The overall residual effect for air quality is not significant in consideration of; the small areas and short duration predicted for concentrations of NO_2, acrolein, benzo(a)pyrene and odourants to be greater than the ambient air quality objectives or odour thresholds; the planned construction TSP, $PM_{2.5}$ and dustfall

monitoring program and adaptive mitigation measures to further control construction PM emission, and the planned odour complaint and management process.

Light trespass and glare is expected to increase regularly at nighttime. Effects of the Project on ambient light are assessed as not significant.

Changes in air quality, ambient light and GHG is restricted to the duration of the construction phase (36 months). At the end of the construction phase, air quality, dustfall, light trespass and glare, and GHG emission contributions are expected to return to pre-construction levels. During the dry operations phase, associated activities will be limited to periodic inspections and routine maintenance and there are no interactions of the Project with air quality, light, or GHG emissions. The Project will result in relatively small change of GHG emissions, which will be continuous, when compared to provincial and national totals. GHG emissions from construction were determined to be not significant.

6.1.2.2 Flood and Post-Flood

Change to the Environment

Although existing background conditions for the flood and post-flood phases are like those associated with the construction and dry operations, air emissions during the flood and post-flood phases are negligible compared to those during construction and dry operations.

Fugitive Emissions

The only potential source of fugitive dust during post-flood operations is wind erosion of deposited sediments in the reservoir after they dry out, and when strong wind conditions occur. Because these emissions are ground based, the greatest air quality changes due to these emissions occur inside and near the PDA, decreasing to baseline levels with increasing distance from the PDA. The main finding of the modeling is the potential for TSP concentrations to be greater than the regulatory criteria outside the PDA. However, given the low recurrence of the floods that result in sediment deposition (i.e. 100 years and design flood [200 years]) and the proposed mitigation measures, it is expected that fugitive dust emissions would not have significant adverse effects on ambient air quality.

Odours

There are two potential sources of odours during flood and post-flood operations. One relates to the possibility of upstream sewage being accidently released due to system failure, entrained into the floodwaters and being deposited in the reservoir. The other relates to submerged and decaying vegetation within the reservoir. Odours are not expected during flood and post-flood operations reservoir filling, reservoir draining, reservoir sediment partial cleanup, channel maintenance, and road and bridge maintenance.

Carbon Sequestration

During the post-flood period, vegetation activity would be decreased prior to the reestablishment of new vegetation cover. This would potentially decrease the natural carbon uptake during the period prior to reestablishing the new vegetation cover. Changes in carbon sequestration are not expected during reservoir filling, reservoir draining, reservoir sediment partial cleanup, channel maintenance, and road and bridge maintenance. The changes to the carbon sequestration capacity of the PDA are expected to be minimal

Mitigation Measures

Fugitive Dust

To some extent, natural mitigation with respect to future potential fugitive dust emissions has already occurred. The 2013 flood removed an appreciable portion of fine sediment (e.g., clay and fine silt) from the upstream Elbow River drainage basin. The remaining surficial materials in the stream bed and on the banks of the Elbow River and its tributaries that may be prone to mobilization during a future flood would comprise mostly larger material (e.g., sand). Hence, most of the sediment deposited in the reservoir during future floods would be dominated by sand, not fine silt. The sand is less prone to result in fugitive dust during dry windy meteorological conditions.

A primary mitigation for wind erosion in the reservoir will be the re-establishment of vegetation cover (e.g., native grasses) after reservoir draining. Natural revegetation success, however, is not assured, given initial high moisture contents and reduced energy input in the autumn. Should wind erosion occur and natural revegetation prove to be ineffective, a tackifier would be applied where required. Tackifiers are a sprayable erosion control product that bonds with the soil surface and creates a porous and absorbent erosion resistant blanket that can last for up to 12 months.

Reapplication of the chemical stabilizer (tackifier) at defined periods is necessary to maintain high control efficiency. Frequent reapplication of a chemical stabilizer can maintain a control efficiency of 90%.

Odours

No sewage is expected to be deposited in the off-stream reservoir. The upstream flood catchment area, which includes Bragg Creek and Redwood Meadows, does not have large septic fields near the banks of the Elbow River that could potentially be damaged by flooding. Hence, the potential for odours emanating from the drained reservoir due to sewage is negligible.

For the design flood, 67 days for the presence of water in the reservoir is short-term with respect to the time required for submerged vegetation to decay and generate odours. There are no Project specific mitigation measures for odours.

Carbon Sequestration

Re-establishment of the vegetation cover on the deposited sediment would mitigate the temporary loss of carbon sequestration capacity. For the design flood, 67 days for the presence of water in the reservoir is short-term with respect to the time required for a substantial change to occur in the carbon sequestration capacity.

Residual Effects and their Significance

A change in ambient air quality is rated as not significant in consideration of:

- the small areas, short duration and short frequency predicted for concentrations of TSP to be greater than the ambient air quality objectives,
- concentrations of TSP greater than the ambient air quality objectives at residence locations near the east PDA boundary are predicted to occur infrequently (one day per year following a 1:100 year flood and up to seven days per year following a design flood), and
- the planned short-term (i.e. application of tackifier) and long-term (i.e. revegetation) mitigation measures to further control fugitive dust emissions from wind erosion of the sediment.

With implementation of the mitigation measures, the change in ambient air quality due to fugitive dust from the post-flood sediment is expected to be minimal. The adaptive management nature of the fugitive dust mitigations is expected to be adequate to control fugitive dust to low levels that do not have appreciable adverse environmental effects.

A change in odour occurrences is rated as not significant since the duration of the submerged vegetation is not considered sufficient to generate unpleasant odours. Because no sewage would be washed into the reservoir, there is negligible potential for sewage type odours to occur.

With respect to residual carbon sequestration effects, following the release of the impounded water, there would be sufficient growing season to allow vegetation to naturally reestablish in regions where the deposited sediment is less than 10 cm deep. The 2013 flood occurred during the third week of June. For a future flood of similar timing and magnitude, the draining of the reservoir would be completed approximately by the third week of August. The climate 30-year normals for the Springbank Airport indicates that there is a 90% probability that the frost-free period extends into the second week of September. Hence, there are approximately three weeks of remaining growing season for moderately affected vegetation to recover.

For areas covered with thicker sediment deposits, the revegetation (e.g., planting of native grasses) would require another season to restore the ability of the reservoir to fix carbon sequestration capacity.

Between floods, the natural regeneration of the grassland areas would occur in areas where the sediment is less than 10 cm thick. It is highly likely that the natural grasses would be able to grow up through a 10 cm layer of sediment. A change in carbon sequestration capacity is rated as not significant since there would be ample time between extreme floods for revegetation to occur in the reservoir.

6.2 ACOUSTIC ENVIRONMENT

6.2.1 Description of the Baseline Conditions

The acoustic environment in the LAA is characterized as a rural environment, with combination of natural environment and human activities including traffic (i.e. existing highways) and an active agricultural industry. During the field survey, a total of 45 receptor locations at four monitoring locations were surveyed. The average and minimum daytime and nighttime sound levels at each receptor location were determined based on the analyses of the collected data. Average measured levels ranged between 39.2 and 54.5 dBA for daytime and 34.9 and 52.1 dBA for nighttime. Minimum measurement sound levels ranged between 37.3 and 52.8 dBA for daytime and 34.6 and 49.5 dBA for nighttime.

6.2.2 Effects on the Environment

6.2.2.1 Construction and Dry Operations

Changes to the Environment

Construction activities within the PDA the will occur at varying times with some activities occurring simultaneously. To capture the variability of these activities, five worst case scenarios (i.e., maximum potential noise effect) were modelled in support of the assessment. These five scenarios are as follows:

- Scenario 1 (less than 2 months)—piling for bridge on Township Road 242, dam embankment earthworks/roadworks, daytime operation only.
- Scenario 2 (less than 2 months)—piling for bridge on Highway 22, dam embankment earthworks/roadworks, daytime operation only.
- Scenario 3 (greater than 2 months but less than 1 year)—earthworks and roadworks, floodplain berm, diversion channel, raising Highway 22 and Springbank Road interchange, diversion structure, bridge works (Highway 22 and Township Road 242), daytime and nighttime operation.

- Scenario 4 (greater than one year)—earthworks and roadworks, dam embankment, floodplain berm, diversion channel, daytime and nighttime operation.
- Scenario 5 (sleep disturbance)—earthworks, dam embankment, diversion channel maximum sound level during peak activity level over nighttime period.

These scenarios were completed to not include proposed mitigation measures. Because the type, number and operating scenarios of equipment are preliminary, noise mitigation options were not incorporated in the acoustic model. Of the five scenarios, only one did not have exceedances to the mitigation noise level thresholds which Health Canada suggests are used. With the application of mitigation measures, it is feasible that the sound levels at many of the identified receptor locations would meet noise thresholds. Upon development of the detailed construction execution plan, mitigation measures would be developed to meet assessment noise thresholds.

Since there are no major anthropogenic noise generating activities associated with operation, no interactions from the Project on the acoustic environment is expected during this phase. Consequently, noise associated with dry operations was not further assessed.

Mitigation Measures

Overall noise emissions are expected to be reduced during the construction of the diversion channel as excavation proceeds and occurs below the existing ground level. In addition, the spoil sites located along the channel are expected to act as noise barriers.

Potential mitigation that would be implemented is the reduction or restriction of equipment activities for specific areas or during specific time periods

The following list of best management practices would be implemented to further mitigate noise effects:

- Residents near to construction noise-generating activities will be notified prior to construction. Noise abatement barriers may be used to reduce noise levels. If noise abatement barriers are ineffective residents may have to be moved temporarily to alternative accommodation during the construction phase producing the noise.
- Machinery and factory supplied noise-abatement equipment (e.g., mufflers) will be maintained in good working order.
- A complaint response procedure will be implemented to address noise complaints should they arise.

Residual Effects and their Significance

The residual environmental effects assessment shows that out of 45 receptors considered for the assessment, up to 33 have the potential to exceed the Health Canada limits without mitigation during the construction phase. However, with the application of mitigation, the residual effects on the acoustic environment are expected to be reduced, and are expected to achieve Health Canada's noise objectives at many of the receptor sites. No exceedances of threshold limits were predicted for Indigenous receptors in any of the assessment scenarios.

6.2.2.2 Flood and Post-Flood

Changes to the Environment

There are no anthropogenic noise generating activities associated with the reservoir filling, reservoir draining, and the drained reservoir; therefore, there are no predicted interactions with the acoustic environment. The post-flood operational activities could require heavy equipment are removal of sediment and debris; and facility maintenance and repair.

During the post-flood phase, inspections would be conducted using light trucks, although some heavy equipment might be brought to site if it is needed for debris removal. The post-flood operational activities that could require heavy equipment are removal of sediment and debris; and facility maintenance and repair. Heavy equipment may be required for sediment and debris removal.

Noise effect at all receptors are expected to be below the Health Canada noise threshold, given the lower quantity and intensity of activities expected during post-flood events.

Mitigation Measures

During the post-flood phase, inspections would be conducted using light trucks, although some heavy equipment might be brought to site if it is needed for debris removal. Mitigation measures are that same as those presented for the Construction and Dry Operations phases.

Residual Effects and their Significance

A significant environmental effect on the acoustic environment would result in an exceedance of applicable local, provincial, federal, or international guideline limits appropriate for the Project. The noise effects at all receptor locations (both Indigenous and non-Indigenous) during the flood and post-flood operations are not predicted to exceed Health Canada noise thresholds. The residual effect on the acoustic environment is not significant.

6.3 HYDROGEOLOGY

6.3.1 Description of the Baseline Conditions

Groundwater elevations within the surficial aquifer generally follow the topography and range from approximately 1,290 m asl in the southwest to 1,125 m asl along the eastern boundary of the RAA. Groundwater depths measured in monitoring wells completed in the unconsolidated deposits ranged for ground surface to 8.0 m below ground level (BGL). Potentiometric surface elevations for the Upper Bedrock Aquifer range from approximately 1,300 m asl in the southwest to 1,123 m asl along the eastern boundary of the RAA.

In support of the Project's EIA, seventeen groundwater samples were collected from wells completed in the unconsolidated deposits in the LAA. Fourteen groundwater samples were also collected from Project related monitoring wells completed in bedrock within the LAA. Samples collected from domestic water wells were also available from the domestic well testing program completed in April 2016.

Samples were analyzed for the following parameters:

- total dissolved solids
- sodium and chloride concentrations
- nutrient concentrations including ammonia, nitrate, nitrite, phosphate and total Kjeldahl nitrogen
- dissolved metals, including dissolved mercury
- hydrocarbons and other contaminants

Groundwater use in the RAA is primarily from shallow bedrock aquifers with some wells also completed in the recent fluvial deposits along the Elbow River. The proposed uses of the wells, as was reported in the Alberta Water Well Information Database for the RAA are:

- 277 for domestic use
- 50 for stock use
- 31 for domestic and stock use
- 7 for industrial purposes
- 2 for irrigation purposes
- 5 for municipal use
- 20 for unknown use

6.3.2 Effects on the Environment

6.3.2.1 Construction and Dry Operations

Changes to the Environment

The Project has the potential to change groundwater quantity in and near the PDA as a result of local, shallow and temporary subsurface dewatering that might be required to facilitate construction of the diversion channel, dam and floodplain berm, outlet works, bridge, excavation of borrow pits, and utility realignments.

The Project has the potential to change groundwater quantity through groundwater seepage into the diversion channel when dry. Groundwater that seeps into the diversion channel would infiltrate back into the groundwater system at a downstream location that is not saturated, or continue to flow by gravity down the diversion channel and into the off-stream reservoir. Once there, groundwater seepage collected in the diversion channel may infiltrate back into the ground (returning to the groundwater system) or, where the local infiltration capacity is exceeded, continue to flow overland toward existing surface water drainage courses. There, groundwater seepage would become part of the surface water system, eventually draining through the outlet structure. Groundwater seepage into the dry diversion channel would occur only in some areas where the local groundwater table is near ground surface and where the diversion channel has been cut to an elevation below the water table.

Mitigation Measures

Construction dewatering, if required, would be done locally and according to the terms and conditions of dewatering licences issued by AEP (where applicable and if required) and best management practices. This would be included as part of the ECO Plan (Environmental Construction Operation Plan, prepared by the selected contractor. Standard construction dewatering methods will be used, including methods to cut off excessive seepage where trenches extend below the water table in order to mitigate preferential flow paths. Other mitigation measures are as follows:

- Water will be discharged in a manner to avoid erosion by the use of turbidity barriers, containment berms and settling ponds. Construction dewatering, if required, will be in accordance with the terms and conditions of the *Environmental Protection and Enhancement Act* approval conditions, and Water Act approval and the federal *Fisheries Act* and *Navigable Waters Protection Act*.
- A Care of Water Plan will include the use of cofferdams, pumping systems, sumps, pipelines, channels, flumes, drains, and other dewatering works to permit construction of the work in the dry.

- TSS levels will be controlled and reduced by the use of silt fences and turbidity barriers to ensure the water quality from care of water system discharges is made equal to or better than the initial water quality. TSS levels will be monitored by carrying out frequent water quality testing.
- Existing water wells within the PDA reservoir footprint will be decommissioned and plugged off to prevent groundwater contamination.
- Regional-scale effects on groundwater quantity can be mitigated by allowing seepage in the dry diversion channel to infiltrate back into the subsurface, or flow back into the Elbow River via surface water drainage pathways. Silt fences and turbidity barriers will be used as required to control TSS and to ensure the water quality from care of water system discharges is made equal to or better than the initial water quality by carrying out frequent water quality testing.

Residual Effects and their Significance

The effects on groundwater quantity near the diversion channel are anticipated to be irreversible because the diversion channel will be in place indefinitely. Effects on groundwater quantity as a result of construction dewatering would not be entirely mitigated at a local scale, since dewatering deliberately seeks to temporarily lower the groundwater table in the PDA in order to facilitate construction. The amount of time required for construction dewatering can be minimized through diligent construction planning. Groundwater that is collected during dewatering would be returned to the local water shed to mitigate regional-scale effects on groundwater quantity.

Based on the effects assessment, the residual effects on groundwater quantity during construction and dry operation phases of the Project are assessed as not significant because they would not decrease the yield of groundwater supply wells to the point where they can no longer be used.

Based on the effects assessment the residual effects on groundwater quality during construction and dry operation phases of the Project are assessed as not significant because changes in groundwater quality would not deteriorate to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality for a consecutive period exceeding 30 days (for those parameters which don't already, under existing conditions, exceed those guidelines).

6.3.2.2 Flood and Post-Flood

Changes to the Environment

Groundwater levels in the RAA are anticipated to respond to floods in the Elbow River due to their hydraulic connection to surface water and interactions between the hydrologic and hydrogeologic systems. These responses to floods are anticipated to occur with or without the Project.

Potential changes in groundwater quality could occur during floods due to alterations in groundwater flow patterns in areas near the Elbow River valley or in areas near the diversion channel and off-stream reservoir. Downward or lateral infiltration of flood affected surface water into the subsurface groundwater system could result in changes in groundwater quality. These potential changes in groundwater quality near the Elbow River are possible because of a flood with or without the Project.

Surface water during a flood is expected to be relatively high in total suspended solids due to the high sediment load caused by high flows.

Mitigation Measures

Because the Project is a mitigation measure, the changes in groundwater quantity is a result of intentional changes in surface water storage in the PDA. No specific mitigation for the temporary increases in groundwater quantity are presented.

Existing water wells within the reservoir footprint (PDA) will be decommissioned and plugged off to prevent groundwater contamination and to prevent flood waters from infiltrating nearby water wells. Thus, water in the reservoir following floods would not interact with groundwater through open wells (as a vertical conduit), but would only interact through slower direct infiltration through shallow surficial sediments.

Residual Effects and their Significance

Based on the results of the three flood simulations, net changes in groundwater levels are greatest for the design flood event. The 1:100 year and 1:10 year floods also result in net changes in groundwater levels, but to a lesser degree and areal extent. Thus, for the purposes of characterizing potential residual effects on groundwater quantity, the results from the design flood are used as a conservative measure.

The effects on groundwater quantity are anticipated to be reversible once the flood has passed and the off-stream reservoir has been emptied. The residual effects on groundwater quantity during flood and post-flood operation phases of the Project are assessed as not significant because they would not decrease the yield of groundwater supply wells to the point where they can no longer be used.

The residual effects on groundwater quality during flood and post-flood operation phases of the Project are assessed as not significant because changes in groundwater quality at existing wells would not deteriorate to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality for a consecutive period exceeding 30 days (for those parameters which don't already, under existing conditions, exceed those guidelines).

6.4 HYDROLOGY

6.4.1 Description of the Baseline Conditions

The Elbow River and its tributaries, with a total watershed area of approximately 1,238 km^2, transition from a steep, generally single channel mountain stream with pool-riffle sequences to a weakly braided/wandering pattern contained within a broad floodplain with low gradients and typically poorly defined tributaries as the Elbow flows towards Glenmore Reservoir. The river is occasionally confined by limited bedrock canyons in the foothills and flows predominantly over gravel and cobble size alluvium for its entire length.

There are two Water Survey of Canada stations on the Elbow River provide long-term flow data relevant to this assessment: Elbow River at Bragg Creek, upstream of the PDA, and Elbow River at Sarcee Bridge, downstream of the PDA. Mean monthly flows for the period 1979 to 2014 for Bragg Creek and Sarcee Bridge show distinct patterns that reflect their position in the Elbow River watershed. At both stations, winter flows are low in response to below freezing air temperatures and precipitation falling predominantly as snow. Spring flows increase first at Sarcee Bridge in March/April, which reflects local inputs of runoff over partially frozen ground with snow melt occurring at progressively higher elevations in the upper basin as spring progresses. Approximately 54% of the annual flow volume occurs during May, June and July in the Elbow River watershed. Of this percentage, 25% of the annual flow typically occurs in June alone. The higher variability evident in June reflects that this is the primary month for flood occurrence.

6.4.2 Effects on the Environment

6.4.2.1 Construction and Dry Operations

Changes to the Environment

All instream works will be completed in a manner that allows for water conveyance. Therefore, hydrology in the Elbow River and low-level outlet will not interact during construction of the water diversion structure, dam and berm, and low-level outlet structure. Hydrology in the Elbow River and associated tributaries in the PDA will not interact with other Project activities such as road and bridge construction, laydown, borrow areas, or reclamation and are not assessed further. Sediment transport will not interact with Project laydown or reclamation as these will be located away from watercourses and are not assessed further.

The dry operations phase of the Project occurs following construction and when there are no floods that require the diversion of portions of the Elbow River flow into the reservoir. As flow is unimpeded in the Elbow River and low-level outlet during dry operations, no interaction with hydrology is anticipated during maintenance activities.

Changes in Hydrology Regime

The Project has the potential to change hydrology during construction and dry operation because alteration of surfaces adjacent to the Elbow River tributaries. Clearing, grading and construction of the diversion channel, dam and floodplain berm may change the runoff response to precipitation events. Increased compaction of surfaces would result in less infiltration and the potential for enhanced runoff. Similarly, removal of vegetation may also increase runoff because of lowered surface roughness. However, changes in hydrology because of enhanced runoff require hydrological connection to the Elbow River or the low-level outlet. Given the distance of most of the PDA from active channels, increases in runoff are unlikely to be measurable within the larger hydrological regime of the Elbow River. Permanent diversion of five small tributaries intersected by the diversion channel and the dam would affect the input of flow from these tributaries into the Elbow River.

During dry operations, there is a potential for increased flows in the low-level outlet through the intersection of the diversion channel with shallow groundwater seepage. Groundwater that seeps into the diversion channel may either infiltrate back into the groundwater system, evaporate or it may flow as surface flow into the reservoir if moisture content prevent infiltration.

Change in Sediment Transport

Construction activities may result in the release of suspended sediment and bedload-sized material into the Elbow River and the low-level outlet. However, best management practices and implementation of erosion and sediment control plans would mitigate this release. Similarly, any sediment released during maintenance would be mitigated by best management practices.

During dry operation, localized changes in hydraulics around the diversion structures in the Elbow River may result in shifts in the location of channel scour and deposition of bedload material. However, these effects would be very localized and are unlikely to have a measurable effect on downstream sediment transport. The lack of sediment transport measured in the low-level outlet under existing conditions and the intermittent flow regime suggest that dry operations is unlikely to have any measurable effect on sediment transport.

Mitigation Measures

Potential effects of erosion and sedimentation on watercourses during construction would be avoided or mitigated through:

- All applicable regulatory notifications, permits, and authorizations including the *Environmental Protection and Enhancement Act*, *Water Act* and the federal *Fisheries Act* and *Navigable Waters Protection Act,* will be obtained before the start of any instream construction.
- Instream work areas will be isolated from the main river flow by using cofferdams, silt fences and turbidity barriers. Suspended solids will be monitored and measured in conformance with Alberta Transportation's Turbidity Monitoring specifications.
- Clean granular fill with less than 5% fines passing the 80um sieve size will be used for instream work such as cofferdams, causeways, access ramps, Bailey bridges, river channel diversions. Fine grained soils may be used, provided only clean granular fill is exposed to the river at any time during construction and restoration operations.
- Sediment and erosion control measures as detailed in Section 5.6.2.1, Aquatic Ecology will be used
- Bank and riparian areas disturbed during construction will be reclaimed and re-vegetated. Silt fences, turbidity barriers and riprap materials will be used to prevent future bank erosion.
- All applicable regulatory notifications, permits, and authorizations, if required, would be obtained before the start of any instream construction.
- Bank and riparian areas disturbed during construction will be rehabilitated and re-vegetated. Silt fences, turbidity barriers and riprap materials will be used to prevent future bank erosion.

Residual Effects and their Significance

Variations in hydrology and sediment transport are expected to have a <15% change from existing conditions and as a result, are likely not measurable within reasonable accuracy or detected by environmental receptors. Should an increase in suspended sediment concentrations occur, it would be mitigated immediately or the work halted until mitigation is in place. The effects of the Project on hydrology during construction and dry operations, given mitigation measures and monitoring during construction in the PDA, are assessed as being not significant.

6.4.2.2 Flood and Post-Flood

Changes to the Environment

The effect of diversion on downstream channel geomorphology and changes to the geomorphology of the low-level outlet would be a function of the reduction in shear stress downstream due to flow diversion and increases in shear stresses in the low-level outlet during release. Changes in morphology in the Elbow River would likely take the form of reduced mobilization on bar heads, decreases in degradation and aggradation and potentially changes in channel planform. Additional input of discharge from tributaries also changes flow dynamics downstream of those confluences and subsequently, the geomorphology.

Change in Hydrological Regime

Project effects on hydrology as a function of water retention in the reservoir, include alteration of both peak flow rate and flow volume. These effects arethe intended purpose of the Project and the diverted volumes are released back into the Elbow River, less evaporation. At a RAA scale, the percentage lost to evaporation is less than 0.5% of the annual flow volume. Given that the probability of diversion is 10% or less in any given year, changes to the hydrological regime due to diversion are unlikely to modify the long term median flow values in a meaningful way. Due to the limited nature of this interaction, the effects on hydrology over the long-term have been assessed to be negligible.

Change in Suspended Sediment Transport

Under flood conditions, the primary particle size carried in flow diverted from, and remaining in the Elbow River, would likely be coarse silt/very fine sand (average grain size of 0.063 mm) and medium sand sized material (average grain size of 0.36 mm. The effects of diversion would be to change suspended sediment concentrations and local suspended sediment yields in the Elbow River. The effect on suspended sediment yields would be localized because the effects of sediment storage and tributary inputs downstream would contribute or remove unknown quantities of suspended sediment.

During retention of water in the reservoir, a portion of the suspended sediment would permanently settle at the bottom of the reservoir. Upon release back into Elbow River through the low-level outlet, sediment remaining in suspension within the reservoir would be removed together with sediment remobilized and resuspended.

The modelled effect on suspended sediment concentrations and yields in the Elbow River suggest that during diversion there would be a high magnitude effect. Higher magnitude floods would have yield reductions greater than 30% compared to existing conditions in Elbow River. Release of water from the reservoir through the low-level outlet would temporarily increase localized suspended sediment concentrations and yields in the Elbow River.

Change in Channel Morphology

Operation of the Project would change the nature of bedload transport in the Elbow River. Under flood conditions, the primary particle size transported in the Elbow River would likely be gravel-sized material, with a median grain size of 21 mm.

During diversion, the project would reduce aggradation and degradation on the Elbow during a large flood. During release, the morphology of the unnamed creek at the low-level outlet would be degraded. Channel planform and bedload movement in the Elbow River is predicted to be maintained and that only the magnitude of aggradation and degradation, during diversion, would be affected. During release, changes to geomorphology are expected in the low-level outlet. However, the majority of the mobilized bed material is predicted to remain within the low-level outlet and minimal interaction with the Elbow River would occur.

Mitigation Measures

The primary purpose of the Project is to mitigate downstream flood hazard to the City of Calgary by modifying the hydrology of the Elbow River during a high flow by temporarily diverting water. The Project has been designed so that diversion can occur when discharge exceeds 160 m3/s in the Elbow River. The aim of this diversion is to maintain 160 m^3/s in the Elbow River up to flows of approximately 760 m^3/s where the diversion capacity of 600 m^3/s is met.

However, because the Project is a mitigation for downstream flood damage, this hydrological interaction is intentional and required. Assessing the effect of the Project (or applying mitigation measures to change this effect) on hydrology under this context is not applicable because the Project is expected to operate whenever hydrological conditions pose a downstream hazard.

Residual Effects and their Significance

Determination of significance is not relevant for changes in hydrology because the purpose of the Project is to actively modify the hydrology of the Elbow River. However, as the hydrology is being intentionally modified and this modification would also change sediment transport, the significance of any resulting changes is assessed by other VCs.

6.5 SURFACE WATER QUALITY

6.5.1 Description of the Baseline Conditions

Water quality in the Elbow River upstream of Glenmore Reservoir (referred to as upper Elbow River) is good in relation to aquatic ecosystem and human uses of water from the river.

Between 1979 and 2016, suspended sediment concentrations in the upper Elbow River mainstem were greatest during the summer season, lowest during the fall and winter, and intermediate in the spring. The concentrations of suspended sediment increased from upstream to downstream in the upper Elbow River between Bragg Creek and Weaselhead Bridge. The increase in concentration from upstream to downstream was particularly distinct during the spring and summer. During fall and winter this spatial pattern were less pronounced, but still present.

Suspended sediment concentrations were lower at the Glenmore Dam than at the upper Elbow River mainstem sites upstream of Glenmore Reservoir, indicating that suspended sediment is stored prior to, or after it enters Glenmore Reservoir. Despite storage, the seasonal pattern, although dampened, was still apparent at Glenmore Dam. The highest measured concentration of suspended sediment observed in the upper Elbow River was 3,570 mg/L at the Highway 22 bridge on June 16, 2002.

The upper Elbow River water temperature existing conditions data varied both seasonally and spatially, where temperatures were greatest during the summer, were lowest during the winter, and generally increased from upstream to downstream locations during all seasons. Water temperatures were higher during all seasons at Glenmore Dam compared to the upper Elbow River mainstem sites upstream of the Glenmore Reservoir.

The upper Elbow River dissolved oxygen concentrations varied seasonally, but were not associated with any apparent spatial pattern. Dissolved oxygen concentrations were greatest during the winter, lowest during the summer, and intermediate during the spring and fall. This seasonal pattern likely reflects the water saturation of dissolved oxygen, which decreases with increasing temperature.

6.5.2 Effects on the Environment

6.5.2.1 Construction and Dry Operations

Changes to the Environment

Change in Water Quality

Water withdrawals for dust suppression and other construction needs can be required and can affect downstream water quality by decreasing assimilative capacity. Volumes for these water withdrawals are not known yet. Given that any water withdrawals during construction will be short term and of relatively small quantity, no effects to downstream assimilative capacity are anticipated, and therefore, this effect pathway was not discussed further in the assessment.

Change in Suspended Sediment Concentration

The main Project effect on water quality is anticipated to be related to the settling of suspended sediment. Land-based construction activities such as riparian vegetation removal or grading may increase erosion potential, resulting in mobilization of sediments to a water body. In addition, instream construction activities and agitation or excavation of the stream bed or banks may cause the release of sediment into a watercourse.

Change in Herbicide Concentration

Vegetation along the Project infrastructure will be maintained and weed growth managed, including the application of herbicides to control weeds. Operational plans for weed management have not been developed yet for the Project. It is possible that herbicides applied on land to control weeds could enter local watercourses.

Mitigation Measures

Mitigation of potential effects of erosion and sedimentation during construction will be as listed in Section 5.4.2.1 for hydrology.

Herbicides would be applied according to Environmental Code of Practice for Pesticides:

- Herbicide mixing and loading will not be allowed within 30 m of an open body of water.
- Open bodies of water within the application sites will be identified and those that are not clearly visible to the applicator will be marked or flagged.

Other substances will be controlled on the construction site through:

- Transport of hazardous materials to and from the Project site, storage, use and disposal will be in accordance with regulatory requirements.
- Construction equipment will be mechanically sound with no oil leaks, fuel or fluid leaks. Equipment will be inspected daily and any leaks will be immediately repaired.
- Persons qualified to handle Construction Equipment fuels and lubricants will perform repairs.
- Service vehicles will carry fuel spill clean-up materials.
- Containment berms and impermeable liners will be used around fuel and lubricant storage tanks.
- A minimum 100 m setback will be maintained between stored fuels and lubricants and rivers, streams and surface water bodies.

Residual Effects and their Significance

The effect of the Project construction on downstream water quality in the Elbow River and the Glenmore Reservoir is negligible, given that sediment concentrations will be monitored during construction and the implementation of the mitigation measures.

The effect of dry operation on water quality through herbicide application, considering the use of the Code of Practice and the low frequency of herbicide use by the Project, is not significant.

6.5.2.2 Flood and Post-Flood

Changes to the Environment

Change in Suspended Sediment and Suspended Sediment Associated Parameters

The main effect on water quality is related to suspended sediment, which comprises organic and inorganic matter that is held in water by turbulence. The silt and clay fractions of suspended sediment comprise clay minerals, iron hydroxides, manganese oxides and organic matter. Water quality parameters that follow similar seasonal patterns as suspended sediment were identified based on existing conditions water quality data in Elbow River. However, it is assumed the parameters likely behave similarly to suspended sediment during a flood because the physical mechanism of negatively charged suspended sediment particles attracting positively charged matter remains the same during flood conditions.

Water temperature can increase during water retention (loss of water velocity) in the reservoir, if air temperature is sufficiently warm. Loss of water velocity can also reduce oxygen mixing into the reservoir water compared to river conditions. However, wind mixing in the relatively shallow reservoir is anticipated to replenish dissolved oxygen in the retained water. Dissolved oxygen can be consumed by retained water because of organic matter decomposition, if the residence time and weather conditions create suitable conditions for decomposition to occur.

Change in Methylmercury Concentrations

Mercury methylation is a chemical process that occurs in soil that is inundated by water, such as a reservoir. Flooded organic carbon in soil and vegetation decomposition results in microbial activity causing the methylation of inorganic mercury (Hg [II]) to methylmercury (CH_3Hg^+). Methylmercury is a toxic form of mercury and it bioaccumulates in aquatic food webs. Both mercury methylation and demethylation occur in concert in aquatic environments, with an equilibrium being established within days to weeks.

Because vegetation and soil in the reservoir would be inundated during flood operation, a potential exists for methylmercury release into the reservoir water and into Elbow River.

Mitigation Measures

No water-quality mitigation measures have been developed for the flood and post-flood phases of the Project.

Residual Effects and their Significance

During flood operation, the Project is expected to result in an increase in sediment concentrations in the Elbow River. This effect would occur with or without the Project. The amount of sediment increase during draining of the reservoir can be managed by the operation of the low-level outlet gate and, possibly, also by using erosion and sediment control measures in the reservoir once it is almost empty. The amount of sediment in the Elbow River and carried down to the Glenmore Reservoir could be less than would occur without the Project, as sediment will be retained in the Project reservoir.

During cleanup, it is not anticipated that the Project would measurably affect water quality in Elbow River or Glenmore Reservoir. Sediment would be removed from Project infrastructure where there is a risk that water flow could be impeded in future flood diversions.

The effect of the Project on water quality is not significant because the change in water quality is not anticipated to cause acute or chronic toxicity or change the trophic status of the Elbow River or Glenmore Reservoir. Even though the total load of sediment in the Elbow River is reduced by the project, flood operation is not predicted to substantially affect the Elbow River suspended sediment concentrations during diversion. The Project does increase suspended

sediment concentrations for a short duration (days) at the end of release of water back into Elbow River.

Because vegetation and soil would be inundated, there is a potential for methylmercury to be retained in water as it is released back into Elbow River. The estimated low and high methylmercury concentrations in all floods are below the Canadian Council of Ministers of the Environment (CCME) Canadian Water Quality Guideline for the Protection of Aquatic Life. The reservoir area is not expected to continue to contribute methylmercury after it is drained.

6.6 AQUATIC ECOLOGY

6.6.1 Description of the Baseline Conditions

The Elbow River and its tributaries transition from a steep, generally single channel mountain stream with pool-riffle sequences to a weakly braided/wandering pattern contained within broad floodplain with low gradients and typically poorly defined tributaries as the Elbow flows towards Glenmore Reservoir. The Elbow River in the LAA is an irregularly meandering channel with sediment deposition across a wide valley. Fish habitat in the Elbow River is rated as primarily good run habitats, interspersed with riffle and pool habitats. Overhead cover is related to undercut banks and overhanging vegetation. Instream cover is mostly woody debris and large sized substrate (boulder / cobble). Substrate composition throughout the Elbow River consists of cobble and pebble, with smaller amounts of gravels and sand. Within the LAA, spawning, overwintering, and rearing habitats are rated as moderate-good to good habitat for forage, coarse, and sport fish.

The Elbow River in the RAA contains a variety of fish species including brook trout, brown trout, bull trout, burbot, cutthroat trout, mountain whitefish, rainbow trout, white sucker, longnose sucker, and mountain sucker. Bull trout and cutthroat trout are considered species of conservation concern in Alberta. Of the fish species present in the LAA, Westslope cutthroat trout are protected under Schedule 1 as threatened under the federal SARA and listed as threatened based on Alberta's General Status of Wild Species 2010 and under the Alberta *Wildlife Act*. Genetically pure (non-hybridized with rainbow trout) Westslope cutthroat trout stocks are considered unlikely downstream of Bragg Creek given existing moderate coldwater habitat conditions. Bull trout are listed as *sensitive*, based on Alberta's General Status of Wild Species 2012 and as a *Species of Special Concern* under the Alberta *Wildlife Act*.

The Elbow River supports a recreational fishery that has been a part of known local and national fishing culture from the early 1990s, with the Glenmore Reservoir being a popular sport fishing location for northern pike, trout, and perch. There are no known commercial fisheries on the Elbow River, nor are there commercial fishing licences on any lakes within the LAA or RAA.

The distribution and relative abundance of fish species is based on 155 electrofishing events over 37 years available (Table 6-1) in AEP online Fisheries and Wildlife Management Information System (FWMIS) database.

Table 6-1 Electrofishing Records Available from Elbow River Upstream of Glenmore Reservoir

Area	Number of Electrofishing Surveys	Sampling Dates
Above Elbow Falls	23	1978-2011
Elbow Falls to the Project	75	1978-2014
Downstream of the Project	57	1988-2015
Total	**155**	**1978-2015**

The relative abundance in Elbow River is calculated by the percent of the catch per unit effort of the electrofishing sampling events (Figure 6-3).

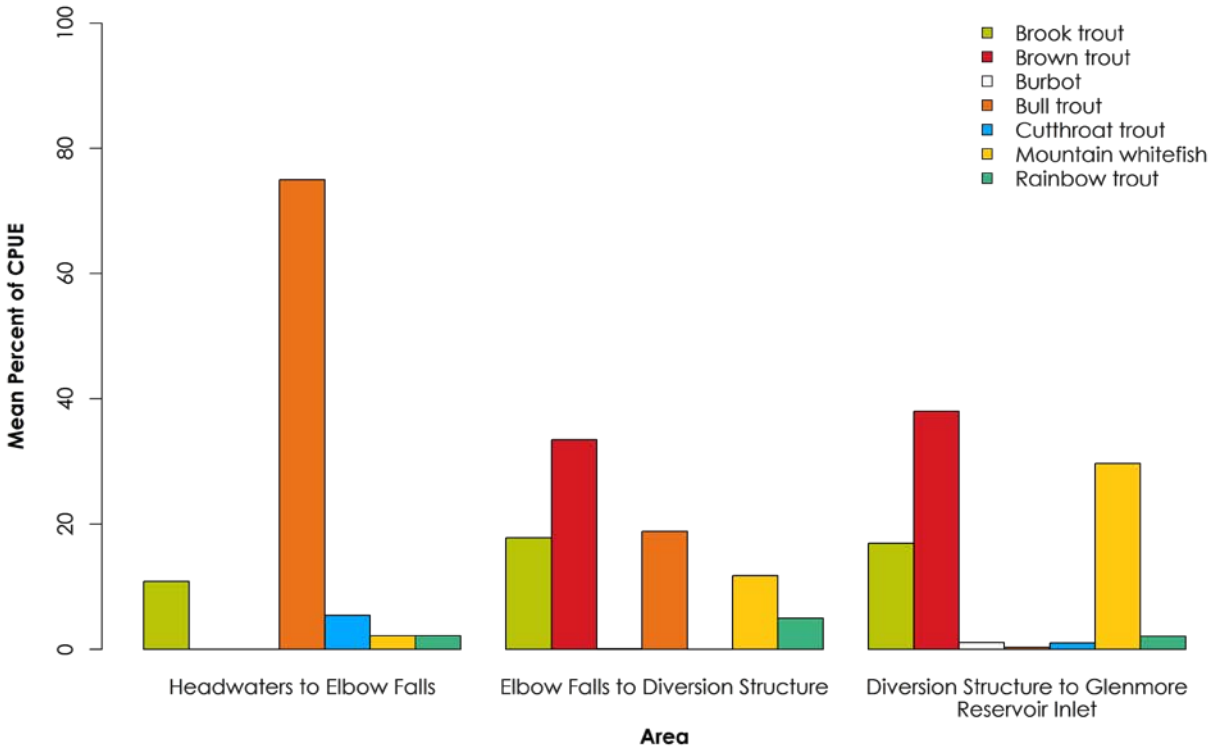


Figure 6-3 Relative Distribution of Sport Fish Species in Elbow River Separated into Three River Segments

Fish species distribution in the LAA reflects the change in channel size, substrates, and gradient as the river habitats change from steep, higher elevation, and erosional channels to lower elevation depositional channels (Figure 6-2). Northern pike and burbot are found in the lower gradient channel near the Glenmore Reservoir, while cutthroat trout (and hybrids) are found in the colder and steeper headwater channels; pure-strain westslope cutthroat trout are not present within the RAA/LAA. To provide a site-specific review of relative abundance and distribution, fish species are sorted into three river segments on Elbow River based on areas of gradient change: Below the project site, project site to Elbow Falls, and above Elbow Falls.

Salmonids are the most abundant fish species caught in the three sections, with Brown trout being the most abundant salmonid in the lower section and bull trout being the most abundant in the sections from the project site to Elbow Falls, and above Elbow Falls. Brook trout and rainbow trout are found consistently throughout the three river segments.

6.6.2 Effects on the Environment

6.6.2.1 Construction and Dry Operations

Changes to the Environment

Permanent Alteration or Destruction of Fish Habitat

Construction activities (such as instream activities) could change sediment concentrations, water temperatures, habitat structure, nutrient concentrations and food supply, migration patterns, and fish access in the Elbow River and tributaries in the LAA. These changes could result in permanent alteration or destruction of fish habitat.

Following construction, the Project could result in increased sedimentation in the waterbodies if exposed soils are transported into the water or if erosion develops because of changes in runoff to channels and waterbodies. Changing flow or channel shape, or temporarily obstructing the river can cause temporary disruption of fish movement and migration past the site. Flows in the Elbow River would be unaffected during construction, but water velocities may change at the diversion site because of channel constriction during construction and changes to the shape of the channel after construction.

During dry operation of the project, the physical structure may be a barrier to upstream fish migration for large fish by creating an area of shallow water over the concrete gates, with depths shallower than 18 cm, that may impede the upstream movement of large fish such as bull trout, during late summer spawning migrations. The transition from the concrete gates to the spilling basin may also create a drop that is too tall for small fish to jump up.

Operational activities such as cleaning or maintenance of bridges or the water diversion structure may result in increased sedimentation that could alter or destroy fish habitat.

Death of Fish

Change in fish/egg mortality includes the increased risk of direct mortality to individuals (i.e., all life stages) and/or their eggs due to increased sedimentation from on-land construction activity, the intensity, duration, and timing of instream work, or through the stranding of fish as a result of a barrier creation such as reduced flows.

There is potential for fish to be stranded during dewatering, resulting in fish mortality or stress. The operation of pumps can also result in the death of fish through impingement against the intake and into the pump. Entrainment occurs when a fish is drawn into a water intake and cannot escape. Impingement occurs when an entrapped fish is held in contact with the intake screen and is unable to free itself. The operation of equipment in the watercourse and the placement of materials can also cause the direct injury or mortality of fish and aquatic organisms that support the fishery.

Mitigation Measures

Environmental protection will be managed during construction through Alberta Transportation's ECO Plan process. Mitigation measures to reduce the effects on aquatic environment and fisheries have been developed based on best management practices described in the Alberta Transportation Fish Habitat Manual, the Code of Practice for Watercourse Crossings, and DFO's *Measures to Avoid Causing Harm to Fish and Fish Habitat*. The mitigation measures are presented in terms of timing of activities, operation of machinery, handling of deleterious substances, erosion and sediment control, water management, stream isolation, reclamation, and structure operation and maintenance.

Works in water will be timed with respect to the restricted activity periods (RAPs) wherever possible. For the Elbow River, the RAP is May 01 – July 15 and September 16 – April 15. Condition and use of restricted activity periods will be provided within further project permitting and authorization under the *Fisheries Act.* For planning purposes, the Elbow River RAP will be applied as an avoidance and mitigation measure.

Mitigation measures with respect to in-stream construction, erosion and sediment control, water management practices, isolation, and reclamation will also be implemented throughout construction.

Residual Effects and their Significance

The residual effects on change in habitat, movement, and mortality risk are unlikely to pose a long-term threat to the persistence or viability of a fish species, including SAR, in the RAA. At river flows below the operation of the diversion structure, there are unlikely to be any residual effects to changes of flow from the Project. The Project would result in direct and indirect alteration of fish habitat during construction and dry operations; however, the amount of fish habitat permanently affected is relatively small compared to the availability of fish habitat remaining in the RAA. The Project would not result in the death of fish that would threaten the long-term persistence or viability of aquatic species of management concern (SOMC) in the RAA because of proposed mitigation during the construction phase. During dry operations, it is expected that mortality risk would be reduced to levels similar to existing conditions.

The area of the diversion structure in the bankfull is approximately 1,854 m^2. Approximately 1,200 m of stream length of a tributary would be cut off and diverted by the diversion channel, although only the lowest 300 m would be fish habitat.

With the application of mitigation and environmental protection measures, residual effects on aquatic ecology are predicted to be not significant.

6.6.2.2 Flood and Post-Flood

Changes to the Environment

Changes in Channel Morphology

The diversion of flows from the river can alter habitats by reducing the flows in the river channel, and therefore, the velocity in Elbow River. Changes in river velocity from floods can reduce the movement of bedload, reduce scour that creates pools, reduce the mobilization and deposition of gravel that creates salmonid spawning habitat, reduce the mobilization of woody debris, and change the slope and vegetative cover on the banks.

Changes in channel morphology might occur from decreased flows resulting in physical alterations to the channel features (i.e., bed and banks, width, depth, and gradient) associated with the excavation of materials required to re-align the channel. Lateral channel migration promotes habitat diversity and can be negatively affected by flow impoundment, which could affect shallow side-channel and nearshore rearing habitats. The increase in bed stability and stable flows can result in the increase of aquatic macrophytes, which can improve habitat, but at a threshold level, can reduce fish spawning habitat and fish and invertebrate access to clean substrates. Resultant decreases in habitat complexity may be detrimental to fish diversity and may change species composition.

During the winter stream resident juvenile salmonids may shift their preference to slower habitat and school together in suitable habitats. Because of the tendency for trout to form schools in slower water, at areas of suitable substrate, depth, and cover, the cleaning action of scouring of gravel substrates and pool habitats is an important function of flooding in rivers. A clean, suitable sized substrate is also important for overwintering trout because they burrow during daytime. Periodic natural bed scouring flows are needed to rejuvenate the food web that supports fish and other higher trophic levels.

Mitigation Measures

Environmental protection would be managed during flood and post-flood operations through the same measures as discussed for construction and dry operations.

The reservoir will be slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be graded to reduce stranding of fish during release of stored flood water from the reservoir. During draining of the reservoir, monitoring will be undertaken to identify isolated pools and the potential that fish may become stranded. If potential fish stranding is identified, further action will be taken to reduce the potential mortality of fish.

Residual Effects and their Significance

Permanent Alteration of Fish Habitat

The Project would result in direct and indirect alteration of fish habitat during flood and post-flood operations.

Channel planform and bedload movement is predicted to be maintained during flood and post-flood phases and only the magnitude of aggradation and degradation during diverted floods would be affected. The release of water from the reservoir through the low-level outlet would temporarily increase localized suspended sediment concentrations and turbidity in the Elbow River. Increased turbidity and the deposition of sediment on substrates could affect the quality of fish habitat in the low-level outlet channel and in Elbow River downstream of the low-level outlet. The effects on fish habitat are assessed as not significant.

Destruction of Fish Habitat

The Project would not result in a destruction of fish habitat by preventing fish passage during flood and post-flood operations. With maintenance on the diversion structure and mitigation, upstream movement of fish during post-flood operations would not differ from upstream movement during dry operations.

Fish Mortality

The Project may result in fish mortality that can threaten the long-term persistence and / or viability of aquatic species and fish of management concern in the RAA. During post-flood operations, stranding in the reservoir is expected to cause mortality of fish that do not swim out of the reservoir during post-flood draining. The potential level of fish mortality is not known, and the ability to rescue stranded fish depends on extent of areas ponded, reservoir drawdown rate, and sediment deposition in the reservoir which effects drainage and fish movement. The diversion structure and reservoir are planned and designed as mitigation measures to limit the effects of floods in the Elbow River. Fish often move into sheltered habitats which experience reduced flows during floods, potentially including the reservoir. The low frequency of floods, design of diversion structure, depth of water held in the reservoir, stranding fish management and the managed rate of downdraw in the reservoir would be used to avoid and limit fish mortality. This indicates that the effects on fish mortality is not fully known, but can be mitigated and is assessed as not significant.

The mortality from entrainment is dependent on the number of fish entering the reservoir and those fish returned to Elbow River during draining of reservoir. Entrainment of fish into the reservoir during active diversion may cause bodily harm to fish as they are transported along the channel. There is potential for fish to be stranded during dewatering of the reservoir, resulting in fish stress or mortality. It is likely that fish mortality would occur due to stranding. Changes in downstream flows can also result in fish stranding in the low-level outlet or Elbow River depending on the extent of shallow habitat features like small pools.

6.7 TERRAIN AND SOILS

6.7.1 Description of the Baseline Conditions

The Project is in western Alberta, approximately 15 km west of Calgary, entirely within the Okotoks Uplands District of the Western Benchlands Section of the Southern Alberta Uplands Physiographic Region. The region is characterized by low relief, undulating and hummocky terrain, with some rolling areas controlled by underlying bedrock. The PDA extends onto the floodplain of the Elbow River and the adjacent escarpment dissected by the Elbow River. Evidence of landslides, such as slumps and debris avalanches, were observed in the field and during the preliminary terrain mapping along the escarpment adjacent to the Elbow River and tributary streams.

The PDA is drained by the Elbow River and its tributary streams between Range Road 35 and Range Road 43. The proposed reservoir area lies in the watershed of an unnamed tributary to the Elbow River (referred to hereon as the tributary stream). The tributary stream watershed is broad and flat to gently sloped. The elevations in the LAA range from approximately 1,165 m asl at the confluence of the Elbow River and the tributary stream to approximately 1,263 m asl, west of the diversion structure.

Soil units include series or phases from the Chernozemic, Regosolic, and Gleysolic, soil orders. Slopes range from class 1 (level) to class 8 (extreme). Ranked in order of extent, fine to very fine textured units dominated by Chernozems and Gleysols occupy approximately 76.8% of the LAA. Moderately to very coarse textured units (Regosolic soils are next most abundant, especially in the Elbow River floodplain occupying approximately 9.1%. Lesser extents of medium textured units (Chernozems) make up approximately 2.0% of the LAA. Complex soil units with a range of materials, taxonomy or textures occupy approximately 6.9% of the LAA. Reclaimed and disturbed land makes up approximately 5.2% of the LAA.

6.7.2 Effects on the Environment

6.7.2.1 Construction and Dry Operations

Changes to the Environment

Change to Terrain Stability

Channel excavation, diversion construction, dam construction, low-level outlet works construction, road construction and borrow extraction may affect terrain stability in areas prone to landslides by changing slope morphology (e.g., steepening of slopes) and changing natural drainage paths. Landslide-prone areas include the Elbow River escarpment at or near the diversion structure and the channel banks along the tributary stream intersecting the low-level outlet works area and dam site. The diversion channel, borrow source areas, waste storage sites and high road cuts may contain steepened slopes that have potential for minor sliding/sloughing. There is a potential for locally exposing acid generating bedrock (i.e., coal strata) but can be managed through site-specific acid rock drainage/metal leaching assessments where coal is encountered.

Change to Soil Quality and Quantity

Project infrastructure planned for the LAA would affect soils and the agricultural land capability of these soils. Construction and reclamation activities for infrastructure components may affect the agricultural land capability through changes to such parameters as topsoil thickness and replacement depths. Activities may affect wind erosion risk through changes to topsoil properties such as texture, organic matter content or structure. Similarly, water erosion risk may be affected by changes to topsoil texture, organic matter content, slope, and related infiltration characteristics. In some cases, areas that could support agriculture would be converted to features that would not support agriculture. Changes to roads, and existing surface drainage may result in changes to soil that in turn affect distribution of agricultural land capability.

Some construction effects may also accrue in the off-stream reservoir, such as the development of erosion control mechanisms (e.g., rip-rap). These features are intended to reduce flow velocity and reduce soil erosion during a flood. Other components of project infrastructure such as lay down areas, borrow pits and soil storage areas are to be reclaimed.

There are no anticipated effects on soil quality during dry operations. Water and wind erosion risk classes at post-construction would have no appreciable change to the proportion or rank of individual risk classes other than an increase in area not rated for water or erosion risk. These changes pertain to areas used for Project infrastructure.

Mitigation Measures

Terrain Stability

Standard construction mitigation that lessen residual effects on terrain stability include:

- Slope stability will be visually monitored on infrastructure features such as berms, dam, and diversion channel.
- A concrete retaining wall will be designed and constructed as part of the diversion structure to stabilize the Elbow River escarpment.
- Materials will not be stockpiled at slopes steeper than 3H:1V. Slopes will be graded smooth upon completion to reduce sliding and sloughing.
- Side slopes in stockpile materials will be cut to reduce sliding/sloughing.
- Channel banks will be seeded and revegetated with native seed or erosion control mix to improve channel bank stability.
- Surface drainage patterns will be re-established where possible.
- Drainage and erosion control measures (e.g. silt fences) will be implemented around stockpiles to prevent erosion.

Soil Quality and Quantity

Key mitigation measures for Project effects on soil include:

- Topsoil will be stripped and stockpiled for future use in the reclamation of disturbed areas.
- Topsoil horizons (O, LFH, A) from areas intended for disturbance will be salvaged separately and stockpiled for later use, to prevent admixing of soils.
- A topsoil replacement plan will be developed for the reclamation of the disturbed areas. These areas will be revegetated.
- Disturbed areas associated with project components such as the water intake, water retention, water outflow and roads will use previously salvaged topsoil material to promote vegetation re-establishment.

Residual Effects and their Significance

During construction and dry operations, the residual effects on terrain stability are anticipated to be both positive and adverse dependent on the project structure. For example, the concrete diversion structure would be excavated through the Elbow River escarpment, which is mapped as terrain stability class V (having a high likelihood of landslide initiation). The diversion structure would stabilize the escarpment behind a concrete wall. In contrast, the diversion channel would be excavated through flat to rolling terrain generally mapped as terrain stability classes I and II (having a negligible to very low likelihood of landslide initiation). The diversion channel side slopes will be graded to a 4H:1V ratio, effectively increasing banks to terrain stability class III (having a low likelihood of landslide initiation). Overall, the result is of moderate magnitude of change with an area increase of 5.5% of terrain having a low likelihood of landslide initiation within the total LAA. The off-stream dam will be located across the tributary stream, which in part would remove 0.8 ha of area mapped as terrain stability class IV (moderate likelihood of landslide initiation following construction compared to existing conditions). The effect of the Project on terrain during construction and dry operations in assessed as not significant.

There is a reduction in the areal extent of land rated as agricultural capability class 3 (mode) by 7% of the LAA during construction and dry operations. This reduction is the result of the construction of the Project components. Because post-construction, the dam and reservoir will not be under agricultural land use, the effect of the changes on soil quality and soil quantity are assessed as not significant.

6.7.2.2 Flood and Post-Flood

Changes to the Environment

Change to Terrain Stability

Reservoir draining has the potential to affect terrain stability along channel banks within the reservoir. Rapid reservoir draining can subject a slope to a high soil pore water pressure gradient (increased shear stress) and cause potential instability. There is a direct relationship between pore water pressure and soil drainage; therefore, the project pathways described for soil are similarly applicable to terrain stability.

During release of reservoir water, the low-level outlet channel would be subject to a major shift in stream flow regime which could destabilize stream banks. Current bankfull discharge in the outlet channel is approximately 1.0 m^3/s, as estimated from monitoring data. The currently planned maximum discharge rate for the low-level outlet for the design flood is 27 m^3/s over a 43-day draining period.

Change to Soil Drainage and Nutrient Properties

Soils would be submerged and saturated over intervals ranging from 5 days for the 1:10 year flood to more than 67 days for the design flood events, sufficient time to saturate the unsaturated zone of the soil profile and parent material.

Submergence and saturation would lead to soil anoxia in all soils subject to flooding. Related effects include increased solubility of anions such as phosphorus, reduction of manganese and iron, denitrification, and conversion of organic carbon to methane. While nutrient properties are not directly included in agricultural land capability ratings, they are critical to ecological function of these soils as well as interactions with aquatic systems. Given that these processes are most active in topsoil horizons, they potentially could affect agricultural land capability by loss of organic carbon. However, because of the relatively short period of potential anoxia, soil oxygen levels in topsoil horizons would be maintained in the aerobic range soon after reservoir drainage, typically within one or two months of reservoir drainage.

Change to Land Capability Class

Flooding would introduce new sediment to the soils in the off-stream reservoir. Sediment added to the soil surface has the potential to affect the quantity of soil and related agricultural land capability ratings, and physical properties of the soil, including texture and related water holding capacity. Sediment is expected to be dominantly in the sand size class, in contrast to the existing particle size dominated by silt and clay. These changes to soil texture and water holding capacity may result in agricultural land capability change. Sediment depths greater than 0.2 m are expected to trigger changes to agricultural land capability. Maximum depth of sediment predicted for the design flood exceeds 3 m.

The sediment is expected to be primarily calcium-carbonate in mineralogy because it is derived from the limestone rich beds of the Rocky Mountains. The primary effect of calcite on soil is through its effect on soil pH.

Both reservoir filling and reservoir drainage are expected to contribute to water erosion and erosion risk, especially of topsoil horizons. Water traveling along the diversion channel and entering the reservoir may retain sufficient energy to erode topsoil. Water erosion may favor the colloidal fraction (clay-organic associations), over larger particle size classes, leading to a depletion of organic carbon and clay. Turbulence in the water column is expected to maintain suspended silt and clay in the water column; therefore, these fractions may be lost. Loss of topsoil would affect ratings for agricultural land capability. Wind erosion may transport sediment with higher calcium carbonate levels and contribute to pH change in receiving soils. Wind erosion risk in the LAA may change after sediment deposition above baseline soil profiles. A sediment depth of 3 cm or greater is expected to trigger a change in wind erosion risk if texture of sediment differs from baseline topsoil texture.

Mitigation Measures

Key mitigation to reduce the effect of soil pore water pressure change within the reservoir during reservoir draining is to conduct drawdown of stored flood waters in a controlled manner to avoid soil erosion and to maintain slope stability.

Standard post-flood mitigation to be employed to lessen the extent of residual effects on terrain stability due to a substantive shift in the stream flow regime within the low-level outlet channel include:

- conducting slope stability inspection and monitoring on the structures to detect and repair any sloughs or failures

- repair and re-armour as required the channel banks to stabilize slopes where flood diversion flows have caused erosion
- seed and revegetate the channel banks with native seed or erosion control mix to improve bank stability where flood diversion flow has caused erosion of the vegetation.

There is no planned mitigation of higher calcium carbonate content in soil and higher pH. Time periods are likely too short to allow any measurable removal of free carbonates through leaching. Therefore, pH can be expected to remain constant for the time periods considered. This would not be critical to plant community function because many prairie upland and wetland plant communities would not be limited by this pH range.

Residual Effects and their Significance

The predicted residual effects on slopes after recommended post-flood mitigation would be a temporary imbalance in soil pore water pressure within the reservoir. This could result in minor, localized bank slumping immediately following reservoir draining and before the dissipation of pore water pressure.

The predicted residual effects on the low-level outlet channel after recommended post-flood mitigation would be a shift in stream flow regime resulting in a change in channel planform and an increase in local bank instability (the likelihood of landslide initiation of some banks mapped as low to moderate would increase). The order of magnitude increase in the stream flow regime for the 1:100 year and design floods would result in a predicted adverse residual effect on terrain stability along the outlet channel.

Within the reservoir, the change in terrain stability following flood and post-flood operations for all modelled floods is predicted to be not significant and with an extent that is confined to the PDA. For the low-level outlet channel, the change in terrain stability following flood and post-flood operations for the 1:100 year and design floods is predicted to be significant and to extend into the LAA.

Within the reservoir, since land use would change from agricultural if the Project is approved, the effects on soil are not considered significant.

6.8 VEGETATION AND WETLANDS

6.8.1 Description of the Baseline Conditions

Landscape and Community Diversity

The LAA is largely composed of agriculture land (48.2%), with annual crop and tame pasture being the dominant land units. The most common native plant communities within the LAA are forested areas (16.3%), native grasslands (8.7%) and shrubland (8.4%).

Forested areas are largely restricted to areas bordering the Elbow River and large patches near the intersection of Range Road 40 and Springbank Road, and west of Highway 22 near Township Road 244. Mixed forest is the most common forest type, occupying 296 ha (6.1% of the LAA), followed by roughly equal area of broadleaf (252 ha, 5.2% of the LAA) and coniferous forest (245 ha, 5.0% of the LAA). Thirteen forest ecosite phases were mapped with most occupying less than 90 ha.

Native grassland is largely rough fescue (382 ha, 7.9% of the LAA); shrubland areas are mostly beaked willow (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 the Elbow River.

Wetlands occupy 6.4% of the total area. The most common wetland type is seasonal graminoid marsh (102.7 ha, 2.1% of the LAA) 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). Graminoid marshes, shallow open water and swamps are mineral wetlands (less than 40 cm of peat), whereas shrubby fens are peat-accumulating wetlands (greater than 40 cm of peat).

Wetlands are widely dispersed in the LAA, but most occur along drainages and adjacent to the Elbow River. A large wetland, a temporary marsh, 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 wetland types surveyed lacked defined inlets and outlets and appear to be closed basins; however, those with inlets and outlets are located along drainages.

Areas of open water in the LAA are the Elbow River, unnamed watercourses, and drainages. The Elbow River is the largest area of open water in the LAA. Unnamed watercourses are generally tributaries to the Elbow River and likely convey water seasonally for a few months and then likely become dry later in the growing season in most years.

Species Diversity

A total of 313 species were observed during 2016 surveys. Forbs represented the majority with 189 species, followed by graminoid plants with 79 species and shrubs with 38 species. The remaining species included three trees and two fern allies.

Three ecological communities of management concern were previously documented in the RAA. One fern, two forbs, twelve lichens, two liverworts, fourteen mosses, one shrub and one tree SOMC have also been previously identified within the RAA. The closest previously recorded SOMC to the PDA were one lichen species, soot lichen, observed in native grassland approximately 2 km northeast of the PDA, and one shrub species, mountain gooseberry, observed along Jumpingpound creek approximately 3.5 km to the west of the PDA.

Wetland Functions

Although wetlands and riparian areas in the PDA and LAA have been altered by land use, mostly agriculture, many of the wetlands provide habitat for native plants and wildlife, as well as ground water 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.

Land use has likely reduced the number and extent of wetlands in the LAA as well as resulted in increased soil disturbance, herbicides and pesticide exposure and altered species composition. Wetlands within the LAA are likely ranked high or moderate value because most of the wetlands are isolated (without outlets), which results in greater water storage, sediment retention, phosphorus retention and nitrate removal and retention. Seasonal wetlands are the most common wetland type in the LAA. Seasonal wetlands, generally have high percent cover of graminoids and forbs, with low percent cover of open water, which results in increased organic matter export.

6.8.2 Effects on the Environment

6.8.2.1 Construction and Dry Operations

Changes to the Environment

Change in Landscape Diversity

Construction and dry operations phases would mostly affect anthropogenic landscape types. Coniferous forest and native grassland cover types would have portions disturbed or bisected, which would reduce the size of the vegetation patch and increase the number of patches. Disturbance to portions or bisecting vegetation patches increases fragmentation in the RAA.

Native vegetation would be removed in the areas of temporary disturbance but these areas would be reclaimed. Vegetation in the areas of the permanent features would be removed.

Change in Community Diversity

Construction and dry operations would mostly affect anthropogenic landscape types in the PDA. Temporary clearing of vegetation is expected to remove 223 ha of upland and 29.5 ha of wetland during the construction phase. Permanent project disturbances would result in the permanent clearing of vegetation and wetlands.

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

Regulated weeds and non-native invasive species were recorded at most survey sites and were generally abundant when observed. The seeds of these regulated weed species would likely remain in the seedbank in stockpiled material and are anticipated to persist following construction. The abundance and introduction and establishment of regulated weeds and non-native invasive species would be managed through the mitigation measures.

Change in Species Diversity

Effects on plant SOMC from vegetation clearing are not anticipated because none were observed in the PDA. Effects on plant SOMC may still occur because unidentified plant SOMC may be present, including slender cress, blunt-leaved water cress and dwarf bulrush observed during rare plant surveys of the PDA, and previously recorded plant SOMC in the RAA.

Additional SOMC could be present because, for many species, the number of plants fluctuate in response to climatic conditions (e.g., annuals may not germinate in dry years) and occur in low numbers. The foothills parkland has 52 vascular, 26 non-vascular and 22 lichen SOMC listed as tracked. Many of these species are associated with wetlands and moist depressions, which are common in the LAA.

Change in Wetland Functions

Because no wetland cover types are lost, measurable changes to ground water recharge/discharge, water storage, sediment retention and carbon sequestration would not occur.

Wetland ecological function (i.e., wildlife habitat and plant diversity) would be altered due to vegetation clearing for permanent structures. 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 wetland area. Temporary work areas would avoid wetlands wherever possible.

Mitigation Measures

Key mitigation measures that would be implemented during construction and dry operation are:

- Restricting construction activities to the approved construction footprint
- Do not apply herbicide 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 this area.
- A licensed industrial pesticide applicator would be contracted to select and apply all herbicide in compliance with the procedures as outlined in the *Code of Practice for Pesticides*. 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, minimize 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.

- Where possible, direct grading/drainage away from wetlands.
- Where there are permanent or temporary access roads, maintain cross drainage to allow water to move freely from one side of the road to the other.

Residual Effects and their Significance

Temporary disturbances to native vegetation cover types would be recontoured to blend in with the surrounding landscape (if required) and 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 reestablish over time in reclaimed native upland areas; however, for the dry operations phase it is assumed these areas would become native grassland.

Effects on landscape diversity are considered irreversible in areas of permanent project disturbance. The geographic extent of residual effects is expected to be restricted to the PDA. Active reclamation of temporally disturbances on native upland areas would use Alberta Transportation custom native seed mix, and it is expected that re-establishment of native vegetation would occur in the PDA; therefore, effects of fragmentation considered reversible in temporary disturbances.

During the construction phase, areas of temporary disturbance would only have above ground vegetation clearing, leaving the soils intact, though there are some areas of soil disturbance. Areas with vegetation clearing only would recover to existing conditions, and areas with soil disturbance would likely take longer for native vegetation to establish and would likely be less similar to existing communities. 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 would 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 from vegetation during rain events. No vegetation and wetland land units would be completely lost, and no lasting effects on vegetation and wetlands would be anticipated.

Active reclamation of areas temporarily disturbed by the Project would occur using Alberta Transportation native custom seed mix, and it is expected that re-establishment of native vegetation would occur in these areas. Additionally, areas where maintenance occurs may require vegetation management (i.e., weed management), but effects are considered reversible. However, because the major project components would be permanent, effects on vegetation and wetlands are considered irreversible. However, where possible, permanent features such as the floodplain berm and dam would be seeded using native species. The

geographic extent of residual effects on vegetation and wetlands are expected to be restricted to the LAA.

SOMC occurrences affected during construction in the PDA would result in residual effects being long-term and likely irreversible because the re-establishment of such species may not always be successful.

Onsite wetland restoration or offsite wetland replacement may offset loss of wetland functions; therefore, effects are expected to be reversible.

Residual effects on vegetation and wetlands during construction and dry operations or during flood and post-flood operations will not result in the loss of native upland or wetland plant communities or wetland functions from the LAA. Effects on unidentified plant SOMC could occur, but such effects would likely be limited, and likely habitat for plant SOMC does exist elsewhere in the LAA as affected vegetation and wetland land units exist elsewhere in the LAA. Effects to plant communities of management concern are not anticipated.

Residual project effects to community diversity, traditional plant use and wetland functions are assessed as not significant.

6.8.2.2 Flood and Post-Flood

Changes to the Environment

Change in Plant Community Diversity

After draining of the reservoir, water may be present at or near the ground surface of the reservoir as water evaporates or infiltrates into the soil. The amount of time needed to return the soil water content back to baseline conditions after a flooding would be dependent on evapotranspiration (the rate of evaporation plus plant transpiration of water that occurs during photosynthesis) and soil type. Flooding may also deposit sediment that could bury or suffocate plants. Sediment deposition patterns and depths were modeled for the design flood.

Change in Species Diversity

All plant SOMC occurrences occur outside the spatial extent of the 1:10 year flood. Therefore, effects on plant SOMC as a result of a 1:10 year flood are not anticipated.

One occurrence of slender cress, a rare species, was observed within the extent of both the 1:100 year and the design flood. Should a design flood occur, it is predicted 1 cm to 3 cm sedimentation would cover the slender cress location. Although slender cress can be found in upland or wetland habitats, it is not tolerant of submerged environments; therefore, it is unlikely to survive the design flood.

Change in Wetland Functions

Inundation due to a design flood would temporarily affect 3.7 ha in the reservoir (86% of the PDA) of high to moderately low value wetland area. 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 a growing season, and lower class marsh and swamp wetlands would be flooded for a duration and depth beyond natural variation.

Mitigation Measures

Mitigation measures that would be implemented during the post-flood and flood phase of the Project are listed below.

- Maintenance activities would be restricted to the PDA to reduce the area of disturbance during post-flood operations.
- All equipment would arrive at the Project site clean and free of soil and vegetative debris. Equipment would be inspected, and if deemed to be in appropriate condition would be approved for use and identified with a suitable marker or tag. Any equipment that does not arrive at the Project site in appropriate condition would not be allowed on the construction footprint until it has been cleaned, re-inspected and deemed suitable for use.
- Areas of sediment deposition where wind erosion might be an issue would be hydroseeded with native plant species and a tackifier to reduce erosion potential. AEP would have an operation and maintenance plan for the reservoir that would include sediment stabilization and debris removal.
- Where sediment partial cleanup would be required to maintain hydrological function of the Project, effort should be made to direct grading equipment and graded soil material away from adjacent wetlands.

Residual Effects and their Significance

Residual project effects are predicted to be significant, at a local scale, should a design flood occur because it would result in the loss of the only known occurrence of slender cress plant SOMC from the PDA. Due to the lack of information of rare plant occurrences in the RAA, a loss of a single rare plant occurrence at the local scale does not imply a significant effect at the regional scale. Slender cress habitat is present in the RAA and, therefore, it is likely that there are other occurrences of slender cress in the RAA that are currently undocumented.

Residual project effects to community diversity, traditional plant use and wetland functions are not anticipated because plant communities are expected to recover post-flood.

6.9 WILDLIFE AND BIODIVERSITY

6.9.1 Description of the Baseline Conditions

Wildlife Habitat, Key Ranges and Zones

The LAA occurs in the Foothills Parkland natural subregion in Alberta as does most of the RAA. The southwestern portion of the RAA extends into the Montane natural subregion. The Foothills Parkland natural subregion is a transition zone between prairie grasslands and montane and alpine forests. It is characterized by rolling topography with hills. The vegetation of the Foothills Parkland natural subregion comprises rough fescue grasslands, willow shrublands, and aspen woodlands. The Montane natural subregion is characterized by Douglas fir, limber pine, and lodgepole pine.

The LAA is dominated by an agricultural landscape, which includes tame pasture, annual cropland and hayland. Although these land cover types provide relatively low habitat suitability for most SOMC, there are native vegetation communities in the LAA that provide relatively higher habitat suitability for wildlife including grassland, shrubland, and mixed forest. Specifically, these habitat types provide suitable habitat for SOMC dependent on grassland (e.g., Baird's sparrow, elk), shrubland (e.g., loggerhead shrike, alder flycatcher) and mixed forest (e.g., western tanager). There is relatively less habitat available in the LAA for species dependent on broadleaf (deciduous) forest, such as Baltimore oriole; coniferous forest, such as great gray owl; and species dependent on wetlands, such as yellow rail, waterfowl, and amphibians.

The LAA and RAA overlap areas identified as key wildlife biodiversity zones (KWBZs), including the Elbow River to the south and the Bow River to the north. KWBZs represent areas along river valleys that are a combination of important winter ungulate (e.g., deer, elk) habitat and areas of high potential for biodiversity. The LAA and RAA also overlap the grizzly bear Support Zone identified in the draft *Alberta Grizzly Bear Recovery Plan*.

The PDA, LAA and RAA occur within sharp-tailed grouse (*Tympanuchus phasianellus*) and sensitive raptor ranges. Sensitive raptors are bald eagle, golden eagle, peregrine falcon and prairie falcon. The assessment areas do not intersect any other key wildlife ranges (e.g., sensitive snake or sensitive amphibian range), wildlife sanctuaries, or internationally significant areas for bird conservation. The RAA overlaps Bragg Creek Provincial Park, Glenbow Ranch Provincial Park, and Gooseberry Provincial Recreation Area.

Species of Management Concern

Based on a review of known species distribution ranges, species life histories, and land cover types in the RAA, there is potential suitable habitat for 86 wildlife SOMC, including 54 birds, 26 mammals, three amphibians and three reptiles. Nineteen species at risk listed on Schedule 1 of SARA have the potential to occur in the RAA: horned grebe, western grebe, yellow rail, long-billed curlew, red knot, short-eared owl, common nighthawk, peregrine falcon, olive-sided flycatcher, loggerhead shrike, bank swallow, barn swallow, Sprague's pipit, Baird's sparrow, bobolink, rusty blackbird, little brown myotis (a bat), western toad, and northern leopard frog. Although federal recovery strategies have been developed for common nighthawk and olive-sided flycatcher, critical habitat has yet to be identified. Recovery strategies for little brown myotis and Sprague's pipit have partially identified critical habitat, but they do not overlap the LAA.

In addition to the 19 wildlife species listed on Schedule 1 of SARA[1], there are three wildlife species designated as special concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) that have potential to occur in the RAA: grizzly bear, American badger and western tiger salamander. Twelve species at risk listed under the *Alberta Wildlife Act* have the potential to occur in the RAA: trumpeter swan, Harlequin duck, western grebe, long-billed curlew, barred owl, peregrine falcon, prairie falcon, loggerhead shrike, Sprague's pipit, Cape May warbler, grizzly bear, and northern leopard frog.

Through the Project-specific Indigenous Engagement program, Tsuut'ina Nation noted that bald eagles and grizzly bears are culturally important species. Other SOMC that are of cultural importance include elk and Sprague's pipit, which are key indictors for this assessment, along with grizzly bear. Of the 86 wildlife SOMC that have the potential to occur in the RAA, 31 are wildlife species of traditional importance to Indigenous communities.

[1] Schedule 1 is the official list of wildlife species at risk. It classifies those species as being either extirpated, endangered, threatened, or a special concern.

6.9.2 Effects on the Environment

6.9.2.1 Construction and Dry Operations

Changes to the Environment

Change in Habitat

During construction, vegetation removal has potential to result in direct habitat loss, reduction, or alteration, which can cause displacement of wildlife into other, less suitable habitat. Construction activities also have potential to result in indirect effects due to sensory disturbance (e.g., noise and artificial light), which can reduce habitat effectiveness in the LAA. The potential for sensory disturbance would occur primarily during the construction phase when increased noise levels associated with heavy machinery, potential blasting events (i.e., diversion channel excavation), and increased levels of human activity occur in the LAA.

The effects of sensory disturbance on wildlife during construction would vary with disturbance type, wildlife species, as well as road type and traffic volume. Elk and grizzly bear typically avoid habitat near high traffic volume roads, which results in reduced habitat effectiveness. In certain cases, elk and grizzly bears can habituate to or tolerate human activity where preferred forage overlaps into disturbed areas.

Many songbird species rely on vocalizations to attract mates and defend territories, and it is therefore reasonable to assume that noise disturbance can affect otherwise suitable breeding habitat. Amphibians, such as northern leopard frog, also vocalize to attract mates, and anthropogenic noise has been shown to alter call rates in males.

Potential sensory disturbance is expected to decrease during the dry operations phase when the levels and frequency of human disturbance would be reduced.

Change in Movement

Construction activities associated with the development of project structures and access roads as well as road realignments have potential to create physical barriers or sensory disturbance that might hinder wildlife movement in the LAA. Although construction activities have potential to temporarily alter wildlife movement for SOMC in the short-term, longer term effects on wildlife movement (e.g., deer and elk) might occur during dry operations when permanent structures, fencing and new access roads are present. Specifically, the diversion channel, floodplain berm, off-stream dam, and associated fencing around the PDA might create hindrances to wildlife movement during dry operations. The extent to which these project structures are perceived as hindrances (i.e., permeable, semi-permeable) or impermeable barriers would vary by wildlife species, location within the PDA (e.g., riparian, upland) and project design features (e.g., use of rip-rap, slope gradient).

Change in Mortality Risk

Construction activities might also result in animal-vehicle collisions (AVC) and increased wildlife-human conflict (e.g., bears). AVC might occur from increased traffic volumes or displacement from the construction area to other locations where wildlife might cross existing roads more frequently. For example, road realignments and modifications at the intersection of Highway 22 and Springbank Road could alter local traffic patterns, potentially increasing traffic volumes on other roadways in the RAA. SOMC with the potential to occur in the LAA - including birds, mammals, and amphibians - are susceptible to road mortality. Ungulates are particularly vulnerable to road mortality due to their use of roadway habitat. Between 2004 and 2014, approximately 81% of AVC on Highway 22 involved deer, 9% involved elk, and 8% involved moose. Moreover, construction activity in ungulate wintering range could add stress to ungulates, causing an increase in energy expenditure, the potential to use less favourable habitat, and face higher predation risk. An increase in wildlife-human conflict could result from attractants (e.g., garbage) in the PDA that might cause wildlife to enter the construction area while humans are still present.

Amphibians and reptiles are especially vulnerable to road mortality compared to other taxa; however, areas of high mortality risk are largely associated with proximity of roadways to breeding wetlands and other important habitat features (e.g., hibernation sites) that amphibians and reptiles might travel between.

Overall, the dry operations phase has limited potential to result in increased direct mortality risk because there would be no ground disturbance (e.g., vegetation clearing) during maintenance activities as well as substantially less human activity and vehicle traffic compared to the construction phase. The reduction in onsite activity would reduce the likelihood of project-related wildlife mortality and wildlife-human conflict (e.g., grizzly bears), compared to the construction phase. There is, however, potential for project structures to alter wildlife movement for some species, which might result in increased road crossing frequency and increased mortality risk.

Change in Biodiversity

During construction, the Project has potential to change biodiversity due to changes in species, community, and landscape diversity. Landscape diversity can be affected through habitat fragmentation, patch isolation and edge effects. One of the most common consequences of habitat fragmentation is an increase in the abundance of edge-influenced habitat and its adverse effects on species diversity and the restrictions in species movement. The degree of contrast along an edge might influence wildlife movement because some species might be reluctant to move across hard edges, or the boundary between the patches can be a barrier to movement.

Habitat fragmentation also results in a decrease in patch size, which can lead to isolation of habitat patches and affect species diversity. Because some wildlife species have minimum patch size requirements (e.g., Sprague's pipit), reducing patch size beyond a certain threshold can result in reduced habitat suitability for some species (i.e., patches that are too small to sustain a local population or individual territories).

Although project effects on species richness and relative abundance are difficult to assess without monitoring, the Project has potential to affect bird and amphibian species richness and relative abundance through the loss and alteration of land cover types. For example, vegetation clearing and soil disturbances would facilitate the dispersal of non-native plants, which can alter the native vegetation community that wildlife species rely on for habitat and forage.

Migratory Birds

Although the olive-sided flycatcher and Sprague's pipit were used as key indicators to focus the assessment, the information presented in the assessment provides a further discussion of migratory birds and their habitat as well as potential changes in movement and mortality risk during Project construction and dry operations.

Change in Habitat

During construction, vegetation removal has potential to result in direct habitat loss for migratory birds and fragmentation of migratory bird habitat, which can cause displacement of birds into other, less suitable habitat. Construction activities also have potential to result in indirect effects caused by increased disturbance (e.g., noise and artificial light, presence of workers), which can reduce habitat effectiveness in the LAA. Many migratory songbirds rely on vocalizations to attract mates and defend territories; noise disturbance can affect otherwise suitable breeding habitat whereby birds avoid the area or incur costs associated with behavioural changes to overcome the noise. The potential for sensory disturbance would occur primarily during the construction phase when increased noise levels associated with heavy machinery, potential blasting events (i.e., diversion channel excavation), and increased levels of human activity occur in the LAA. During dry operations, there is no potential for further direct habitat loss or fragmentation (i.e., no clearing of vegetation to occur), and potential sensory disturbance is expected to decrease during dry operations when the levels and frequency of human disturbance would be reduced.

Change in Movement

The Project has potential to affect wildlife movement in the LAA for amphibians and large mammals through the construction of project structures, access roads, and road realignments, which might act as physical barriers to movement. However, birds can fly over terrestrial disturbances. Because no tall structures would be erected that might affect migration patterns, flyways, local movement, and seasonal habitat use, there is limited potential for the Project to affect migratory bird movement during construction and dry operations. Temporary local shifts in distributions might occur where migratory birds could avoid areas with increased noise levels.

Change in Mortality Risk

During construction, potential for direct migratory bird mortality or nest destruction could occur through vegetation removal and ground disturbance, thus increasing direct mortality risk for migratory birds. Construction activities can also cause indirect mortality from nest failure due to sensory disturbance. Sensory disturbance associated with construction activities and use of access trails can affect nest site selection and contribute to nest failure in some migratory bird species such as Sprague's pipit. Dry operations has limited potential to result in increased direct mortality risk because there would be no ground disturbance (e.g., no vegetation clearing) during maintenance activities as well as substantially less human activity and vehicle traffic compared to the construction phase.

Species at Risk

Project construction has the potential to result in the loss of habitat of species at risk and destroy nests of bird species or roosts or hibernaculum of little brown myotis. Movement patterns of grizzly bear, American badger, elk, western toad, northern leopard frog and western tiger salamander could be affected by construction. Mortality could occur due to vehicle collisions or, in the case of mammals, removal of nuisance animals.

Mitigation Measures

Construction activities including vegetation removal and ground disturbance have the potential to affect habitat directly and indirectly for SOMC and key indicators in the LAA including migratory birds and species at risk. Mitigation measures to reduce potential effects on wildlife habitat for SOMC (including migratory birds and species at risk) are described below:

- Where possible, temporary workspaces and access roads will be located in areas that avoid wildlife features and native vegetation (e.g., shrubland, treed areas, wetlands). Existing access roads and previously disturbed areas will be used, where feasible.
- Pre-construction surveys will be conducted to identify wildlife features (e.g., nests, dens) and appropriate site-specific mitigation developed.

- Vegetation removal will be avoided during the RAP for nesting migratory birds and raptors. RAPs are primarily based on Environment and Climate Change Canada (ECCC) guidance to avoid risk of incidental take of migratory birds. ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, is from April 15 to August 31. The recommended RAP to avoid destruction and disturbance to raptor nests is from February 15 to August 15. Therefore, the combined RAP dates to avoid is from February 15 to August 31.
- If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist would inspect the site for active nests within seven days of the start of the proposed construction activity (e.g., vegetation removal, blasting).
- If an active nest or den is found, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation.
- Where possible, construction activities during the RAP for the KWBZ identified along the Elbow River (December 15 to April 30) will be avoided or reduced. This would limit potential sensory disturbance to wintering ungulates. If construction activities must occur during this period, a wildlife mitigation and monitoring plan will be developed in consultation with regulators, which would include monitoring ungulate habitat use and response to human disturbance.
- Where possible, lights will be focused internally to the work site to reduce potential sensory disturbance to wildlife in the surrounding habitat.
- Temporary work spaces will be reclaimed using native species that are compatible with pre-construction site conditions, as outlined in the reclamation plan.

Key mitigation measures to reduce potential effects on wildlife movement are described below:

- Construction activities will be avoided during the RAP for the KWBZ identified along the Elbow River (December 15 to April 30). This would reduce potential effects on wildlife movement and wintering ungulates. If construction during the RAP cannot be avoided, site-specific mitigation will be developed in consultation with AEP.
- The side slopes and bottom of the diversion channel will be vegetated, except under the proposed bridges and at Pirmez Creek. Vegetated areas would provide a more conducive material to move across the channel.
- The diversion channel will be built with 3H:1V side slopes, which is within the range that most large mammals (e.g., elk,) are known to traverse.

- To maintain ungulate movement within the KWBZ, the floodplain berm will be revegetated with materials conducive for ungulate movement. The section of reinforced concrete (~250 m) closest to the Elbow River will be covered with top soil and seeded with native grasses. The central portion of the floodplain berm includes approximately 550 m of exposed riprap, where sections will be filled with substrate finer than riprap, such as sand, gravel and vegetation to allow for more walkable sections. The south portion, farthest from the Elbow River, will be a 450 m earthen embankment vegetated with native grasses.
- Where fencing is proposed to restrict livestock access to project structures (e.g., diversion channel), wildlife-friendly fencing will be installed to allow ungulate passage.

Key mitigation measures to reduce mortality risk are described below:

- Seasonally appropriate surveys will be undertaken to identify key habitat and habitat features (e.g., wetlands, nests) of SOMC before undertaking construction.
- Identified wildlife features will be avoided during construction activities, as identified by the appropriate signage and/or fencing. The Environmental Inspector(s) or designate and Wildlife Resource Specialist(s) will recommend the appropriate setback distance for identified wildlife features.
- Vegetation removal will be avoided during the RAP for nesting migratory birds and raptors. RAPs are primarily based on ECCC guidance to avoid risk of incidental take of migratory birds. ECCC direction to protect bird nests in the foothills parkland and prairie ecozone of Alberta, with consideration of migratory bird species at risk, is from April 15 to August 31. The recommended RAP to avoid destruction and disturbance to raptor nests is from February 15 to August 15. Therefore, the combined RAP dates to avoid is from February 15 to August 31.
- If vegetation removal is scheduled to occur within the RAP for migratory birds and raptors, a qualified wildlife biologist will inspect the site for active nests within seven days of the start of the proposed vegetation removal or ground disturbance and appropriate mitigation developed.
- If an active nest or den is found, it will be subject to a recommended setback buffer and site-specific mitigation measures developed in consultation with regulators.
- All construction traffic will adhere to safety, road closure regulations, and other access measures and guidelines for the construction area and associated access roads.
- Wildlife or livestock will not be harassed or fed. Waste will be stored in wildlife-proof containers and wildlife awareness training will be provided to staff on site to reduce human-wildlife conflict (e.g., bears, see Jorgenson 2016).
- Personnel will not be permitted to have dogs at the construction site. Firearms are not permitted in project vehicles or on the construction footprint, or at associated project facilities. Incidents with wildlife will be reported to an Alberta Transportation representative.

- Sightings of species of interest will be reported to the environmental inspector(s) or designate. Protection measures might be implemented and the sighting will be recorded.
- If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests are identified during construction), then the occurrence will be reported to the environmental inspector(s) or designate.
- Unanticipated wildlife issues encountered during construction will be discussed and resolved by the environmental inspector(s) or designate, wildlife resource specialist(s), and the responsible regulatory agencies, if necessary.
- Unauthorized vehicles will be prevented from access from public roads by using gates.

Mitigation recommended for change in habitat, change in movement, and change in mortality risk would also mitigate potential changes in biodiversity, migratory birds and species at risk; therefore, no additional mitigation measures are recommended for biodiversity, migratory birds and species at risk.

Residual Effects and their Significance

A significant environmental effect on wildlife and biodiversity is one that threatens the long-term persistence or viability of a wildlife species in the regional assessment area, including effects that are contrary to or inconsistent with the goals, objectives or activities of recovery strategies, action plans and management plans.

With the application of mitigation and environmental protection measures, residual environmental effects on wildlife, including migratory birds and species at risk, and biodiversity are predicted to be not significant. The residual effects on change in habitat, movement, and mortality risk are unlikely to pose a long-term threat to the persistence or viability of a wildlife species including migratory birds and species at risk in the RAA.

6.9.2.2 Flood and Post-Flood

Changes to the Environment

Change in Habitat

Flood operations have the potential to directly affect wildlife habitat in the LAA through the temporary diversion of flood waters into the off-stream reservoir. The deepest part of the off-stream reservoir would be near the low-level outlet channel and would be approximately 25 m deep for the design flood, 17 m deep for the 1:100 year flood, and 5 m deep for the 1:10 year flood. The depth and extent of flood water would temporarily render habitat inaccessible in the flooded area for most terrestrial wildlife species (e.g., elk, grizzly bear) and for non-aquatic bird species that depend on grassland, shrubland, and forested areas (e.g., Sprague's pipit and olive-sided flycatcher), reducing habitat suitability. This change in habitat

would be temporary and is expected to last up to 43 days and extend approximately up to 39 more days for the reservoir to recede and post-flood maintenance activities to occur.

During post-flood operations, potential direct effects on wildlife habitat would include sediment deposition that would result in covering vegetation and reducing habitat suitability for wildlife in the drained reservoir as well as revegetation of the diversion channel, off-stream dam, and floodplain berm, which might be damaged or eroded during a flood event.

Sensory disturbance caused by maintenance equipment might contribute to temporary indirect effects on wildlife (i.e., habitat avoidance or displacement).

The additional time for vegetation, and thus habitat, to return to baseline conditions (i.e., dry operations) following a flood would depend on the magnitude of the flood. The flood tolerance of plants varies with species and age, frequency and duration of floods, water quality, and site characteristics. Wetlands in the off-stream reservoir are likely to tolerate flood events; however, upland vegetation and tame pasture in the off-stream reservoir are not adapted to prolonged flooding compared to wetland or floodplain vegetation and are unlikely to survive prolonged flooding.

Some wildlife species, however, might benefit from flood events. For example, draining the off-stream reservoir would create pools of water and soft soil that is attractive to wading birds such as Wilson's snipe, which feed on macroinvertebrates. In addition, any fish left in the off-stream reservoir after draining might be scavenged by wildlife such as bald eagle.

During a flood event, diversion of flood water to the off-stream reservoir might also limit potential changes in habitat on the Elbow River floodplain downstream of the diversion structure. For example, natural flood events of moderate magnitude can help maintain riparian habitat; however, extreme events with higher flow rates are more likely to be destructive.

Change in Movement

The diversion of flood waters into the off-stream reservoir would retain wildlife habitat connectivity and movement corridors downstream of the diversion structure that would otherwise be temporarily flooded; however, the effects of flooding would be moved into the upland area of the off-stream reservoir during diversion. During flood and post-flood operations, the water contained in the off-stream reservoir and diversion channel has potential to create physical barriers that might temporarily hinder terrestrial wildlife movement in the LAA. Barriers to movement can fragment a species' habitat and reduce the connectivity of movement corridors and landscape linkages. This might reduce access to resource patches, affect daily or seasonal movement patterns, or change dispersal events. Flood operations are not likely to restrict the movement of birds; however, floods can temporarily attract waterbirds because they perceive the area as a waterbody that has potential to provide feeding habitat. As a result, floods can affect bird movement.

Amphibians rely on aquatic habitats and, as with birds, flooded areas can appear attractive and affect local movement. Floods can also result in temporary loss of wetland habitat; however, flood water can also connect isolated patches of wetland, increasing the chances of dispersal. Although amphibians can swim, they typically avoid swimming in deep, open waters because of increased predation risk by fish. As such, amphibians are more likely to move along the shoreline. Because amphibians have smaller dispersal ranges relative to medium and large mammals, it would take amphibians longer to go around physical barriers.

Constructed reservoirs, and their associated canals, can act as barriers to wildlife movement. Movement of large mammals such as ungulates, cats and bears could be affected by temporary physical barriers created by flood operations. However, smaller, less-mobile mammals (e.g., rodents and weasels) are most likely to be affected by physical barriers due to their smaller ranges. The diversion channel and off-stream reservoir would be flooded with water during a flood and serve as a physical barrier to wildlife.

The diversion channel overlaps a KWBZ that follows the Elbow River. Although flood operations would create temporary physical barriers to wildlife, during post-flood operations, barriers to wildlife movement would mainly be through sensory disturbance related to post-flood maintenance of project infrastructure (e.g., cleanup and repair of the diversion channel, off-stream reservoir, and the low-level outlet channel), public roads and bridges.

Change in Mortality Risk

Flood and post-flood operations have the potential to result in increased mortality risk for wildlife in the PDA. Direct wildlife mortalities could result from destruction or abandonment of wildlife residences (e.g., nests), drowning in diverted flood water, and animal-vehicle collisions. Mortality risk would vary depending on the magnitude of the flood and water depths.

Although diversion of flood waters might increase mortality risk for wildlife within the off-stream reservoir, it might decrease mortality risk for wildlife in the Elbow River floodplain downstream of the diversion structure where flood levels would be reduced.

Post-flood operations might require equipment to travel over potential migratory songbird nesting habitat (e.g., vegetated off-stream dam and floodplain berm) during the Primary Nesting Period (PNP), or through amphibian habitat created during a flood (e.g., pools of water left behind in the off-stream reservoir after draining) where there might be amphibians residing or stranded in these areas. These activities might increase mortality risk for nesting birds and amphibians in the PDA. Road closures (e.g., Springbank Road) due to floods would divert traffic to other areas of the RAA, altering traffic patterns, but increased vehicle use during post-flood maintenance (e.g., maintenance crews bringing in heavy equipment) would increase the risk of animal-vehicle collisions. Dead fish or other animals deposited in the previously flooded area of the off-stream reservoir might attract scavenger species and create potential for human-wildlife

conflicts during post-flood maintenance. These conditions could result in the destruction of nuisance animals, particularly bears and other carnivores.

Change in Biodiversity

Floods have the potential to change species and community, diversity through soil saturation and sediment deposition, which can affect vegetation composition and distribution (i.e., wildlife habitat), and plant and wildlife species diversity. Intermediate levels and frequencies of disturbance events, such as floods, typically result in higher levels of biodiversity. However, flooding for the Project would occur infrequently and in upland habitat, with vegetation that is typically not adapted to flooding. Vegetation productivity would likely be constrained for inundated upland vegetation. These changes could potentially affect species and community diversity.

Indirect effects of the Project on biodiversity in the Elbow River floodplain downstream of the diversion structure would reduce the extent of flooding from extreme events, such as the design flood and 1:100 year flood, that would likely to be destructive and would temporarily reduce biodiversity along the Elbow River. Diversion of these flood waters into the off-stream reservoir would be beneficial for biodiversity downstream. However, the 1:10 year flood is a more common event that could be relied upon for biotic diversity to persist.

Change in Wildlife Health

Floods have the potential to result in changes to wildlife health. Methylmercury occurs naturally in aquatic environments where microbes convert (methylate) mercury into this organic substance. Although methylmercury occurs naturally, high levels can be toxic to wildlife.

Filling the off-stream reservoir with water would initiate the process of mercury methylation; however, accumulation of methylmercury in aquatic environments to levels that are hazardous can take many years. Elevated levels of methylmercury combined with bioaccumulation can lead to higher health hazards for wildlife, especially piscivorous (fish-eating) species.

Floods can transport pathogens and contaminants from one area to another. Therefore, flood operations can potentially deposit contaminated sediments into the off-stream reservoir, and draining of the reservoir would leave the deposited sediment behind. The risk of sediment becoming airborne through wind erosion could be present.

Migratory Birds

Although the olive-sided flycatcher and Sprague's pipit were used as key indicators to focus the assessment, the information presented in the assessment provides a further discussion of migratory birds and their habitat as well as potential changes in movement, mortality risk, and health during flood and post-flood operations. Because potential flood events typically occur in the spring or summer, the assessment focuses on the migratory bird breeding season.

Change in Habitat

Flood operations would temporarily render habitat inaccessible in the flooded area for migratory and non-migratory bird species that depend on grassland, shrubland, and forested areas (e.g., Sprague's pipit and olive-sided flycatcher), thus reducing habitat suitability. During post-flood operations, potential direct effects on migratory and non-migratory bird habitat are:

- drained reservoir would leave behind sediment covering vegetation and reducing habitat suitability for birds
- revegetation of the diversion channel, off-stream dam, and floodplain berm, which might be damaged or eroded during a flood

Sensory disturbance caused by maintenance equipment might contribute to temporary indirect effects on migratory and non-migratory birds (i.e., habitat avoidance or displacement).

Some migratory and non-migratory birds might benefit from floods. For example, draining the off-stream reservoir would create pools of water and soft soil that is attractive to wading birds such as Wilson's snipe (*Gallinago delicata*), which feed on macroinvertebrates.

Change in Movement

Flood operations are not likely to restrict the movement of migratory birds; however, floods can temporarily attract waterbirds because they might perceive the area as a waterbody that has potential to provide feeding habitat. Flood operations have limited potential to affect non-waterbird migratory birds that fly over the Project. Waterbird local movement is more likely to change in the LAA and RAA because of their attraction to larger waterbodies. During the design flood and 1:100 year flood, waterbirds might perceive the flooded off-stream reservoir as a lake and use it for feeding or resting. However, waterbirds are unlikely to establish nesting while the off-stream reservoir is flooded because floods are more likely to occur late in the breeding season (e.g., June) when nesting territories have already been established elsewhere in the LAA or RAA. Effects on bird movement would diminish to baseline as the water in the off-stream reservoir recedes.

Change in Mortality Risk

The diversion of flood waters would reduce mortality risk to migratory birds in riparian habitats along the Elbow River floodplain downstream of the diversion structure, but would increase mortality risk for migratory birds nesting in the off-stream reservoir. Reservoir filling during flood operations is likely to increase nest failure of migratory birds in the flooded area through nest destruction or abandonment. Mortality risk would vary depending on the magnitude of the flood (i.e., how much area is covered by water). There are no potential pathways for flood and post-flood operations to change predator/prey relationships that may affect bird populations. The risk of direct mortality due to nest flooding during a design flood for tree nesting migratory birds is low due to higher nest heights from the ground. Compared with tree nesting birds, ground nesting migratory birds have a higher risk of mortality during flood events.

Species at Risk

Some species at risk will experience temporary alteration or inaccessibility of habitat during reservoir filling and draining as well as post-flood operations (i.e., presence of sediment and debris). Reservoir filling could result in increased mortality risk because of flooding of active nests or dens. For mammals and amphibians, flood and post-flood operations could result in changes to movement patterns (daily or seasonal) because of habitat change and sensory disturbance. Reservoir filling and draining could result in increased exposure to contaminants brought in by flood water.

Mitigation Measures

Mitigation to reduce effects on wildlife habitat (including for migratory birds and species at risk) include:

- Maintenance activities will be restricted to the reservoir footprint to reduce the area of disturbance during post-flood operations.
- If sediment partial cleanup and debris removal in the off-stream reservoir occurs more than seven days following reservoir draining, and during the RAP for nesting migratory birds and raptors, nest searches will be conducted by qualified wildlife biologist. If an active nest or den is found, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation.
- Maintenance activities will be reduced as much as possible in the KWBZ identified along the Elbow River from December 15 to April 30. This would reduce potential sensory disturbance to wintering ungulates.

- Weed propagation will be reduced by using appropriate equipment cleaning protocols.
- Areas of sediment deposition where wind erosion might be an issue will be hydroseeded with native plant species to reduce erosion potential. AEP would have an operation and maintenance plan for the reservoir that would include sediment stabilization and debris removal.

Key mitigation measures to reduce potential effects on wildlife movement (including migratory birds and species at risk) include operational and design features as described below:

- The side slopes and bottom of the diversion channel will be vegetated, except under the proposed bridges and at Pirmez Creek. Vegetated areas would provide a more conducive wildlife passage across the channel.
- Post-flood infrastructure maintenance will be temporary and the duration would be reduced as much as possible.
- Post-flood maintenance will be localized and occur only during daylight hours.

Although some Project-related mortality risks cannot be mitigated (e.g., nest and burrow destruction due to reservoir filling), others might be reduced through appropriate mitigation; for example:

- The diversion channel will be built with 3H:1V side slopes, which is within the range that most large mammals (e.g., elk,) are known to traverse. The side slopes of the diversion channel would be vegetated, which would provide a more conducive material to help facilitate escape from rising flood waters or when swimming across the channel.
- The side slopes and bottom of the diversion channel will be vegetated, which would provide a more conducive material to help facilitate wildlife escape from rising flood waters or when swimming across the channel.
- Restrict all post-flood maintenance activities to the approved project footprint and reduce the area of disturbance during operations. All maintenance traffic will adhere to safety and road closure regulations.
- If post-flood maintenance in the off-stream reservoir occurs more than seven days following reservoir draining, and during the RAP for nesting migratory birds and raptors, nest searches will be conducted by qualified wildlife biologists to reduce potential mortality risk to birds attempting to nest in the area.
- If an active nest or den is found, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation.
- Do not harass or feed wildlife. Store waste in wildlife-proof containers and provide wildlife awareness training to all staff on site.

- Report sightings of project-specific species of interest to the Environmental Inspector(s) or designate. Protection measures might be implemented and the sighting will be recorded.
- If previously unidentified listed or sensitive wildlife species or their site-specific habitat (e.g., dens, nests) are identified during maintenance operations, report to the Environmental Inspector(s) or designate.
- Unanticipated wildlife issues encountered during flood and post-flood operations will be discussed and resolved by the Environmental Inspector(s) or designate, Wildlife Resource Specialist(s), and the responsible regulatory agencies, if necessary.

Project-specific mitigation measures recommended for change in habitat, change in movement, and change in mortality risk would work together to reduce effects on biodiversity, migratory birds and species at risk. As such, there are no additional mitigation measures recommended to reduce potential Project effects on biodiversity, migratory birds, and species at risk during floods.

Mitigation to reduce effects on wildlife health (including migratory birds and species at risk) are:

- The off-stream reservoir will be seeded only if there are dust issues.
- If revegetation is not successful, a tackifier or sprayable erosion control product will be applied within the off-stream reservoir to reduce wind erosion

Residual Effects and their Significance

The Project would result in temporarily unavailable wildlife habitat during flood operations and post-flood operations, with some permanent loss of wetlands from sedimentation, which would be converted into upland communities. The Project is also likely to have a greater temporary effect on ungulate movement than movement of birds, amphibians, and grizzly bears during a flood. The Project is predicted to increase wildlife mortality risk in the PDA during a flood. Whether the risk is low or moderate depends on the species and magnitude of the flood.

Overall, there would be little change to wildlife health based on the expected frequency and duration of floods. Methylmercury levels would be lower than for permanent reservoirs or dams. Additionally, the sediment deposited in the off-stream reservoir is not expected to increase the hazard associated with contaminants that floods can transport. Mitigation measures used to reduce soil erosion due to wind would further reduce residual effects.

With the application of mitigation measures, project residual environmental effects on wildlife, including migratory birds and species at risk, and biodiversity are predicted to be not significant. The residual effects on habitat, movement, and mortality risk would be unlikely to pose a long-term threat to the persistence or viability of a wildlife species, including migratory birds and SAR, in the RAA.

6.10 LAND USE AND MANAGEMENT

6.10.1 Description of the Baseline Conditions

The PDA, LAA, and RAA are in Rocky View County. There are no urban or residential communities in the PDA. There is one First Nations reserve in the LAA: Tsuut'ina Nation 145 is 400 m to the south of the PDA. The community of Springbank and the Townsite of Redwood Meadows are in the RAA. The Townsite of Redwood Meadows includes several residences, businesses, services such as the Tsuut'ina Fire Department, a community building, and recreational facilities. The Hamlet of Bragg Creek is not in the Land Use LAA or RAA for Land Use.

There are no provincial or federal parks or protected areas in the PDA, LAA, or RAA. There are no heritage rivers that intersect the PDA, LAA, or RAA.

There are no designated historic sites in the PDA. Our Lady of Peace Roman Catholic Mission is a designated historic site that intersects the LAA, about 100 m from the PDA to the southwest of the water intake components. Although the Mission church building is no longer present, there is a cairn and monument plaque to mark its site, the first church in southern Alberta.

There is no public access on private land in the assessment areas.

Access for consumptive recreation and livelihood, non-consumptive recreation, and to unique sites or special features may be along existing roads and other public ROWs that intersect these areas. For example, sportfishing is likely 'walk and wade': anglers may drive along Highways 22 and 8 and walk along public ROWs that intersect the river. Access to Our Lady of Peace Roman Catholic Mission cairn and monument plaque at the southern end of Range Road 43 is accessible via Highway 22 and Township Road 242.

In primary and secondary sources reviewed for the Project, Indigenous groups, including Kainai First Nation (Blood Tribe), Tsuut'ina Nation, Samson Cree Nation, and Ktunaxa Nation, identified the importance of trails and travelways to access traditional territory and resource use areas as key to their way of life. Trails and travelways include rivers used in the past for canoeing.

6.10.2 Effects on the Environment

6.10.2.1 Construction and Dry Operations

Changes to the Environment

Change in Land Use

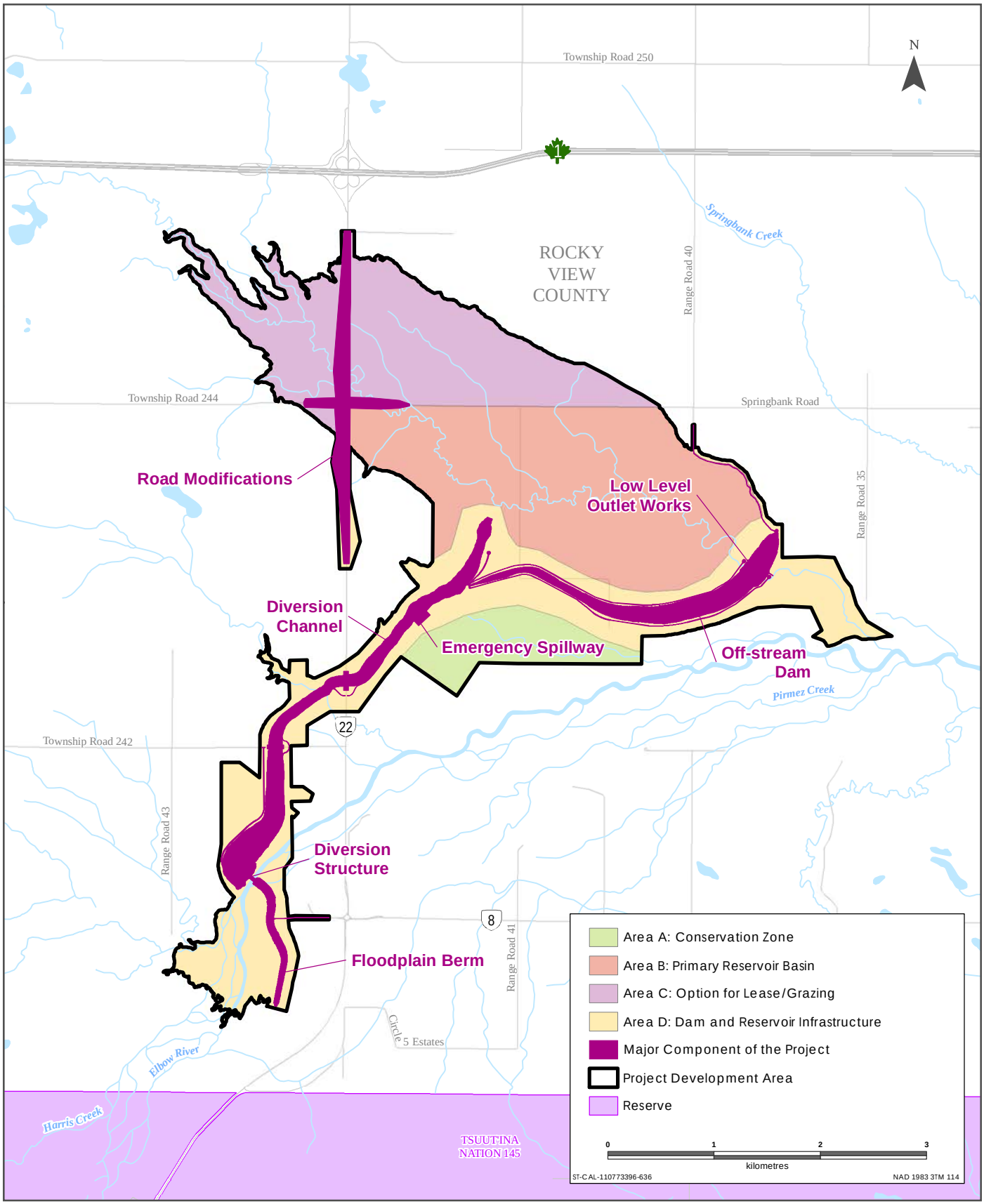
As part of construction, private land in the PDA would be acquired by the Alberta government. Twenty-four individuals, four businesses, and the Kiwanis Club of Calgary would be affected through direct loss of private land in these areas. Land acquisition in the PDA would be carried out by Alberta Transportation, and landowners in these areas would be compensated for land acquired.

As a result of construction, agricultural land in the PDA would decrease from 632.8 ha to 573.9 ha and the distribution of agricultural land units within each land use area would change.

Proposed land use in the PDA is shown on Figure 6-4. The PDA would be managed for primary and secondary land uses during dry operations. Area A would be a conservation area with low impact recreation opportunities. Area B would be primarily used as a reservoir for flood management with opportunities for research during dry operations. Area C may be leased out for grazing. Area D would be used for water intake components and the off-stream dam. The PDA covers 1,438 ha of land over 38 quarter sections. Of this, 511.5 ha of agricultural lands in Areas A, B, and D of the PDA would be removed because of construction; however, 62.3 ha in Area C may be used for grazing.

There are residences, businesses, and recreation organizations that occupy land in the LAA. Many residents farm, ranch, and otherwise cultivate lands in the LAA. There are seven dispositions related to residences, businesses, recreation organizations, and grazing in the LAA.

Construction would take place on land acquired by the provincial government in the PDA and would not result in the direct loss of land owned by residents, businesses, or recreation organizations in the LAA, which are predominantly privately owned. Construction would also not result in the direct loss of lands in Tsuut'ina Nation 145 or lands held under disposition in the LAA, except for lands associated with bank stabilization in LSDs 05, 06, and 11-03-024-04 W5M. These lands would not be removed or altered from current use.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - ERBC, Government of Alberta, Stantec Ltd

Proposed Land Use in the PDA

Change Parks and Protected Areas and Unique Sites or Special Features

The PDA does not overlap with the cairn and monument plaque of Our Lady of Peace Roman Catholic Mission; therefore, construction would not result in removal or degradation of this site. Individuals who access this site may be indirectly affected by construction activities through access restrictions during construction of road realignments and modifications and noise, light, and air emissions. Detours because of roadworks are common in the region; however, individuals who typically access this site using Springbank Road and Highway 22 would be required to detour to access this site. Construction of road realignments and modifications is anticipated to last for approximately one month. After construction is completed, noise, light, and air emissions would cease.

Mitigation Measures

Key mitigation measures to limit change in land use and management during construction and dry operations include the following:

- Residents, businesses, and recreation organizations who experience direct loss of private land in the PDA would be compensated for their land and improvements.
- Alberta Transportation will consult with landowners and disposition holders in the LAA and notify them of Project construction activities and schedule. Adequate warning will be provided to landowners to allow for management of livestock and other farming operations.
- Fences and gates (e.g., Texas gate) will be installed where required.
- Harassment of livestock and other wildlife will be prohibited by Project workers.
- Workers will be prohibited from carrying firearms.
- Food waste will be secured in appropriate facilities or vehicles.
- Construction activities will follow mitigation measures and guidelines outlined in the Project's ECO Plan to reduce noise, light, and air contaminant emissions in proximity to the Project.
- Alberta Transportation is in consultation with operators of utilities in the PDA to discuss retrofitting and relocation of utilities. Alberta Transportation will develop crossing agreements with operators of utilities in the PDA. Alberta Transportation will continue to consult with utility operators in the PDA and LAA regarding rerouting and realignment of utilities on a case by case basis.
- Alberta Transportation will implement access management plans, which includes gating approaches to Project access roads to restrict public access to the PDA.
- Access roads to the Project and in the PDA, including emergency access roads, will remain in place for the life of the Project.

- AEP will develop a management plan for the PDA that may allow for recreation in Area A during dry operations. Area A will be naturalized and access will not be restricted, although development of recreation infrastructure is not planned.
- AEP would avoid the substantial interference with public navigation of the Elbow River through the following design practices:
  - As part of construction, a permanent portage will be developed around the in-stream water intake components.
  - Signs directing traffic to detours will be installed during construction of road realignments and modifications.
  - Signs will be installed along the existing Elbow River channel and on the dam. Multiple signs will be placed upstream and downstream of the water intake components on both banks of the Elbow River. These signs will warn users on the Elbow River that they are approaching in-stream water intake components and of the associated danger with this infrastructure and to direct them to a portage location. A floating, high visibility boom will be in place upstream and downstream of the water intake components.
- Integrated landscape management policies will be implemented in the PDA through management of areas with primary and secondary land uses. Area A will become a conservation area and be naturalized at the completion of construction. Access to Area A would not be restricted; however, access (e.g., parking lots, hiking trails) would not be developed in Area A. Areas B, C, and D will be restricted to public access using barbed wire fencing, gates, and signs indicating “Danger” and “No Trespassing”. Area B and some of Area D will be revegetated at the completion of construction and would remain vegetated through dry operations. Grazing may be permitted on Area C. A management plan for the PDA will be developed by AEP in consultation with land users and the public.

Residual Effects and their Significance

Temporary construction areas (e.g., laydown yards) would be reclaimed.

Although the purpose and intent of the Project is not consistent with the vision of the Rocky View County Municipal Development Plan (MDP) and Land Use Bylaw, which protects agricultural land use in the region, the provincial *Municipal Government Act* (MGA) states that authorizations granted by the AEP and NRCB would prevail over compliance with the MDP and Bylaw. The SSRP would therefore provide the land use framework for lands in the PDA (as outlined in the MGA).

The end land use of the PDA complies with outcomes and strategic directions outlined in the SSRP. Management of lands in the PDA by AEP would allow for multiple and at times competing land uses in the PDA. Land use in the PDA includes a conservation area with low intensity recreation, which is one strategy of integrated landscape management of land identified in the SSRP. Integrated landscape management would also be employed in the PDA through timely reclamation of the construction area. The Project achieves other outcomes and strategic directions outlined in the SSRP including advancing watershed management and including Indigenous peoples in land use policy development. Land use activities in Area A of the PDA would be directed by a management plan, which would be developed in consultation with land users, including Indigenous peoples. The Project would therefore comply with land use plans and policies established for the end land use of the PDA.

Current land uses such as industrial activity, livelihood and consumptive and non-consumptive recreation, and access to the LAA would be disrupted by construction, but these land uses would be able to continue at or near current levels during dry operations. The Project would create a change or disruption in current land uses such as agricultural use on private property or use of private property for residences, businesses, and recreational organizations to a point where these activities cannot continue at or near current levels in the PDA (except in Area C, where grazing may be permitted). However, landowners would be compensated for their lands and improvements.

Unique sites or special features near the Project would not be substantially or irreversibly compromised because of reduced access or reduced quality.

Therefore, residual effects on land use and management during construction and dry operations are predicted to be not significant.

6.10.2.2 Flood and Post-Flood

Changes to the Environment

Change in Land Use

Once construction is completed, lands in the PDA would be managed by AEP for the life of the Project (i.e., indefinitely) and there would be no change to land designation in the PDA. However, land uses in each area of the PDA may be affected during flood and post-flood operations.

For each of the floods, the minimum amount of time that diverted water would remain in the reservoir is 43 days. Draw down time would depend on various factors including flow rate in the Elbow River.

The distribution of vegetation communities in the PDA would be affected because of flooding and sedimentation.

During post-flood operations, deposits such as gravel and debris would be cleaned up. The settling of silt over the floodplain would not be appreciable. Affected areas would be left to revegetate naturally and monitored.

Area A is primarily used as a conservation area with low impact recreation. Access to Area A would not be restricted and consumptive recreation and livelihood and non-consumptive recreation has the potential to occur in the area, although a management plan for this area has yet to be developed. For each flood, primary use of Area A would not change.

It is assumed that there would be no users on the Elbow River during flood operations. During post-flood operations, users on the Elbow River downstream of the Project may experience increased volume and flow rate as waters are released from the reservoir. However, use of the river for sportfishing and recreational boating during post-flood operations would return to baseline conditions and would be facilitated by the permanent portage.

Change in Access

Land users in the LAA, including those who access the Our Lady of Peace cairn and monument plaque, would experience change in access during 1:100 year and design floods (Springbank Road and other access roads would be flooded). Access restrictions are anticipated to last until flood waters are released from the off-stream reservoir. After diverted waters are released, flood damage to Springbank Road, and other access roads, would be repaired, as necessary. However, Range Road 40 and Township Road 242 could be used as detours when Springbank Road is flooded.

Mitigation Measures

Key mitigation measures for effects on change in land use during flood and post-flood events include the following:

- Integrated landscape management policies will be implemented in the project footprint, which would allow for management of flood waters in the off-stream reservoir during floods. A management plan for the PDA will be developed by AEP in consultation with land users and the public.
- Project design includes armouring of the floodplain berm along the north side and armouring the river bank along parts of the south side, including at the water intake components to prevent flooding outside of the PDA.

- The following signs will be installed:
  - Areas B, C, and D will be restricted to public access using wildlife-friendly fencing, gates, and signs indicating “Danger” and “No Trespassing”.
  - Multiple signs will be placed upstream and downstream of the water intake components on both banks of the Elbow River. These signs will warn users on the Elbow River that they are approaching the diversion structure with associated dangers and direct them to a portage location.
  - Multiple warning signs and alarms to draw attention will be placed along the diversion channel at road crossings and at walking trails; at the emergency spillway; and at the tributary low-level outlet works, along trails leading to the tributary, and at the confluence of the tributary and Elbow River. When alarms are sounding during flood events, including the release of water from the off-stream reservoir, evacuation of areas around these infrastructure components will be implemented.
  - Multiple signs will be placed along Highway 22 to the north and south sides of the PDA. These signs would advise the public against swimming or using watercraft on the water when it is present in the diversion channel or off-stream reservoir.
  - Gates and signs will be placed along Springbank Road to the north, west and east of the PDA. Gates would be closed during all floods. Signs would advise vehicles that the roads are closed and to use an alternate route.
- Flood damage to Springbank Road will be repaired, as necessary.
- Gated approaches into the project footprint will be constructed to restrict public access.
- Access roads into the PDA, including emergency access roads, will remain in place for the life of the Project for repair activities during post-flood operations and for access to the PDA for emergency vehicles during flood and post-flood operations.
- Inspection and maintenance of all infrastructure will occur regularly during post-flood operation. Post-flood cleanup will include removal of debris and other material that may interfere with the flow of the tributary. Further mitigation measures such as re-seeding areas that have been inundated and repairing areas where soil has eroded may be implemented depending on the results of inspection after flooding events.

Residual Effects and their Significance

Land ownership in the PDA would not change in the event of a flood; however, recreation in Area A and research in Area B would be suspended. Additionally, grazing in Area C would be suspended during 1:100 year and design floods.

Access to areas in the PDA and to the LAA would be affected by 1:100 year and design floods because Springbank Road is anticipated to be flooded by these events. Post-flood operation includes repair of Springbank road and cleanup and repair, as necessary, in the PDA.

The Project would comply with the SSRP and implement integrated landscape management policies. Residual effects on change in land use during flood and post-flood operations are predicted to be not significant.

Unique sites or special features near the Project would not be substantially or irreversibly compromised because of flooding events or during post-flood operations. Access to these unique sites or special features in the LAA would be affected by 1:100 year and design floods because Springbank Road would be flooded by these events and visitors to the Our Lady of Peace cairn and monument would need to use detours to access this unique site. Post-flood operation includes repair of Springbank Road and cleanup and repair of the PDA. Residual effects on parks and protected areas and unique sites or special features during flood and post-flood operations are predicted to be not significant.

6.11 HISTORICAL RESOURCES

6.11.1 Description of the Baseline Conditions

6.11.1.1 Archaeology

The Project is located within the Northern Plains Culture Area, and there is firm archaeological evidence that this area has been occupied since the end of the last glaciation, approximately 13,000 years ago. Evidence for any earlier occupation would have been obscured by glacial processes. The first people to occupy the northern plains hunted now-extinct ice-age animals, including mammoth, camel, muskox, horse and bison. These large animals became extinct or decreased in size after approximately 10,000 years ago, and the landscape of the northern plains became dominated by bison.

Human groups occupying the northern plains were focal hunter-gatherers, specializing on bison. The tipi became the dominant form of dwelling, and northern plains groups began to produce ceramics and participate in trade for domesticated crops, such as corn. Eventually, some of these crops were grown in the northern plains by horticultural groups. Archaeological evidence for the spiritual life of people prior to European contact is seen in different types of sites—such as rock art sites, medicine wheels (arrangements of stone in meaningful patterns), ribstones (glacial erratics with incised lines representing bison ribs) and burial sites.

Direct European contact in the northern plains was preceded by the acquisition of the horse through trade, and the influx of European diseases such as smallpox and measles, which devastated Indigenous groups. Trade goods, such as metal artifacts and glass beads, begin to appear in the archaeological record with increasing frequency after approximately 1750 A.D. and direct European contact related to the fur trade increased throughout the 19th century. The Hudson's Bay Company maintained jurisdiction over southern Alberta until the transfer of Rupertsland to the Dominion of Canada in 1869. By this time, increasing European presence relating to the trade in buffalo hides was putting tremendous pressure on bison, which were extirpated in the project area by the late 1870s. The Our Lady of Peace Roman Catholic Mission was established immediately west of the PDA in 1872 and the Royal Canadian Mounted Police (RCMP) established Fort Calgary to the east in 1875. Local Indigenous groups, including the Niitsitapii (Siksika, Kainai and Piikani), Tsuut'ina and the Stoney/Nakoda, signed Treaty 7 in 1877. Large scale cattle ranching began in the project area with the establishment of the Cochrane Ranche, but by the early 20th century the large ranching interests were replaced as the land in the Springbank area was subdivided and homesteaded. Roads, bridges and schools were built in the following decades.

During the HRIA, 262 shovel tests were completed in areas of high archaeological potential and 698 surface exposures were inspected. A total of 11 precontact period sites and 11 historic period sites were assessed within the PDA. The precontact period sites include five isolated finds of single lithic (stone) artifacts. These isolated finds are of limited heritage value and, in most cases, documentation of the site, photography and collection of the artifact is believed to have sufficiently mitigated project effects. Additional investigation has been recommended at one of these sites of higher heritage value based on the recovery of a stone tool (biface). Through the Project-specific Indigenous engagement program, Piikani Nation, Siksika Nation and Blood Tribe (Kainai First Nation) noted that the biface was found at a Blackfoot wintering camp.

6.11.1.2 Palaeontology

The Project area is within the eastern limit of the disturbed belt for Cordilleran deformation, where strata have been uplifted and tilted. The geological formations extend diagonally in bands with the older Cretaceous units in the southwest and younger Paleocene units in the northeast. The units include the Brazeau, Coalspur and Porcupine Hills/ Paskapoo formation. All units are fossiliferous. Paleocene strata contain numerous early mammal fossil sites in the Calgary and Cochrane areas and there are Cretaceous shellbeds south of Cochrane. These sites also contain the remains of ancient fish, amphibians, lizards, crocodiles and molluscs. The closest fossil localities are the Nordic Ski Quarry, Bearpaw Dam, Cochrane, Radnor dinosaur locality, Jumpingpound Creek and an unnamed site in Fish Creek Provincial Park. There are no previously recorded fossil localities within the PDA and no lands with historical resource values for palaeontology.

The Elbow River valley is mapped as thin fluvial overbank sediments overlying fluvial channel sand. There are two bedrock ridges draped in till of the Spy Hill Formation, which was deposited by a glacier that flowed out of the Rocky Mountains to merge with the continental ice sheet. Lowlands are covered by lacustrine silt and clay, deposited following the last glaciation. Till underlies the thin lacustrine sediments. The greatest potential for palaeontological resources in the surficial sediments is in the fluvial and lacustrine deposits. Late Quaternary mollusc localities have been recorded in fluvial and lacustrine sediments within the foothills region, including a site near Cochrane.

In bedrock, the HRIA field surveys documented three palaeontological sites and recorded fossil occurrences of plant remains. The three sites consist of shellbeds in Cretaceous to Paleocene strata exposed along the Elbow River. These shellbeds contain molluscs and one contains rare microvertebrate material (i.e., teeth, scales and small bones of fish, amphibians, reptiles and mammals). Vertebrate sites also occur in these strata outside of the LAA. The presence of these sites indicates that the local palaeontological potential of the strata in the LAA is high. The likelihood of encountering palaeontological sites of high heritage value during excavation through bedrock is therefore considered high.

Through the Project-specific Indigenous engagement program, Piikani Nation, Siksika Nation and Blood Tribe (Kainai First Nation) indicated the importance of fossils to the Blackfoot culture. They consider fossils to be Iniskim (also known as buffalo stones, these are generally pieces of ammonite but can be any rock or fossil that is attributed a spiritual value). Iniskim are considered culturally significant and are incorporated into bundles.

No Quaternary localities were documented during the Historical Resources Impact Assessment (HRIA) field surveys. One chance find of a bison skull on the Elbow River floodplain was documented. Quaternary sediments along the low banks of the Elbow River are frequently obscured. In general, the palaeontological potential for Quaternary sites along watercourses is considered high.

6.11.2 Effects on the Environment

6.11.2.1 Construction and Dry Operations

Changes to the Environment

Loss of or alteration to historical resource site contents or site contexts

Project activities within the PDA would disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burials have been identified within the PDA. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. The Our Lady Peace Mission Site, a provincially protected historical resource of high heritage value, is located outside of the PDA.

Construction activities for some components of the Project would disturb bedrock, including:

- construction of the diversion inlet
- excavation of the diversion channel (nearly 30 m deep in some areas)
- realignment of Highway 22
- open trenching to re-locate three existing pipelines under the diversion channel

The bedrock in these areas consists of the Brazeau, Coalspur and Porcupine Hills/Paskapoo formations. These are fossiliferous units that produce dinosaurs, fish, early mammals and other fossils, meaning that they have high palaeontological potential. Any buried palaeontological sites could be lost to construction activities. Therefore, the likelihood of effects on palaeontological resources is considered high. The Project could also potentially interact with buried Quaternary palaeontological resources.

Mitigation Measures

HRIA permit requirements state that all artifacts be curated at the Royal Alberta Museum. As required under provincial legislation, should an unexpected find of a significant historical resource occur during construction, Alberta Culture and Tourism (ACT) will be notified and will determine the appropriate mitigation. ACT is the repository for all HRIA data and only they can share locality information.

ACT has reviewed the HRIAs for the historical and palaeontological conditions of the PDA and have requested additional work, the results of which will be reviewed and further mitigation measures identified.

There are areas within the PDA where potentially fossiliferous Holocene sequences may have accumulated in low catchment areas set back from the river. There are no exposures in these areas and they would be invested further in a planned deep testing program in conjunction with the archaeology studies. This program would only be completed after Project approval.

Residual Effects and their Significance

The HRIA field studies required by ACT for archaeology and palaeontology have been completed, except for deep testing, which would be completed prior to construction, and HRIA studies for archaeology in some areas for which landowner access could not be obtained. Mitigation and/or construction monitoring required by ACT, based on the HRIAs, will be completed. After implementation of the required mitigation measures, there are no residual effects predicted.

Alberta Transportation would implement all mitigation required by ACT and would obtain all required approvals under the HRA. A chance find protocol would be enacted if unexpected discoveries of historical resources are made during construction. With the application of regulatory standards (including application of chance find protocols required by ACT during construction), the Project effects on historical resources are assessed as being not significant.

6.11.2.2 Flood and Post-Flood

Changes to the Environment

Loss of or alteration to historical resource site contents or site contexts

Since project-specific environmental effects on historical resources are continually mitigated to the standards established by ACT, after implementation of the required avoidance and mitigation measures stipulated for construction and dry dam operations, there are no residual environmental effects to historical resources within the PDA from flood and post flood operations.

Mitigation

ACT has issued conditions for *Historical Resources Act* clearance. Meeting these conditions serve as mitigation for effects on historical resources. The conditions include conducting additional field investigations and reporting any findings.

Residual Effects and their Significance

Flood and post flood operations (draining of the reservoir) could potentially affect sites of high heritage value downstream of the PDA. The significance of these potential effects is unknown.

After implementation of the required avoidance or mitigation measures no residual effects are predicted. Alberta Transportation has committed to fulfilling all requirements issued under the *Historical Resources Act* to obtain approval prior to construction and Project operations. Since all effects within the PDA would be mitigated prior to or during Project construction, adverse effects would be not significant.

6.12 TRADITIONAL LAND AND RESOURCE USE

6.12.1 Description of the Baseline Conditions

The Project is in an area that has been substantially modified, starting before the signing of Treaty 7 in 1877, by existing physical activities, including the church, Our Lady of the Peace, founded in 1872 and land conversion for agricultural purposes, which began in the 1870s. Since the late 1800s, land privatization; creation of transportation networks, pipeline rights-of-way and utility corridors; tourism and recreation activities; and commercial and residential development have contributed to the modification of land use in the area. At existing conditions, 33.8% of the terrestrial RAA contains anthropogenic lands. These developments have already contributed substantially to effects on TLRU by altering the distribution and abundance of traditionally harvested resources, reducing the extent of lands available for traditional activities, disturbing or restricting access to TLRU sites and areas, and changing conditions such as air quality, water quality, aesthetics and noise that may influence TLRU. However, current land use by Indigenous groups continues in the RAA on unoccupied Crown lands, such as the riparian zone along the banks of the Elbow River, and other lands to which Indigenous groups have been granted permission to access by private landowners.

Through the Indigenous engagement program for the Project, Tsuut'ina Nation stated, "Our citizens continue to depend on the lands and waters in our traditional territory, including the Project area, to support traditional activities. These include hunting, fishing, and harvesting of various species including medicinal plants." Tsuut'ina Nation, Stoney Nakoda Nations, Kainai First Nation, Siksika First Nation and Piikani Nation also identified trails and travel routes, fishing, plant gathering, trapping, as well as cultural and archaeological sites within the RAA. Kainai First Nation, Ermineskin Cree Nation and Samson Cree Nation have or may have cultural and historical resources in the Project area. Siksika Nation explained that "the natural resources and heritage sites found there [Project area] are central to our culture." Stoney Nakoda Nations explained that a Stoney Nakoda cultural story talks about Springbank Creek.

Through the Indigenous engagement program for the Project, Métis Nation of Alberta, Region 3 stated, "The Metis, along with First Nations, historically used, travelled and occupied these lands and waterways. The Metis have documentation that provides clues to how our ancestors lived on the land and waterways since coming west. Specifically, Hudson Bay trading posts: Fort Calgary, Berry's Post, Bow River Post, Livingston Post, Bow Fort and the Canmore NWMP [Northwest Mounted Police] Barrack which were established as early as 1832 and continued as late as 1929. For these forts/posts to survive they relied upon the Metis to bring supplies, trade goods along with building and living within the areas they occupied." Métis Nation of Alberta, Region 3 also noted the potential for "Métis homesteads, cart trails, historical use areas and potential burial site within the proximity of the [Project]." Métis Nation of Alberta, Region 3 stated, "the homesteads and cart trails physically are not there anymore, [but] this may not be the case with the possible burial sites." The locations of these potential sites had not been identified as of March 2018.

In addition, resources and environmental features for current use by Indigenous groups are present in the RAA.

Literature Review

The literature review did not identify recorded current use sites or areas, or trails and travelways within the RAA that are used by Indigenous groups other than the Treaty 7 First Nations identified for consultation by the Alberta ACO.

The literature review shows that traditional hunting, trapping, fishing and plant harvesting practices continue to be important for Indigenous groups engaged on the Project, although no site-specific information regarding TLRU activities, practices, sites, or locations relative to the PDA was obtained through this review. The literature review shows that consumption of traditional resources also remains an important way of life for Métis communities due to the health benefits, reduced cost, preferential taste, and enjoyment of the harvesting process.

The literature review was used to identify resources and land use features for current use that could be present in the RAA. Specifically, regulatory applications provided insights into concerns regarding other industrial development projects that could apply to the Project and changes that have affected existing conditions for current use.

6.12.2 Effects on the Environment

6.12.2.1 Construction and Dry Operations

Changes to the Environment

Change in Availability of Traditional Resources for Current Use

The Project has the potential to affect the availability of traditional resources during construction and dry operation. The potential pathways that could affect the availability of traditional resources, are related to the other VCs presented in this summary, and are as follows:

- change in habitat
- change in movement patterns for wildlife and fish
- change in wildlife biodiversity
- change in mortality risk for wildlife and fish
- change in water quantity and quality
- changes to conditions for current use
- change in riparian vegetation
- change in country foods
- change in drinking water

Through the Indigenous engagement program for the Project, issues, concerns and recommendations were received relating to each of the above VCs, and how the affects to these VCs could affect the availability of traditional resources for current use.

Change in Access to Traditional Resources or Areas for Current Use

The Project has the potential to affect access to traditional resources or areas during construction and dry operation. Access to traditional resources and areas for current use is already hindered in the RAA by the amount of private land, commercial developments, transportation and utility networks, tourism and recreation activities, and other infrastructure.

Access to traditional resources or areas for current use can be affected through the direct loss or alteration of trails or travelways, restrictions on the ability to navigate to and through current use area, or limitations on the ability to undertake current use activities in proximity to the Project. Loss and alteration can result from direct physical disturbance or destruction (e.g., destruction of a traditional trail), physical deterrents or obstructions (e.g., fencing) that prevent access or increase effort required either spatially or temporally, changes in the landscape (e.g., vegetation clearing) that make an aspect of a trail or travelway unrecognizable either partially or completely, or changes in the conditions (e.g., construction traffic) required for current use of trails and travelways.

Indigenous groups have identified potential ways in which the Project could affect access to traditional resources or sites. At a meeting with representatives from Kainai First Nation, Piikani Nation, and Siksika Nation regarding the Project, participants expressed concern that there is potential for cultural and spiritual sites in the traditional territories to become inaccessible as a result of the Project. Through the engagement program for the Project, Montana First Nation asked whether the Project lands that would be acquired would become Crown land, while Stoney Nakoda Nations inquired whether Crown land would be set aside to offset effects of the Project.

In the TUS report, Siksika Nation and Kainai First Nation identified Elbow River as an important travel route and its importance to Blackfoot traditions and culture. Through the engagement program for the Project, Siksika Nation explained that the Project "is in the middle of a prime transport corridor for our people along the Elbow River between the prairies and the mountains." Through the engagement program for the Project, Tsuut'ina Nation identified that there is potential for the Project to affect the Nation's ability to use Elbow River as a transportation route. Through the engagement program for the Project and in another information source, Kainai First Nation and Ermineskin Cree Nation reported that, in general, navigable waterways were travel routes. In the Kainai First Nation and Siksika Nation TUS and the Piikani Nation TUS, two trails were identified during fieldwork. Few details were provided about these trails, but they occur on private lands and appear to be primarily historical. Through the engagement program for the Project, Kainai First Nation reported that there is a travelway in the Project area on the Robinson property.

Indigenous groups have noted effects of other development projects on access to traditional resources and sites. Regarding a different project, Ermineskin Cree Nation noted that access to some plant-harvesting locales has decreased and the travel distance required to hunt and fish has increased as a result of development.

Change in Current Use Sites or Areas

The Project has the potential to affect current use sites or areas during construction and dry operation. Current use sites and areas, including, but not limited to sites and areas for cultural or spiritual practices, or archaeological and palaeontological sites and areas, have the potential to be affected by direct physical disturbance associated with Project.

Indigenous groups have raised the potential for the Project to affect current use sites or areas. Indigenous groups have raised the potential for the Project to affect current use sites or areas. Through the Indigenous engagement program for the Project, Tsuut'ina Nation also identified the potential for effects on both physical and cultural heritage resources as a result of construction activities, and expressed concerns regarding the removal of existing infrastructure, including pipelines. Tsuut'ina Nation also noted that a historical trading route falls within the Project area. Through the Indigenous engagement program for the Project, Tsuut'ina Nation also

stated there are several possible archaeological and cultural sites in the Project area, including tipi sites, rock cairns, and portions of a medicine wheel and explained that the Project area is an area with high potential for recovery of archaeological resources. Tsuut'ina Nation explained that the rock cairns mark the places of tree burials and are concerned about the potential for their disturbance from the Project; the exact locations of these rock cairns marking burial locations were not identified.

Kainai First Nation, Piikani Nation, and Siksika Nation reported that cultural and archaeological sites and artifacts have been recovered in the Project area, including in the flats north of the berm location, the bottom of the Elbow riverbed, and in a tributary creek channel off Elbow River; they explained that there is potential for additional cultural and archaeological sites and artifacts to be unearthed during construction of the berm and diversion channel, particularly from the cliff on the west side of Elbow River (PN n.d.; KCO & SCO 2017; Indigenous engagement results). Through the engagement program for the Project, Siksika Nation emphasized the need to protect the artifacts found in the Project area. Kainai First Nation, Piikani Nation, and Siksika Nation shared concerns about the effects of construction and operation on Blackfoot cultural and ceremonial sites; Kainai First Nation expressed concern about the loss of tipi rings and effigies, as well as effects on former Blackfoot campsites. Through the Indigenous engagement program for the Project and in the TUS report, Siksika Nation and Kainai First Nation identified a number of Blackfoot traditional use and cultural sites throughout the area around the planned outflow channel (KCO & SCO 2017).

Siksika Nation and Kainai First Nation indicated that the outflow channel is located at a natural creek and that the creek, surrounding hilltops and flats could be affected, damaging these traditional use and cultural sites (KCO & SCO 2017). Through the engagement program for the Project, Kainai First Nation and Siksika Nation expressed concern that evidence of wintering grounds with many tipi rings will be lost during the excavation of the outfall channel. Siksika Nation also expressed concerns, through the engagement program for the Project, for the potential for the Project to disturb the area of the identified wintering grounds. Siksika Nation is also concerned about the location of the outfall channel in relation to the tipi rings identified adjacent to the unnamed creek. At a meeting with representatives from Kainai First Nation, Piikani Nation, and Siksika Nation regarding the Project, participants indicated that an archaeological site is situated at the bottom of the Elbow riverbed and is associated with ceremonies that have been practiced along the river for many years; this area may be associated with the North Trail. Through the Indigenous engagement program for the Project, Métis Nation of Alberta, Region 3 identified the potential of the Project to affect cultural heritage, as well as effects to sites and objects of historical significance, including archaeological, paleontological, architectural, and structural components. Métis Nation of Alberta, Region 3 also expressed concerns that the Project would affect potential historical homestead sites, cart trails, use areas, or burial sites.

Through the Indigenous engagement program for the Project, Tsuut'ina Nation identified the potential for effects on Elbow River and noted that Elbow River is a communal gathering and a fishing area and medicinal plants are harvested in wetlands and riparian areas along the river. Tsuut'ina Nation also noted that the Project may result in downstream effects on Elbow River, or permanently change the flow of the river itself. Tsuut'ina Nation has identified Elbow River as an important water source (TN 2013). Through the Indigenous engagement program for the Project and in the TUS report, Kainai First Nation and Siksika Nation reported that medicinal plants are found in the PDA, including on either side of Elbow River at the proposed location of the diversion inlet and service sluiceway (KCO & SCO 2017) and on the Robinson property. Siksika Nation, also through the engagement program for the Project, expressed concerns that the excavation of the diversion channels would affect Blackfoot cultural items that might exist in the area. Through the Indigenous engagement program for the Project, Stoney Nakoda Nations explained that sand bars, some of which are present in Elbow River, hold cultural importance; Stoney Nakoda Nations also reported that there are trapping areas in the Project area. Given the importance of Elbow River, Siksika Nation, through the engagement program for the Project, expects that effects on Siksika traditional sites "will be substantial."

Through the Indigenous engagement program for the Project, Tsuut'ina Nation noted the potential for the effects of the Project to extend beyond the PDA, although the specific effects extending by the PDA were not identified; Tsuut'ina Nation also stated that the Project is expected to remove access to private land currently used to practice traditional activities. Through the Indigenous engagement program for the Project, Métis Nation British Columbia identified the potential for the Project to affect Métis land use in the Kootenay region.

Change in Indigenous Commercial Activities the Project is located downstream from identified Indigenous commercial activities, including Redwood Meadows Golf and Country Club. Therefore, no interactions are anticipated to occur between the Project and Indigenous commercial activities during construction and dry operation.

Mitigation Measures

Mitigation measures provided for hydrology (Section 6.4.2.1), surface water quality (Section 6.5.2.1) aquatic ecology (Section 6.6.2.1) vegetation and wetlands (Section 6.8.2.1) and wildlife and biodiversity (Section 6.9.2.1) are applicable for mitigating effects on traditional land and resource use. In addition, the following mitigation measures will be implemented:

- 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.
- The area along the Elbow River flood plain will be accessible for some TLRU activities; this would be a conservation zone with public access and opportunities for low impact recreation.

- Alberta Transportation will limit disturbance of cultural and spiritual sites and subsurface impacts. Alberta Transportation will follow heritage resource protection methods as mandated by the *Historical Resources Act*.
- At the request of Indigenous groups, Alberta Transportation will participate in ceremonies (if invited) prior to the start of construction, including making offerings.
- Should additional historical resources be encountered during construction, Alberta Transportation will follow current ACT policies and guidelines.
- Alberta Transportation would provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction.
- Alberta Transportation will participate in discussions with Indigenous groups regarding possible monitoring opportunities.
- Alberta Transportation would provide Indigenous groups with project maps and design information and preliminary project scheduling.

Residual Effects and their Significance

The Project is anticipated to result in a change in the availability of traditional resources for current use through alteration, reduction, or loss of habitat. Although individual plants will be removed from the PDA, none of the traditionally used species identified will be lost in the LAA, nor will vegetation communities supporting traditionally used plants be lost from the PDA. Construction and operation of the Project has the potential to hinder the movement of traditionally harvested animals within the LAA due to physical barriers (i.e., permanent structures, access roads, and road realignments) and sensory disturbance.

With the implementation of mitigation measures outlined in Section 6.6.2.1 (Aquatic Ecology), it is unlikely that fish mortality (including eggs) would occur at a level that reduces the productivity or sustainability of a CRA fishery. During dry operations, there will be no changes to flow in Elbow River, and therefore no alterations to the quality of fish habitat.

Although the specific degree to which the PDA is being accessed for traditional purposes is not known, given that the majority of the land is private, the Project will restrict access to traditional resources, current use sites or locations because of the loss of access to Areas B, C, and D (see Section 6.10.2). The permanent portage may marginally affect the use of Elbow River for transportation, including the use of waterways for recreational purposes by Indigenous groups, by forcing users to avoid the in-stream water intake components.

Current use sites or areas located within the area of permanent structures and the primary reservoir basin will be permanently removed. It is anticipated that following construction, current use sites or areas would remain largely unchanged outside the PDA. The adverse effects of the Project will be restricted to the PDA.

The residual environmental effects from the Project on TLRU are determined to be not significant because they do not result in the long-term loss of availability of traditional use resources or access to lands currently relied on for traditional use practices or the permanent loss of traditional use sites and areas in the LAA and RAA.

6.12.2.2 Flood and Post-Flood

Changes to the Environment

Project components and activities related to flood and post-flood operation have the potential to affect the availability of traditional resources.

Change in Availability of Traditional Resources for Current Use

The Project has the potential to affect the availability of traditional resources during activities related to flood and post-flood operation. The potential pathways that could affect the availability of traditional resources, are related to the other VCs presented in this summary, and are as follows:

- change in habitat for vegetation, wildlife, fish
- change in wildlife health
- change in wildlife movement
- change in mortality risk for wildlife and fish
- change in channel morphology
- changes to conditions for current use
- change in country foods
- changes to drinking water

Through the Indigenous engagement program for the Project, issues, concerns and recommendations were received relating to each of the above VCs, and how the affects to these VCs could affect the availability of traditional resources for current use.

Change in Access to Traditional Resources or Areas for Current Use

Once construction is completed, lands in the PDA would be managed by AEP for the life of the Project (i.e., indefinitely) and there would be no change to land designation thereafter. The area along the Elbow River flood plain (i.e., Area A; see Figure 6-3) would be accessible for some TLRU activities; this would be a conservation zone with public access and opportunities for low impact recreation. The discussion of effects on access as a result of flood and post-flood operation therefore focuses on Area A. Indigenous groups have raised the potential for the Project to affect access to current use sites or areas.

Because of the historical occupation of the land by Indigenous groups, other trails may occur in Area A, even if these sites have not been specifically identified by Indigenous groups. Although the exact location and direction of the trails and trading route have not been disclosed there is potential for portions of these trails to also extend into Area A. However, access along these trails in Area A would likely be maintained during floods and is unlikely to be hindered by post-flood operations.

Through the Indigenous engagement program for the Project and in a TUS report, it was identified Elbow River as an important year-round travel route however, it was assumed that the Elbow River would not be used as a travelway, which includes the use of Elbow River as recreational water by Indigenous groups during flood operations. Post-flood operations, the Elbow River downstream of the Project would be subject to increased volume and flow rate as waters are released from the reservoir. Access to Area A could also be affected by flood and post-flood operation by restricted access to Springbank Road and other access roads.

Change in Current Use Sites or Areas

Indigenous groups have raised the potential for the Project to affect current use sites or areas through flood or post-flood operation. Through the Indigenous engagement program for the Project, Tsuut'ina Nation expressed concern that burial sites would be destroyed should the reservoir be filled. Tsuut'ina Nation also noted that artifacts within the project area cannot be moved and are not protected from flooding. Through the Indigenous engagement program for the Project, Kainai First Nation identified the potential for physical and cultural heritage sites or areas (e.g., ceremonial sites, burial sites, and cultural landscape) to be destroyed by the Project.

Although only the area along the Elbow River flood plain (i.e., Area A) would be accessible for some TLRU activities following construction, effects from flood and post-flood operation are anticipated on sites and areas that are currently used elsewhere in the PDA. Current-use sites and areas, which include but are not limited to, harvesting sites and areas, sites and areas for cultural or spiritual practices, or archaeological or palaeontological sites and areas, could be affected in the flood and post-flood operation phase by direct physical disturbance (e.g., reservoir filling or draining, sediment deposition or debris, or reservoir sediment partial cleanup).

Mitigation Measures

In addition to applicable mitigation measures for construction and dry operations discussed above, mitigation measures discussed for hydrology (Section 6.4.2.2), surface water quality (Section 6.5.2.2) aquatic ecology (Section 6.6.2.2) vegetation and wetlands (Section 6.8.2.2) and wildlife and biodiversity (Section 6.9.2.2) are applicable for mitigating effects on traditional land and resource use during the flood and post-flood phases.

Residual Effects and their Significance

Overall, the residual effects resulting from flood and post-flood operation of the Project on access to traditional resources, current use sites or locations are anticipated to be low. Restrictions on access to use of Area A or use of the Elbow River as a travelway during floods would be temporary, beyond the minimum retention period after the design flood, but not beyond the complete release of water from the off-stream reservoir. Effects are expected to be reversible.

The residual environmental effects from flood or post-flood operation on TLRU are determined to be not significant because they would not result in the long-term loss of availability of traditional use resources in the LAA or RAA. Short-term effects from flood and post-flood operations on access to lands relied on for traditional use practices or current use sites in Area A are anticipated to be reversible and are not expected to critically reduce or eliminate current use in the RAA.

6.12.2.3 Effects on Aboriginal and Treaty Rights

Effects on potential or established Aboriginal or Treaty rights are addressed through the assessment of the current use of lands and resources for traditional purposes. By acknowledging a link between practice-based rights and current use, this assessment accepts that adverse residual effects on availability of traditional resources for current use, on access to traditional resources or areas for current use, or on sites or areas for current use will have a consequent effect on the ability of Indigenous groups to exercise potential or established Aboriginal and Treaty rights. Given that the residual effects for the Project on TLRU are predicted to be not significant, no effects on potential or established Aboriginal or Treaty rights is expected to occur as a result of the Project.

6.12.2.4 Effects on Intangible Components

Intangible components relate to beliefs, perceptions, values and qualitative experience, which are subjective, experiential, and conditional, and are not readily amenable to assessment and residual effects criteria because they cannot be realistically measured or mitigated. These intangible components of TLRU are presented when an Indigenous group has identified a related concern in a TUS report or through the Indigenous engagement program for the Project.

Alberta Transportation recognizes the importance of cultural transmission and the spiritual connection to ancestors as components of TLRU, as explained by Kainai First Nation, Piikani Nation, Siksika Nation, and Stoney Nakoda Nations in relation to the Project. Alberta Transportation is unable to determine the weight of these intangible components for this environmental assessment, as experiential values can only be meaningfully evaluated by individuals and communities experiencing them. Similarly, any mitigation measure that could lessen effects on intangible components should be identified by those individuals and

communities. These intangible components are presented as shared by Indigenous groups for consideration by the CEA Agency and NRCB in the larger context of the Project.

6.13 PUBLIC HEALTH

The public health valued component examines the effects of the Project on health risks associated with inhalation of airborne chemicals, country foods harvesting and use of water.

6.13.1 Description of the Baseline Conditions

6.13.1.1 Air Quality

The air quality for baseline conditions (and applicable Project phases) are based on the results of the air quality dispersion modelling, which was conducted as part of the assessment of air quality and climate. The air dispersion model included predictions of ground-level concentrations of CACs, VOCs, PAHs, and metals in the study area.

CACs include sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and diesel exhaust particulate (DEP). VOCs are organic compounds with a high vapour pressure at ambient temperatures that allow these substances to volatilize or evaporate into the air relatively quickly. The VOCs considered in the Human Health Risk Assessment (HHRA) are those associated with emissions from fuel combustion: specifically, 1,3-butadiene, 2,2,4-trimethylpentane, acetaldehyde, acrolein, benzene, ethylbenzene, formaldehyde, propionaldehyde, toluene and xylenes.

PAHs are also byproducts of fuel combustion, but they have low vapour pressures and remain in a solid or liquid state. PAHs from fuel combustion are typically bound to particulates in the air, and do not readily exist in a gas phase at ambient temperatures. The PAHs were considered in the HHRA were: acenaphthene, acenaphthylene, anthracene, benz(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3-c,d)pyrene, naphthalene, phenanthrene, and pyrene. The metals associated with vehicle exhaust emissions were arsenic, chromium, manganese, mercury, and nickel.

The health-based guidelines used to calculate the exposure ration (ER) for CACs, VOCs and PAHs include the AAAQO and the Canadian Ambient Air Quality Standards (CAAQS). The health-based guidelines evaluate non-carcinogenic health risks.

Human receptors are people within the study area that could be exposed to chemicals of potential concern (COPCs), while human receptor locations are the places where they are likely to be present. The characterization of human receptors is important because distinct groups of people (e.g., infants, elderly, people with existing health conditions, and Indigenous people) may have varying degrees of sensitivity to a COPC, or their behaviours may cause them to be

exposed to COPCs in different ways. For many air contaminants, children with asthma, people with chronic obstructive pulmonary disease (COPD), and the elderly are considered the sensitive sub-groups. Members of these sensitive sub-groups may be present at any residential location; however, their presence is more likely at institutional facilities such as schools, hospitals, retirement complexes, and assisted care homes.

Human receptors are hypothetical people of all age group (e.g., infant, toddler, child, adolescent, or adult) who could potentially be exposed to the COPC. Two types of receptors were considered for the evaluation of risks to human health: a residential receptor and an Indigenous receptor. Both residential and Indigenous receptors are assumed to have the opportunity to gather, harvest and consume local foods from the study area including garden produce, wild plants, berries, and fish from the Elbow River. Human receptors also include visitors, tourists, and recreational users. However, these people would only be in the area temporarily and they are expected to have a lower exposure to Project-related COPCs compared to residential and Indigenous receptors who also participate in recreational and traditional activities in the area.

Human receptor locations are important if the exposure to a COPC is dependent on the location of the person. For example, exposure to airborne COPCs is dependent on the location of the person, since the concentration in the air will vary between locations. In total, 58 receptor locations within a 5 km radius of the PDA were considered in the HHRA. The 5 km radius from the PDA was selected because the changes in air quality from vehicle and equipment emissions are generally greater with proximity to the PDA. Locations in the study area that are further than 5 km from the PDA would experience less change in air quality, and there would be a lower degree of change in the health risk. The receptor locations represent the range of current and anticipated future land use in the LAA, including residential, recreational, educational, commercial, and industrial uses. The 58 human receptor locations characterized according to type of land use (e.g., residential, recreational, industrial, educational) and occupancy or frequency of use (e.g., permanent, seasonal, or temporary). Receptor locations identified as those where Indigenous receptors are likely to be present correspond to locations on the Tsuut'ina Nation reserve.

6.13.1.2 Country Foods Harvesting

The existing conditions for country foods harvesting includes a consideration of the types of country food harvested in the region by local Indigenous groups, a description of the area of land within the PDA that is currently available for country food harvesting, and the potential for country foods to be present within the PDA. Country foods are animals, plants, and fungi used by Indigenous groups for nutritional, medicinal, spiritual or cultural purposes that are harvested through hunting, fishing and gathering. For example, elk and moose may provide food, clothing and tools. Plants and plant parts (e.g., roots, leaves, bark, twigs) are used in traditional medicine and spiritual ceremonies.

A list of the country foods harvested by local Indigenous groups was identified through a review of publicly available information, traditional use studies, and the Indigenous engagement program. The list includes a broad range of animal and plant species that are harvested in the region of southern Alberta; but not necessarily within the PDA:

Wildlife	**Fish**	mushrooms (chanterelle, morel, pine, puff balls)
badger	burbot	northern bedstraw
bear (black, grizzly)	minnow	old-man's beard
beaver	pike (northern), jackfish	old-man's whiskers
bobcat, bobtail	trout (bull, cutthroat, rainbow)	onion (wild, prairie)
cougar	sucker	pigweed (lamb's quarter, red)
coyote	whitefish (mountain)	pine (lodgepole, sweet)
deer (mule, white-tailed)	**Vegetation and Fungus**	pineapple weed
duck (American coot)	alsike clover	pin cherry
eagle (golden, bald)	aspen	plantain (common, whiteman's foot)
elk	bearberry, *kinnikinnick*	prairie clover
fox (red)	bear root	prairie coneflower
fisher	bitter berry	rabbit root
goose (Canada, white, dark)	black root	raspberry (wild)
gopher	blueberry (high-bush, low-bush, dwarf)	red clover
grebe	bunchberry	red osier dogwood, *nipiswasiskwatew*
grouse (including prairie, mountain)	camas	rosehip
hare, rabbit	caribou weed	sage (bush, prairie)
lynx	cattail	saskatoon berry
marten	cedar (including western red)	saw-grass
moose	chokecherry	silverberry, wolf willow, white sage berry
mountain goat	cloudberry, dewberry	smelly root*
Mink	cohosh, honeysuckle	soapberry, hoshum
muskrat	cottonwood (black), poplar	spruce
owl	cow parsnip	stinging nettle
partridge (chukar)	cranberry (low-bush), eye berry, mooseberry	strawberry
pheasant	currant	sweetgrass
porcupine	dandelion	tiger lily
ptarmigan	diamond willow fungus	tumbleweed
sheep (mountain, bighorn, stone, ram)	fireweed	twinberry
skunk	frog plant	western dock
Sprague's pipit	fungus (tree, wood, green wood-cup)	wheat
squirrel	goldenrod	white birch
swan	gooseberry (northern)	
weasel		

wolverine	green alder	wild asparagus
wolf	horse grass	wild carrot
	huckleberry	wild chives
	juniper (ground, berry)	wild potato
	king root	wild rice
	Labrador tea, muskeg tea, muskeg leaves	wild rose
	lichen (tree)	wild tobacco
	mint, peppermint, wild mint	wild turnip
	moss (spike, sponge)	willow (red)
		yarrow

* denotes a resource that could not be associated with the scientific name and/or the spatial distribution of the resource could not be confirmed

While the main exposure route for airborne COPCs is inhalation, deposition of air contaminants onto soils have the potential to be taken up by plants and stored in their tissues. Animals may also consume soil and vegetation. The absorption of contaminants in the tissues of plants and animals could change their chemical quality and increase the amount of chemicals people could be exposed to when consuming country foods. Therefore, the human health assessment considered the potential for dustfall from emissions to affect country foods and interact with the health of residential and Indigenous receptors.

To identify COPC for indirect exposure pathways related to deposition (e.g., deposition of contaminant onto soil and uptake into plants and/or animals), the fate and persistence of airborne chemical emissions were assessed. The characterization of persistence and bioaccumulation is consistent with provincial and federal guidance. Based on their chemical properties, metals and some PAHs were identified as persistent and/or bioaccumulative.

Because changes in soil quality are caused by deposition over time, the end of the construction phase represents the point where contaminant accumulation in the soil will have reached its highest level. Therefore, the end of the three-year construction period represents the most conservative assessment of changes in country food quality. Soil concentrations for the potentially persistent or bioaccumulative COPC were predicted based on the maximum annual deposition rates. Project-related changes in soil chemistry were considered negligible since:

- Maximum changes in soil chemistry are less than 5% and/or
- Predicted concentrations are less than health-based screening levels.

The location of maximum deposition is located near the boundary of the PDA. Deposition rates (and hence potential changes in soil chemistry) at the receptor locations are lower. Given the negligible change in soil chemistry, the potential for changes in country food quality is also considered negligible.

Even without chemical uptake from soil, dustfall onto vegetation can also make vegetation unsuitable for consumption. Dust generated by earthworks during construction is essentially inert earthen material and would have a similar chemical composition as the surrounding soil in the construction area. Dust deposition to the surrounding plants would only apply during construction, when public access to the area would be limited due to safety factors. Dust on plants would be removed by precipitation and wind on a regular basis. There are no substantial dust generating activities during dry operations. Based on these considerations, there are no project interactions with public health related to changes in country food quality during construction and dry operations.

Health Canada indicates that an important consideration when deciding whether a country foods study is merited is whether local plants and animals are being harvested. There is a low probability that the PDA can provide sufficient country foods for local harvesters to affect human health.

With regards to traditional country food access, the PDA is currently used for ranching for several types of livestock. Therefore, vegetation in the PDA is mostly tame pasture, such as grasses with sparse shrubs and trees. The types of vegetation in the PDA provide very limited harvesting opportunities. During construction and dry operations, most of the PDA would not be accessible to the public. Based on these considerations, there are no Project interactions for changes in human health to residential or Indigenous receptors from country food during construction and dry operations.

6.13.1.3 Water Quality and Public Health

In consideration of both residential and Indigenous receptors, there are no project interactions with public health related to changes in water quality for drinking and recreational use during construction and dry operations. The PDA does not overlap any confirmed or suspected contaminated site and, therefore, the Project would not mobilize contaminants and affect the water quality in the Elbow River or downstream at the Glenmore Reservoir.

During the dry operations phase, stormwater runoff would drain into the diversion channel and the off-stream reservoir for eventual release into the Elbow River through the low-level outlet channel. Concerns with runoff are primarily related to the potential for increased turbidity to affect municipal treatment. Sedimentation and erosion control measures would be implemented to mitigate the effects on water turbidity. Residual suspended solids would either settle out of the water column in the Glenmore Reservoir or be removed by water filtration processes at the Glenmore Water Treatment Plant before distribution through the municipal water distribution system. Therefore, there are no Project interactions for changes in human health from changes in water quality during dry operations.

Water entering the Glenmore Water Treatment Plant is subjected to a clarification and flocculation process to remove silt, debris and microorganisms, followed by a chlorination process to disinfect the water, and a final filtration process to remove residual silt, debris and microorganisms before entering the municipal water distribution system.

6.13.1.4 Current Health Status

There are no specific publicly available health data for the LAA, and therefore the information presented relies on publicly available data for the Calgary Zone the local geographic area of Cochrane-Springbank. The information should not be interpreted as a definitive baseline for residents of the LAA; however, it may be useful for identifying critical receptors as well as in interpreting the HHRA in the context of population baseline, project and cumulative risks.

Health Indicators

Alberta Health has developed a series of reports to provide a broad range of demographic, socio-economic, and population health statistics for various local geographic areas. The Project is located within the Cochrane-Springbank local geographic area, within the Calgary health services zones. Some of the key findings of the community profile for Cochrane-Springbank were:

- The percentage of obese adults in the Calgary Zone was lower than the provincial percentage in 2014 (19.8% Calgary Zone versus 22.8% Alberta)
- The Calgary Zone reported a lower proportion of inactive people compare to the provincial proportion during the same year (39.4% Calgary Zone versus 43.1% Alberta)
- Cochrane-Springbank's population increased by 295.8% between 1996 and 2016 (compared to 62.2% increase for Alberta) and currently stands at 44,090 people
- The largest age group in Cochrane-Springbank in 2016 was 35-64 year olds, who accounted for 43.2% of the population compared to 40.4% for Alberta
- Cochrane-Sprinbank had a similar proportion of First Nations and Inuit people compared to Alberta (0.5% versus 2.8% Alberta)
- The percentage of female lone-parent families was lower than the provincial percentage (6.5% versus 11.1% Alberta)
- A lower proportion of families with an after-tax low-income level were reported in Cochrane-Springbank compared to Alberta (7.6% versus 10.7% Alberta)
- Cochrane-Springbank reported a higher proportion of people with university certificates, diplomas or degrees compared to Alberta (43.6% versus 30.3% Alberta)

- The mortality rate (per 100,000 population) due to all causes was lower in Cochrane-Springbank in 2013-2015, compared to the province (471.4 versus 634.7 for the Alberta) and the most frequent cause of death reported between 2006 and 2015 was neoplasms
- Acute upper respiratory infections were the most common reason for emergency visits (among select conditions) in 2014, and had a higher rate (per 100,000 population) compared to the provincial rate (4,885.9 versus 3,601.8 Alberta); emergency room visit rates for asthma (per 100,000 population) were similar to the provincial rate (501.5 versus 496.8 Alberta) but emergency room visit rates for emphysema and chronic bronchitis were higher than the provincial rate (564.2 versus 331.1 Alberta)

Cancer and Respiratory Disease

Mortality data for the most common cancers and respiratory diseases are available for the Government of Alberta's Interactive Health Data Application (IHDA). Mortality rates (per 100,000 population) in the Calgary Zone from 2003 to 2012 for lung, colorectal breast, and prostate cancer in women and men in the Calgary Zone are similar to or less than the provincial averages.

The Alberta IHDA also provides mortality data are also available for asthma and COPD (Government of Alberta 2018). The mortality rates (per 100,000 population) for COPD and asthma in women and men in the Calgary Zone (from 2000 to 2015) are similar to or less than the provincial averages.

6.13.2 Effects on the Environment

6.13.2.1 Construction and Dry Operations

Changes to the Environment

Health Risk from Inhalation

Exposure estimates are the predicted concentrations of airborne COPCs that were modelled as part of the Air Quality and Climate VC. During construction phase combustion exhaust and fugitive dust would be emitted. Combustion exhaust includes CACs such as NO_2, SO_2, CO, and $PM_{2.5}$. Combustion exhaust also includes VOCs, PAHs, and metals. CACs, VOCs, PAHs, metals and fugitive dust may be inhaled by people, and this exposure may result in an increased health risk to the local population.

Two basic categories of contaminants are commonly recognized by regulatory agencies and applied when assessing human health risk. These are the "threshold" approach (typically used to evaluate non-carcinogens) and the "non-threshold" approach (typically used for carcinogenic compounds). The concept of exposure ratio (ER) is used to facilitate comparison of risks associated with both carcinogenic and non-carcinogenic classes of chemicals. For threshold COPC, the ER is the ratio of the estimated receptor exposure to the exposure limit (or toxicological reference value; TRV). The potential risk expressed as an ER is calculated as follows:

$$\text{Exposure Ratio (unitless)} = \frac{\text{Exposure Estimate}}{\text{Exposure Limit (or TRV)}}$$

For threshold COPC, the ER is the ratio of the estimated receptor exposure to the exposure limit (or toxicological reference value; TRV); for carcinogens, the ratio is equal to the estimated exposure concentration or dose to the risk-specific concentration or dose, respectively, where the latter are expressed in relation to the accepted target incremental lifetime cancer risk (i.e., 1 in 100,000). For inhalation exposures to COPC, an ER that is less than 1.0 represents a low or negligible health risk. An ER that is greater than 1.0 suggests a potentially unacceptable risk to human health, and indicates that a more detailed evaluation may be required to characterize the potential health risk.

For the assessment of carcinogenic effects, the risk-specific concentrations (and the ER) are only applicable to the Project alone scenario as they were developed to address cancer risks that are above background (i.e., the Incremental Lifetime Cancer Risk, or ILCR). There are no regulatory benchmarks of acceptable or tolerable cancer risk for background cancers.

Mitigation Measures

The mitigation measures described in the assessment of air quality and climate during construction would reduce emissions of CACs, VOCs, PAHs, and particulate matter. These are listed in Section 6.1.2.1. These mitigation measures are intended to reduce the potential change in air quality, which indirectly reduces the potential for a change to human health. No additional types of mitigation measures are recommended for the public health related to inhalation.

Residual Effects and their Significance

The results indicate that the health risk from exposure to SO_2 and CO are below the criteria of 1.0 indicating that there are no unacceptable health risks from chronic exposure.

The ERs for annual NO_2 are less than 1.0, and indicate that there are no unacceptable health risks from chronic exposure to NO_2. The ERs for 1-hour NO_2 are greater than 1.0 at four human receptor locations (Receptor locations 1, 9, 19, and 41), which are within 100 metres of the PDA. This indicates that there are potentially unacceptable acute risks from exposure to NO_2. However, given that the ERs at these locations range from 1.0 to 1.1, the overall conservative

nature of the air quality model, and the uncertainty factors applied in the derivation of the TRVs, it is improbable that there would be an unacceptable risk from acute NO_2 exposure.

For $PM_{2.5}$, the short-term (1-hour or 24-hour) and long-term (annual) ERs are greater than 1.0 at up to 16 of the 58 human receptor locations. These 16 receptor locations are located near project activities associated with the construction of the diversion structure and diversion channel along Highway 22, and the borrow material area at the intersection of Springbank Road and Range Road 40. The results indicate that with partial mitigations to reduce $PM_{2.5}$ along the haul road and borrow material area, there could still be an unacceptable short-term risk to human health for residents and people adjacent to the PDA.

Concentrations of $PM_{2.5}$ are expected to be lower than the modelled predictions. More intensive dust mitigation measures can be applied during the construction phase. These mitigations include dust suppressants or water on haul roads on an as-needed basis during dry periods with high wind conditions. Real-time $PM_{2.5}$ monitors can be deployed in the areas of concern to indicate when more intensive dust mitigation measures may be needed. The construction schedule may also be adjusted to reduce the number of dust generating vehicles operating in an area during dry periods with high wind conditions.

These more intensive mitigation measures are intended to reduce the potential change in air quality, which effectively reduces the potential risk to human health. The mitigation measures are expected to be effective in reducing concentrations of $PM_{2.5}$ below the applicable TRV at human receptor locations near the PDA. Consequently, $PM_{2.5}$ can be managed to levels that do not result in an unacceptable risk to human health.

Short-term exposures to DEP were assessed by comparing 1-hour concentrations to the acute (2-hour) exposure limit. The ERs at multiple residential receptor locations were higher than the benchmark of 1.0; the ERs at Indigenous receptor locations and schools were less than 1.0. As indicated, maximum frequency of exceedances at receptor locations is less than 5%. Multiple studies have concluded that at concentrations above the DEP exposure limit, healthy and/or mildly asthmatic participants may experience increased measures of airway resistance and/or respiratory inflammation. Large-scale epidemiological studies examining the acute effects of diesel exhaust in the general population would likely provide a better understanding of the exposure–response relationships and characterization of population health risks associated with short-term diesel exposure.

The ERs for the VOCs 1,3-butadiene, 2,2,4-trimethylpentane, acetaldehyde, acrolein (annual), benzene, ethylbenzene, propionaldehyde, toluene, and xylenes are less than 1.0, indicating that there are no unacceptable risks to human health from these COPCs. The ERs for acrolein (1-hour) and formaldehyde (1-hour) are less than 1.0, and indicate that there are no unacceptable health risks from acute exposure to these COPCs.

The ERs for carcinogenic PAH (expressed as benzo(a)pyrene) and naphthalene are less than 1.0. The difference between the Base Case and Application Case ERs are negligible, indicating that the Project is not a substantial contributor to the risk associated with these substances in the LAA/RAA. Based on this information, there are no unacceptable risks to human health from benzo(a)pyrene and naphthalene, and these substances are not assessed further.

The ERs for the metals arsenic, chromium (1-hour), manganese, mercury and nickel are less than 1.0, indicating that there are no unacceptable risks to human health from these COPCs.

The ERs for annual chromium are less than 1.0 for the Project Case, with the exception of one receptor (a rural residence adjacent to Township Road 242). This indicates that there may be an unacceptable risk to human health throughout the study area for long-term cancer risk.

To characterize the risk more accurately, the conservative assumptions applied in the HHRA are examined to determine the effect of these assumptions on the quantified ER. Firstly, the air quality model was generally conservative. For example, the air quality was modelled over three years, and the year with the poorest air quality was applied as the Project Case. Another assumption in the air quality model was that all chromium emissions were hexavalent chromium. However, contributions from soil are unlikely to contain hexavalent chromium, and the US EPA reports that an analysis of emissions from on-road vehicles show that only 18% of the total chromium is composed of hexavalent chromium. The remaining 82% of chromium is composed of the less toxic forms of chromium (e.g., Cr-2, Cr0, and Cr+3), that are also not carcinogenic. If this was factored into the air quality model, the Project Case ER at the receptor location in question would be reduced from 1.3 to 0.23.

The air quality model also only applied partial mitigations to reduce vehicle emissions, since the construction schedule and use of vehicles is flexible. During the construction phase, further operational mitigations can be applied that reduce the number of vehicles and equipment operating in an area with nearby human receptors. This would effectively reduce vehicle emissions, but the degree of effect on chromium emissions cannot be quantified without a more detailed construction schedule.

Another factor affecting the characterization of cancer risk is the duration of the construction phase. The Project's contribution to chromium in the air only lasts for 36 months during construction. After this time, the cancer risk from hexavalent chromium will likely return to Base Case levels. Given that cancer risk is amortized over a lifetime exposure (80 years), Health Canada recommends adjusting cancer risk from inhalation for the fraction of time exposed (i.e., 3 years/80 years). The effect of this adjustment would reduce the Base Case ER at the affected receptor from 0.23 to 0.0087 for non-threshold cancer risk.

Based on these factors, there is no unacceptable cancer risk to human receptors from chromium during the construction phase.

With the application of intensive mitigation measures, the assessment of public health shows that the residual effects from inhalation (air quality), water quality and country foods are not significant for the construction and dry operations phases.

6.13.2.2 Flood and Post-Flood

Statements of concern were received following consultation and engagement with Indigenous groups, the public and regulators. Concerns related to the Project for the flood and post-flood operation phases included the potential contamination of flood waters and flooded land, which could affect drinking water quality. The concern is that flood waters in the reservoir could contain contaminants, and that these contaminants would eventually be released back into the Elbow River, which flows into the Glenmore Reservoir that supplies municipal water to the resident of Calgary.

Concerns were also raised that the retention of flood waters in the Project development area (PDA) reservoir could convert naturally occurring inorganic mercury in the soil to methylmercury, which could result in increased levels of methylmercury in fish in the Elbow River. People who consume these fish could be exposed to increased levels of methylmercury.

Local Indigenous groups made statements of concern regarding the loss of available land and reduced harvesting opportunities through the changes in road access. Although this does not affect the quality of country foods, it could affect access and availability of country foods.

Concerns were raised regarding dust generated during the post-flood operation phase. Dust and particulates may be generated from wind erosion of sediments deposited in the reservoir after draining. As a result of concerns related to potential dust, $PM_{2.5}$ is assessed for potential health effects during the post-flood operation phase for short-term exposure durations only (1-hour and 24-hour). Long-term (chronic) annual exposure durations also do not apply because the potential for a dust event after a flood lasts for up to six months. After six months, either the sediment has been removed to maintain reservoir function, or vegetation will set into the area, and the roots will provide stability to the sediment and remove the potential for wind-blown dust.

Changes to the Environment

Health Risk from Inhalation

As described in the Air Quality and Climate VC, there would be no emissions of criteria air contaminants or other air pollutants when the reservoir is filling and draining during the flood and post-flood operation phases. There would be emissions of criteria air contaminants (e.g., sulphur dioxide, nitrogen dioxide, and $PM_{2.5}$) during reservoir cleanup, channel maintenance, and road and bridge maintenance from vehicles and machinery associated with these activities. However, the short-term, transient nature of these emissions and the low number of vehicles and equipment required to perform these activities do not produce criteria air contaminants to a

level that could reasonably change the local air quality in a manner that could affect the health of the population.

Dust and particulates may be generated from wind erosion of sediments deposited in the reservoir after draining. As a result of public concerns related to potential wind-blown dust, $PM_{2.5}$ is assessed for potential health effects during the post-flood operation phase for short-term exposure durations only (1-hour and 24-hour). Long-term (chronic) annual exposure durations also do not apply because the potential for a dust event after a flood event lasts for up to six months. After six months, either the sediment has been removed to maintain reservoir function, or vegetation will set into the area, and the roots will provide stability to the sediment and remove the potential for dust events.

Coarse dust, characterized as particulate matter referred to as PM_{10} (i.e., particulate matter ranging in diameter from 2.5 to 10 micrometres) or larger, may also be produced during a dust event. The composition of this dust would be soil and silt, which is inert crustal material. When inhaled, coarse dust is trapped in the upper respiratory passages (e.g., mouth, nasal cavity, pharynx) which are subsequently swallowed, while $PM_{2.5}$ can penetrate deep into the lungs, bronchioles and alveoli. Federal and international health regulatory agencies (e.g., Health Canada, World Health Organization) recognize that health risk from dust inhalation is primarily associated with fine particulate matter ($PM_{2.5}$), rather than coarse particulate matter (PM_{10}). For example, Health Canada reviewed studies that indicated, "…only limited evidence that crustal coarse particulate matter from Asian dust storm events has an effect on mortality, in spite of the extremely high levels of PM_{10} from dust storms". In contrast, traffic-related $PM_{2.5}$ had a stronger demonstrable relationship with adverse health effects. The World Health Organization notes that, "the effects of long-term particulate matter exposure on mortality seem to be attributable to $PM_{2.5}$ rather than coarse particles". Consequently, coarse dust from wind erosion is discussed in the Air Quality and Climate VC but it is not a factor related to public health.

Country Foods Harvesting

There is no interaction with terrestrial country food and public health for the flood and post-flood operations phases. Although the PDA does not overlap with a known or suspected contaminated site, several of the key considerations recommended by Health Canada are useful. Specifically, Health Canada indicates that the ability of the chemical of potential concern to bioaccumulate or bioconcentrate in edible tissues, and whether local plants and animals are being harvested as two important considerations. The Project does not introduce chemicals into the environment that could bioaccumulate or bioconcentrate in edible tissues of terrestrial country foods, and there is a low probability that the PDA can provide a substantial amount of terrestrial country foods for local harvesters.

Project interactions with fish from the Elbow River are considered in relation to the potential for methylmercury accumulation in fish tissues. If methylmercury concentrations increase in the post-flood operation phase, it may bioaccumulate and biomagnify in the aquatic food chain. People who harvest and consume fish from the Elbow River could be exposed to higher concentrations of methylmercury in fish tissue.

Water Quality and Public Health

There are no Project interactions with public health related to changes in water quality except increases in TSS and the conversion of naturally occurring inorganic mercury in the soil to methylmercury when the reservoir is filled.

The PDA does not overlap with a known or suspected contaminated site and therefore there is no reason to suspect that the proposed activities for the flood and post-flood phases of the Project could mobilize contaminants and affect the water quality in the Elbow River or downstream at the Glenmore Reservoir. During a flood when the reservoir is filled with water and subsequently drained back into the Elbow River, no contaminants would be introduced. Consequently, the changes in water quality discussed in the context of public health focus on TSS and the potential conversion of existing inorganic mercury in the soil to methylmercury.

Mitigation Measures

There are no mitigation measures recommended for the protection of public health with respect to air quality, water quality or country food quality.

Mitigation measures with regards to air quality are already described for the Air Quality and Climate VC (see Section 6.1.2.2). These mitigations include re-establishing vegetation cover (e.g., native grasses) of the reservoir after it has been drained. This would be a naturally occurring process that would not require any human intervention. However, if natural re-vegetation is too slow or otherwise unsuccessful within the six months after a flood event, a tackifier would be applied when and where required to prevent wind erosion. Tackifiers are a sprayable erosion control product that bonds with the soil surface and creates a porous and absorbent erosion resistant blanket that can last for up to 12 months.

Regarding water quality, the Glenmore Water Treatment Plant can manage high concentrations of TSS to produce safe drinking water. During the 2013 flood in Calgary, boil-water advisories were avoided for municipal waters from the Glenmore Reservoir due to earlier investments in water treatment infrastructure. Therefore, a flood similar in magnitude to the 2013 flood in Calgary would have a very low probability of needing mitigations to protect the drinking water quality. The Project would further reduce the TSS load in the flood waters entering the Glenmore Reservoir.

Residual Effects and their Significance

The significance criteria for public health may occur when the exposure ratio is greater than 1.0 with consideration of the context in which the health risk exists. For changes in human health from changes in drinking water quality, the Project would reduce the TSS load in the Elbow River and Glenmore Reservoir during the flood phase, since approximately 97.6% of the sediment load contained in the diverted flood water would remain in the reservoir after draining. The Glenmore Water Treatment Plant is capable of removing the expected levels of TSS in municipal water after a flood, given that it was able to remove very high TSS loads during the 2013 flood in Calgary within its normal operating capacity.

For changes in methylmercury concentration in the water, the predicted increase in methylmercury concentration of up to 0.002 µg/L in water drained from the reservoir is negligible relative to the Canadian drinking water quality guideline of 1 µg/L for total mercury. The estimated concentration of methylmercury in the water is also less than the water quality guideline for the long-term protection of freshwater aquatic life of 0.004 µg/L. The results for TSS and methylmercury suggest that the potential residual effect to public health during the flood phase is not significant.

The conclusion is further supported by the short-term duration that the Project would alter the water quality during the flood phase. The short-term influx of less than 0.002 µg/L of methylmercury into the Elbow River from the drained reservoir would not influence the long-term viability of the drinking water supply. Health-based drinking water guidelines are also derived using conservative assumptions assuming long-term consumption of the drinking water. Therefore, if the short-term increase in methylmercury in the water is below the drinking water guideline, there is a low probability of both short-term or long-term health effects to consumers of water from the Glenmore Reservoir.

In consideration that there have been no fish consumption advisories for methylmercury in the Elbow River recently, there is a low probability that a single water release from the off-stream reservoir after a flood could substantially change the viability of fish. The process of methylmercury formation and accumulation is typically observed over the course of years. Specifically, the process of methylmercury uptake by lower trophic level aquatic organisms, followed by predators consuming these organisms in the food chain and accumulating methylmercury in its tissues is a process that may take years for an observable effect. There may be insufficient time for the bioaccumulation and biomagnification process to occur within the period of one month. It is unlikely that the long-term viability of fish from the Elbow River would be changed with respect to methylmercury content. Consequently, there are no unacceptable risks to human health from exposure to methylmercury in fish harvested from the Elbow River in the post-flood operation phase. The overall health risk to people who harvest and consume fish from the Elbow River would remain the same as the current conditions.

6.13.2.3 Indigenous Health

Given the nature of the Project, the potential exposure pathways, the lack of seasonal or temporary receptors, the Project's location on predominantly private land, and its proximity to a major urban centre, the Project-related health effects to Indigenous people are considered to be the same as the health effects to non-Indigenous people.

6.14 INFRASTRUCTURE AND SERVICES

6.14.1 Description of the Baseline Conditions

Rocky View County contains farms, small acreages, commercial developments, natural resource extraction sites and some light industry relating to the oil and gas sector. The County is predominantly rural and has 17 hamlet and country residential communities. Between 1991 and 2011, the County's population almost doubled, growing from 18,939 to 36,461 residents. In 2016, the population of Rocky View County was 39,407. County residential development accounted for much of the growth, with 48% of new homes located in the communities of Bearspaw, Bragg Creek, East Balzac, Elbow Valley, and Springbank.

In March 2015, 50% of the homes on the market in Rocky View County were single-detached units with valuations exceeding $850,000. The average price of a home in Rocky View County was $916,229 in 2015 and $1.2 million in 2016. Overall sales activity in Rocky View County has been slowing down since 2015. Between January and October 2015, there were 128 Multiple Listing Service (MLS) sales in Rocky View County of properties over $1 million compared with 205 for the same period in 2014. Luxury homes in Rocky View County are often going for much lower than list price.

The City of Calgary is Canada's third largest municipality with a 2016 population of about 1.25 million. The Calgary region represents a diverse economic environment that includes energy, agriculture, manufacturing, transportation and logistics, film, television and creative industries. Calgary's geographic location and size make it a major urban centre and service provider for the southern half of the province of Alberta. There are more than 220 public schools across Calgary with 15 new school openings expected from 2016 to 2018. There are eight hospitals and five cancer care centres in the Calgary Zone and, in 2016, Calgary ranked number two in Canada for healthy lifestyle and life satisfaction.

The City of Calgary has a large and diverse housing stock and a large supply of rental housing. Calgary has recently been experiencing a decline in housing demand because of a slow-down in economic activity that has resulted in losses in full-time employment and slower population growth. While the vacancy rate is forecast to decline in 2017 (7.5%) and 2018 (6.5%), it is expected to remain above historical averages.

6.14.2 Effects on the Environment

6.14.2.1 Construction and Dry Operations

Changes to the Environment

Project construction would require approximately 450 workers. It is assumed that nearly all the construction workers would live within daily commuting distance and would not require additional housing or rental accommodations. Specialist workers may need to relocate to the LAA/RAA for part of the construction, however, there is an abundance of temporary accommodations in the City of Calgary. Similarly, since most Project workers are anticipated to be local, it is not likely that additional population-based demands would be placed on community infrastructure and services, including those related to power, water and sewer, waste, recreation, and education.

There are oil and gas pipelines and a power line within the diversion channel, dam, and reservoir areas. Pipelines that cross the diversion channel would be buried beneath it and those in conflict within the dam and reservoir would be relocated. The power line would be moved. It is assumed that these changes would occur without long interruptions in service.

During dry operations, only two full-time employees would be required, therefore dry operations has no interaction with infrastructure and services.

Change in Transportation Infrastructure and Services

Environmental effects on transportation infrastructure and services would occur as a result of the Project construction activities, including road and bridge construction.

The presence of construction vehicles and equipment on the local roads and highways and the transportation of Project workers to the Project site would periodically increase local traffic and might cause brief traffic disruptions. As well, road and bridge work on Highway 22, Springbank Road and Township Road 242 have the potential to affect traffic flows.

Modifications to certain roads in the RAA as a result of the Project consist of the following:

- raising the gradeline of Highway 22 west of the existing lanes and building a new bridge over the diversion channel on the existing alignment
- retaining existing Springbank Road and Township Road 244 except for a new raised intersection at Highway 22; and upgrading Range Road 40 to serve as a detour, along with Township Road 250, when the off-stream reservoir is flooded
- building a bridge over the diversion channel on the existing alignment of Township Road 242 and Highway 22

The proposed improvement plans have been presented to Rocky View County.

Mitigation Measures

Key mitigation measures to reduce the Project's effects on transportation infrastructure are outlined below.

- A project specific traffic accommodation strategy will be developed for the Project.
- The details of day-to-day road construction management such as detours, signage, flagpersons and timing of activities will be set out in traffic accommodation strategies (TAS) that will be developed by the contractor(s) and reviewed and approved by Alberta Transportation.
- AEP will consult regularly with Rocky View County to provide flood updates, and to identify and address project-related traffic problems and other potential implications for services and infrastructure.

Residual Effects and their Significance

During construction, traffic along Springbank Road may be diverted to Range Road 40 and Township Road 250 or a temporary detour to Highway 22 may be constructed. This may create a longer travelling distance for residents of Rocky View County but would not create additional demands on Springbank Road. Range Road 40 and Township Road 250 have the capacity to handle additional traffic created by the detour. Because the modifications to Highway 22 would be constructed alongside and prior to closure of the existing road, access to the area would be uninterrupted and existing infrastructure would be able to accommodate Project-related traffic increases.

The addition of equipment to the local roadways for Project construction may cause traffic disruptions. However, construction would occur beside the existing Highway 22 and is not anticipated to adversely affect traffic. Vehicles may be expected to slow down in construction areas but no additional demands on the local roads are expected. Employee commuter traffic and traffic delivering construction materials, supplies and services to the site may increase traffic volumes; however, with mitigations described above and the capacity of the local road network, the traffic associated with the Project can easily be accommodated.

Construction of the Project would affect existing roadways and local traffic in the RAA because of road improvements and Project-related traffic, but residual adverse effects on transportation infrastructure and services are predicted to be not significant.

6.14.2.2 Flood and Post-Flood

Changes to the Environment

Three assessment scenarios are considered in this EIA: 1:10 year flood; 1:100 year flood; and the design flood (the 2013 flood). Of the three scenarios, only the design flood would interact measurably with infrastructure and services.

In the other two flood scenarios, floodwaters would not affect the existing road network, and maintenance operations in the diversion channel and off-stream reservoir can likely be completed without disrupting traffic on public roads. Consequently, these two flood scenarios (1:10 and 1:100) are not further assessed. The presence of the drained reservoir would not interact with infrastructure and services. The workforce required during the flood and post-flood scenarios would be sourced locally and not affect accommodation availability in the RAA.

During a design flood, 3.1 km of Springbank Road east of Highway 22 would be submerged and traffic would be rerouted to Range Road 40 and Township Road 250, potentially causing traffic disruptions and placing additional demands on transportation infrastructure and services.

Once floodwaters have receded sufficiently, affected roadways and bridges would be inspected for damage. If repairs were necessary, Springbank Road would remain out of service until repairs were completed. Highway 22 might sustain minor wave damage to the roadway sideslopes, requiring single-lane closures during repairs.

Following the design flood, accumulations of sediment and debris would be removed from the diversion channel and, possibly, the off-stream reservoir to restore to their original level of functionality (sediment would be removed if it risks impairing water flow during a future flood event). The waste sediment and debris would be trucked to a suitable landfill facility and this would create additional traffic.

Mitigation Measures

Key mitigation measures to reduce the Project's effects on transportation infrastructure and services are:

- A project specific traffic accommodation strategy will be developed for the Project.
- Road modifications will protect roadways and reduce effects on transportation infrastructure and services during flood and post-flood operations.
- AEP will consult regularly with Rocky View County to provide project updates, and to identify and address project-related traffic problems and other potential implications for services and infrastructure.

Residual Effects and their Significance

The Project would not result in:

- an exceedance of available capacity or
- a substantial decrease in the quality of a service provided, on a persistent and ongoing basis, which cannot be mitigated with current or anticipated programs, policies, or mitigation measures

Flood and post-flood operations during a design flood would affect existing roadways, but residual adverse effects on transportation infrastructure and services are predicted to be not significant.

6.15 ECONOMY AND EMPLOYMENT

6.15.1 Description of the Baseline Conditions

As of 2016, the LAA population was 1,285,620 persons, which represents 31.6% of the provincial population. 2016 Statistics Canada Census data for Indigenous peoples will not be made publicly available until October 25, 2017. In 2011, approximately 3% of the LAA population was of Indigenous identity with the greatest proportion of Indigenous persons relative to total population (by location) in Tsuut'ina Nation 145 (Sarcee 145). Drawing from population projections developed by the Alberta Treasury Board and Finance, the population of Census division 6 (which includes Census subdivisions and tracts within the LAA) forecasts an increase in population from 2012 to 2041 ranging from 47% (low-growth scenario) to 92% (high-growth scenario).

The 2011 labour force in the LAA consisted of 677,460 persons over the age of 15 years, of whom 74% were employed or actively seeking work (participation rate). The unemployment rate of the LAA in 2011 was 6.0%. Of the employed labour force, approximately 37% were employed in basic industries, such as resource development, manufacturing, agriculture, and construction, and 55% were employed in non-basic industries (e.g., service sectors). Eight percent were employed in industries not captured under the North American Industry Classification System (NAICS). A basic to non-basic ratio of 0.68 has been estimated for the LAA.

Employment in occupations related to sales and service accounted for the greatest number of employed persons (22% of the labour force) with employment in trades, transport and equipment operators and related occupations (those most related to construction) accounting for 13.7% of the employed labour force. Of the LAA population aged 15 years and older, approximately 15% held no certificate, diploma or degree, 8.0% held an apprenticeship or trades certificate or diploma, and 20.4% held a bachelor degree.

6.15.1.1 Labour Force

In 2011, the labour force of the LAA consisted of 677,460 persons over the age of 15 years. Of these individuals, approximately 74% were employed or actively seeking work and 6.0% were unemployed, with the participation rate and unemployment rate of the LAA being similar to that of the province overall. Of the locations comprising the LAA, the unemployment rate of Tsuut'ina Nation 145 was the highest at 8.0%, there were approximately 40,480 unemployed workers in the LAA, 975 who live outside of the City of Calgary.

6.15.1.2 Provincial Economy

As a result of the decline in oil and gas prices, Alberta's gross domestic product (GDP) decreased by 3.6% in 2015, the first decline since the global financial crisis of 2009. Despite this decline, over the past 20 years, Alberta has led Canada in economic growth with an average growth in GDP of 3.2% annually. Between 1985 and 2015, Alberta's total GDP increased from $67.6 billion to $326.4 billion. Despite a decline in its share of provincial GDP from 36.1% in 1985 to 19.4% in 2015, oil and gas remains the largest economic sector in Alberta. From 1985 to 2015, the highest-growing sectors (based on share of GDP) were:

- business and commercial services, growing from 5.5% to 11.6%
- construction, from 6.7% to 11.4%
- health care, from 3.6% to 5.7%
- finance and real estate from 11.0% to 14.8%
- retail and wholesale from 8.1% to 9.2%

Decreases in percent share of GDP between 1985 and 2015 were seen in the agriculture and forestry sector (from 3.0% to 1.5%), the oil and gas sector (from 36.1% to 19.4%), and the transportation and utilities sector (from 7.7% to 6.2%).

Alberta tax revenue for 2016–2017 is forecasted at $21.8 billion, a 1% increase of $172 million from 2015–2016.

6.15.2 Effects on the Environment

6.15.2.1 Construction and Dry Operations

Changes to the Environment

Change in Provincial Economy

Project spending would affect local and regional labour forces, populations and businesses and contribute to municipal, provincial and federal tax revenue. Provincial and federal GDP would also be affected.

Change in Regional Labour Force

The Project's workforce is estimated to peak at 360 persons during construction with an additional 155 persons directly employed through contractors retained by the Project. A peak dry operations workforce of 6 persons is estimated. Based on these estimates, project construction, ramp-up and ramp-down, would have the greatest effect on the regional labour force. During ramp-up, Project demand for qualified labour from the LAA could decrease the number of unemployed persons in the LAA, but also contribute to labour shortages, increase costs for regional businesses and stimulate in-migration.

Change in Regional Economy

Project spending can benefit and adversely affect regional businesses. Benefits typically relate to increased revenues, which can increase the capacity of local businesses by supporting capital investment and hiring. Adverse effects relate to increased demand for labour, goods, and services, which can increase operational costs (and therefore decrease revenues) through wage inflation and employee turnover. Increased competition for labour can also decrease the capacity of local businesses through labour shortages. Project spending can also adversely affect the affordability of accommodations through the in-migration of workers to the LAA in search of Project employment.

Mitigation Measures

Project effects on the provincial economy are expected to be positive in direction with the addition of direct, indirect, and induced employment income and GDP. As such, no mitigation measures are proposed to address adverse effects.

Alberta transportation will adhere to government procurement policies and procedure with respect to labour, and goods and services.

Residual Effects and their Significance

In determining effects of the Project on employment and economy, the assessment considers expected change in labour supply and demand, effects on commercial businesses from project spending (i.e., regional economy), and changes to the provincial economy. The Project would not materially affect labour supply and demand in the LAA during construction or dry operations because the available labour force greatly exceeds the workforce requirements. The Project is expected to have a largely beneficial effect on commercial businesses operating in the LAA because of opportunities associated with project spending. While there is potential for adverse effects due to competition for available labour and cost of labour supply, because of the large available workforce in the LAA, this effect is predicted to be negligible. The Project is predicted to have a beneficial effect on the provincial economy as a result of increased GDP and government revenue associated with construction expenditure.

6.15.2.2 Flood and Post-Flood

Changes to the Environment

During a flood, the Project would be operated to prevent or minimize flooding downstream. During reservoir filling, additional personnel may be required to operate the reservoir, but because of the short duration of this flood, the economic effect would be minimal. Similarly, a limited number of personnel would be involved in the controlled release of flood waters from the reservoir during draining.

The assessment of the financial cost of floods considers flood damage at different return periods and compares the financial costs if the Project were not built.

Change in Financial Cost of Floods

The flood damage savings resulting from the Project is estimated by comparing annualized average damages (AAD) between the no-Project and Project scenarios. Information presented in IBI Group's 2017 report "Benefit/Cost Analysis of Flood Mitigation Projects for the City of Calgary and environs on the Elbow River with Emphasis on MC1 and SR1" formed the basis of quantitative analysis for this assessment.

Mitigation Measures

The Project provides a benefit because it reduces the likelihood of flooding. The Project itself is a mitigation measure for flooding effects from Elbow River.

Residual Effects and their Significance

In consideration of existing mitigation measures, the financial cost of 1:50, 1:100, and 1:200 floods from Elbow River is estimated at approximately $470 million, $1.1 billion, and $1.9 billion respectively, with the average annual damage estimated at approximately $42 million, construction of the Project would reduce the average annual damage of floods by $28 million to $14 million. Over an assumed 100-year operating life, the Project's discounted benefits in terms of flood damage avoidance, exceed its costs; therefore, it would have a net economic benefit.

The Project results in beneficial effects, so a significance determination was not made.

6.16 FEDERAL LANDS

The federal lands identified within the assessment, are the Tsuut'ina Nation Reserve 145 (Tsuut'ina Nation Reserve) and the Stoney Nakoda Nation Reserve 142, 143 and 144 (Stoney Nakoda Nation Reserve). No other federal lands were identified in the RAA.

Although the PDA is adjacent to the Tsuut'ina Nation Reserve, none of the proposed Project facilities are located directly on the reserve lands. However, the LAAs and RAAs of several VCs overlap the Tsuut'ina Nation Reserve and Stoney Nakoda Nation Reserves (Figure 6-1 and Figure 6-2).

The predicted Project effects on VCs that will occur on federal lands during construction and dry operation, as well as flood and post-flood are as follows:

- Air Quality and Climate: The air quality and climate LAA/RAA overlaps the northwest portion of the Tsuut'ina Nation Reserve to approximate distance of 5 km. Due to the short duration and small areas predicted for air emissions (i.e., inside or near the PDA), as well as planned construction monitoring programs (e.g., targeting potential TSP and $PM_{2.5}$) and mitigation measures, the residual effects on air quality during construction and dry operations are not expected to be felt on the Tsuut'ina Nation Reserve. However, the effect of GHG emissions is determined on provincial and federal level. During the post-flood phase, modelling results show the highest concentrations of TSP and $PM_{2.5}$ occurring immediately east of the PDA or near the TransCanada Highway-Highway 22 intersection. Concentrations on the Tsuut'ina Nation Reserve are all below the ambient air quality objectives.

- Acoustic Environment: The acoustic environment LAA overlaps the northwestern part of the Tsuut'ina Nation Reserve. The RAA, which extends 5 km beyond the PDA (also overlapping the northwestern part of the Tsuut'ina Nation Reserve), was used to account for noise emissions from other works and area facilities that might interact with those from the Project. No exceedances of noise threshold limits were predicted for the Indigenous receptors in the Tsuut'ina Nation Reserve in any of the construction assessment scenarios. Noise was not identified as an issue during the dry operations, flood or post-flood operations.
- Hydrogeology: The hydrogeology LAA is reduced where the buffer extends outside of the floodplain and terrace of the Elbow River to the south; the LAA and RAA overlaps a small area at the northwest of the Tsuut'ina Nation Reserve. Project effects on groundwater will be restricted to the LAA and to the north side of the Elbow River which forms a hydraulic divide for shallow groundwater, with flow directions on either side of the valley directed inward towards it. Groundwater will not flow south of the river to the Tsuut'ina Nation Reserve. For both changes in groundwater quantity and quality in the flood and post-flood phased, due to the limited interaction of the Project with groundwater resources, and due to the limited areas over which this infiltration could occur, and the short period and eventual flow paths of the flood affected water, the residual effects on groundwater quantity and quality within the Tsuut'ina Nation Reserve would be not significant.
- Hydrology: The LAA for hydrology overlaps the northern edge of the Tsuut'ina Nation Reserve along the Elbow River and the RAA encompasses the majority of the Tsuut'ina Nation Reserve. Given the limited interaction between the Project and hydrology in the LAA, effects on Tsuut'ina Nation Reserve resulting from changes to hydrology and sediment transport will be negligible and are predicted to be not significant. In the post-flood phase, most of the changes to the Elbow River due to the Project will occur outside the Tsuut'ina Reserve.
- Surface Water Quality: The LAA overlaps the northeastern edge of the Tsuut'ina Nation Reserve along the Elbow River, and the RAA encompasses the majority of the Tsuut'ina Nation Reserve. Given the limited interaction between the Project and water quality in the PDA, effects on Tsuut'ina Nation Reserve resulting from changes to surface water quality will be negligible and are predicted to be not significant.
- Aquatic Ecology: the LAA overlaps the northwest and northeast of the Tsuut'ina Nation Reserve along the Elbow River. The RAA encompasses the majority of the Tsuut'ina Nation Reserve. While the Project would result in some permanent alteration or loss of fish habitat during construction, this loss would not occur on the Tsuut'ina Nation Reserve. During dry operations, it is expected that mortality risk would be at levels similar to existing conditions. As a result, effects on aquatic resources on the Tsuut'ina Nation Reserve are considered to be negligible and not significant. In the flood and post-flood phases, the Project would not result in the death of fish that would threaten the long-term persistence or viability of aquatic SOMC in the RAA. As a result, effects on aquatic resources on the Tsuut'ina Nation Reserve are considered to be negligible and not significant.

- Terrain and Soils: Effects to terrain stability and to soil quality and quantity will be restricted to the PDA and does not overlap the Tsuut'ina Nation Reserve. As a result, effects on terrain and soils on the Tsuut'ina Nation Reserve are considered to be negligible and not significant as the PDA falls outside the Reserve.
- Vegetation and Wetlands: the vegetation and wetlands LAA overlaps a small part of the northwest edge of the Tsuut'ina Nation Reserve. The majority of the Tsuut'ina Nation Reserve and the northeastern part of the Stoney Nakoda Nation Reserve are located within the vegetation and wetlands RAA. Direct effects on vegetation and wetlands resulting from the Project would be restricted to the PDA. Construction and dry operations of the Project would not result in the loss of native vegetation communities, wetland functions, or known occurrences of SOMC or traditional use plants from the LAA, which overlaps the Tsuut'ina Nation Reserve. As a result, effects on vegetation and wetlands on the Tsuut'ina Nation Reserve are considered to be negligible and not significant. Effects on vegetation and wetlands on the Stoney Nakoda Nation Reserve are not predicted.
- Wildlife and Biodiversity: The LAA for wildlife and biodiversity overlaps the northern edge of the Tsuut'ina Nation Reserve. The majority of the Tsuut'ina Nation Reserve and part of the Stoney Nakoda Nation Reserve are located within the RAA. Project activities during construction and dry operations are predicted to be restricted to the PDA. As a result, the Project will not result in an increased wildlife mortality risk or alteration of movement on the Tsuut'ina Nation Reserve or the Stoney Nakoda Nation Reserve. There will be no direct effect to wildlife habitat on the Tsuut'ina Nation Reserve or Stoney Nakoda Nation Reserve as a result of the Project; however, there is the potential for reduced habitat effectiveness (i.e., from sensory disturbance) in the small area of the LAA that overlaps the Tsuut'ina Nation Reserve near Highway 22. Although there is potential for reduced habitat effectiveness in this area, the highway already results in existing sensory disturbance to wildlife. This effect is expected to be low magnitude and not significant. The Project is not expected to affect biodiversity on the Tsuut'ina Nation Reserve or the Stoney Nakoda Nation Reserve.
- Land Use and Management: the LAA overlaps the northwestern edge of the Tsuut'ina Nation Reserve, and the RAA encompasses a larger portion of the northwestern part of the Tsuut'ina Nation Reserve. Project activities during construction and dry operations will be restricted to the PDA. While there will be no direct effect to land use on the Tsuut'ina Nation Reserve as a result of the Project, land users in the LAA portion of the Tsuut'ina Nation Reserve may be affected by temporary changes to access and nuisance noise, light, and air emissions during construction. However, these effects are limited to the construction phase or shorter and land users in the Tsuut'ina Nation Reserve are not anticipated to be affected during dry operations. Therefore, this effect is expected to be low magnitude in the Tsuut'ina Nation Reserve and not significant.

- Historical Resources: Effects on historical resources will be restricted to the PDA, which does not overlap the Tsuut'ina Nation Reserve. As a result, there will be no effects to historical resources on the Tsuut'ina Nation Reserve, and not significant as the PDA falls outside the Reserve.
- Traditional Land and Resource Use: The Project is located on what is currently private land. The PDA does not include the Tsuut'ina Nation Reserve or the Stoney Nation Nakoda Reserve. Traditional land and resource use, as practiced on federal lands will not be affected by the Project.
- Public Health: the public health LAA/RAA overlaps the northwestern part of the Tsuut'ina Nation Reserve. The assessment of public health shows that there are no interactions between public health with water quality and country foods. The effects from air quality, for emissions during construction and the post-flood phases are related to $PM_{2.5}$ and TSP. Although the values for these are above ambient air quality objectives at some locations within or adjacent to the PDA, concentrations on the Tsuut'ina Nation Reserve are within the objectives. The effects are assessed as being not significant.
- Infrastructure and Services: The LAA and RAA for infrastructure and services are the same and include the Tsuut'ina Nation Reserve and part of the Stoney Nakoda Nation Reserve. Project activities will not interact directly with any infrastructure and services located on either reserve; therefore, changes to infrastructure and services on federal lands are predicted to be not significant.
- Economy and Employment: For employment and economy, the LAA and RAA are the same and includes the communities that are most likely to be called upon to provide labour, goods and services required for construction and operations. Both the Tsuut'ina Nation Reserve and part of the Stoney Nakoda Nation Reserve are included in the RAA. The Project would not materially affect labour supply and demand in the LAA during all Project phases because the available labour force greatly exceeds the workforce requirements. The Project is expected to have a largely beneficial effect on commercial businesses operating in the LAA because of opportunities associated with project spending. While there is potential for adverse effects due to competition for available labour and cost of labour supply, because of the large available workforce in the LAA, this effect is predicted to be negligible.

6.17 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions are events or conditions that are not planned. These events and conditions could occur as a result of acts of nature, human error, equipment failure, or other possible causes. Many accidents and malfunctions are preventable and may be avoided or effects mitigated by appropriate planning, design, equipment selection, hazard analysis and corrective action, emergency response planning, and security management. Where relevant, the assessment includes the cumulative effect of an accident or malfunction for overlapping existing and potential future projects (pipelines, roads) during all phases of the Project (construction, dry operation, flood and post flood).

Potential accident and malfunction scenarios are the following:

- off-stream storage dam failure or breach—uncontrolled release of retained water from the off-stream reservoir as a result of structural or design failure of the dam and subsequent inundation of surrounding areas
- diversion structure failure or breach—failure or breach of the floodplain berm during flood operations as a result of electrical or design failure
- fire—an explosion or fire, including wildfires
- hazardous materials spill—spills of fuel, petroleum products or other chemicals used on site, or during transportation to site.
- vehicle accident— vehicle collision because of traffic to and from site and the operation of equipment on-site
- pipeline rupture—leak or rupture of pipelines in the project development area (PDA)

6.17.1 Changes to the Environment

6.17.1.1 Off-Stream Storage Reservoir Dam Failure or Breach

The off-stream storage dam is designed to a hazard classification “extreme” per the CDA guidelines. The dam has an emergency spillway that has the capacity to pass the flood water that can be delivered to the dam during the Probable Maximum Flood (PMF) and prevent overtopping. The dam is equipped with sensors that are monitored for seepage and deformation during operations. If stability issues arise or for other reasons the flow to the reservoir needs to be stopped, the gates at the diversion inlet can close and the inflow stopped to mitigate risk of failure of the dam.

If an off-stream storage dam failure or breach did occur, public health (drinking water, country foods), the biophysical environment (hydrology, surface water quality, aquatic ecology, vegetation, soils, wildlife), lands used for traditional and non-traditional use (including federal

lands), infrastructure and services, and employment and economy would be affected. Failure or breach would result in similar effects to VCs relative to an unmitigated flood (in the absence of the Project), including inundation of surrounding areas, as well as residential and commercial property. The characteristics of the contaminants released would be determined by the material carried into the off-stream reservoir during the flood (e.g., suspended solids, vegetation). Conditional to the volume of water released, additional vegetation and debris from the area immediately surrounding the dam structure could also be washed downstream with the surge of water.

Depending on the size of the flood and volume of water in the off-stream reservoir at that time, the magnitude of residual effects would vary from low to high. Emergency response plans would be implemented to address public safety concerns and mitigate damage to infrastructure and services. Residual effects of the worst-case dam failure on public health are predicted to be significant; residual effects on other identified VCs are predicted to be not significant.

6.17.1.2 Diversion Structure Failure or Breach

The floodplain berm, auxiliary spillway and service spillway are designed to a hazard classification “very-high” per the CDA guidelines. The service spillway and auxiliary spillway have the capacity to pass up to 1/3 the flow rate between the 1:1000 year flood and the PMF, in accordance with the guidelines. The auxiliary spillway is designed to activate when inflow exceeds the capacity of the service spillway and diversion inlet.

In addition to excessive inflow, the delivery of sediment and woody debris could affect the capacity of the system and raise the backwater in the diversion structure. To mitigate the risk of overtopping, the service spillway gate bays and the gate bays of the diversion inlet have been designed to pass debris; but, also maintain operation should debris accumulate on key components. The pneumatic system that raises the service spillway gates are designed to operate effectively if one or more key components are damaged: should a failure occur the gates would be in the downward position for safe passage of flow. The auxiliary spillway is a full depth concrete structure designed to maintain is resiliency from frequent overtopping. Though not desirable, such overtopping could occur if debris accumulations, sediment accumulations, or turbulence cause sudden rises in its backwater during operation.

The system has been designed to prevent flooding upstream of the diversion structure. Backwater influence during a failure to operate is limited to the most upstream extent of the floodplain berm.

In the event of failure or breach of the floodplain berm, the biophysical environment (hydrology, surface water quality, aquatic ecology, vegetation, soils, wildlife), lands used for traditional and non-traditional use, infrastructure and services, and employment and economy would be affected. Failure or breach would result in similar effects to VCs relative to an unmitigated flood

(in the absence of the Project), including inundation of surrounding areas, as well as commercial property. However, effects are predicted to be short-term (approximately 30 minutes). Should a failure occur, the characteristics of the contaminants released would be determined by the material gathered during the flood (e.g., suspended solids, vegetation).

With the implementation of design and emergency response plans to address public safety concerns and mitigate damage to infrastructure and services, residual effects on identified VCs are predicted to be not significant.

6.17.1.3 Fire

The likelihood of fire because of Project component and equipment malfunction is low. Fire is more likely to occur because of lightning strikes and wildfire during dry weather and anthropogenic activities. During a fire, potential contaminants would depend upon the material under combustion. Combustion of hydrocarbon-based operational chemicals, such as hydraulic oil or motor fuel, would primarily generate CO_2, CO, combustion gases, and water vapour. Smoke and other particulate matter would impair air quality for the duration of the fire.

A large fire could result in effects on public health, changes in air quality, the biophysical environment (vegetation, wildlife) and immediate threats infrastructure. It could also affect lands used for traditional and non-traditional use, and employment and economy. However, the potential for fires because of Project activities is low and fire prevention measures on-site will meet applicable standards. If fires occur because of natural events, emergency response procedures are designed to extinguish fires quickly and limit damage. Fire would be most likely restricted to the Project site if it was caused by Project component and equipment malfunction or from human error.

With the implementation of preventative measures and emergency response procedures, residual effects of fire on identified VCs as a result of Project components are predicted to be not significant.

6.17.1.4 Hazardous Materials Spill

Hazardous material spills may occur as the result of improper handling, use, or storage of these materials on-site. Hazardous materials will also be transported to and from the Project site. The likelihood of a hazardous material spill is highest during construction when fuel and materials will be stored on-site. Hazardous materials may include fuels (e.g., gasoline, diesel and propane), lubricants (e.g., engine oil, transmission or drive train oil, hydraulic oil, gear oil and lubricating grease), coolants (e.g., ethylene glycol and propylene glycol), and methanol, paints and solvents.

A hazardous materials spill could result in effects of the biophysical environment (air quality, surface water quality, aquatic ecology, vegetation, soils, wildlife), public health (drinking water, country foods), and lands used for traditional and non-traditional resource use. However, training and appropriate handling, use, and storage of hazardous materials on-site are designed to prevent hazardous materials spills. If they occur, hazardous materials spills are therefore anticipated to be small in scale and to be cleaned-up and remediated using standard equipment. With the implementation of preventative measures and emergency response procedures, residual effects of hazardous materials spills on identified VCs are predicted to be not significant.

6.17.1.5 Vehicle Accidents

Vehicle traffic will occur during all phases of the Project and all seasons as a result of the movement of equipment, supplies, materials, and personnel to and from the Project site and normal public use of roads. A vehicle collision could occur on the roads leading to or from the Project (e.g., Highway 22), or within the Project site (e.g., roads on major components of the Project. Vehicle accidents can result in injury or death to humans and wildlife, the release of hazardous materials into a waterbody or on land, as well as damage to property or habitat. Contaminants that may be released because of a vehicle collision are primarily fuel (e.g., gasoline or diesel); however, the introduction of additional contaminants are subject to what the vehicle is carrying at the time of collision (e.g., dust suppressants, earth, domestic waste, lubricants). The amount of contaminant released would be a function of the size of the vehicle.

Vehicle accidents could result in wildlife mortality and immediate threats to public health. A vehicle collision resulting in the release of fuel or hazardous material could also have localized effects on the biophysical environment (surface water quality, aquatic ecology, vegetation, soils, wildlife). All workers would be required to work in a safe manner and complete health, safety, and environment training. Project-related vehicles would be required to follow traffic rules such as speed limits and weight restrictions and federal and provincial highway regulations.

An accident occurrence that results in human injury would be significant; however, employee training and traffic accommodation plans are designed to reduce the risk of vehicle accidents. Project-related traffic is not anticipated to increase the likelihood of vehicle accidents.

6.17.1.6 Pipeline Rupture

As a mitigation measure to reduce the likelihood of a potential pipeline rupture or adverse interaction with the Project, selected pipelines within the PDA of the off-stream reservoir will be re-located or retrofitted. Retrofitting and re-location of pipelines would be undertaken by the pipeline operators. Publicly available information shows the pipelines that occupy the current PDA of the Project are transporting high vapour pressure (HVP) product and low vapour pressure (LVP) product. Specific operational details (e.g., pressures) and not publicly available.

In a conservative case scenario, two mechanisms have been considered that would result in a pipeline rupture: a rupture of a third-party pipeline during retrofitting or re-location activities undertaken by the pipeline operator, and a rupture of a third-party pipeline during flood operations when there is water in the off-stream reservoir. If a rupture were to occur, public health (air quality, drinking water, country foods), the biophysical environment (surface water quality, aquatic ecology, hydrogeology, vegetation, soils, wildlife), and lands used for traditional and non-traditional use could be affected. In the event of a rupture, the pipeline operators would be responsible for the cleanup of any contaminated terrestrial or aquatic environments and would be required to meet applicable guidelines for each.

Companies responsible for the re-location or retrofitting of the pipelines will have an emergency preparedness plan to reduce the probability of a rupture as well as an emergency response plan, in the unlikely event of a rupture. In the event that a rupture was to occur during flood operations and enter the off-stream reservoir, the water would not be released back to the Elbow River until applicable guidelines were met.

Depending on the nature of the rupture event, even with the implementation of preventative measures, there is a potential for significant effects on identified VCs. However, the probability of such an event to result in significant effects is low because the likelihood of a large flood event is already very low and likelihood of a failure resulting from such an event would be even less.

6.17.1.7 Mitigation Measures

The Project is regulated by AEP *Dam and Canal Safety Guidelines* and the CDA *Dam Safety Guidelines*. The Project would meet design standards established by these safety guidelines.

Alberta Transportation has an Environmental Management System (EMS) that will be applied to the Project. The EMS includes standard environmental practices and procedures and spill release reporting procedures. In addition to the EMS, Alberta Transportation requires an ECO Plan to be developed by the selected construction contractor using Alberta Transportation's ECO Plan framework which is a joint document prepared by Alberta Transportation, the City of Calgary, and the City of Edmonton. The ECO Plan will be a project-specific plan that identifies and mitigates the potential environmental effects of construction. The ECO Plan is required to specifically identify hazardous materials handling

measures and emergency response procedures. The contractor will be responsible for developing and implementing the ECO Plan.

In addition to Alberta Transportations requirements, in the event of a major emergency, both the City and Calgary and the Province of Alberta have emergency response procedures in place.

Additional measures to prevent accidents and malfunctions include: the incorporation of the hazard classification for the Project into Project design, traffic accommodation plans, environmental protection plans, worker training during all phases of the Project, and consultation with pipeline operators.

Emergency preparedness and response measures would be implemented should accidents or malfunctions occur.

6.18 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The AEP Terms of Reference for the Project requires that the environmental impact assessment identifies stages or elements of the Project that are sensitive to changes or variability in climate parameters, including frequency and severity of extreme weather events and discusses the potential impacts over the life of the Project. The CEA Agency Guidelines for the Project requires an analysis of how local conditions and natural hazards, such as severe and/or extreme weather conditions and external events could adversely affect the Project and how this in turn could result in effects on the environment.

Effects of the environment on the Project are risks associated with local conditions and natural hazards that influence the Project. Mitigation tools to prevent or reduce the severity of adverse effects of the environmental on the Project include engineering design, construction methods planning and implementation, and operations preparation so that the Project can withstand normal and extreme environmental conditions.

Eight environmental conditions that could affect the Project were assessed:

- precipitation and flooding
- climate change
- slope instability
- erosion
- subsidence
- wildfires
- seismic events
- tornadoes

These environmental conditions could affect personnel, equipment, and schedule during Project construction and functionality of the dam during operations.

Design measures have been incorporated into the Project to mitigate risks of environmental conditions affecting the Project. Contingency plans and emergency response measures would be implemented in the event of adverse and extreme weather or seismic events. With project design and the implementation of response measures, potential residual effects of the environment on the Project are limited to climate change and damage to infrastructure because of wildfires, seismic events, and tornadoes. Potential residual effects would extend into the RAA and are rated not significant, except for dam failure or breach, which would be significant in the unlikely event of damage to Project infrastructure during a high magnitude flooding event.

7.0 CUMULATIVE EFFECTS ASSESSMENT

The AEP Terms of Reference for the Project requires that the EIA address the potential for cumulative effects. The CEA Agency Guidelines for the Project requires that the EIA identify and assess the Project's cumulative effects using the approach described in the Agency's Operational Policy Statement entitled *Addressing Cumulative Environmental Effects under the Canadian Environmental Assessment Act 2012* and the guide entitled *Cumulative Effects Assessment Practitioners' Guide.*

The assessment of cumulative effects is presented consistent with the residual effects assessment: the assessment of effects is considered for the Project in two scenarios: construction and dry operations; and flood and post-flood operations. The cumulative effects assessment evaluates flood and post-flood operations that include consideration of overlapping infrastructure (pipelines, transmission lines, roads), other flood mitigation works, and considers the effects from reasonably foreseeable projects in regional and community development plans.

Cumulative effects for accidents and malfunctions during construction, flood and post-flood operations for overlapping existing and potential future projects including pipelines, transmission lines and road infrastructure are addressed under Accidents and Malfunctions (Section 6.17).

7.1 REGIONAL CONTEXT

Originally mixed-grass prairie, the regional landscape surrounding the Project site, has been largely converted since the late 1800s to agriculture and settlement. The region is now a mosaic of various types of development (e.g., urban, industrial, infrastructure), agriculture and native grassland cover types with some other remnant vegetation patches, some along riverine valleys.

The PDA reflects this general landscape, mostly ranch and farm on private land, and, slightly beyond its boundaries, by individual residences, camps and rural sub-divisions (especially Springbank to the east). Roads, pipelines and transmission lines cross the PDA or are adjacent. The City of Calgary, about 8 km east of the Project site, dominates the region as a major metropolitan centre with a population of about 1.4 million. A dominant land use in the region is the Tsuut'ina Nation Reserve, about half kilometre south of the Project site.

This landscape is reflected in the five major land use groupings in the Project Inclusion List (PIL): agriculture; infrastructure; residential and communities; recreation and tourism; and the City of Calgary. Projects and physical activities considered for the assessment of cumulative effects are listed in Table 7-1, and shown on Figure 7-1.

The Project is of relatively small size in this landscape, as measured by permanent surface features. The size of the PDA on maps appears much larger than what one would experience (as project surface features) if one were to walk across the project site. That is because a large portion of the PDA (the off-stream reservoir), when in operation, would be flooded. During dry operations, it is left fallow or may continue with agricultural use (as most of the PDA is pasture or grassland). Specifically, the permanent area of the PDA is about 179 ha, or 12% of the total PDA of about 1,438 ha, the difference in area is maximum flooded extent of the reservoir during a design flood (1,259 ha).

In consideration of the above, the nature and extent of cumulative effects of the Project with other projects and physical activities is generally limited. Many of the Project's effects are relatively spatially confined to the PDA or much smaller areas within it. Being in a rural area, other developments often are dispersed and sufficiently distant reduce the likelihood of cumulative effects. In contrast, there is some likelihood for cumulative effects in the case of roads and other rights-of-way that traverse through or near the PDA, or for some users traversing onto the land.

Other projects or physical activities that have been or will be carried out are identified for inclusion in the cumulative environmental effects assessment, based on their potential for residual environmental effects that could interact spatially and temporally with the residual environmental effects of the Project. The assessment considers the nature and degree of change from these existing conditions due to both the Project and the other projects or activities.

The other projects or physical activities identified for consideration in the cumulative environmental effects assessment for this EIA are listed in Table 8-1, referred to as a PIL. Future projects and physical activities were identified from publicly available information and are "certain, planned, or reasonably foreseeable" as per CEAA guidelines.

Table 7-1 Other Projects or Physical Activities for Consideration of Cumulative Environmental Effects

General Category of Projects or Physical Activity	Specific Project or Activity	Description
Past and Present (have been carried out)		
Agriculture	Use of land or resources for ranching or farming activities	Agricultural activities, such as ranching or farming, have occurred in the region west of Calgary for over 120 years.
Infrastructure	Roads	A network of roads and road allowances exists within PDA and region. These include, through the PDA: Springbank Road, Highway 22 and several township and range roads (Range Road 40, Township Roads 242 & 250).
	Power transmission	Power transmission lines have existed in the region for 90 years.
	Pipelines	Several pipelines and associated facilities (e.g., compressor station) occur in the area. The PDA overlaps with several operating, abandoned or inactive pipelines. The active pipelines carry a variety of substances including high-pressure and low-pressure product (e.g., natural gas).
	Telecommunications	Communications services, in the form of cables and towers, have existed in the region for 90 years.
	Bank Stabilization	Alan Grant Young has a disposition for Bank Stabilization (DLO 010386) at 05-03-024-04-W5, 06-03-024-04-W5 and 11-03-024-04-W5.
	Surface Material Extraction Site	Alberta Transportation has a Surface Material Extraction Site (DRS 1006) at NW-11-024-04-W5.
	Fisheries Habitat Protection Area	Canmore's AEP Fish and Wildlife Office has a Fisheries Habitat Protection Area disposition (DRS060074) covering 49.1 ha in NE-11-024-04-W5. Foot access only for fishing and hiking.
	Watercourse Protection	The AEP's Rangeland District Lands Division Calgary Office has a Watercourse Protection Protective Notation (PNT753998) for 84.34 ha in NE-11-024-04-W5 and NW-11-024-04-W5. (Elbow River Boy Scout Camp - High Recreational Value, No Timber Removal).

Table 7-1 Other Projects or Physical Activities for Consideration of Cumulative Environmental Effects

General Category of Projects or Physical Activity	Specific Project or Activity	Description
Residential and communities	Residential dwellings and communities	Residential areas have and will continue to develop west of Calgary. These include Springbank, Bragg Creek, Redwood Meadows, and acreages off Hwy 8 near the PDA.
	Community of Harmony	The Community of Harmony Stage 1 conceptual scheme was adopted by the County of Rocky View in 2007 for the development of a community on approximately 707 ha of land adjacent to the Springbank Airport, to include residential, commercial/retail, infrastructure, institutional and tourism/recreational components. In 2008, Stage 1 Neighborhood Plan was approved; and in 2015 development permits issued and 15 show homes built.
	Reserves	The Tsuut'ina Nation (Reserve 145) is located 395 m south of the PDA. The Stoney Nation (Reserves 142, 142B, 143 and 144) is also located near the PDA.
Recreation and tourism	Kamp Kiwanis	Kiwanis Club of Calgary's Kamp Kiwanis was founded in 1951, and serves to provide the summer camp experience to underprivileged children and families. The Kamp is in the PDA.
	Camp Gardner	Scouts Canada has held the lease for Camp Gardner from July 1966 until 2017. Hope Mission currently runs a recreational camp for children at the site. Their lease expires in July 2018. The Camp is in the PDA.

Table 7-1 Other Projects or Physical Activities for Consideration of Cumulative Environmental Effects

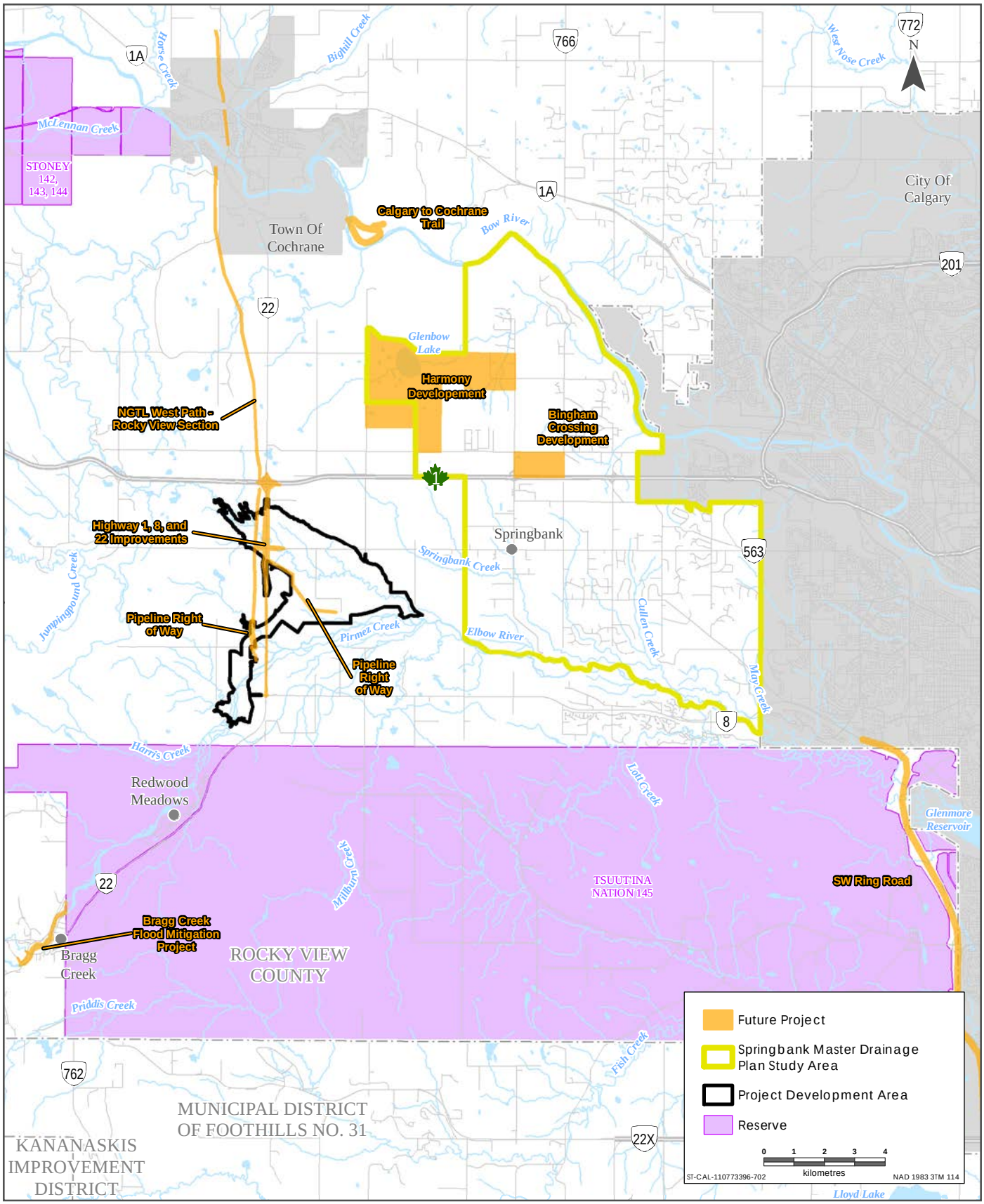
General Category of Projects or Physical Activity	Specific Project or Activity	Description
	Backcountry Trail Remediation	Remediation in Rocky View County is being undertaken by AEP on trails with erosion and other damage to bridges and amenities from the June 2013 flood. The program will restore priority trails and trails systems along the eastern slopes that are used for motorized and non-motorized recreational users. Some trails may be re-established in more ecologically appropriate and sustainable areas so they are better suited to withstand future floods. Trail systems near Bragg Creek, including the Diamond T-loop and Jumping Pound Ridge, will be evaluated. The program ran from June 2014 – March 2017.
	Redwood Meadows Golf and Country Club	A golf course within the Community of Redwood Meadows
	Calgary to Cochrane Trail – Phase 1	Phase 1 has been completed by the Glenbow Ranch Park Foundation. The "C to C Trail" will join the northwest corner of Calgary (via Haskayne Park) to Glenbow Ranch Provincial Park to provide opportunities for walking, hiking and biking. It will fill a gap in the Trans Canada Trail. Phase 1, the 2.2 km Bearspaw Trail, was constructed in September 2015 between the City of Calgary and Michael's Creek in Glenbow Ranch Provincial Park on the north side of the Bow River.
	Historic Site	The 'Our Lady of Peace' Roman Catholic Mission (est. 1872), a protected provincial historic resource, is located close to the diversion structure and channel component of the Project. The associated cairn site is located approximately 30 m from the PDA.
City of Calgary	Various	Continuing development in the City of Calgary

Table 7-1 Other Projects or Physical Activities for Consideration of Cumulative Environmental Effects

General Category of Projects or Physical Activity	Specific Project or Activity	Description
Future (may or will be carried out)		
Residential communities and business development	The Community of Harmony - Stages 2 and 3	Development on approximately 700 ha includes residential, commercial, recreational, infrastructure and institutions. Stage 2 construction starts 2019. By 2020 Harmony anticipated population of 1,200 in over 500 homes. Development will continue beyond 2020 in the same approved development area; however, no specific details are available.
	Bingham Crossing	A pedestrian oriented shopping and lifestyle with a seniors housing complex development in approximately 60 acres. Development is scheduled to be complete in 2019; however, minimal construction has so far occurred. and no further details are available.
	City of Calgary	Developments within City of Calgary. Several residential, commercial/retail, infrastructure, and institutional projects within the City of Calgary are planned for development.
Roads and Trails	Upgrades to Highways 1, 8 and 22	Upgrading of: Highway 1 and 22 interchange; Highway 8 and 22 interchange; and Highway 22 to four lanes and ultimately six lanes. These future road developments are not listed in the Provincial Construction Program for 2017-2020, assumed that construction start after 2020. No specific footprint details are available.
	Southwest Calgary Ring Road (SWCRR)	The SWCRR will connect Highway 8 to Macleod Trail SE. It will consist of 31 km of six and eight lane divided highway. Major construction commenced in early 2017 and is expected to be completed in 2021.
	Calgary to Cochrane Trail - Phase 2 and 3	Phase 2 involves building a railway crossing along the Bowbend Trail pathway (by 2018) and Phase 3 involves building a pedestrian bridge over the Bow River near Cochrane (by 2020).

Table 7-1 Other Projects or Physical Activities for Consideration of Cumulative Environmental Effects

General Category of Projects or Physical Activity	Specific Project or Activity	Description
Pipelines and Transmission Lines	Realignment of existing pipelines and utilities in PDA	Oil and gas pipelines within the PDA would either be relocated within the PDA or retrofitted. One power line crosses the diversion channel and some power pole locations would be adjusted to permit a clear span over the channel. Alterations to infrastructure would occur in 2019-2020.
	NGTL West Path Rocky View Section pipeline	A 21.5 km, 42-inch diameter, natural gas pipeline paralleling and adjacent to existing pipeline right-of-way extending between Cochrane and an existing valve station just north of the Elbow River. The right-of-way crosses underneath the Springbank Off-stream Reservoir Project diversion channel. Construction is anticipated from 2019 to 2020.
Water Management	Bragg Creek Flood Mitigation	Flood defenses in Bragg Creek consisting of earth dykes, concrete retaining walls, rock erosion protection and drainage systems. Detailed engineering design is currently undergoing regulatory review and approval. Construction is proposed from May 2018 – February 2019, with site reclamation and clean up occurring from May – November 2019. Final footprint details are currently not available.
	Rocky View County Springbank Master Drainage Plan	This plan, prepared in 2016, proposes requirements to manage stormwater runoff from future development in the community of Springbank and to address existing drainage issues. No specific footprint of infrastructure is yet available.



Sources: Base Data - ESRI, Natural Earth, Government of Alberta, Government of Canada
Thematic Data - Alberta Environment and Parks (AEP), Alberta Conservation Information Management System (ACIMS), ERBC, Government of Alberta, Stantec Ltd

Future Projects and Physical Activities

7.2 SELECTED VALUED COMPONENTS BY PROJECT PHASE

The cumulative effects assessment builds on the Project-specific residual effects assessments. In accordance with the the CEA Agency Guidelines for the Project a cumulative effects assessment is required for a VC only where the Project may result in adverse residual effects on that VC; if a VC would not be affected by the Project or would be affected positively, then it may be omitted from the cumulative effects assessment.

7.2.1 VCs Assessed in Both Scenarios

The Project-specific VCs for which adverse residual effects are anticipated during both assessment scenarios and, therefore, also assessed for potential cumulative effects in both scenarios are:

- air quality and climate
- hydrogeology
- surface water quality
- aquatic ecology
- terrain and soils
- vegetation and wetlands
- wildlife and biodiversity
- land use management
- traditional land and resource use
- public health
- infrastructure and services

7.2.2 VCs Only Assessed in Flood and Post-flood Operations

The Project-specific VC for which adverse residual effects are anticipated only during the flood and post-flood operations and, therefore, also assessed only for potential cumulative effects in that scenario, is hydrology. Hydrology was not assessed for construction and dry operations because Project-specific environmental effects on hydrology and sediment transport, with the implementation of mitigation measures, are neutral (i.e., no net change in measurable parameters for hydrology relative to existing conditions). In the absence of residual effects, there is no pathway for cumulative effects and, therefore, no cumulative effects assessment is warranted for hydrology during construction and dry operations.

7.2.3 VCs Not Assessed in Either Scenario

The Project-specific VCs for which adverse residual effects are not anticipated during either assessment scenarios and, therefore, are not assessed for potential cumulative effects, are:

- acoustic environment
- employment and economy
- historical resources

The following explains why these VCs are not assessed for potential cumulative effects.

Reason for Exclusion of Acoustic Environment VC

Construction and Dry Operations

Due to the preliminary status of the construction execution plan, the potential effects of construction and dry operation on the acoustic environment are modelled without the application of mitigation measures. The unmitigated sound levels at most receptor locations during some phases of construction exceed the noise limits, based on Health Canada's preferred approach for environmental assessments. However, with the application of mitigation, the residual effect on the acoustic environment are expected to be reduced to achieve Health Canada's noise objectives. Upon availability of the detailed construction execution plan, mitigation measures will be developed to meet assessment noise thresholds. No residual effects are predicted. In the absence of residual effects, there is no pathway for cumulative effects and, therefore, no cumulative effects assessment is warranted.

Flood and Post-flood

During the post-flood phase, inspections would be conducted using light trucks, although some heavy equipment might be brought to site if it is needed for debris removal or facility maintenance and repair. The quantity of equipment required would depend on the severity of the flood. The maximum quantity of heavy equipment required during the post-flood operation would be substantially less than the equipment requirement for construction. Noise effect at all receptors are expected to be below the mitigation noise level (MNL) threshold of 57 dBA L_{dn}, given the lower intensity of activities expected during post-flood operations. Therefore, residual effects on the acoustic environment during post-flood are not predicted. In the absence of residual effects, there is no pathway for cumulative effects and, therefore, no cumulative effects assessment is warranted.

Reason for Exclusion of Employment and Economy VC

Construction and Dry Operations

Potential adverse effects of Project spending relate to increased operational costs due to wage inflation and employee turnover. However, with the implementation of mitigation, it is anticipated that adverse project-specific effects on labour availability will be negligible (i.e., no measurable change from existing conditions). In the absence of residual effects, there is no pathway for cumulative effects and, therefore, no cumulative effects assessment is warranted.

Flood and Post-flood

In consideration of existing mitigation measures, the financial cost of 1:50 year, 1:100 year, and design floods from Elbow River, in the absence of the Project, is estimated at approximately $470 million, $1.1 billion, and $1.9 billion, respectively. With the AAD estimated at approximately $42 million, construction of the Project would reduce the AAD of floods by $28 million to $14 million. Over an assumed 100-year operating life, the Project's discounted benefits in terms of flood damage avoidance, exceed its costs; therefore, it would have a net economic benefit. Given that the residual effect will be positive, no cumulative effects assessment is required.

Reason for Exclusion of Historical Resources VC

The following applies to both scenarios.

Project-specific environmental effects on historical resources will be mitigated to the standards established by ACT. With mitigation following the recommendation of ACT, no adverse residual environmental effects on historical resources are anticipated. In the absence of residual effects, there is no pathway for cumulative effects and, therefore, no cumulative effects assessment is warranted.

7.3 APPROACH TO ASSESSING CUMULATIVE EFFECTS FOR EACH SCENARIO

The following provides an explanation, given some unique aspects of both the Project and the assessment, of how the two scenarios were assessed in consideration of other projects and activities and the regional context. The first scenario is construction and dry operations and the second is flood and post-flood operations. Note that these encompass the four project *phases*, which is each of those four activities named in the scenario names.

Each VC includes a table entitled "Interactions with the Potential to Contribute to Cumulative Effects". This table identifies which past, present and future projects effects may interact with the same effects (for the same VC) for the Project. These interaction tables, like the PIL, are organized by past and present, and then future. The "project-related physical activities" row recognizes for completeness the Project's effects.

7.3.1 Construction and Dry Operations

The effects of the Project are assessed within the LAA for each VC for both the construction and dry operations phases, with the unique effects of each phase recognized. Those assessments consider any past and present projects and physical activities in the LAA, and are assessed in a study area adequate to ensure the identification and characterization of effects directly attributable to the Project. The baseline state of the VCs in those assessments reflects the VC's response to conditions in the LAA, and often also to conditions beyond the LAA. Therefore, these effects typically are representative of similar interacting effects more broadly in the region. The assessment of potential cumulative effects of the Project with past and present other projects and activities is accomplished by recognizing in the interactions table where such interactions may occur, and in consideration of the regional context.

During construction and dry operations, the baseline conditions (past and present) are all those identified in Table 8-1 under the heading "past and present (have been carried out)", and the future conditions are all those identified under the heading "Future (may or will be carried out)". Most future projects and physical activities are identified by a specific project name and proponent.

A particularly unique situation occurs with the realignment of existing pipelines. While these, for completeness, have been itemized as a future physical activity in Table 8-1, they occur entirely within the PDA with that activity only a consequence of the Springbank Off-stream Reservoir Project (versus happening for other reasons by the owner of those pipelines). As such, the effects of these activities have already been accounted for, and adequately so from a cumulative effects perspective, by the residual effects assessment for construction.

Given the above, the focus of the assessment of potential cumulative effects is on the potential interactions of the Project with each future project and physical activity because they have not yet been accounted for elsewhere in this EIA.

7.3.2 Flood and Post-flood Operations

The assessment of flood and post-flood operations borrows much the same fundamental approach to assessing potential cumulative effects as for construction and dry operations. The following describes how the assessment of the flood and post-flood scenario differs:

1. The baseline for the assessment of effects for flood and post-flood operations is shifted to the conditions represented by the dry reservoir phase. As such, the Project has been constructed and is ready to mitigate a flood, if that occurs.
2. Predicting the year of a future flood is not possible. Currently, the Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood) in the spring of 2021, and be completely constructed (able to accommodate the design flood) in the spring of 2022. A conservative approach was taken and cumulative effects for flood and post-flood operations assume that a design flood would occur in 2022 i.e., the earliest time at which the Project could accommodate a design flood. According to the project design, the reservoir would then be drained over a period of approximately 40 days; this draining is included in flood operations.
3. Most of the future projects would have been built by 2022, and so become part of the new baseline for this scenario; i.e., those projects and physical activities no longer are future (in 2022), but are past and present. Those projects and physical activities that in any way carry forward in time do not, however, have specific descriptive information available to further characterize effects. As such, little more can be done than to acknowledge that these projects and physical activities may in some way cause future effects. The four projects and physical activities for which this applies are:
    - The Community of Harmony - Stage 2 and 3 will be further developed but will remain within the same boundary for that development as was used for the construction and dry operations for the Project.
    - Upgrades to Highways 1, 8 and 22 are lacking specific details regarding the disturbance footprint and associated activities.
    - Rocky View County Springbank Master Drainage Plan is lacking specific details of physical projects and activities arising from this plan, which only implies that at some time in the future projects and physical activities may happen. Also, the Springbank Off-stream Reservoir Project PDA is outside and to the west of the Springbank Master Drainage Plan study area, each area occupying a separate drainage. As such, there is no hydraulic connectivity between the two areas. Therefore, this plan is not discussed further in the VC cumulative assessments.
    - City of Calgary is recognized largely for its general contribution to socio-economic effects in the region; specific projects and physical activities do not need to be identified. Therefore, this is not discussed further in the VC cumulative assessments.

4. The major known and measurable change in this scenario, given what is described above, is therefore the changes of the Springbank Off-stream Reservoir Project itself; namely, the purposeful flooding of the reservoir to mitigate downstream effects during a flood. This has implications for example to regional availability of habitat when the reservoir contains diverted flood water, and to regional vegetation when the reservoir has been drained. This scenario includes three conditions regarding the presence and movement of water: full of water (to the extent of each flood), draining water, and drained of water.
5. Given the above, the focus of assessment of potential cumulative effects is focused on unique interactions that may occur, specific to each VC and effect, and focused on one or more of the conditions regarding the presence and movement of water.

7.4 CUMULATIVE EFFECTS ASSESSMENT – CONSTRUCTION AND DRY OPERATIONS

- **Air Quality and Climate**: The construction phase will result in exhaust emissions (that include GHG) from construction equipment and fugitive dust emissions from surface disturbance activities. In addition, nighttime construction activities will require artificial lighting. With the appropriate mitigation, these effects are found to be not significant. The dry operations phase will be limited to periodic inspections and routine maintenance activities. Therefore, there are negligible interactions of the Project with air quality, light, and GHG emissions. With respect to cumulative effects during construction, the expected Project construction period of 275 days could be spread over a two to three calendar year period. Most of the construction is expected to occur during non-winter periods when the ground is not frozen or covered with snow. The future physical activities identified in Table 8-1 have construction activities that are also of limited duration. Emissions associated with the construction of the Bragg Creek Flood Mitigation, Calgary to Cochrane Trail and the Calgary South west ring road are not within the air quality LAA or RAA and are unlikely to overlap with Project emissions. Other physical activities that occur in the air quality LAA or RAA, and could take place during the Project construction period, are the Community of Harmony and Bingham Crossing developments, NOVA Gas Transmission Ltd. (NGTL) West Path Rocky View Section pipeline and the realignment of existing pipelines and utilities located in the PDA for the Project. The Project construction phase requires mobile lighting to provide a secure and safe working environment. Associated mitigation measures identified in Section 6.2 limit potential effects on light trespass, glare, and sky glow. No additional mitigation measures specific to cumulative effects are proposed.

- **Hydrogeology**: The Project has the potential to change groundwater quantity in and near the PDA because of local, shallow and temporary subsurface dewatering that might be required to facilitate construction of the diversion channel, dam and floodplain berm, low-level outlet works, bridge, excavation of borrow pits, and utility realignments. Modelling results indicate the Project is anticipated to have adverse residual effects, but not significant effects, on groundwater quantity. The duration of the effect due to construction dewatering would be short term because it will be limited to construction only. Construction of the NGTL West Path Rocky View Section pipeline will involve a horizontal directional drill under the diversion channel. The implementation of industry best practice and the relatively minor size of the project will minimize any potential for effects on groundwater. The Community of Harmony and the Bingham Crossing development have a limited overlap with the northeast perimeter of the RAA defined for hydrogeology. As noted above, Project effects on water quantity will be limited to the PDA and LAA and will be limited to construction. Construction activities at the Community of Harmony and the Bingham Crossing development may occur at the same time as Project construction and may interact with groundwater. However, given the distance of the two developments from the Project PDA and the duration of potential Project effects (construction only), the potential for cumulative effects on ground water quantity are negligible.
- **Surface Water Quality**: The Project is anticipated to have adverse residual effects, but the effects are not significant, on surface water quality because of changes in sediment levels and herbicide application. The effect of construction on water quality through change in suspended sediment concentration, considering construction mitigation measures (Section 6.5) and construction monitoring, is low in magnitude, restricted to the PDA, and short-term in duration. The effect of the Project construction on downstream water quality in Elbow River and Glenmore Reservoir is negligible, given that sediment concentrations would be monitored during construction and given the mitigation measures. The effect of dry operation on water quality through herbicide application, considering the use of the Environmental Code of Practice for Pesticides, is low in magnitude, restricted to the LAA and short-term in duration. Given the very low frequency of herbicide detection in the watershed, the effect is reversible through dilution. Given the distance between future developments and the PDA/LAA of the Project, and the fact that standard industry mitigation and best management practices would be implemented at the identified developments, the potential for cumulative effects on surface water quality is considered negligible.

- **Aquatic Ecology**: The Project is anticipated to have adverse residual effects, but not significant, on aquatic ecology from the permanent alteration or destruction of fish habitat during construction and dry operation. Both the Calgary to Cochrane Trail and the Community of Harmony development are located outside the RAA (the Elbow River watershed) defined for aquatic ecology. Therefore, no pathway for cumulative effects are anticipated. Construction of the NGTL West Path Rocky View Section pipeline will not affect surface water bodies. The Bingham Crossing Development, potential upgrades to Highways 1,8, and 22, and the realignment of existing pipelines and utilities would occur within the RAA. However, these projects will implement standard and accepted industry avoidance and mitigation measures, as well as applicable best management practices that will avoid and/or mitigate the potential for serious harm to fish or negative effects to the aquatic environment. Therefore, residual effects on aquatic ecology, through the permanent alteration or destruction of fish habitat, or the death of fish, are not anticipated. The two projects within the RAA with the potential to act cumulatively with the Project are the Bragg Creek Flood Mitigation and the Southwest Calgary Ring road (SWCRR). Both projects would likely have similar effect pathways on fish and fish habitat as those identified for the Project. Project specific mitigation measures include timing of activities, operation of machinery, handling of deleterious substances, erosion and sediment control, water management, stream isolation, reclamation, and structure operation and maintenance (Section 6.6). No additional mitigation measures specific to cumulative effects are proposed.
- **Terrain and Soils**: The Bragg Creek Flood Mitigation, Calgary to Cochrane Trail, Bingham Crossing development and Southwest Calgary Ring road are located outside the RAA defined for terrain and soils. Therefore, no pathway for cumulative effects are anticipated. The realignment of existing pipelines and utilities will occur within the PDA. Residual effects to terrain are isolated to specific project components due to engineering design (i.e., the diversion channel banks, off-stream dam and at the diversion structure). Similar effects on terrain would not be expected from the residential development of the Community of Harmony or highway upgrades. Therefore, no pathway for cumulative effects are anticipated. Future projects with the potential to act cumulatively with the Project are the Community of Harmony, NGTL West Path Rocky View Section and upgrades to Highways 1, 8 and 22. These projects would be expected to have similar effect pathways to soil quality and quantity as those identified for the Project during construction (i.e., a change in agricultural land capability (LCC) and reclamation suitability due to admixing, compaction and rutting, and wind and water erosion). Specific project mitigation and monitoring measures are presented in Section 6.7. No additional mitigation measures specific to cumulative effects are proposed. Other future projects would be expected to implement standard mitigation measures during construction and operation.

- **Vegetation and Wetlands**: Future projects with the potential to act cumulatively with the Project are the Bragg Creek Flood Mitigation, Calgary to Cochrane Trail, Community of Harmony (approximately 700 ha in the RAA), Bingham Crossing development (approximately 60 ha in the RAA), NGTL West Path Rocky View Section and upgrades to Highways 1, 8 and 22. These projects would be expected to have similar effects on vegetation and wetlands as those identified for the Project during construction (i.e., loss or alteration of vegetation and wetland species from stripping, or introduction and establishment of regulated weeds and non-native invasive species). Identified future projects would be expected to result in the removal of vegetation and potentially affected wetlands. However, the future projects are located primarily on disturbed or agricultural lands, which indicates that the potential for effects on native vegetation or SOMC would be limited. Specific Project mitigation and monitoring measures include machinery operating guidelines, erosion and sediment control, and reclamation (Section 6.8). No additional mitigation measures specific to cumulative effects are proposed. Other future projects would be expected to implement standard mitigation measures and wetland compensation, as appropriate.
- **Wildlife and Biodiversity (including Migratory Birds and Species at Risk)**: Potential cumulative effects on wildlife habitat due to future projects and activities have similar effects as those identified for the Project. Specifically, vegetation removal associated with future projects has potential to result in direct habitat loss or alteration. In addition, construction activities also have potential to result in indirect effects due to sensory disturbance (e.g., noise and artificial light), which can reduce habitat effectiveness. During construction, the Project would contribute to existing cumulative effects, however, the change in habitat abundance represents less than 1% of the upland and wetland cover types available in the RAA. Specific project mitigation and monitoring measures to reduce potential project effects on wildlife habitat are presented in Section 6.9. These are viewed as sufficient to also address potential cumulative effects. Other future projects would be expected to implement industry standard mitigation measures as appropriate. The contribution of the Project to cumulative effects on wildlife and biodiversity, when considered in a regional context with existing and future projects and activities, is expected to be relatively minor because a large portion of the project construction area contains agricultural lands that do not provide high suitability wildlife habitat for SOMC. Although there will be small areas of wildlife habitat directly and indirectly affected, the Project's contribution to residual cumulative effects is not expected to measurably affect the abundance or sustainability of wildlife in the RAA because the footprint of the Project's permanent structures is small relative to the remaining habitats available in the RAA.

- **Land Use Management:** The Calgary to Cochrane Trail, Bingham Crossing and Southwest Calgary Ring Road are located outside the RAA defined for land use and management. No pathway for cumulative effects is anticipated. The upgrades to Highways 1, 8 and 22 occur within the RAA defined for land use and management. However cumulative effects on land use and management are not anticipated to result from these activities because the upgrades to Highway 1, 8 and 22 would be expected to occur within the existing right of way and would therefore not result in changes to current land use. The realignment of existing pipelines will occur within the PDA and the effects of these activities have been accounted for within the residual effects assessment for the Project. Construction of the NGTL West Path Rocky View Section pipeline will involve reclaiming the right-of-way and largely a return to previous use. Land use in the PDA would be affected by construction of the Project, including permanent removal of private property and agricultural lands and changes to industrial development infrastructure. Current land uses such as industrial activity, livelihood and consumptive and non-consumptive recreation, and access to the LAA would be disrupted by construction, but these land uses would be able to continue at or near current levels during dry operations. Mitigation measures to address change in land use and management are included in Section 6.10.
- **Traditional Land and Resource Use**: Adverse residual effects on current use sites and areas from the Project are limited to the PDA and are therefore not anticipated to act cumulatively with the residual effects of future developments in the TLRU RAA. Cumulative effects on trails and travelways, which are intersected by the PDA but also extend into the LAA and RAA, are assessed for cumulative effects. Potential cumulative effects on the availability of traditional resources for current use due to future projects and activities have similar effects as those identified for the Project. Project mitigation and monitoring measures to reduce potential Project effects on availability of traditional resources for current use are presented in Section 6.12. Although it is unknown the specific mitigation measures that would be implemented by other future projects to reduce potential residual cumulative effects in the RAA, standard mitigation is expected to be implemented. No specific recommendations or mitigation regarding cumulative effects on the availability of traditional resources for current use were identified by Indigenous groups in the TUS reports or through the results of the Indigenous engagement program.

- **Public Health**: There are no projects that act cumulatively with the Project, as it relates to public health. There is limited temporal overlap between emissions from the Project during the construction phase, and emissions from other projects. Although these projects contribute emissions to the air, they must be produced in the same time frame in order to have cumulative effects on health. Consequently, there is no pathway for cumulative effects with the Project during the construction phase. There are no activities during the dry operation phase that influences health, and therefore, no cumulative effects during this phase. The realignment of existing pipelines will occur within the PDA and the effects have been accounted for within the residual effects assessment for the Project. Emissions from the NGTL West Path Rocky View Section pipeline will be minor and intermittent, limited to some equipment as construction moves along the right-of-way. Due to the anticipated construction activities and schedule, distance between the Community of Harmony and Bingham Crossing and the PDA, and prevailing wind conditions, it is considered there are limited opportunities for emissions from the three projects to overlap. Emissions from the Community of Harmony and Bingham Crossing would not be expected to materially change the predicted Project residual effects conclusions. Given this, cumulative effects to public health because of air quality emissions during construction are not predicted.
- **Infrastructure and Services**: Projects that may act cumulatively with infrastructure and services are residential and commercial developments in the RAA (Community of Harmony and Bingham Crossing), upgrades to Highway 1, 8 and 22, the Calgary to Cochrane Trail, Bragg Creek Flood Mitigation, NGTL West Path Rocky View Section pipeline and the realignment of existing pipelines and utilities. These projects may cause temporary disruption to transportation, increase the population of the area, either temporarily or permanently, placing additional demands on transportation in the RAA. Mitigation measures to reduce the Project's effects on transportation are described in Section 6.14. In order to manage cumulative effects on provincial and municipal services and infrastructure, proper planning by relevant agencies, and implementation of appropriate management strategies, particularly with respect to population growth, will be required.

7.5 CUMULATIVE EFFECTS ASSESSMENT – FLOOD AND POST-FLOOD

- **Air Quality and Climate:** The post-flood phase of the Project could result in fugitive dust emissions from wind erosion from the reservoir surface of the deposited sediment during high wind speed conditions. In addition, there is a potential for odours related primarily to decaying vegetation in reservoir (after draining) and a potential for decrease of the carbon sequestration capacity during the post-flood period due to reduced vegetation activity. Potential odours and change in carbon sequestration capacity do not have adverse effects on ambient air quality and climate and are, therefore, not included in the cumulative assessment. The residual effects are found to be not significant. Because the reservoir will contain water during reservoir filling and draining, no fugitive dust emissions are expected during flood operations. Adverse residual effects during flood operations are not anticipated. Adverse air quality effects due to the Project occur along and near the eastern boundary of the PDA. The contribution of the other identified future physical activities at this boundary is limited. The Project is anticipated to contribute more to the cumulative effect on air quality than the other identified future physical activities; however, it will be limited in duration because exposed sediments are expected to be revegetated within a one-year period, and limited in frequency given the rarity of floods. Mitigation measures will be implemented to manage and reduce Project fugitive dust emissions during the post-flood operations (Section 6.1). A primary mitigation for wind erosion in the reservoir would be the re-establishment of vegetation cover (e.g., native grasses) after reservoir draining. In short term, the natural revegetation could be ineffective due to various factors and, therefore, a tackifier would be applied where required. No additional mitigation measures specific to cumulative effects are proposed.
- **Hydrogeology**: Groundwater levels in the RAA are anticipated to respond to floods in Elbow River due to their hydraulic connection to surface water and interactions between the hydrologic and hydrogeologic systems. These responses to floods are anticipated to occur with or without the Project. Completion of construction of the Community of Harmony, which also has limited overlap with the northeast perimeter of the RAA, has not been determined; therefore, a conservative assumption is that construction may still be occurring in 2022 during flood and post-flood operations. Effects on groundwater quality and quality due to the Project during flood and post-flood operations are anticipated to be limited to the LAA. While located within the RAA, the Community of Harmony and upgrades to Highways 1,8 and 22 would not be expected to affect the hydrology of Elbow River and, therefore, no pathway exists for cumulative effects with the Project. No additional mitigation measures specific to cumulative effects are proposed (Section 6.3).

- **Hydrology**: The purpose of the Project is to actively modify the hydrology of Elbow River in order to reduce flood damage downstream of the Project. During diversion, there would be a high magnitude effect on the morphology of Elbow River. The Project would reduce aggradation and degradation on Elbow River during a large flood. During release, there would be a high magnitude effect on the morphology of the unnamed creek at the low-level outlet. Although high magnitude effects are predicted in Elbow River, channel planform and bedload movement is predicted to be maintained and that only the magnitude of aggradation and degradation, during diversion, would be affected. While located within the RAA, the Community of Harmony and upgrades to Highways 1,8 and 22 would not be expected to affect the hydrology of Elbow River and, therefore, no pathway exists for cumulative effects with the Project.
- **Surface Water Quality:** The Project is anticipated to have adverse residual effects on surface water quality during flood and post-flood operations. The effect of the Project on water quality is not significant because the change in water quality is not anticipated to cause acute or chronic toxicity or change the trophic status of Elbow River or Glenmore Reservoir. Even though the total load of sediment in Elbow River is reduced by the Project, flood operations is not predicted to substantially affect Elbow River suspended sediment concentrations during diversion. The Project does increase suspended sediment concentrations for a short duration (days) at the end of release of water back into Elbow River. Detailed construction schedules are not available for the Community of Harmony and the upgrades to Highways 1, 8 and 22. Therefore, it is conservatively assumed that construction may still be occurring in 2022, at the same time as assumed flood and post-flood operations. The Community of Harmony is located a 5 km to 6 km from the PDA/LAA within which Project residual effects during a flood are predicted. Given the distance between the development and the PDA/LAA and the fact that standard industry mitigation and best management practices (Section 6.5) would be implemented at the development site, the potential for cumulative effects on surface water quality during flood and post-flood operations is negligible. Potential upgrades to Highways 1, 8 and 22 will implement standard industry mitigation and best management; residual effects on surface water quality are not anticipated. In the absence of residual effects from these activities on surface water quality, there is no pathway for cumulative effects with the Project during flood and post-flood operations.

- **Aquatic Ecology**: The Project is anticipated to have adverse residual effects on aquatic ecology (due to permanent alteration of fish habitat and the death of fish during flood and post-flood operations). During the diversion of flood water from Elbow River to the off-stream reservoir, fish, at any of their lifestages present, would encounter the diversion structure. This could result in the entrainment of up to 80% of the fish (based on that percentage of volume flow diversion during the design flood) that are upstream and near the diversion structure or being swept downstream during flooding. Increased mortality from water quality is not considered to cause significant effects because the change in water quality is not anticipated to cause acute or chronic toxicity or change the trophic status of Elbow River or Glenmore Reservoir. The Community of Harmony development is located outside the RAA (the Elbow River watershed) defined for aquatic ecology. Therefore, no pathway for cumulative effects are anticipated. Potential upgrades to Highways 1,8, and 22 would occur within the RAA. However, these projects will implement standard industry mitigation and best management (Section 6.6). Therefore, residual effects on aquatic ecology because of permanent alteration of fish habitat are not anticipated.
- **Terrain and Soils**: The Project is anticipated to have adverse residual effects on terrain stability, soil quality and soil quantity during flood and post-flood operations. Detailed construction schedules are not available for the Community of Harmony and the upgrades to Highway 1, 8 and 22; therefore, it is conservatively assumed that construction may still be occurring in 2022, at the same time as flood and post-flood operations. Reservoir draining has the potential to affect terrain stability along channel banks within the off-stream reservoir. During release of reservoir water, the low-level outlet channel would be subject to a major shift in stream flow regime that could destabilize stream banks. Similar effects on terrain would not be expected from the residential development of the Community of Harmony or highway upgrades. Therefore, there is no pathway for cumulative effects with the Project. The cumulative effects to LCC (i.e., loss of agricultural land) from the Project and the Community of Harmony and highway upgrades is addressed under dry operations, Section 8.4. No additional effects during flood and post-flood operations on LCC are expected because the land use during operations will be non-agricultural. In the absence of effects to LCC during flood and post-flood operations, there is no pathway for cumulative effects.
- **Vegetation and Wetlands**: The Project is anticipated to have adverse residual effects on vegetation and wetlands during flood and post-flood operations. The cumulative effects of future physical activities and the Project on vegetation and wetlands have been assessed in Section 8.4 for construction and dry operations. Additional changes from the other activities during a flood are not anticipated and their contribution has already been accounted for at baseline. At flood and post-flood operations, baseline conditions include permanent structures of the Project (i.e., dry operations) and all future project developments as new permanent loss of habitat in the RAA, and floods as temporary inundation (i.e., inaccessible) and/or alteration of habitat. As such, change from baseline in the RAA will only be from floods.

- **Wildlife and Biodiversity (including Migratory Birds and Species at Risk)**: The Project is anticipated to have adverse, short term effects on wildlife during flood and post-flood operations. These include temporary reduction in habitat availability (i.e., inaccessible habitat), some alteration in habitat from sedimentation, temporary disruption to movement, and a temporary increase in mortality risk for certain species. The effects would be primarily limited to the LAA and would be reversible. At flood and post-flood operations, the cumulative change in habitat considers baseline conditions as permanent structures of the Project (i.e., dry operations) and all future project developments as new permanent loss of habitat in the RAA, and floods as temporary inundation (i.e., inaccessible) and/or alteration of habitat. As such, change from baseline in the RAA will only be from floods. Because construction on other projects may still occur at the time of a flood, the Community of Harmony and the upgrades to Highway 1, 8 and 22 also have potential to act cumulatively with changes in movement and mortality risk to wildlife during flood and post-flood operations. Mitigation recommended for change in habitat will reduce residual effects of the Project (Section 6.9). Highway upgrades and construction at the Community of Harmony would be expected to implement industry-standard mitigation measures to reduce potential effects on wildlife habitat in the RAA. The project contribution to cumulative changes to wildlife habitat, movement and mortality risk are minor, given the duration and temporary nature of flood and post-flood operations. The Project's contribution to cumulative effects during flood and post-flood operations is not expected to result in a change to the long-term sustainability of wildlife in the RAA.
- **Land Use Management:** The upgrades to Highways 1, 8 and 22 occur within the RAA defined for land use and management. However cumulative effects on land use and management are not anticipated to result from these activities because the upgrades to Highway 1, 8 and 22 would be expected to occur within the existing right of way and would, therefore, not result in changes to current land use. During flood and post-flood operations there would be an incremental change to land use and management. However, additional changes from the other activities during a flood are not anticipated and their contribution has already been accounted for in construction and dry operations. In the absence of additional effects from other activities during flood and post-flood operations, there is no pathway for cumulative effects.

- **Traditional Land and Resource Use**: Detailed construction schedules are not available for the Community of Harmony and the upgrades to Highway 1, 8 and 22. Therefore, it is conservatively assumed that construction may still be occurring in 2022, at the same time as when the Project first becomes operational to mitigate floods in the Elbow River. During flood and post-flood operations, low magnitude residual effects on access to traditional resources or areas are anticipated; however, additional changes from other future activities during a flood are not anticipated and their contribution has already been accounted for in construction and dry operations. In the absence of additional effects from other future activities during flood and post-flood operations, there is no pathway for cumulative effects on access to traditional resources or areas for current use. Adverse residual effects on current use sites and areas from the Project are limited to the PDA and therefore are not anticipated to act cumulatively with the residual effects of future developments in the TLRU RAA. No specific recommendations or mitigation regarding cumulative effects on the availability of traditional resources for current use were identified by Indigenous groups in the TUS reports or through the results of the Indigenous engagement program.
- **Public Health**: The Project has the potential to have adverse residual effects on public health. The potential health concerns include the inhalation of fine particulate matter in the initial 6-month period of the post-flood phase. Wind erosion of dry sediments in the dry reservoir may cause wind-blown dust with fine particulate matter that people can inhale. Mitigation measures such as applying tackifiers (i.e., a sprayable erosion control product that bonds with the soil surface and creates a porous and absorbent erosion resistant blanket, lasting up to 12 months) can effectively reduce fine particulate matter to negligible levels in the air. There is also the concern that naturally occurring inorganic mercury in the flooded reservoir could be converted into methylmercury, and accumulate up the aquatic food chain. These health concerns were determined to be not significant during the flood and post-flood phases of the Project. There are no projects that act cumulatively with the Project as they relate to public health, since there are no significant changes to human health from inhalation of fine particulate matter. The listed projects in Table 7-1 and physical activities are also not associated with the production or emission of methylmercury in the terrestrial or aquatic environment, and would have no influence on methylmercury in the food chain. Consequently, there is no pathway for cumulative effects with the Project during flood and post-flood operations.

- **Infrastructure and Services**: During a flood and post flood operations, there would be an incremental change to transportation infrastructure and services from the Project; however, additional changes from the other activities during a flood are not anticipated. Should upgrades to Highways 1,8 or 22 or construction at the Community of Harmony occur at the same time as a flood, then the potential exists for a cumulative effect to the disruption of local traffic. Mitigation measures to reduce the Project's effects on transportation infrastructure and services during flood and post-flood operations are detailed in Section 6.14. Alberta Transportation will be responsible for any upgrades to Highways 1, 8 and 22 and will, therefore, coordinate traffic management in the event of a flood. Alberta Transportation will also coordinate with Rocky View County. In the absence of additional effects from the other activities during flood and post flood operations, there is no pathway for cumulative effects.

7.6 CUMULATIVE EFFECTS ASSESSMENT SUMMARY

Table 7-2 summarizes the significance conclusions of Project contribution to cumulative effects for each assessed VC and each scenario. Valued components that show "no interactions" have no cumulative interactions and so no further detailed assessment is done. Valued components showing "not assessed" were not assessed for cumulative effects at all for that scenario.

Valued components not assessed in any way for cumulative effects (and so do not appear in the table) are acoustics, employment and economy, historical resources, as identified in Section 8.2.1.3.

Table 7-2 Significance Conclusions for Project Contribution to Cumulative Effects

Valued Component	Construction and Dry Operations	Flood and Post-flood
Air quality and climate	not significant	not significant
Hydrogeology	no interactions	no interactions
Hydrology	not assessed	no interactions
Surface water quality	no interactions	no interactions
Aquatic ecology	not significant	no interactions
Terrain and soils	not significant	no interactions
Vegetation and wetlands	not significant	not significant
Wildlife and biodiversity	not significant	not significant
Land use management	not significant	no interactions
Traditional land and resource use	not significant	not significant
Public health	no interactions	no interactions
Infrastructure and services	not significant	not significant

Proposed mitigation for residual effects from the Project for all assessed VCs is adequate to mitigate potential Project contribution to cumulative effects.

A significance conclusion for overall cumulative effects, which is the effects from all possible sources (i.e., projects and physical activities) on VCs is not provided because, given the regional context discussed in Section 8.1, such a conclusion would not be meaningful. The existing region is no longer largely reflective of dominant retention of natural post-glacial natural values; instead, it is an extensively transformed landscape by purposeful intent over more than one hundred years of settlement and development. All lands are zoned to accept and manage either human land use or natural values. The Project contributes not at all or minimally so to a change locally or to the overall state of the region (i.e., the overall cumulative effect) during its multiple decades of operational readiness. The one unique exception is that the Project's intent by design, and for a relatively brief period of time, is a positive effect by reducing the outcomes of a major natural flood on some of the human and natural values in that region.

8.0 PROPOSED FOLLOW-UP AND MONITORING PROGRAMS

The proposed preliminary environmental follow-up and monitoring programs for the Springbank Off-stream Reservoir Project are outlined described below. Final follow-up and monitoring plans will rely on approval conditions (both provincial and federal), future refinement of Project planning, and the results of ongoing consultation with Indigenous groups and stakeholders. Final follow-up and monitoring plans will include guidelines for preparing monitoring reports (number, content, frequency and format). If the Project is approved, Alberta Transportation will follow government procurement policies and procedure with respect to labour, and goods and services. Alberta Transportation is willing to discuss possible monitoring opportunities with Indigenous groups.

- **Air Quality and Climate**: Monitoring will be implemented, in conjunction with emissions mitigation, to provide understanding of meteorological conditions, and off-site concentrations, and determine whether the need for more rigorous mitigation is needed. Monitoring will include visual observation of increased particulate matter and dust and the installation and operation of an environmental beta attenuation monitor (EBAM) to measure ambient $PM_{2.5}$ and TSP concentrations. During the construction phase, the monitoring equipment will be placed at two locations along the road between the diversion channel excavation work and the dam construction site. Monitoring equipment will also be placed adjacent to the borrow source, if it is used. The exact locations of the monitoring stations will be determined following the detailed construction plan developed by the construction contractor. Monitoring will be continuous, and results will be reported to the environmental inspector during the construction phase who will pass them on to the Alberta Transportation Provincial Environmental Coordinator who would initiate action. During the post-flood operations, particulate monitoring sites will be established at locations based on the presence of dry surfaces and expected paths of wind-blown materials. During the post-flood operations, results will go to the Environmental Coordinator for Alberta Environment and Parks, the Project operator.
- **Acoustic Environment**: Continuous sound level monitoring will be conducted at specific active construction sites. The monitoring equipment will be positioned at the nearest receptor(s) to the construction activity. The noise levels will be recorded. Alberta Transportation will establish a call-in number for noise complaints and notify residents in the local assessment area of this number. If complaints are received, noise level information will be provided to the complainant and whether or not Health Canada or World Health Organization guidelines are exceeded. All complaints will be addressed by Alberta Transportation's Environmental Coordinator. Mitigation measures, which may include the use of sound barriers or adjustment of construction timing, will be implemented.

- **Hydrogeology**: To monitor for potential effects to groundwater, a selection of domestic water wells outside the project footprint but within the LAA will be sampled during dry operations and as soon as practical following a diverted flood. The location of the water wells will be determined based on those sites sampled for the hydrogeological baseline study and with the permission of the well owners. Data collected will include water level and a broad suite of analytical parameters that were analyzed for the groundwater baseline conditions. These parameters include routine major ions, dissolved metals, nutrients, various organic parameters including benzene, toluene, ethylbenzene, xylenes (BTEX) and F1 to F2 fraction hydrocarbons, and bacteriological parameters. Results of the groundwater analysis will be reviewed by AEP. Changes in water quality that cause constituents to exceed Canadian Drinking Water Quality Guidelines will be further investigated and a remediation plan developed.
- **Hydrology**: Following a flood where water is diverted from the Elbow River, channel morphology studies will be implemented on the Elbow River and outlet channel. LiDAR mapping and instream observations of the river and low-level outlet channel will be completed prior to release of water from the reservoir and after such a release. The results will be analyzed and compared to modelling results and be provided to AEP and to DFO. Suspended sediment levels will be monitored following a flood. This will include suspended sediment levels in the Elbow River following the flood but prior to release of water from the reservoir and following release of the water. The results will be provided to AEP, to DFO and to the City of Calgary.
- **Surface Water Quality**: Suspended sediment concentrations will be monitored upstream and downstream of instream construction activities to identify potential sediment-related effects from construction. Monitoring will include daily visual inspections for signs of sediment influx. If such occurrences are noted, the source of the sediment will be investigated by the environmental inspector and actions to prevent further influx will be implemented. Mitigation measures would include those from Alberta Transportation's Erosion and Sediment Control Manual, and those listed in Section 7.5.2.

- **Aquatic Ecology**: During construction, turbidity monitoring will be conducted following Alberta Transportation's Special Provision on Turbidity. Compliance monitoring will include regular monitoring of sediment and erosion control measures to reduce potential effects on the aquatic environment. After construction is complete, an as-built survey will be conducted to measure the final footprint of the Project in fish habitat. During dry operations, follow-up and monitoring will include monitoring of vegetation re-growth and reclamation and effectiveness of post-construction sediment and erosion controls, including erosion on ditches, slopes, and watercourse banks. Dry operations monitoring will also include an assessment of fish passage over the diversion structure. Details of fish passage success criterial will be developed with regulatory agencies. A post-construction report will be provided to DFO at the completion of construction that will outline the as-built condition of the offsetting measures. Monitoring will be undertaken in the reservoir using a number of different approaches dependent upon conditions; for example, use of a drone to identify isolated pools, by crews in shallow draft boats (airboats, light rafts with oars and jet motor, kayaks), or by crews on foot if the depth and substrate conditions are safe to wade in. Isolated pools will be identified, marked, and a determination with Qualified Aquatic Environmental Specialists (QAES) will be made as to whether there are stranded fish in the pool that require rescue and relocation to secure habitats in the Elbow River. When the water has been fully drained, the low-level outlet channel will also be surveyed to identify isolated pools where fish might be stranded. In the case that fish are identified in the pools, a fish rescue contingency plan will be initiated. Fish rescues in isolated pools will be undertaken using seine nets, minnow traps, and backpack electrofishing, or with tote barge or boat based electrofishing if the pool is too deep to wade safely. The fish rescue would be deemed successful if rescue efforts no longer result in captured fish, or the pool is dry and fish are not observed.
- **Terrain and Soils**: The Terrain and Soils follow-up program will consist of erosion and sediment monitoring which will be developed as part of the construction contractor's permanent erosion and sediment control plan for the project, required under Alberta Transportation's Erosion and Sediment Control Manual.
- **Vegetation and Wetlands**: Monitoring during construction will be the responsibility of the contractor and included as part of the Project-specific ECO plan. Such monitoring includes inspection that topsoil stripping and soil storage follows the procedures proposed in Section 7.7.2. Soil monitoring will focus on compaction, erosion and areas of poor vegetation growth. Deficiencies identified during monitoring inspections will be addressed by applying supplementary mitigation measures, such as hydroseeding and the application of tackifiers in areas that may be at risk of wind erosion. Following a flood which results in the diversion of water to the reservoir, and after the draining of the reservoir, the area covered with sediment may be sprayed with surfactants to reduce the effects of wind erosion.

- **Wildlife and Biodiversity (including Migratory Birds and Species at Risk)**: Prior to construction, surveys will be conducted to identify key habitat and habitat features (e.g., wetlands, bird nests) for SOMC that might require mitigation. If such features are discovered and the RAP cannot be avoided, site-specific mitigation will be developed, and appropriate setback distances will be applied. A remote camera program will be designed in consultation with AEP, to identify whether the diversion channel acts as a barrier to wildlife movement during dry operations, especially for ungulates, and determine the effectiveness of mitigation implemented throughout the diversion channel.
- **Land Use Management**: Land users in the LAA may be affected by temporary changes to access and nuisance noise, light, and air emissions during construction. However, these effects are limited to the construction phase or shorter. Land users in the LAA are not anticipated to be affected during dry operations. Access to areas in the PDA and to the LAA would be affected by 1:100 year and design floods because Springbank Road is anticipated to be flooded by these events. Post-flood operation includes repair of Springbank Road and cleanup and repair, as necessary, in the project area. Given the sort-term nature and non-significance of the effects, no follow-up or monitoring is proposed for land use and management.
- **Historical Resources**: Additional studies will address the following locations: Gap areas requiring assessment: NE 10-24-4 W5 (diversion channel), NW 10-24-4-W5M (diversion channel), E 1/2 15-24-4 W5M (diversion channel), and 4, 5 & 12-23- 24-4 W5M (Highway 22); and a deep testing program in areas of significant sedimentation. Backhoe testing for legal locations 18 & 19-24-3 W5M (reservoir and low-level outlet channel), NW 13-24-4 W5M (reservoir and dam), SE 15-24-4 W5M (diversion channel), 24-24-4 W5M (reservoir), and SE 27-24-24-W5M (reservoir). Results of the follow-up and monitoring program and will be submitted to ACT. Additional paleontology studies will consist of a construction monitoring program and deep testing program, to be conducted wherever at least 4 m of bedrock will be excavated (including diversion inlet and emergency spillway, or off-stream reservoir in conjunction with archaeological studies).
- **Traditional Land and Resource Use**: The Project is to be located on what is currently private land. Access to most of the area will be restricted once the Project is constructed. No follow-up or monitoring is proposed with respect to traditional land and resource use beyond what has been identified in other sections, such as wildlife and public health.
- **Public Health**: Follow-up and monitoring with respect to public health is associated with follow-up and monitoring for air quality, acoustic environment and water quality. Issues identified in those programs that affect public health will be addressed.
- **Infrastructure and Services**: Flood and post-flood operations during a design flood would affect existing roadways, but residual adverse effects on transportation infrastructure and services are predicted to be not significant. Given the low magnitude and non-significance of the effects on Infrastructure and Services, no follow-up or monitoring is proposed.

- **Employment and Economy**: The Project would not materially affect labour supply and demand in the LAA during construction or dry operations because the available labour force greatly exceeds the workforce requirements. The Project is expected to have a largely beneficial effect on commercial businesses operating in the LAA because of opportunities associated with project spending. While there is potential for adverse effects due to competition for available labour and cost of labour supply; however, because of the large available workforce in the LAA, this effect is predicted to be negligible. The Project is predicted to have a beneficial effect on the provincial economy as a result of increased GDP and government revenue associated with construction expenditure. The Project will have a net economic benefit during post-flood operations compared to there be no Project. No follow-up or monitoring is for employment and economy.
- **Cumulative Effects**: Alberta Transportation has committed to a wide range of mitigation measures and follow-up programs to address residual environmental effects identified in Section 7 and in the above sections. Many of these measures will also assist in reducing the Project's contribution to cumulative environmental effects. As noted in Section 8.6, no significant cumulative environmental effects are predicted for the Project and, in the majority of cases, Project contributions to cumulative effects are low. Alberta Transportation is responsible for mitigating and monitoring the effects of the Project; however, AT is not responsible for monitoring impacts of future projects and activities of other proponents or the impacts of future government regulatory initiatives on regional development.

8.1 COMPLIANCE MONITIORING

Alberta Transportation has an EMS that will be applied to the Springbank Off-stream Reservoir Project. The EMS includes standard environmental monitoring and requires an ECO Plan to be developed by the selected construction contractor using Alberta Transportation's ECO Plan framework (Volume 4, Supporting Documents), which is a joint document prepared by Alberta Transportation, the City of Calgary, and the City of Edmonton.

The ECO Plan is a project-specific plan that identifies and mitigates the potential environmental effects of construction, which will include the mitigation measures detailed in the EIA and listed in Table C-1, and Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects*. The selected construction contractor will be responsible for preparing the ECO Plan specific to the work and the Project site. Alberta Transportation and the Construction Management Consultant will review and approve the ECO Plan before construction begins. The selected construction contractor will ensure the effective implementation of the approved ECO Plan, including the mitigation measures listed for each VC in Section 7.

Implementation of mitigation measures will be triggered by the requirements and processes as detailed in Alberta Transportation's signed and executed Project construction contract documents. The selected contractor will be responsible for carrying out the mitigation measures required during the construction phase of the Project as detailed in the contract specifications. The owner and operator, AEP, will be responsible for the mitigation measures required for the flood and post-flood phases of the Project. Flood and post-flood mitigation measures will be detailed in the project specific Operations, Maintenance and Surveillance Manual which will be prepared in compliance with Alberta Transportation's Project construction contract specifications and as per the ECO Plan Framework and Checklist.

Alberta Transportation will delegate responsibility to its retained Consultant with the task of monitoring and inspecting the contractor's activities to ensure compliance with commitments, policies, auditing and enforcement programs. Consultant inspectors will be on site during all construction activities and expert personnel, such as QAES, will be present to monitor and inspect the contractor's activities and to ensure compliance. Mitigation measures will be inspected daily and any non-compliance issues will be immediately addressed with the contractor and, if required, will be reported to the appropriate Regulatory Agency. The non-compliance activity will be stopped and will not be allowed to recommence until compliance is achieved.

Alberta Transportation also maintains an ECO Plan Audit Program and conducts yearly audits of active projects to ensure conformance to the ECO Plan Framework and Project commitments. As the operator of the Project, Alberta Environment and Parks will be provided an operation, maintenance and surveillance plan developed by Alberta Transportation for the operation of the Project.

9.0 CONCLUSION

The purpose of the Project is to help reduce the effects of future extreme floods on infrastructure, watercourses, and people in the City of Calgary and downstream communities, including the northeast part of the Tsuut'ina Reserve. Subject to regulatory approvals, the Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood) for floods starting in the spring of 2021, and be completely constructed (able to accommodate the design flood) for the spring of 2022. Any delay in Project approval or land acquisition beyond the end of 2018 will delay the construction of the Project and the ability to mitigate floods in 2021 or beyond.

The EIA/EIS assessed the potential changes to the environment as a result of the Project, and determined that, with the implementation of the proposed commitments and mitigation measures, adverse residual environmental effects of Project-related construction and operation are predicted to be not significant for all VCs. No significant cumulative effects were predicted for any VC.

Attachment A PUBLIC ENGAGEMENT ISSUES AND CONCERNS TABLE

Attachment A Public Engagement Issues and Concerns Table
March 2018

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Public Engagement	
Concerns were expressed about a lack of transparency between Alberta Transportation and the public regarding Project details and Project costs.	Alberta Transportation has been engaged with the public on SR1 since the fall of 2014 including providing Project information, holding public meetings and open houses and responding to issues and concerns. Engagement activities have included three facilitated presentations to affected landowners, ten public Open Houses, over 40 meetings with affected landowners and organized stakeholder groups and ongoing meetings with Rocky View County and the City of Calgary.
A concern was raised about the Government of Alberta not progressing fast enough with the construction of the Project and was not fulfilling the mandate that was meant to protect public interests.	The Project has been progressing through the provincial and federal environmental assessment and regulatory processes. The construction of SR1 will commence once provincial and federal approvals for the Project are obtained.
Project Alternatives (see Volume 1, Section 2 and Volume 4, Supporting Documentation)	
The McLean Creek Dam (MC1) is a favorable alternative as it is on crown land instead of private land that was prime for development; MC1 would be less disruptive to landowners. Why was SR1 favored over the McLean Creek Dam? SR1 was supported as the preferred location for the Project as the land affected was not environmentally pristine, the likelihood of effects were small, the potential effects were reversible, and a small number of people were directly affected. A preference has been stated for the McLean Creek Dam option because it provides flood protection for Bragg Creek, Redwood Meadows and Tsuut'ina Nation.	The SR1 Project has gone through a rigorous selection process as detailed and described in Volume 1, Section 2.2.1. An assessment of the McLean Creek option was included as part of the Project Location Alternatives assessment in the EIA/EIS (Volume 1, Section 3, Volume 4, Supporting Documentation). AT is applying for the SR1 Project. SR1 is the preferred option for environmental, technical, economic and timing reasons.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Why has the City of Calgary not considered berms as a Project alternative?	Berms or barriers were not considered viable because of the cost and the size and scale of the barrier structures that would be needed to contain a flood of the magnitude of the 2013 flood event. Barriers with a height of up to 6 metres would be required on both sides of the Elbow River along its entire length downstream of Glenmore dam. See City of Calgary Water Services Bulletin August 2017.
Why has the government not considered using the SR1 budget to acquire houses that were at risk of flooding - acquiring houses would have no environmental impact.	To mitigate the extent of flooding that occurred in 2013 would require the purchase and demolition of a vast number of homes, businesses and facilities within the City of Calgary's downtown core and along the river valley. This would also require the removal and relocation of roads and public transportation systems. At a conservative estimate this cost could total in the tens of billions of dollars.
Why was the third flood mitigation, the tunnel from the Glenmore Reservoir to the Bow River not chosen?	This was not a viable option due to the high costs.
Tri-River Joint Reservoir of Alberta would be preferable for water storage, hydroelectric power, and recreation.	Many flood mitigation projects, including the Tri-River Joint Reservoir were investigated. SR1 was chosen as the preferred flood mitigation project. SR1 is preferred environmentally, technically, economically and for timing reasons.
SR1 does not offer flood protection for Bragg Creek. Are there any flood mitigation plans to protect Bragg Creek and Redwood Meadows?	A flood mitigation project for Bragg Creek is being funded by Alberta Government through Rocky View County. Alberta Transportation is also engaged with Tsuut'ina regarding flood mitigation for Redwood Meadows.
Did IBI Group include both primary and secondary benefits when calculating present value benefits?	The benefits were referred to as direct and indirect benefits which included components such as business intelligence and displacement.
There is a lack of factors included in the present value benefits for the McLean Creek Dam and SR1.	Monetizing certain factors caused more assumptions to be made, which increased uncertainty regarding the cost-benefit analysis.
Why does MC1 have more geotechnical issues than SR1.	MC1 has complex bedrock and buried gravel; in addition, there is thin bedrock which requires remedial work to be done.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Engineering Design and Concept (see Volume 1, Section 3)	
Does SR1 have the potential to become a wet dam? Calgary would require the water.	SR1 is designed as a dry reservoir that will temporarily store excess flood water and release it back into the Elbow River when the risk of flooding subsides. It is not designed to permanently store water.
What is the potential risk of debris in the diversion channel? There is a concern about debris blocking the reservoir channel during a flood.	There is a high risk of debris flowing into the diversion channel. The diversion structure has been designed to allow debris to pass and it is not expected to block the diversion channel.
What is the annual risk of the 2013 floods?	The annual risk for a repeat flood of the 2013 event is 0.5 percent annually or one flood about every 230 years.
Will the diversion channel be concrete?	Only parts of the channel near the diversion structure would be concrete; the rest would be earth fill berms with rip rap erosion protection. The berms will be vegetated by seeding to grass.
There is a concern about using soil from the reservoir channel to build the berm, because the clay is saturated, slippery and the berm would fail.	The material has been analyzed and it meets the requirements for construction of the dam. Construction of the dam will conform to the Canadian Dam Association Guidelines.
Why could the dam not be located further upstream, store water, and be a recreational area.	Locating a dam further upstream would lessen the catchment area that the SR1 location provides. An upstream location for a storage reservoir would be an in-stream dam that would a greater environmental impact on the river and surrounding areas.
What is the southern portion of the Project Development Area for?	The area south of the diversion structure would be used for backwater storage during a flood event.
What is the extra space in the Project Development Area for?	The land contained within the Project Development Area is necessary for the safe and efficient operation, maintenance and surveillance of the Project.
There is a possibility that the reservoir would not be able to drain in time if a series of flood events occurred.	The reservoir is designed to accommodate the probable maximum flood (which is about twice the 2013 flood). In the unlikely event of a series of floods occurring when the reservoir is at capacity, the surplus water would continue downstream of the facility.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Given the height of the bridge under Highway 1 on Range Road 40, will a school bus fit underneath?	Yes, the height of the bridge under Highway 1 on Range Road 40 is sufficient for a school bus to pass.
Air Quality (see Volume 3A and 3B, Section 3)	
Will air quality be monitored?	Air quality will be monitored during construction and after flood waters had receded.
Why is fog due to a standing body of water not being considered?	The temporary nature of standing water in the reservoir (~ 60 days at most) is not expected to result in substantive fog effects.
What tackifier would be used to suppress dust following draining of the reservoir?	There are a number of tackifiers used for erosion control and to suppress dust. The ones chosen for the Project will be determined at the time of need as to whether they are used as part of hydroseeding or only for erosion and dust control.
Hydrogeology (see Volume 3A and 3B, Section 5)	
Will wells in the Project Development Area be capped?	Yes, wells in the Project Development Area will be decommissioned and capped.
How will water pressure from the back-flood area impact the groundwater table?	The water table within the alluvial aquifer system (which is laterally confined to within the Elbow River valley) will increase with the same magnitude as the river stage elevation as the two systems are directly affected. The water table within the upland areas (above the Elbow River Valley) will not be directly affected by the backwater since this upper water table system is at a higher elevation.
Hydrology (see Volume 3A and 3B, Section 6)	
Why could the Glenmore Reservoir not be drained to accommodate future floods.	The Glenmore Reservoir is a water storage reservoir, not built for flood control. The water stored in the reservoir is to meet the water requirements for a portion of Calgary.
Building SR1 would negatively impact the meandering Elbow River.	The diversion structure, the only component of the Project in the Elbow River, would have minor effects on the meandering Elbow River.
Surface Water Quality (see Volume 3A and 3B, Section 7)	
If the sand contains Bisphenol A, its toxicity may impact to the water quality.	Bisphenol A is associated with the production of certain plastics especially for food and beverage containers. It is not expected to be in the sands deposited by the Elbow River.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
E. coli from cattle ranches could be a potential problem when the flood waters were drained.	Water from the reservoir will be tested prior to draining. Concentrations will need to meet the Alberta or CCME Water Quality Guidelines prior to release back into the Elbow River.
There is a concern about the impacts to local water wells.	Once the land is acquired by the Project, water wells located within the Project Development Area would be decommissioned. Many wells within the development area and surrounding area were sampled during the EIA preparation. Groundwater modelling showed non-adverse effects to the water wells; post construction and post flood modelling will be carried out on a selection of wells in the local assessment area.
How will the Project address the presence of deceased fish and standing water in the reservoir, as it could contaminate the drinking water.	Water from the reservoir will be tested prior to draining. Concentrations will need to meet the Alberta or CCME Water Quality Guidelines prior to release back into the Elbow River.
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
In order to maintain biodiversity, the Elbow River should be allowed to flood naturally.	SR1 is designed as a flood mitigation project. Only larger floods (1:10 year or greater) will be diverted and only those volumes that cannot be handled by the Glenmore reservoir. Biodiversity effects are expected to be negligible.
There are concerns regarding Pirmez Creek and the impact of the Project on the aquatic environment.	Pirmaz Creek is outside the Project Development Area and is on the south side of the Elbow River downstream of the diversion structure. The Project is designed to mitigate the effects of large floods on the Elbow River downstream of the diversion structure, including Pirmez Creek. The effects of the Project on the aquatic environment have been assessed as being not significant.
Terrain and Soils (see Volume 3A and 3B, Section 9)	
How will soil contamination be identified if the Project area was flooded.	Soil testing of the deposited sediment will be conducted after any flood event, if required.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
There is a concern that the land drained after a flood would not be able to support machinery for drainage control and revegetation until it dried. In the interim, this land would be vulnerable to weeds.	The use of tracked vehicles or rig mats will allow access following draining.
Vegetation and Wetlands (seeVolume 3A and 3B, Section 10)	
A weed infestation occurred following the 2013 flood which eradicated the vegetation.	Following drainage of the reservoir, exposed sediment will be monitored for weeds; revegetation, with a tackifier, if required, will be implemented as necessary.
There are concerns about 24 wetlands in the area between Springbank and the Glenmore reservoir.	The wetlands between Springbank and the Glenmore reservoir are not expected to be affected by the Project, beyond the reduction of flooding during large floods.
Land Use (see Volume 1, Section 1, Volume 3A and 3B, Section 12)	
What does the conservation zone on the future land use map designate?	Area A in the post-development land use is a conservation area with public access and opportunities for low impact recreation; it will have limited improvements beyond restoration of areas affected by Project construction.
What is the size of the Project footprint?	The Project Development Area covers approximately 3,610 acres.
What is the quantity of leased and privately-owned land in the Project area?	With the exception of the Elbow River, road allowances and a small area of land designated 'public service' near the intersection of highways 22 and 8, the Project Development Area is all privately-owned land. There is no leased land.
How will the Project affect Kamp Kiwanis? There is a concern regarding spillways for the Project that could impact access for Kamp Kiwanis.	The Kamp Kiwanis buildings were flooded during the 2013 flood event. The buildings are located outside of the Project footprint and the SR1 Project will protect them from future flooding. Access to the camp will not be affected. The existing access may be used to accommodate construction traffic and it would be a shared access with camp traffic. Any interaction between construction and public or private traffic will be controlled by the development of a "Traffic Accommodation Strategy"
What will be the effect on groundwater at Kamp Kiwanis?	The EIA examined potential effects to groundwater in the Local Assessment Area. Effects on groundwater at Kamp Kiwanis are assessed as being not significant.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
How many landowners are within the Project footprint?	There are 17 landowners within the Project footprint.
Are the pipeline alignments and the Highway 22 pipeline realignment located on public or private land?	The pipelines are on what is currently private land.
Could SR1 be used as a campsite?	There will be no public access to the Project components and the reservoir south of Springbank Road for safety and operational reasons. The area along the Elbow River will remain open to the public.
All Project lands should have public access.	If the Project is approved access will vary across the project area. • Area A is a conservation area with public access and opportunities for low impact recreation; limited improvements beyond restoration of areas affected by Project construction. • Area B is the reservoir, which will be owned and operated by AEP. The area will also be used for research on flood restoration activities, and monitoring of mitigation and environmental effects. There is limited or no public access. There is no public access for public safety and security. • Area C: has options for grazing through public leases. The land would be publicly owned and privately stewarded, with limitations on improvement to support the primary use as a reservoir. • Area D is the location of project infrastructure. There is no public access and is fenced for public safety and security. Once the Project is constructed, access will be available in Area A and indigenous groups will have the ability to access this area for traditional use purposes. There will be no public access in Areas B and D. Area C will be publicly accessible.
The Project Development Area is productive land. It should not be sterilized and could be used for grazing.	Area C in the post-development land use has the potential to be used for grazing.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Reservoirs located in other countries allow recreational use. With adequate forecasting tools, recreational areas in the Project Development Area could be safely monitored.	Access to Areas B and D is restricted for safety, liability and operational reasons.
Will landowners have use of the land for grazing during non-flood years?	The area north of Springbank Road would be potentially available for grazing during non-flood years.
What will be the loss of agricultural farming land?	The Project Development Area contains approximately 3,610 acres. The majority is grazing or hay land. Approximately 400 acres is tilled land. Approximately 850 acres north of the Springbank Road may be used for grazing.
What will happen with pipeline relocations?	Oil and gas pipelines operated by four companies (TransCanada Pipelines Ltd., Pengrowth Energy Corp., Veresen Inc., and Plains Midstream Canada) are located within the diversion channel, dam, and reservoir areas. Alberta Transportation are currently in contact with these utility owners and crossing agreements will be developed. Buried pipeline and overhead utilities will be relocated, moved or lowered as required. Prior to any soil disturbance, utility locate sweeps will be done and buried lines and pipelines will be flagged and marked. Pipeline crossings will be designed and maintained as required by the utility owners and in strict compliance with regulations. Daily hazard assessments will be conducted before work is undertaken in the vicinity of utilities. In the event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address pipeline emergency response. The implementation preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities. In the unlikely event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address and coordinate the emergency response. The implementation of preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Health and Safety (see Volume 3A and 3B, Section 15, Volume 3D, Section 1)	
There are concerns about airborne and waterborne sediments causing illness.	The human health risk assessment found there would be no unacceptable risks to human health from the Project.
There is a concern about saturation below the dam causing a potential failure.	Geotechnical conditions of the soil at the dam footprint have been used to design the dam to Canadian Dam Safety standards.
There is a concern about long grass in the reservoir being a fire hazard. How will the dry reservoir be treated to prevent fire and control weeds?	Fire is a naturally occurring phenomenon in grasslands. Fires will be responded to as with any other fire in the area.
A concern was expressed regarding the risk to downstream areas due to a rapid filling of the earthen dam.	The Project is designed as having a hazard classification of 'high' for the diversion structure and 'extreme' for the dam. The design complies with Canadian Dam Association Dam Safety Guidelines and Technical Bulletin Nos. 1 through 9, current Alberta Transportation Design Standards, relevant Alberta Transportation Design and Construction Bulletins.
Concerns were raised regarding the adverse effects of mud flats, dust and deceased animals in the reservoir following draining.	Sediments in the reservoir following draining would be moved to allow drainage. Dust suppression means will be implemented as required. If there are deceased animals in the reservoir, they will be removed as required.
Project Costs (see Volume 4, Supporting Documentation)	
Who is funding this Project?	The Government of Alberta is funding the Project.
Who would be responsible for the cost and cleanup of the land once the water was released from the reservoir?	Alberta Environment and Parks, the owner and operator of the Project, will be responsible for the operational costs, maintenance and surveillance of the Project.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns were raised about the Project cost - it did not account for the value of the land and loss of future tax and income to Rocky View County, community structure, and ranching culture.	Costs for SR1 include land acquisition costs with industry premiums applied for moving, "like for like" housing and business disruption. The loss of future taxes relates to agricultural taxes because that is the identified highest and best use. These are expected to be nominal and would be more than offset by the fact that Rocky View County would no longer be providing the previous level of services in the area of the reservoir. With regards to community structure the SR1 Project has minimal impact as the various planning documents do not identify this area for anything other than agriculture. The project displaces some ranching activity which can be readily replaced elsewhere in the County.
Forest harvesting at McLean Creek could bring in revenue to lower the Project cost of the McLean Creek Dam (MC1).	The McLean Creek Dam is actually located in the Elbow River at McLean Creek. Forest harvesting at the site would provide very little cost savings.
How will the budgeted $140 million for land acquisition be allocated?	The $140 million would be used to purchase 6,800 acres.
Was the Highway 22 right of way included in the budget for $21 million.	Yes, the Highway 22 right-of-way was included in the cost.
Why were the cost of the berms in Bragg Creek not included in the McLean Creek Dam cost analysis? The costs of Bragg Creek's berms and potential increases of road kill, animal control, and healthcare services were not accounted for in the Project budget.	The Bragg Creek flood mitigation work is a stand-alone project that has been independently assessed and as such it is not a cost consideration that should be included the MC1 cost analysis. The Bragg Creek flood mitigation work will be completed ahead of SR1.
Costs for SR1 should include the costs to upgrade the Glenmore Reservoir and include the costs for flood mitigation to the Bragg Creek and Redwood Meadows areas.	Flood mitigation projects for Bragg Creek and Redwood Meadows are separate projects and will be proceeding on their own merits and timelines; therefore, their costs are not included in the budget for SR1.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Land Acquisition	
Will the land acquisition be forced?	It is Alberta Transportation intention to negotiate with landowners to purchase the lands.
How is the cost for land procurement determined? Will land purchased by the Alberta Government be sold back to developers?	Land will be evaluated at fair current market value. Land purchased surplus to requirements for the construction, operation and maintenance of the Project, may be resold by Alberta Transportation.
Why is Alberta Transportation purchasing the land in the Project area instead of creating an easement?	Construction, operation and maintenance of a reservoir project such as SR1 requires total ownership and control of the Project footprint lands to allow effective and safe operation of the infrastructure. Alberta Transportation's ownership secures the land and the infrastructure for its intended use.
How were the compensation amounts for land purchases determined?	The land value assessments are based on the IBI Group "Benefit/Cost Analysis of Flood Mitigation Projects for The City of Calgary and Environs on the Elbow River with Emphasis on MC1 and SR1" see Volume 4 Appendix I of the EIA/EIS.
It is unfair for Alberta Transportation to purchase landowner property only to sell it back to developers.	Some landowners have requested to have the option of Alberta Transportation purchasing the full parcels (quarters) where the Project's footprint bisects the parcel. Land purchased surplus to requirements for the construction, operation and maintenance of the Project, will be resold by Alberta Transportation.
General	
There is a concern about Springbank Road being closed for an extended period.	Springbank road could be closed for less than 60 days following a 1:50 year or greater flood. Access would still be provided via Range Road 40 and Township Road 250.
The removal of heritage land and ranch land from local families is a social issue.	Acquisition of the land is needed for the Project. It is indeed a social issue and Alberta Transportation is very sympathetic to the impact the loss of the land will have on the landowners. However, there is $1.6 billion dollars at risk in the City of Calgary in the event of a 2013 flood occurring again. Up to 88,000 people were evacuated and thousands of homes and business were severely damaged as a result of the 2013 flood.
There is concern about the welfare of the landowners and the impact of the Project on their lifestyle.	Alberta Transportation is very sympathetic to the impact the loss of the land will have on the landowners.

Table A-1 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
Will the Project footprint resemble an industrial site?	No, the Project footprint would blend into the existing topography with much of the dam, berm and spillways being covered with topsoil and seeded to grass.
What will the dam look like from the nearby roads?	The dam would be terraced, earthen, and might look like a unique hill.
How will the accumulation of sediment and debris after a flood occurred be managed?	Earth moving equipment will be used if necessary to maintain drainage if sediment and debris block the drainage channels within the reservoir basin.
When will the Project be operational?	Subject to regulatory approval, the current timeline shows the Project will be functionally operational and able to accommodate a 1:100 year flood event by fall 2020 and will achieve final completion and be able to accommodate water volumes equal to the 2013 flood event by early 2022
Why are there no drought mitigations considered?	SR1 is designed as a flood mitigation project; not a drought mitigation project.

Attachment B INDIGENOUS ENGAGEMENT ISSUES AND CONCERNS TABLES

Table B-1 Ermineskin Cree Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Engagement	
Transportation has not made adequate efforts to obtain information about: an assessment of country foods relied upon by the Ermineskin Cree Nation; traditional territory of Ermineskin Cree Nation; impacts to drinking water and recreational waters by Ermineskin Cree Nation; and potential health and socio-economic effects of the project on Ermineskin Cree Nation.	Following CEAA'S non conformancy review revisions to the EIA/EIS were underway to address regulator comments. In December 2017 AT was looking for feedback from the Ermineskin Cree Nation on the TLRU sections. As the TLRU was updated in early February, a revised TLRU section was sent to Ermineskin Cree Nation on February 5th and AT requested feedback on that document. AT offered a workshop with Ermineskin Cree Nation to better understand how the project potentially impacts Ermineskin Cree Nation. No response was received. The potential effects to country foods, drinking water and health have been assessed within the EIA/EIS, and were included in the revised TLRU section sent on February 5th. Effects to socioeconomic conditions have been included in this EIA/EIS. Any information provided by the Ermineskin Cree Nation has been included within the assessment.
Request clarification as to why Ermineskin Cree Nation is being asked for comments on the EIA, given that the EIA does not conform to the EIS guidelines. Information cannot be provided in the time frame given. Request Transportation's timeline for amending the EIA.	Following CEAA'S non conformancy review revisions to the EIA/EIS were underway to address regulator comments. In December 2017 AT was looking for feedback from the Ermineskin Cree Nation on the TLRU sections. As the TLRU was updated in early February, a revised TLRU section was sent to Ermineskin Cree Nation on February 5th and AT requested feedback on that document. AT offered a workshop with Ermineskin Cree Nation to better understand how the project potentially impacts Ermineskin Cree Nation and is awaiting a response. Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1st in order to meet a resubmission date of end March 2018. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
Request sufficient time and resources to provide additional information regarding other areas of non-conformity.	Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Ermineskin Cree Nation with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Ermineskin Cree Nation and to provide responses to the concerns raised to date, and is awaiting a response.

Table B-1 Ermineskin Cree Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
Ermineskin indicated they would like to tour the SR1 lands and potentially undertake a Traditional Land Use and Traditional Ecological Study.	AT has requested a budget from Ermineskin Cree Nation to undertake a site visit and a traditional land use/traditional ecological study. AT offered a workshop with Ermineskin Cree Nation and is awaiting a response.
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Loss of medicinal plants.	Vegetation will be cleared from the project development area during construction. However, effects of the Project are not anticipated to result in the loss of traditionally used species in the local assessment area. The effects on plants and traditional use are assessed in the EIA in Volume 3A and 3B, sections 10 and 14. AT would provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction
Wildlife (see Volume 3A and 3B, Section 11)	
Concerns expressed for eagle nesting in the area, other wildlife (ungulates) such as elk, moose, deer and bears	Several raptor stick and platform nests were observed in the LAA, including an active bald eagle stick nest along the Elbow River. This nest occurs in the construction area near the off-stream dam and low-level outlet. If an active nest or den is found during construction, it will be subject to a provincial or federal disturbance setback buffer and site-specific mitigation. Details of setback distances for species of management concern with potential to occur in the project development area are provided in the EIA Volume 3A, section 11.
Maintaining the migratory patterns and game trails for wildlife.	Although the Project would result in additional anthropogenic features on the landscape that might hinder wildlife movement in the local assessment area, Alberta Transportation (AT) has made adjustments to accommodate wildlife movement such as revegetating the floodplain berm with materials conducive for ungulate movement. The EIA concluded that the project residual effects on wildlife movement are unlikely to pose a long-term threat to the persistence or viability of a wildlife species, including species at risk (EIA, Volume 3A and 3B section 11).

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Engagement	
Blood Tribe stated that access was not provided to areas the Blood Tribe wanted to visit.	Alberta Transportation approved all the Kainai First Nation budgets for site visits to SR1 and facilitated access to private lands with landowners on all properties the Kainai First Nation requested. Nation members visited the site on 13 days. All areas that Kainai First Nation requested access to were arranged and facilitated by AT.
Concern that the Blood Tribe was not notified about upcoming public open houses on the SR1 project. Stated that public open houses were not part of Consultation.	Notification of the Public Open Houses/Information Sessions for SR1 was provided to the Kainai First Nation prior to the various information sessions as a courtesy and that notification clearly stated that they were not as part of the consultation with the Kainai First Nation ongoing for the SR1 Project.
Expressed concerns that the CEAA tour of the SR1 lands was from the public road allowances, rather than seeing First Nation heritage sites and hearing from First Nations about their use of the lands.	The tour in question was a tour arranged by CEAA on 19 Sept 2017. Indigenous groups were invited to participate by CEAA. CEAA requested that AT facilitate the tour. At the time of the tour, private land access was not available to all areas of the project development area (PDA).
Request clarification as to why Kanai First Nation is being asked for comments on the EIA, given that the EIA does not conform to the EIS guidelines. Information cannot be provided in the time frame given. Request AT's timeline for amending the EIA.	Following CEAA's non conformancy review revisions to the EIA/EIS were underway to address regulator comments. In December 2017, AT was looking for feedback from the Kainai First Nation on the TLRU sections. As the TLRU was updated in early February, a revised draft TLRU section was sent to Kainai First Nation on February 5th, 2018 and AT requested feedback on that document. AT offered a workshop with Kainai First Nation to better understand how the project potentially impacts Kainai First Nation and is awaiting on a suitable date to meet. Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1st in order to meet a resubmission date of end March 2018. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
Transportation has not made adequate efforts to obtain information about: an assessment of country foods relied upon by the Kanai First Nation; traditional territory of Kanai First Nation; impacts to drinking water and recreational waters by Kanai First Nation; and potential health and socio-economic effects of the project on Kainai First Nation	AT has been engaged with the Indigenous groups since 2014 to understand how the Project potentially impacts rights, interests and traditional uses including offering and funding site visits and TUS studies. AT funded and provided the opportunity for the Kainai First Nation to visit the site. Nation members visited the site on 13 days. An interim TUS report was delivered by the Kainai First Nation in March 2017. The TUS study was used in the environmental impact assessment (EIA). However, Permission to use the spatial information from the TUS study has not been received by AT, therefore the information regarding sites and areas has been generalized for use in the EIA and exact locations, including those in the project development area, are not provided. The potential effects to country foods, drinking water and health have been assessed within the EIA, and were included in the draft TLRU section (Volumes 3A and 3B) sent to Kainai First Nation for review and comment on February 5th. Effects to socioeconomic conditions have been included in this EIA/EIS. AT offered a workshop with Kainai First Nation to better understand how the project potentially impacts Kainai First Nation and is awaiting on a suitable date to meet.
Request time to provide a report outlining Kanai First Nation's use of the project area.	An interim TUS report was delivered by the Kainai First Nation in March 2017. The TUS study was used in the environmental impact assessment (EIA). However, Permission to use the spatial information from the TUS study has not been received by AT, therefore the information regarding sites and areas has been generalized for use in the EIA and exact locations, including those in the project development area, are not provided.

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Request sufficient time and resources to provide additional information regarding other areas of non-conformity.	Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further Indigenous engagement activities. The draft TLRU section (Volumes 3A and 3B) sent to Kainai First Nation for review and comment on February 5th. Feedback was requested by March 1st in order to meet a resubmission date of end March 2018. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
The Kainai First Nation questioned the additional indigenous groups that had been included in the CEAA guidelines, as historically this area was Blackfoot territory.	The list of Indigenous groups required for engagement on the Project was provided to AT by the Canadian Environmental Assessment Agency (CEAA).
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Kainai First Nation request impact information on fish and fish habitat resulting from the SR-1 project	The Project will result in the permanent loss of 1,854 m^2 fish habitat at the diversion structure. This area has been identified as suitable foraging habitat for trout including, mountain whitefish, brown trout and rainbow trout. The area that will be lost is small compared to the habitat available within the local assessment area, which is approximately 3,100,000 m^2. Given the limited extent of the habitat affected impacts to fish and fish habitat are predicted to be not significant. The assessment of effects to fish and fish habitat are provided in the EIA Volumes 3A and 3B, section 8.
Kainai First Nation request information on how the design of the SR-1 is being done to ensure during a flood/drain event that the mortality of fish is limited.	After a flood, the water flows in the diversion channel will be gradually reduced and the reservoir slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be graded to reduce stranding of fish during release of stored flood water from the reservoir. During draining of the reservoir, monitoring will be undertaken to identify isolated pools and the potential that fish may become stranded. If potential fish stranding is identified, a fish rescue program will be undertaken to return the fish to the river.

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Concerns expressed related to the protection of off-river sloughs as animals and fish in and around the Elbow River rely on the sloughs.	The Project would result in the loss of 8 ha of estimated high value wetland area and 13 ha of moderate wetland area in the local assessment area. Approximately 312 ha of the local assessment area contains wetland cover types No vegetation and wetland land units are completely lost, and therefore no significant effects on vegetation and wetlands are predicted. *Water Act* approval would be obtained for disturbances to wetlands before construction, and permanent disturbance to wetlands would be replaced in accordance with the *Alberta Wetland Policy*. Effects to wetlands are assessed in the EIA in Volumes 3A and 3B section 10.
Concerns expressed on the potential impact to medicinal and ceremonial plants.	Vegetation will be cleared from the project development area during construction. However, effects of the Project are not anticipated to result in the loss of traditionally used species in the local assessment area. The effects on plants and traditional use are assessed in the EIA in Volume 3A and 3B, sections 10 and 14. AT would provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction
Wildlife (see Volume 3A and 3B, Section 11)	
Kainai First Nation request information on Species at Risk (Wildlife and Plants) gathered during the SR-1 investigations	Twenty-six species of management concern, including 15 birds and 11 mammals were observed during wildlife field surveys between 2015 and 2017. No plant species at risk were recorded during field surveys. Results of the field work are provided in the EIA; Volume 4, Appendix H and L, and Vol 3A sections 10 and 11.
Concerns regarding impact to annual homes, such as beavers.	No beaver dams were identified during surveys conducted for the Project. It is not anticipated that the Project would affect beaver dams. In the event of a flood, effects to beaver dams may occur whether the Project is in place or not. The effects of the Project to wildlife and aquatic species are discussed in the EIA Volumes 3A and 3B, sections 8 and 11.

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Heritage Resources (see Volume 3A and 3B, Section 13)	
Concern that evidence of wintering grounds and tipi rings will be lost if the area is excavated for the SR1 outfall. If tipi rings are disturbed, they will have no meaning. Concerns related to ceremonial locations and impacts to Blackfoot cultural sites.	Project activities within the project development area would disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burials have been identified within the project development area. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. Effects to historical resources are detailed in the EIA, Volume 3A and 3B, section 13. ACT independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT.
Construction may disturb human remains.	Should any chance find of human remains be made during construction, all construction will immediately cease in the area, the site will be secured and all provincial regulations regarding the chance find of human remains will be followed.
Kainai First Nation request archaeological information gathered during the SR-1 Site investigations be shared with the Kainai Nation.	AT is not authorized to disclose the information requested directly to the Kainai First Nation. AT contacted Alberta Culture and Tourism and obtained the Treaty 7 representative contact details and passed those details to the Kainai First Nation. The Kainai First Nation can make their request for the information directly to this individual.
Debris and sediment left in reservoir after a flood, which would cover evidence of Blackfoot people being there.	It is anticipated that sediment and debris will enter the reservoir area during a flood. The volume of sediment and debris will depend upon the size of the flood. Debris that has the potential to affect the functioning of the reservoir will be removed after a flood event. ACT independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Traditional Land and Resource Use (see Volume 3A and 3B, Section 14)	
Concern that if they share information with the Crown they may lose ownership of that information. Concerns over how the traditional knowledge the Kainai First Nation elders or technicians provide will be used, and that the knowledge needs to be protected.	A joint interim TUS report was delivered by Kainai and Siksika First Nation in March 2017. The TUS study was used in the environmental impact assessment (EIA). However, permission to use the spatial information from the TUS study has not been received by AT, therefore the information regarding sites and areas has been generalized for use in the EIA and exact locations, including those in the project development area, are not provided.
General Comments	
Would like to see the Environmental Impact Assessment (EIS) and Traditional Knowledge Study done at the same time.	Alberta Transportation (AT) provided funding for the Kainai First Nation to conduct a Traditional Use Study (TUS) on the project lands. An interim report was delivered by the Kainai First Nation in March 2017. The TUS study was used in the EIA/EIS.
Request for a job fair and employment opportunities for members of the Kainai First Nation	If the Project is approved, AT will follow government procurement policies and procedure with respect to labor, and goods and services. AT is willing to discuss possible economic opportunities with the Kainai First Nation.
Request for Kainai First Nation monitors on site during construction.	If the Project is approved, AT is willing to discuss possible monitoring opportunities with the Kainai First Nation.

Table B-2 Kainai First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concern about their history being erased due to growth and development in the province, and how this will be accommodated.	Project activities within the project development area will disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burials have been identified within the project development area. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. Effects to historical resources are detailed in the EIA, Volume 3A and 3B, section 13. Alberta Culture and Tourism's (ACT) independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT.
Blackfoot members should have accompanied Stantec during their EIA/EIS work.	AT funded and provided the opportunity for the Kainai First Nation to visit the site. Nation members visited the site on 13 days.
Concerns expressed related to impact on upstream and downstream effects.	Upstream effects as a result of the Project are not anticipated. Some backup of flood water when the diversion structure is in operation is expected, however the backup would reach approximately 500m upstream from the diversion structure. The purpose of the Project is to protect lands and communities downstream. The EIA details the potential effects on all valued components during both construction and dry operations and during a flood.

Table B-3 Louis Bull Tribe – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Request for Traditional Land Use and Cultural Impact Assessment studies.	Alberta Transportation (AT) approved Louis Bull Tribe's budget for a cultural impact assessment. As of March 16th, 2018, the cultural impact assessment report has not yet been received by AT.

Table B-4 Métis Nation of Alberta Region 3 – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Surface Water Quality (see Volume 3A and 3B, Section 7)	
Will there be sediment testing after a flood?	Sediment testing will occur after a flood event. Following a flood that results in the diversion of water to the reservoir and prior to discharge from the reservoir, water samples will be collected at the low-level outlet channel and analyzed for a number of parameters including total suspended sediment. The results will be provided to The City of Calgary water services department.
Concern about sediment build up.	Suspended sediment concentrations will be monitored upstream and downstream of instream construction activities to identify potential sediment-related effects from construction. Construction will follow the mitigation measures detailed in Alberta Transportation's Erosion and Sediment Control Manual. Modeling has indicated that sediment will be deposited in the reservoir after a flood event. The amount of sediment will depend on the flood conditions. Sediment will be removed from the reservoir and infrastructure if it affects the future operational efficiency of the Project.
Wildlife (see Volume 3A and 3B, Section 11)	
Expressed concern over the potential impacts to wildlife caused by the diversion of water from Elbow River and the construction of SR-1	Potential impacts to wildlife, as a result of the Project, are described in the EIA and include a loss/change of habitat, disruption to movement, mortality risk and changes in biodiversity. With the application of mitigation and environmental protection measures, residual environmental effects on wildlife, including migratory birds, species at risk, biodiversity, and provisions to maintain ungulate movement which was recommended by Indigenous groups are predicted to be not significant. Project effects on wildlife are discussed in the EIA Volumes 3A and 3B, section 11.
Heritage Resources (see Volume 3A and 3B, Section 13)	
There was a short-lived fort (Old "Bow Fort") in the area of SR-1.	The Old Bow Fort is included in the historical resources assessment (EIA, Volume 3A, Section 13). Alberta Culture and Tourism's (ACT) independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT.

Table B-4 Métis Nation of Alberta Region 3 – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns expressed that the SR-1 project would disrupt potential homesteads, cart trails, historic use areas, and/or buried Métis sites.	Project activities within the project development area would disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burials have been identified within the project development area. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. Effects to historical resources are detailed in the EIA, Volume 3A and 3B, section 13. ACT independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT.
Mitigation (see Volume 4, Appendix C)	
Waste recovery within the basin after a flood should be considered.	A debris management program would also be implemented during all phases of Project operation. This program would include measures such as debris removal in the Elbow River at the diversion structure, upstream of the diversion structure, and within the off-stream reservoir.
Soil Handling (see Volume 4, Appendix D)	
Why there is not a reclamation and remediation consideration?	Reclamation will occur after construction for those areas temporarily affected during construction, EIA Volume 4, Appendix D. There are no plans to decommission the Project, as it will provide long term flood protection mitigation for all lands and communities down river of the Project.
General Comments	
Concern over whether tax payer money would be used to fix Springbank Road should a flood event occur and cause damage	The Springbank Road is under the jurisdiction of the Rockyview County. In the event of a flood, once floodwaters have receded sufficiently, affected roadways and bridges would be inspected for damage. If repairs were necessary, Springbank Road would remain out of service until repairs were completed. Public funds will be utilized for repair.

Table B-4 Métis Nation of Alberta Region 3 – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
With Parks assuming operations and control, why would this not be a suitable place for people to have access to?	If the Project is approved access will vary across the project area. • Area A is a conservation area with public access and opportunities for low impact recreation; limited improvements beyond restoration of areas affected by Project construction. • Area B is the reservoir, which will be owned and operated by AEP. The area will also be used for research on flood restoration activities, and monitoring of mitigation and environmental effects. There is limited or no public access. There is no public access for public safety and security. • Area C: has options for grazing through public leases. The land would be publicly owned and privately stewarded, with limitations on improvement to support the primary use as a reservoir. • Area D is the location of project infrastructure. There is no public access and is fenced for public safety and security. Once the Project is constructed, access will be available in Area A and indigenous groups will have the ability to access this area for traditional use purposes. There will be no public access in Areas B and D. Area C will be publicly accessible.
EIS should not be deemed complete as many Indigenous groups have not completed their studies. Concerns expressed that more research and information was needed to discover and document the past use of the area by the Métis.	AT has been engaged with the Metis Nation since 2016to understand how the Project potentially impacts rights, interests and traditional uses including offering and funding site visits and TUS studies. Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1st in order to meet a resubmission date of early April. Information received after submission of the EIA/EIS will be considered in project planning and execution. AT approved the Métis Nation of Alberta Region 3's budget for a historical research and resources impact assessment study. As of March16th 2018 the report had not been received by AT. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-5 Montana First Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
General Comments	
Montana First Nation has not been formally engaged in any traditional knowledge study specific to the SR1 Project.	A meeting was held in January 2017 with Montana First Nation. At that meeting the Montana First Nation requested if funding was available to which AT responded that funding was available and requested that Montana First Nation submit a budget. No budget has been received to date. AT continues to engage with the Montana First Nation.
Materials representing Montana First Nation were taken from sources that have no relevance to the specific SR1 project.	The publicly available information used in the TLRU section summarizes traditional resources that are generally known to be used by Indigenous groups and can be found in the area of the Project. The information in the TLRU section is based on available sources. The list of resources is not intended to be an exhaustive list of resources used by Indigenous groups, nor does the absence of information imply that an Indigenous group is not exercising traditional use in the regional assessment area. The list of resources noted in the October 2017 TLRU was updated in this revised EIA/EIS.

Table B-6 Piikani Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Engagement (see Volume 1, Section 7, Volume 4 Appendix B)	
The Piikani Nation wanted to have their Elders involved in Site Visits on SR1 to assess impacts to medicinal plants and Blackfoot Traditional Knowledge. They stated that they would need additional funding for this work.	Alberta Transportation (AT) provided funding for a Piikani Traditional Use Study (TUS). Piikani Nation spent 13 days in the field in 2016. The TUS report was delivered in February 2017.
Air Quality (see Volume 3A and 3B, Section 3)	
Effect on air quality from flood residue spread by the wind.	The only potential source of fugitive dust during post-flood operations is wind erosion of deposited sediments in the reservoir after they dry out, and when strong wind conditions occur. Because these emissions are ground based, the greatest air quality changes due to these emissions occur inside and near the project development area, decreasing to background levels with increasing distance from the project development area. The main finding of the modeling completed for the EIA is the potential for dust concentrations to be greater than the regulatory criteria outside the project development area. However, given the low recurrence of the floods that result in sediment deposition (i.e. 100 years and design flood [200 years]) and the proposed mitigation measures, it is expected that fugitive dust emissions would not have significant adverse effects on ambient air quality.
Surface Water Quality (see Volume 3A and 3B, Section 7)	
Impact of the silt shadow on downstream forests and river valleys.	Flood-operations would occur when suspended sediment concentrations in the Elbow River are already high. The Project would not substantially change these high concentrations during diversion. During the last few days of water release back into Elbow River, suspended sediment concentrations are predicted to increase in the low-level outlet and cause a short-term peak. Suspended sediment concentrations are expected to be high during Elbow River floods and settle out of the water when the water is retained in the reservoir. Most of the settled sediment would stay in reservoir during water release.

Table B-6 Piikani Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Piikani Nation request impact information on fish and fish habitat resulting from the SR-1 project.	The Project will result in the permanent loss of 1,854 m^2 fish habitat at the diversion structure. This area has been identified as suitable foraging habitat for trout including, mountain whitefish, brown trout and rainbow trout. The area that will be lost is small compared to the habitat available within the local assessment area, which is approximately 3,100,000 m^2. Given the limited extent of the habitat affected impacts to fish and fish habitat are predicted to be not significant. The assessment of effects to fish and fish habitat are provided in the EIA Volumes 3A and 3B, section 8.
Piikani Nation request information on how the design of the SR-1 is being done to ensure during a flood event that the mortality of fish is limited.	After a flood, the water flows in the diversion channel will be gradually reduced and the reservoir slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be graded to reduce stranding of fish during release of stored flood water from the reservoir. During draining of the reservoir, monitoring will be undertaken to identify isolated pools and the potential that fish may become stranded. If potential fish stranding is identified, a fish rescue program will be undertaken to return the fish to the river.
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Concerns about wetlands.	The Project would result in the loss of 8 ha of estimated high value wetland area and 13 ha of moderate wetland area in the local assessment area. Approximately 312 ha of the local assessment area contains wetland cover types No vegetation and wetland land units are completely lost, and therefore no significant effects on vegetation and wetlands are predicted. Effects to wetlands are assessed in the EIA in Volumes 3A and 3B section 10.
Impacts to wildlife and medicinal plants, especially if one species is altered or annihilated, how this will affect the ecosystem.	Vegetation will be cleared from the project development area during construction. However, effects of the Project are not anticipated to result in the loss of traditionally used species in the local assessment area. The effects on plants and traditional use are assessed in the EIA in Volume 3A and 3B, sections 10 and 14. AT would provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction

Table B-6 Piikani Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	With the application of mitigation and environmental protection measures, residual environmental effects on wildlife, including migratory birds, species at risk, biodiversity, and provisions to maintain ungulate movement which was recommended by Indigenous groups are predicted to be not significant. The residual effects on change in habitat, movement, and mortality risk are unlikely to pose a long-term threat to the persistence or viability of a wildlife species including migratory birds and species.
Wildlife (see Volume 3A and 3B, Section 11)	
Piikani Nation request information on Species at Risk (Wildlife and Plants) gathered during the SR-1 investigations	Twenty-six species of management concern, including 15 birds and 11 mammals were observed during wildlife field surveys between 2015 and 2017. No plant species at risk were recorded during field surveys. Results of the field work are provided in the EIA; Volume 4, Appendix H and L, and Vol 3A sections 10 and 11.
Concerns expressed on SR1 construction impact to animal homes, such as the beavers.	No beaver dams were identified during surveys conducted for the Project. It is not anticipated that the Project would affect beaver dams. The effects of the Project to wildlife and aquatic species are discussed in the EIA Volumes 3A and 3B, sections 8 and 11.
Heritage Resources (see Volume 3A and 3B, Section 13)	
Piikani Nation inspected two tipi rings, and old campsite, and the old North South Trail. Piikani Nation are concerned the evidence of these wintering camp grounds and Teepee Rings will be lost if this area is excavated for the SR1 diversion dikes.	Project activities within the project development area would disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burial sites have been identified within the project development area. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. Effects to historical resources are detailed in the EIA, Volume 3A and 3B, section 13. There will be some limited excavation at the outfall structure (18m) to reduce the speed of the water entering the natural channel. Beyond 18m from the outfall no excavation is proposed. Alberta Culture and Tourism's (ACT) independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT.

Table B-6 Piikani Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Piikani Nation request archaeological information gathered during the SR-1 Site investigations	AT is not authorized to disclose the information requested directly to the Piikani Nation. AT contacted Alberta Culture and Tourism and obtained the Treaty 7 representative contact details and passed those details to the Piikani Nation. The Piikani Nation can make their request for the information directly to this individual.
The proponents of the project need to revise the language regarding mitigation and consider participation of Siksikaitsitapii (Keepers of our Language) in the official assessment by the experts utilized to confirm the authenticity of the historic and archeological sites discovered. If the project proceeds to the stage of construction another stage of consultation needs to proceed with Siksikaitsitapii prior to actual excavation and removal of material from the sites of the diversion.	ACT independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historic resources as determined by ACT. If the Project is approved, AT is willing to discuss possible monitoring opportunities with the Piikani First Nation.
Traditional Land and Resource Use (see Volume 3A and 3B, Section 14)	
Recommend ongoing mitigation after the finalization of the SR-1 Project to ensure no further derogation of Treaty and Aboriginal Rights are infringed upon in the designated SR-1 Project Area	Effects on potential or established Aboriginal or Treaty rights are addressed through the assessment of the current use of lands and resources for traditional purposes. By acknowledging a link between practice-based rights and current use, this assessment accepts that adverse residual effects on availability of traditional resources for current use, on access to traditional resources or areas for current use, or on sites or areas for current use will have a consequent effect on the ability of Indigenous groups to exercise potential or established Aboriginal and Treaty rights. Given that the residual effects for the Project on TLRU are predicted to be not significant, no effects on potential or established Aboriginal or Treaty rights is expected to occur as a result of the Project. Mitigation measures for TLRU can be found in Volume 3A and 3B, section 14. Follow up and monitoring can be found in Volume 3C, Section 2.

Table B-6 Piikani Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
General Comments	
Request for monitors during construction so they could observe the work being done and to protect Blackfoot artifacts.	If the Project is approved, AT is willing to discuss possible monitoring opportunities with the Piikani First Nation.
Concern raised regarding the effect on the environment after a flood, and what mitigation will occur when the area is flooded.	The potential effects on the environment after a flood are detailed in the EIA, Volume 3B, including mitigation measures for post flood activities. Follow up and monitoring will occur after a flood, the details of which are presented in the EIA, Volume 3C, section 2.
Upstream and downstream effects.	Upstream effects as a result of the Project are not anticipated. Some backup of flood water when the diversion structure is in operation is expected, however the backup would reach approximately 500m upstream from the diversion structure, Volume 3A, Section 18, Figure 18-3. The purpose of the Project is to protect lands and communities downstream. The EIA details the potential effects on all valued components during both construction and dry operations and during a flood.

Table B-7 Samson Cree Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
General Comments	
Inquired if environmental assessments would include Traditional Ecological Knowledge.	The EIA does incorporate Traditional Ecological Knowledge. The description of existing conditions relies on results of the Indigenous engagement program for the Project, including available Traditional Use Study (TUS) reports.
Inquired if project would create First Nation jobs.	If the Project is approved, AT will follow government procurement policies and procedure with respect to labor, and goods and services. AT is willing to discuss possible economic opportunities with the Samson Cree Nation.
Concerns that Transportation is not fulfilling meaningful consultation.	AT has been engaged with the Samson Cree since 2016 to understand how the Project potentially impacts rights, interests and traditional uses including offering and funding site visits and TUS studies. Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1st in order to meet a resubmission date of early April. Information received after submission of the EIA/EIS will be considered in project planning and execution. AT hosted a workshop with the Samson Cree on Feb 23, 2018 to better understand how the project potentially impacts Samson Cree's rights, interests and traditional uses. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-8 Siksika Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Siksika Nation request impact information on fish and fish habitat resulting from the SR-1 project	The Project will result in the permanent loss of 1,854 m^2 fish habitat at the diversion structure. This area has been identified as suitable foraging habitat for trout including, mountain whitefish, brown trout and rainbow trout. The area that will be lost is small compared to the habitat available within the local assessment area, which is approximately 3,100,000 m^2. Given the limited extent of the habitat affected impacts to fish and fish habitat are predicted to be not significant. The assessment of effects to fish and fish habitat are provided in the EIA Volumes 3A and 3B, section 8.
Siksika Nation request information on how the design of the SR-1 is being done to ensure during a flood event that the mortality of fish is limited	After a flood, the water flows in the diversion channel will be gradually reduced and the reservoir slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be graded to reduce stranding of fish during release of stored flood water from the reservoir. During draining of the reservoir, monitoring will be undertaken to identify isolated pools and the potential that fish may become stranded. If potential fish stranding is identified, a fish rescue program will be undertaken to return the fish to the river.
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Concerns expressed related to the protection of off-river sloughs as animals and fish in and around the Elbow River rely on the sloughs.	The Project would result in the loss of 8 ha of estimated high value wetland area and 13 ha of moderate wetland area in the local assessment area. Approximately 312 ha of the local assessment area contains wetland cover types No vegetation and wetland land units are completely lost, and therefore no significant effects on vegetation and wetlands are predicted. Effects to wetlands are assessed in the EIA in Volumes 3A and 3B section 10.
Concerns expressed on the potential impact to medicinal and ceremonial plants.	Vegetation will be cleared from the project development area during construction. However, effects of the Project are not anticipated to result in the loss of traditionally used species in the local assessment area. The effects on plants and traditional use are assessed in the EIA in Volume 3A and 3B, sections 10 and 14. AT would provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction

Table B-8 Siksika Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns expressed related to upstream and downstream effects.	Upstream effects as a result of the Project are not anticipated. Some backup of flood water when the diversion structure is in operation is expected, however the backup would reach approximately 500m upstream of the diversion structure. The purpose of the Project is to protect lands and communities downstream. The EIA details the potential effects on all valued components during both construction and dry operations and during a flood.
Wildlife (see Volume 3A and 3B, Section 11)	
Siksika Nation request information on Species at Risk (Wildlife and Plants) gathered during the SR-1 investigations	Twenty-six species of management concern, including 15 birds and 11 mammals were observed during wildlife field surveys between 2015 and 2017. No plant species at risk were recorded during field surveys. Results of the field work are provided in the EIA; Volume 4, Appendix H and L, and Vol 3A sections 10 and 11.
Concerns expressed on SR1 construction impact to animal homes, such as the beavers	No beaver dams were identified during surveys conducted for the Project. It is not anticipated that the Project would affect beaver dams. In the event of a flood, effects to beaver dams may occur whether the Project is in place or not. The effects of the Project to wildlife and aquatic species are discussed in the EIA Volumes 3A and 3B, sections 8 and 11.
Heritage Resources (See Volume 3A and 3B, Section 13)	
Expressed concern on potential impact from the SR1 on Blackfoot artifacts, such as tipi rings, wintering grounds, old camp sites, rock markers, ceremonial locations. Concern that the tipi rings are potentially located adjacent to the SR1 reservoir outfall along an unnamed creek into the Elbow River.	Project activities within the project development area would disturb 11 precontact period and 11 historic period archaeological sites. No traditional land use sites of very high heritage value, such as spiritual sites or human burials have been identified within the project development area. Identified sites include isolated finds, artifact scatters, campsites and historic remains such as homesteads and a school. Effects to historical resources are detailed in the EIA, Volume 3A and 3B, section 13. There will be some limited excavation at the outfall structure (18m) to reduce the speed of the water entering the natural channel. Beyond 18m from the outfall no excavation is proposed. Alberta Culture and Tourism's (ACT) independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the *Historical Resources Act*. If the Project is approved AT will follow all the requirements for the protection of historical resources as determined by ACT.

Table B-8 Siksika Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Siksika Nation request archaeological information gathered during the SR-1 Site investigations	AT is not authorized to disclose the information requested directly to the Siksika Nation. AT contacted Alberta Culture and Tourism and obtained the Treaty 7 representative contact details and passed those details to the Siksika Nation. The Siksika Nation can make their request for the information directly to this individual.
Traditional Land and Resource Use (See Volume 3A and 3B, Section 14)	
The Siksika Nation wanted to have their Elders involved when medicinal plants and Traditional Knowledge is being assessed.	Alberta Transportation (AT) funded a Siksika Traditional Use Study (TUS). Siksika Nation spent 7 days in the field in 2016, and delivered an interim TUS co-authored with the Kainai Nation in March 2017. The findings of the TUS study were incorporated into the EIA.
The Siksika Nation indicated they would like to complete a Traditional Use Study of the SR1 Project Area.	Alberta Transportation (AT) funded a Siksika Traditional Use Study (TUS). Siksika Nation spent 7 days in the field in 2016, and delivered an interim TUS co-authored with the Kainai Nation in March 2017.
The project is being constructed to protect people and property in Calgary, while negatively impacting Siksika rights and interests.	Effects on potential or established Aboriginal or Treaty rights are addressed through the assessment of the current use of lands and resources for traditional purposes. By acknowledging a link between practice-based rights and current use, this assessment accepts that adverse residual effects on availability of traditional resources for current use, on access to traditional resources or areas for current use, or on sites or areas for current use will have a consequent effect on the ability of Indigenous groups to exercise potential or established Aboriginal and Treaty rights. Given that the residual effects for the Project on TLRU are predicted to be not significant, no effects on potential or established Aboriginal or Treaty rights is expected to occur as a result of the Project.
General	
As the Siksika Nation had been severely impacted by the 2013 flood they were concerned and wanted their membership to be informed on the ongoing attempt to mitigate future floods.	Alberta Transportation agreed to work closely with Siksika to provide a professionally developed article for the Siksika website and newspaper. The article was published in the Siksika newspaper "Aitsiniki" in November 2014 (Volume 21, Issue 8). Alberta Transportation also held a workshop with Siksika in Calgary on February 26, 2018 and are working with Siksika to reschedule a workshop on the Siksika reserve.

Table B-8 Siksika Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns expressed as to what would happen to the Oil /Gas pipelines that cross the SR1 site.	The proposed PDA currently contains active pipelines operated by third-parties. As a mitigation measure to reduce the likelihood of a potential pipeline rupture or adverse interaction with the Project, pipelines within the PDA of the off-stream reservoir will be re-located or retrofitted
Upstream and downstream effects	Upstream effects as a result of the Project are not anticipated. Some backup of flood water when the diversion structure is in operation is expected, however the backup would reach approximately 500m upstream of the diversion structure. The purpose of the Project is to protect lands and communities downstream. The EIA details the potential effects on all valued components during both construction and dry operations and during a flood.
Siksika Nation request front line Monitors be present throughout the SR-1 construction	If the Project is approved, AT is willing to discuss possible monitoring opportunities with the Siksika First Nation.
Concern that the Blackfoot Nations were not involved in the EIA/EIS work.	AT has been engaged with Siksika since 2014 to understand how the Project potentially impacts rights, interests and traditional uses. Alberta Transportation has provided funding to Siksika for a traditional use study. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 7 site visits by Siksika within the Project Development Area (PDA) over the period between the fall of 2016 to the late summer of 2017. A joint interim TUS report was delivered by Siksika and Kainai First Nation in March 2017. The TUS study was used in the environmental impact assessment (EIA). However, permission to use the spatial information from the TUS study has not been received by AT, therefore the information regarding sites and areas has been generalized for use in the EIA and exact locations, including those in the project development area, are not provided. Alberta Transportation sent the link to the October 2017 EIS to Siksika on November 3, 2017. On December 5th, 2017 AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities.

Table B-8 Siksika Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	Alberta Transportation provided Siksika with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Siksika and to provide responses to the concerns raised to date. A workshop was held with Siksika on February 26th, 2018 and was facilitated by CEAA. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU sections in the EIA/EIS have not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
Establish ASAP the following: who will be employed in the development of the proposed project, what community benefits will be available, and what steps will be taken to address and accommodate future impacts to Siksika interests. Begin a process that would work concurrently with the study of the physical reservoir, toward a community benefits agreement for Kainai.	If the Project is approved, AT will follow government procurement policies and procedure with respect to labor, and goods and services. AT is willing to discuss possible economic opportunities with the Siksika First Nation.
Siksika Nation stated that access was not provided to areas the Siksika Nation wanted to visit.	Alberta Transportation approved all the Siksika Nation budgets for site visits to SR1 and facilitated access to private lands with landowners on all properties the Siksika requested.

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Engagement (See Volume 1, Section 7, Volume 4 Appendix B)	
Stoney Nakoda Nation confirmed the SR1 project is in their Traditional Territory. They want to be able to complete an internal Cultural Review of the project area with Elders. The Stoney Nakoda Nation feel a Cultural Use Study, a Stoney Hydrology report, and a wildlife impacts study are required.	AT has been engaged with Stoney Nakoda Nation since 2014 to understand how the Project potentially impacts rights, interests and traditional uses. Alberta Transportation has provided funding for the Stoney Nakoda Bearspaw, Chiniki, Wesley Nations to conduct a Traditional Use Study on the project lands. No report has been received to date, March 16th, 2018. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 11 site visits by Stoney Nakoda Nations within the Project Development Area (PDA) in the fall of 2016. Alberta Transportation sent the link to the October 2017 EIS to Stoney Nakoda Nation on November 3, 2017. On December 5th, 2017, AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Stoney Nakoda Nations with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Stoney Nakoda Nations and to provide responses to the concerns raised to date. A workshop was held with Stoney Nakoda Nation on February 12th, 2018, and was facilitated by CEAA. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU sections in the EIA/EIS have not been updated to include information discussed. A second workshop is planned for March 20th, 2018. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
The Stoney Nakoda Nation expressed concerns with the Stoney lack of mapping capability and requested some assistance understanding the SR1 mapping.	Alberta Transportation provided a PDF and Google KMZ map of the test Bore holes completed during the site investigation phase at the SR1 project.

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Indicated desire to do a site visit with elders. (Sept 2017)	At the time of the request AT's agreement with the landowners for access had expired. Any additional access would need to be requested on an owner by owner basis.
Requested about having an on-reserve presentation on the SR1 project,	AT presented the SR1 Project to the Stoney Nakoda Nation at the Stoney Nakoda Resort on Feb 12th, 2018. A further workshop at the Stoney Nakoda Resort has been scheduled for Feb 20th, 2018.
Desire for their consultation team and elders to undertake a ceremony on the SR1 lands. They wanted Alberta Transportation and CEAA to participate.	At the request of Indigenous groups, Alberta Transportation will participate in ceremonies (if invited) prior to the start of construction, including making offerings.
Hydrology (See Volume 3A and 3B, Section 6)	
Concerned about the hydrology of the SR1 area. In particular Elbow River vs. groundwater impacts.	The EIA considered the effects of the Project on both surface water (Volume 3A and 3B, section 6) and groundwater, including the Alluvial Aquifer (Volumes 3A and 3B, section 5, Appendix I). The assessment used a complex numerical groundwater model (FEFLOW) to evaluate potential changes to the hydrogeologic system, including aquifer pressure, caused by floods and construction and operation of the Project. The results of a series of the modeling scenarios showed that the groundwater levels and flow patterns are altered within the vicinity of the proposed Project. Changes are observed within the reservoir area during flooding and recede toward pre-flood conditions following floods. Changes in the groundwater flow regime are also observed along the proposed diversion channel. The model results were used as the basis for the EIA. The assessment concluded that effects to groundwater quantity and quality would not be significant. The residual effects on groundwater quantity from the Project are assessed as not significant because they would not decrease the yield of groundwater supply wells to the point where they can no longer be used. The residual effects on groundwater quality from the Project are assessed as not significant because changes in groundwater quality at existing wells would not deteriorate to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality for a consecutive period exceeding 30 days (for those parameters which don't already, under existing conditions, exceed those guidelines). Effects to groundwater would be limited to the local assessment area.

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Concerns that the SR1 project will act as a barrier to the migration of wildlife and fish.	Although the Project would result in additional anthropogenic features on the landscape that might hinder wildlife movement in the local assessment area, Alberta Transportation has made adjustments to accommodate wildlife movement such as revegetating the floodplain berm with materials conducive for ungulate movement. The EIA concluded that the project residual effects on wildlife movement are unlikely to pose a long-term threat to the persistence or viability of a wildlife species, including species at risk (EIA, Volume 3A and 3B section 11). During Project design it was recognized that the diversion structure could result in an increase in flow rates of the Elbow River at the structure and potentially affect the ability of fish to pass upstream. In order to avoid affecting fish passage design elements were incorporated to ensure that under normal river conditions flow rates are maintained within the range suitable for fish passage.
Wildlife (see Volume 3A and 3B, Section 11)	
Emphasized the importance of wildlife crossings and was concerned that if not properly managed could be a problem for the SR1 project.	Although the Project would result in additional anthropogenic features on the landscape that might hinder wildlife movement in the local assessment area, Alberta Transportation has made adjustments to accommodate wildlife movement such as revegetating the floodplain berm with materials conducive for ungulate movement. The EIA concluded that the project residual effects on wildlife movement are unlikely to pose a long-term threat to the persistence or viability of a wildlife species, including species at risk (EIA, Volume 3A and 3B section 11).
Concerns regarding wildlife, fish, and birds, and that the project will drive away these animals.	The Project will result in direct and indirect loss of wildlife habitat during construction and dry operations; however, the amount of wildlife habitat permanently affected (168 ha) is relatively small compared to the availability of wildlife habitat remaining in the local assessment area (4,860 ha). Although there would be temporary displacement and disturbance to wildlife during construction, a measurable change in the abundance of wildlife in the regional assessment area is unlikely.

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Expressed concerns over wildlife passage through the SR1 area following construction. He inquired if there would be wildlife crossings built over HWY 22 or Highway 8.	There is no plan to build wildlife overpasses. The diversion channel and dam were contoured to allow for wildlife passage through the SR1 area during non-flood times. The channel will be directed under HWY 22 and Township Road 242. The area underneath the bridges will contain rip rap however, the rip rap under the bridges will be filled with gravel potentially enabling animals to move under the bridges and avoid crossing the roads. With respect to Project design, the side slopes and bottom of the diversion channel will be vegetated, with the following exceptions. Where the diversion channel passes through bedrock, the channel would remain as an exposed bedrock cut. Articulated concrete matting will be provided in select areas of the channel where pipelines cross. Riprap erosion protection will be provided at critical areas including at bridge crossings, around the emergency spillway and for a 1.4 km stretch at the diversion channel outlet structure. The south portion, farthest from Elbow River, will be a 450-m earthen embankment vegetated with native grasses. The floodplain berm will also be covered with materials conducive to ungulate movement (see Volume 3A, Section 11). A remote camera program will be designed in consultation with Alberta Environment and Parks (AEP), to identify whether the diversion channel acts as a barrier to wildlife movement during dry operations, especially for ungulates, and determine the effectiveness of mitigation implemented throughout the diversion channel. The remote camera program will also include monitoring along the Elbow River to determine if wildlife use of the Key Wildlife and Biodiversity Zone (KWBZ) has been affected by the construction and operation of the Project.
Expressed concerns that the fences that would be built around the SR1 site might impact wildlife passage through the area.	Fences that are planned for the SR1 project would be similar to the farm fencing that already exists and should not have any additional impact to wildlife than currently exists.
Traditional Land and Resource Use (See Volume 3A and 3B, Section 14)	
There are two trap lines out there and Stoney members use the area for trapping.	Based on available information there are no registered traplines within the PDA. AT has requested the locations of the two traplines and were the Stoney members trap in order to determine if there is potential impact from the Project.

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns were expressed for the Stoney Nakoda cultural practices, their current use of lands and resources for traditional purposes, and concerns to their Treaty Rights.	Effects on potential or established Aboriginal or Treaty rights are addressed through the assessment of the current use of lands and resources for traditional purposes. By acknowledging a link between practice-based rights and current use, this assessment accepts that adverse residual effects on availability of traditional resources for current use, on access to traditional resources or areas for current use, or on sites or areas for current use will have a consequent effect on the ability of Indigenous groups to exercise potential or established Aboriginal and Treaty rights. Given that the residual effects for the Project on TLRU are predicted to be not significant, no effects on potential or established Aboriginal or Treaty rights is expected to occur as a result of the Project. In addition, a conservative assumption was made that Indigenous groups had access to the PDA to practice traditional use activities notwithstanding access to these private lands is limited.
Accidents and Malfunctions (See Volume 3D, Section 1)	
Inquired about the Oil Pipelines that cross the SR1 lands and what would happen to them as part of SR1.	The procedures for dealing with overhead and buried utilities located within constructions zones is highly regulated. All regulatory requirements will be strictly adhered to. Oil and gas pipelines operated by four companies (TransCanada Pipelines Ltd., Pengrowth Energy Corp., Veresen Inc., and Plains Midstream Canada) are located within the diversion channel, dam, and reservoir areas. Alberta Transportation are currently in contact with these utility owners and crossing agreements will be developed. Buried pipeline and overhead utilities will be relocated, moved or lowered as required. Prior to any soil disturbance, utility locate sweeps will be done and buried lines and pipelines will be flagged and marked. Pipeline crossings will be designed and maintained as required by the utility owners and in strict compliance with regulations. Daily hazard assessments will be conducted before work is undertaken in the vicinity of utilities. In the event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address pipeline emergency response. The implementation preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities. In the unlikely event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address and coordinate the emergency response. The implementation of preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities

Table B-9 Stoney Nakoda Nations – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
General Comments	
Crown land should be set aside to replace lands taken for SR1.	If approved, the project requires the acquisition of private land. Landowners would be provided monetary compensation. These private lands will not be replaced.
Transportation has used incorrect maps of Stoney IR 142, 143, 144.	The EIA has been updated to use the correct maps of the Stoney Nakoda Nation Reserve 142,143, 144. The map was sourced from Natural Resources Canada, Lands and Minerals Sector - Geobase http://ftp.geogratis.gc.ca/pub/nrcan_rncan/vector/geobase_al_ta/
Asked when/how historical/indigenous impact studies will be conducted for the McLean Creek option.	There is no intention to complete historical/indigenous impact studies for the McLean Creek option. An assessment of the McLean Creek option was included as part of the Project Location Alternatives assessment in the EIA/EIS (Volume 1, Section 3, Volume 4, Supporting Documentation). AT is applying for the SR1 Project.
EIA and project cannot be looked at in isolation from other flood control measures.	Following the floods of June 2013, the government of Alberta assessed various flood mitigation measures as detailed in the Project Location Alternatives section of the Volume 1 Project Description of the EIA/EIS. The SR1 Project was selected as the preferred option. In addition, flood mitigation projects for Bragg Creek and Redwood Meadows are underway.
Provide map of location of traditional territory of Stoney Nakoda.	The EIA provides a description of the Stoney Nakoda traditional territory from source - SIB 2014: Amended Statement of Claim, Court File Number 0301-19586 This amended statement of claim was prepared and filed by Stoney Nakoda Nations in the context of Action Number 0301-19586. This source was used to provide background information for Stoney Nakoda Nations, including information on the traditional territory. The scope of the identified traditional territory is one of the issues in dispute in the context of this litigation.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Engagement (See Volume 1, Section 7 and Volume 4, Appendix B)	
Concerned that Alberta Transportation have not engaged Tsuut'ina on the additional work set forth in the Appendix A of the May 30, 2016, letter and is now moving forward with the EIS submission Requests engagement with Tsuut'ina on the collection of the information identified in Appendix A (of the May 30, 2016 letter) and other information needed to understand the SR1 impacts. Recommend: Engagement with Tsuut'ina to prepare a consultation work plan to guide the remainder of the review process for the Project.	AT has been engaged with Tsuut'ina Nation since 2014 to understand how the Project potentially impacts rights, interests and traditional. Alberta Transportation has provided funding to Tsuut'ina for a traditional use study. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 21 site visits by Tsuut'ina within the Project Development Area (PDA) over the period between the fall of 2016 to the late summer of 2017. A TUS study was not received in time to be incorporated in the EIA/EIS submitted in October 2017. A draft TUS has now been received however Tsuut'ina's permission to include the information from it in the revised EIA/EIS re-submission has not been received. Alberta Transportation sent the link to the October 2017 EIS to Tsuut'ina on November 3, 2017. On December 5th, 2017. AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Tsuut'ina Nation with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Tsuut'ina Nations and to provide responses to the concerns raised to date. AT arranged 4-day workshop with Tsuut'ina on March 1, 5, 6 and 7th, 2018. The workshop was facilitated by CEAA with the goal of better understanding potential impacts to Tsuut'ina from the Project and to provide responses to the concerns raised to date. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU section has not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerned that while Alberta Environment are preparing a hydrology study on SR1, there has not been sufficient engagement with Tsuut'ina to know if this study covers the areas or issues of most concerns to us	The following reports, were sent by registered mail to Chief Crowchild and Tsuut'ina's Consultation Office on February 9th. 2018. • Hydrology - Springbank Off-Stream Storage Project Hydrology Flood Frequency Analysis – Report on Methods and Results (March 22, 2017) • Dam Breach Analysis – Breach Analysis and Inundation Mapping – Springbank Off-Stream Reservoir (SR1) (March 6, 2017) • EIA/EIS - Volume 3B, Section 5.0 Assessment of Potential Effects on Hydrogeology (November 2017) • EIA/EIS - Appendix I Hydrogeology – Hydrogeology Baseline Technical Data Report (November 2017) An email with a link to the draft Hydrology Report was also provided on February 9th. 2018.
Recommend: An opportunity for Tsuut'ina to review the draft EIS before it is submitted to the Agency.	Alberta Transportation sent the link to the October 2017 EIS to Tsuut'ina on November 3, 2017. On December 5th, 2017. AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Tsuut'ina Nation with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Tsuut'ina Nations and to provide responses to the concerns raised to date. AT arranged 4-day workshop with Tsuut'ina on March 1, 5, 6 and 7th, 2018. The workshop was facilitated by CEAA with the goal of better understanding potential impacts to Tsuut'ina from the Project and to provide responses to the concerns raised to date. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU section has not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerned by the lack of engagement on the project.	AT has been engaged with Tsuut'ina Nation since 2014 to understand how the Project potentially impacts rights, interests and traditional. Alberta Transportation has provided funding to Tsuut'ina for a traditional use study. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 21 site visits by Tsuut'ina within the Project Development Area (PDA) over the period between the fall of 2016 to the late summer of 2017. A TUS study was not received in time to be incorporated in the EIA/EIS submitted in October 2017. A draft TUS has now been received however Tsuut'ina's permission to include the information from it in the revised EIA/EIS re-submission has not been received. Alberta Transportation sent the link to the October 2017 EIS to Tsuut'ina on November 3, 2017. On December 5th, 2017, AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIA/EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Tsuut'ina Nation with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. AT also offered a workshop with the goal of better understanding potential impacts of the Project to Tsuut'ina Nations and to provide responses to the concerns raised to date. AT arranged 4-day workshop with Tsuut'ina on March 1, 5, 6 and 7th, 2018. The workshop was facilitated by CEAA with the goal of better understanding potential impacts to Tsuut'ina from the Project and to provide responses to the concerns raised to date. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU section has not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.
Concerns that Tsuut'ina's ability to review the environment assessment is extremely limited without capacity funding.	Funding is available to Indigenous groups through CEAA to review the EIA/EIS and participate in the regulatory review process.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Critical that the McLean Creek (MC1) location was not identified on the Stantec maps of the SR1 project area.	The MC1 location has been mapped and these maps are included in the EIA/EIS submission.
Tsuut'ina should have been part of the project selection process and should have been part of the technical EIA work completed by Stantec on behalf of Alberta Transportation. Tsuut'ina should be a decision maker and want the SR1 project to require Tsuut'ina's "Consent" as part of the current process.	Immediately following the 2013 flood, the Government of Alberta through Alberta Transportation hired the engineering company, AMEC, to prepare a report on options to mitigate damage due to flooding on the Elbow River including the SR1 and the Maclean Creek option. The report was completed in early 2014 and recommended the SR1 flood mitigation option. In 2015, Alberta Transportation hired Deltares to review Amec's report. The Deltares review agreed with Amec's report recommendation. Based on these report recommendations, Alberta Transportation chose to proceed with the SR1. Alberta Transportation has provided the Amec and Deltares reports with the Tsuut'ina Nation as part of the current ongoing engagement process. A detailed assessment as to why SR1 was chosen is also provided in the EIS/EIA. Alberta Transportation has provided funding to Tsuut'ina for a traditional use study. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 21 site visits by Tsuut'ina within the Project Development Area (PDA) over the period between the fall of 2016 to the late summer of 2017. A TUS study was not received in time to be incorporated in the EIA/EIS submitted in October 2017. A draft TUS has now been received however Tsuut'ina's permission to include the information from it in the revised EIA/EIS re-submission has not been received. Alberta Transportation sent the link to the October 2017 EIS to Tsuut'ina on November 3, 2017. On December 5th, 2017. AT requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Tsuut'ina indicated that they live in an arid climate and water is very important, they saw McLean Creek as an opportunity to benefit from water that could be stored behind the (McLean Creek) dam.	The conceptual design for the MC1 option is a dry reservoir but maintains a small permanent pond of 3.5 million m^3 of water to control sediment migration to the outlet structure. The MC1 option does not provide water storage.
Need for a ceremony for the wellbeing of all. Tsuut'ina Nation still has a desire to hold a ceremony and feast (the ceremony had been postponed earlier).	Funding for a ceremony and feast was provided by AT in February 2018.
Impacts to Federal Lands (Tsuut'ina Reserve) (See Volume 3A and 3B, Section 18)	
Concerns regarding the selection of the SR1 site within 395 metres of the Tsuut'ina Reserve.	The closest point of the project to the Tsuut'ina Reserve is 930 m. This is the distance from the reserve to the edge of back water on the river in the event of a flood of the 2013 flood magnitude. The closest point of a physical SR1 component to the Tsuut'ina Reserve is 1130 m, the distance from the Tsuut'ina Reserve to the flood plain berm, Volume 3A, Section 18, Figure 18-3.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Potential for flood waters to back up onto Reserve, including debris or contamination.	No back up of water onto Tsuut'ina Reserve is expected, including debris and contamination. The Project will provide flood protection for communities and lands downstream of the diversion structure, including the northeastern part of the Tsuut'ina Reserve that is located downstream of the diversion structure. During a flood event, it is expected that some water will "back-up" upstream of the diversion structure. However, modeling studies have shown that the "back-up" of water would not reach the Tsuut'ina Reserve upstream even in a 2013 design flood event. At its closest point the back-up water would be approximately 1,130 m from the Reserve Volume 3A, Section 18, Figure 18-3. In the event the diversion structure does not operate properly, and water continually backs up behind the structure, the auxiliary spillway and floodplain berm have been designed with a low point that will allow flood water to pass over the berm and continue downstream, thereby preventing back up flooding.
Concern about project impacts to Tsuut'ina economic interests at Redwood Meadows such as the Golf and Country Club in the NW section of the Reserve.	The Project will have no effects on the Redwood Meadows Golf and Country Club (the "Club"). The Club is outside of the Project development area and upstream of the Project components. During a flood event, it is expected that some water will "back-up" upstream of the diversion structure. Modeling studies have shown that the "back-up" of water would not reach the Tsuut'ina Reserve upstream or the Redwood Meadows Golf and Country Club located on the reserve. At its closest point the back-up water would be approximately 1,100m from the Reserve. In the event the diversion structure does not operate properly, and water continually backs up behind the structure, the auxiliary spillway and floodplain berm have been designed with a low point that will allow flood water to pass over the berm and continue downstream, therefore preventing back up flooding. A flood mitigation project for Bragg Creek is being funded by Alberta Government through Rocky View County. Alberta Transportation is also engaged with Tsuut'ina regarding flood mitigation for Redwood Meadows. Alberta Transportation has contacted Tsuut'ina and a technical committee has been formed to assess flood mitigation options. Alberta Transportation is awaiting a response from Tsuut'ina in order to get the Redwood Meadows flood protection project planning underway.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Visual impacts to reserve lands as the Diversion Structure and the Storage Dam are likely to be visible from reserve.	The diversion structure is located about 2000 metres from the northwestern boundary of the Tsuut'ina Reserve and it is not likely to be visible from the Tsuut'ina reserve lands. The easterly portion of the off-stream reservoir dam is located north of the Elbow River. The earth fill dam is approximately 27 metres tall at its highest point and it will be seeded to grass. It will blend into the existing contours and landscape. The dam at its highest point will be lower than the level of the surrounding high ridge immediately south of the Springbank road that currently dominates the local landscape. The dam may possibly be visible from Highway 8 south of the Elbow River, but it will most likely be hidden from view by the tall heavy tree growth along the river valley and its grass seeded side slopes.
Concerned about how other uses of the Elbow River will be affected, including for transportation and as community's water source.	The Project's effects on river transportation consists of the need to portage around the diversion structure. Alberta Environment and Parks, the final operator of the Project, will avoid the substantial interference with navigation of the Elbow River through design and best management practices. As part of construction, a permanent portage will be developed around the in-stream water intake components. Signs directing traffic to detours will be installed during construction of road realignments and modifications. Signs will be installed along the existing Elbow River channel and on the dam. Multiple signs will be placed upstream and downstream of the water intake components on both banks of the Elbow River. These signs would warn users on the Elbow River that they are approaching in-stream water intake components and of the associated danger with this infrastructure and to direct them to a portage location. A floating, high visibility boom will be in place upstream and downstream of the water intake component. Through the Indigenous engagement program, Tsuut'ina Nation identified Elbow River as a source of drinking water and noted the importance of the river's connection to groundwater. Tsuut'ina Nation also indicated that they depend on the groundwater in the Elbow River Alluvial Aquifer for the reserves' domestic drinking water. The Tsuut'ina noted that there are over 1500 wells on the reserve. The EIA concluded that with the application of standard construction mitigation measures potential effects of the Project on surface water quality and groundwater quality and quantity are not significant. In respect of these conclusions, it is anticipated that there will be no effects on the sources of drinking water identified by Tsuut'ina Nation, or the ability of other Indigenous groups to use Elbow River as a source of drinking water.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns regarding the entire project lying within Tsuut'ina's traditional territory.	The Tsuut'ina reserve lands have been included in the EIA/EIS. The potential effects of the Project have been assessed using three geographic areas. The Project Development Area (PDA), the Local Assessment Area (LAA) and the Regional Assessment Area (RAA). The PDA represents the project footprint i.e., immediate area of physical disturbance and construction activities (approximately 1440 ha). The PDA located on private land, north of the Elbow River, and this area is the same for all the valued components (VCs). The LAA is an area larger than the PDA and is considered to be the area where Project effects would be reasonably expected to occur and where effects can be predicted or measured with a reasonable degree of accuracy. The RAA is an area larger than the LAA and is an area within which Project effects may interact or accumulate with the effects of other projects or activities. The size of the LAA and RAA varies depending on the VC being assessed. In many cases the assessment areas include the Tsuut'ina Reserve. In addition to the assessment of VCs the EIA document also contains an assessment of the potential Project effects on Federal Lands, including the Tsuut'ina Reserve (Volume 3A and 3B, Chapter 18).
Concern the SR1 would cause road closures.	During construction, there will be no road closures with the exception of Range Road 41 which currently dead-ends south of Springbank Road, it will be permanently closed. To accommodate construction of bridges over the diversion channel on TWP Road 242 and Hwy 22, traffic will be detoured to bypass construction activities. Springbank road will be closed temporarily during a flood event that inundates the road. Local traffic will be detoured to access Hwy 1 to the north to bypass the temporary closure.
Potential impacts to the Reserve from the realignment of Highway 22 which abuts the Reserve	The Tsuut'ina Reserve will not be impacted by the proposed realignment of Highway 22. The location of the outlet works, and realignment of Highway 22 are described in the Project Description (Volume 1 of the EIA/EIS).
Air Quality and Noise (See Volumes 3A and 3B, Sections 3 and 4)	
Noise, dust, and air pollution during construction.	Noise, dust and air pollution levels will be monitored in compliance with regulatory requirements and the Project specific ECO Plan. The effects of noise, dust and air pollution during construction are also addressed in the EIA, Volumes 3A and 3B sections 3 and 4.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concern of potential impacts to air quality from the Project, including the potential for contaminated dry dust (for example with raw sewage) to be carried by the wind from the Project area.	Air quality data was collected for the Project and an air quality assessment was carried out as part of the EIA. The results, presented in Volumes 3A and 3B, Section 3, found the Project would have no significant effects on air quality. The main sources of air emissions due to the Project construction are vehicle exhaust and fugitive. As these emissions result from ground based sources, the greatest air quality changes due to these emissions occur inside and near the project development area, decreasing to background levels with increasing distance from the project development area. The main finding is the potential for dust concentrations to be greater than the regulatory criteria outside the project development area. Since estimated dust emissions are rated "indeterminate", the assessment does indicate the need for ambient monitoring during construction to confirm if the adopted dust control mitigation is adequate. On this basis, Alberta Transportation plans to implement an air quality monitoring and record keeping program to provide appropriate mitigation. The only potential source of fugitive dust during post-flood operations is wind erosion of deposited sediments in the reservoir after they dry out, and when strong wind conditions occur. Because these emissions are ground based, the greatest air quality changes due to these emissions occur inside and near the project development area, decreasing to background levels with increasing distance from the project development. The main finding of the modeling is the potential for dust concentrations to be greater than the regulatory criteria outside the project development area. However, given the low recurrence of the floods that result in sediment deposition (i.e. 100 years and design flood [200 years]) and the proposed mitigation measures, it is expected that fugitive dust emissions would not have significant adverse effects on ambient air quality. To some extent, natural mitigation with respect to future potential fugitive dust emissions has already occurred. The 2013 flood removed an appreciable portion of fine sediment (e.g., clay and fine silt) from the upstream Elbow River drainage basin. The remaining surficial materials in the stream bed and on the banks of the Elbow River and its tributaries that may be prone to mobilization during a future flood would comprise mostly larger material (e.g., sand). Hence, most of the sediment deposited in the reservoir during future floods would be dominated by sand, not fine silt. The sand is less prone to result in fugitive dust during dry windy meteorological conditions.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	A primary mitigation for wind erosion in the reservoir would be the re-establishment of vegetation cover (e.g., native grasses) after reservoir draining. Natural revegetation success, however, is not assured, given initial high moisture contents and reduced energy input in the autumn. Should wind erosion occur and natural revegetation prove to be ineffective, a tackifier may be applied where required. Tackifiers are a sprayable erosion control product that bonds with the soil surface and creates a porous and absorbent erosion resistant blanket that can last for up to 12 months.
Groundwater (See Volumes 3A and 3B, Section 5)	
Concerns that the SR1 Project may impact groundwater in the Elbow River Alluvial Aquifer. Concerns water stored in the Reservoir may cause an increase in aquifer pressures, altering local ground water flow regime.	The EIA considered the effects of the Project on both surface water (Volume 3A and 3B, section 6) and groundwater, including the Alluvial Aquifer (Volumes 3A and 3B, section 5, Appendix I). The assessment used a complex numerical groundwater model (FEFLOW) to evaluate potential changes to the hydrogeologic system, including aquifer pressure, caused by floods and construction and operation of the Project. The results of a series of the modeling scenarios showed that the groundwater levels and flow patterns are altered within the vicinity of the proposed Project. Changes are observed within the reservoir area during flooding and recede toward pre-flood conditions following floods. Changes in the groundwater flow regime are also observed along the proposed diversion channel. The model results were used as the basis for the EIA. The assessment concluded that effects to groundwater quantity and quality would not be significant. The residual effects on groundwater quantity from the Project are assessed as not significant because they would not decrease the yield of groundwater supply wells to the point where they can no longer be used. The residual effects on groundwater quality from the Project are assessed as not significant because changes in groundwater quality at existing wells would not deteriorate to the point where it becomes non-potable or cannot meet the Guidelines for Canadian Drinking Water Quality for a consecutive period exceeding 30 days (for those parameters which don't already, under existing conditions, exceed those guidelines). Effects to groundwater would be limited to the local assessment area.
Concerns that there is no plan to line the Reservoir, which causes concerns that any contaminants would seep into the ground water.	Given the nature of the Project, the hydrogeological conditions in the area and the sediment composition within the reservoir area, the potential for contamination of groundwater sources as a result of seepage from flood waters is not predicted. Accordingly, there is no plan to line the reservoir.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Hydrology (See Volumes 3A and 3B, Section 6)	
Concerns that the permanent structure in the Elbow River will permanently change the flow of the river and tributaries.	The Diversion Structure will have minimal effect on the flow of the Elbow River or its course downstream when constructed. The three additional streams refer to small ephemeral streams that flow only part of the time. During construction of the diversion channel, the unnamed tributary (ID 1350) would be diverted into the diversion channel. Approximately 1,200 m of the tributary would be destroyed, with the lowest 300 m being fish habitat that would be lost. The loss of the 300 m of habitat in the tributary could be offset by the enhancement or construction of side channel habitat on the Elbow River that could provide rearing habitat for salmonids and cover for small-bodied fish. The Project is designed to reduce the changes to the course of the river during extreme floods. The channel of the Elbow River experiences seasonal changes in flows. Such changes are greater during flood events. As discussed in Volume 3B, Section 6.4.4, the presence of the Project would decrease the amount of deposition and erosion of the channel bed during extreme flood events, compared to changes without the Project. Channel form and bedload (river bed particles) movement during extreme floods would remain the same with or without the Project. The Project is assessed as not resulting in significant changes to the Elbow River or local ecosystem. The diversion structure is designed to allow fish passage under all conditions.
Concerns related to significant changes to these waterbodies and local ecosystem and the permanent destruction of fish habitat.	The Project will result in the permanent loss of 1,854 m^2 fish habitat at the diversion structure. This area has been identified as suitable foraging habitat for trout including, mountain whitefish, brown trout and rainbow trout. The area that will be lost is small compared to the habitat available within the local assessment area, which is approximately 3,100,000 m^2.
It is a concern that the Tsuut'ina budget for a hydrology study had not been approved.	A Hydrology report has been prepared for the EIA/EIS submission that has gathered all baseline information and assesses l the potential impacts and effects of the Project.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Tsuut'ina requested an opportunity to review the draft hydrology report before it is submitted to the agency.	The following reports, were sent by registered mail to Chief Crowchild and Tsuut'ina's Consultation Office on February 9th. 2018. • Hydrology - Springbank Off-Stream Storage Project Hydrology Flood Frequency Analysis – Report on Methods and Results (March 22, 2017) • Dam Breach Analysis – Breach Analysis and Inundation Mapping – Springbank Off-Stream Reservoir (SR1) (March 6, 2017) • EIA/EIS - Volume 3B, Section 5.0 Assessment of Potential Effects on Hydrogeology (November 2017) • EIA/EIS - Appendix I Hydrogeology – Hydrogeology Baseline Technical Data Report (November 2017) An email with a link to the draft Hydrology Report was also provided on February 9th. 2018.
Surface Water Quality (see Volume 3A and 3B, Section 7)	
Potential for methylmercury contamination upstream and downstream.	Filling the off-stream reservoir with water would initiate the process of mercury methylation; however, accumulation of methylmercury in aquatic environments to levels that are hazardous can take many years and depends on several factors (e.g., net methylation rates, sources of mercury, and sources of organic matter for microbial activity). Large, permanent reservoirs and dams are known for having elevated concentrations of methylmercury because of increased conversion rates. Elevated levels of methylmercury combined with bioaccumulation can lead to higher health hazards for wildlife, especially piscivorous (fish-eating) species. However, as the Project is a dry dam with limited water residency times when in use, methylmercury accumulation is not considered to be a risk. Modeling of low and high uptake rates of methylmercury in all Project flood scenarios are below the CCME Canadian Water Quality Guideline for the Protection of Aquatic Life. The reservoir area is not expected to continue to contribute methylmercury after it is drained.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Impacts to spawning beds.	The EIA/EIS addressed potential impacts to spawning beds by considering the potential impact to fish habitat. The Project will result in the permanent loss of 1,854 m^2 fish habitat at the diversion structure. This area has been identified as suitable foraging habitat for trout including, mountain whitefish, brown trout and rainbow trout. The area that will be lost is small compared to the habitat available within the local assessment area, which is approximately 3,100,000 m^2.
Impacts to overwintering habitat for fish.	Hydrological modeling, undertaken for the EIA, indicates that during dry operations, there would be no changes to flows in the Elbow River and no changes to the pattern of erosion and deposition in bars or pools. Given this there would be no changes expected to the maintenance of spawning or overwintering habitat in the Elbow River for salmonid species. Hydrological modelling also indicates that there would be no significant changes in sediment transport (Volume 3A, Section 6.5.3 of the EIA), and therefore that there would be no alterations to the quality of fish habitat, including for fish that support Aboriginal fisheries.
Downstream sedimentation in the Elbow River and tributaries during construction and operation.	A site-specific Erosion and Sediment Control Plan will be developed by the selected construction contractor as part of the project-specific construction plan, and implemented during the various phases of the Project's construction and should include site-specific mitigation measures to suit the site and finalized design and construction plans. During operation suspended sediment in the Elbow River would be expected to decrease slightly as water is diverted into the reservoir. Suspended sediment concentration in the diverted water decreases rapidly, and most suspended sediment would remain in the reservoir after discharge back to Elbow River. Suspended sediment concentration is predicted to increase during the last few days of discharge because of sediment re-mobilization in the reservoir and sediment mobilization in the low-level outlet. However, it is anticipated that this increase in suspended sediment concentration can be mitigated with the operation of the low-level outlet and with physical sediment barriers.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Disruption to fish migration during construction.	In compliance with Regulatory requirements (Fisheries Act and the Water Act) and to allow construction of the Diversion structure in the dry, the current river channel flow will be routed around the construction work by excavating a bypass channel and temporarily diverting the river flow through this channel. This will provide unimpeded fish passage both upstream and downstream of the construction work.
Concerns fish may not be able to pass through diversion channel during operation.	During Project design it was recognized that the diversion structure could result in an increase in flow rates of the Elbow River at the structure and potentially affect the ability of fish to pass upstream. In order to avoid affecting fish passage design elements were incorporated to ensure that under normal river conditions flow rates are maintained within the range suitable for fish passage.
Fish stranding	During a flood event it is anticipated that fish will pass into the diversion structure and into the reservoir. After a flood, the water flows in the diversion channel will be gradually reduced and the reservoir slowly drained to facilitate the movement of fish from the reservoir, back to the Elbow River with the receding water. The outlet will be designed and operated in a manner that allows fish egress out of the reservoir, downstream into the outlet channel. Drainage areas within the reservoir will be graded to reduce stranding of fish during release of stored flood water from the reservoir. During draining of the reservoir, monitoring will be undertaken to identify isolated pools and the potential that fish may become stranded. If potential fish stranding is identified, a fish rescue program will be undertaken to return the fish to the river.
Diversion of HWY 22 and bridge construction could impact fish and fish habitat.	The optimal design option for Highway 22 does not involve diversion of the Highway. The Highway will be raised to above the design flood level, and culverts inserted to prevent the highway from flooding. A new bridge will be required where Highway 22 crosses the diversion channel. The effects of the highway modifications and bridge have been considered within the EIA. With the implementation of mitigation measures no impacts to fish and fish habitat are predicted.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Temperature changes to Elbow River from water being released from the reservoir impacting fish.	There is a potential that the temperature of the flood water held within the reservoir may increase during the time the water is retained within the reservoir. The amount of temperature change would depend upon a number of factors including water volume, air temperature, wind regime and residency time. As the water from the reservoir is then released, it would mix with Elbow River water and potentially increase water temperature in the river. If a change in temperature did occur, it would be expected to be temporary and localized due to the rapid mixing with the Elbow River water. Effects to fish as a result of any localized and temporary changes in water temperature are not predicted.
Impact to fish migration when reservoir is holding water.	During the diversion of flood water from Elbow River to the off-stream reservoir, it is assumed that fish, at any of their lifestages present, may encounter the diversion structure. During floods, flows of approximately 160 m^3/s, which are close to the 1:10 year flood would continue in Elbow River downstream of the diversion structure. These flows are considered channel forming and would shift bed materials which would maintain overwintering and spawning habitat and shallow side-channel and nearshore rearing habitats. Brown trout, brook trout, and mountain whitefish spawn in the fall, and therefore should not be undergoing migration movements during the potential operational period of the diversion structure (May-June of a flood year), although immature individuals may encounter the diversion when young disperse to rearing habitats. Given the low probability of the design flood and the 1:100 year flood, the reduction in magnitude of erosion and deposition is unlikely to occur at a frequency to negatively affect overwintering habitat, such as the scouring of pools and deeper runs for trout species, nor negatively affect spawning habitat in the in Elbow River. Because flows in Elbow River would be less during active water diversion (compared to flows without the Project), fish migration in Elbow River at the diversion structure should not be impeded any more than during the dry operation condition, which has been modelled to show that upstream fish passage is possible. During natural flooding, fish species may seek side channels and lower velocity flooded riparian areas, then return to the main river channel as flood water recedes. It is unlikely that fish are migrating upstream during the high flow situations when the diversion would be operational. The Elbow River would return to normal flow patterns over the summer period, and with gradually reducing water levels in the reservoir and grading that avoids the formation of pooled areas, fish should be able to move out of the reservoir with receding water.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Changes to wetlands functions.	During a flood event it is predicted that wetlands within the project development area will be temporarily inundated with flood water. A design flood i.e. maximum flood, is predicted to temporarily affect: 3.7ha of high value wetland habitat, 7.1 ha of moderate value habitat and 1.2 ha of low value habitat. The wetland functions of habitat, plant and wildlife, and hydrology would likely be reduced in these areas as plant composition may be changed and cover reduced, at least for a growing season, and lower-class marsh and swamp wetlands would be flooded for a duration and depth beyond natural variation, i.e., a few days to a few weeks. Residual Project effects to community diversity, traditional plant use and wetland functions are not anticipated because plant communities are expected to recover once the reservoir has been drained. Residual effects on vegetation and wetlands after a flood would not result in the loss of native upland and wetland plant communities, or wetland functions from the local assessment area.
Loss of wetlands.	Wetlands are widely dispersed in the local assessment area, but most occur along drainages and adjacent to the Elbow River. A large wetland occurs just north of Highway 1, a temporary marsh; however, most graminoid marshes are small scattered ponds with an average size of 0.68 ha, occurring mainly in agriculture land. Approximately 312 ha of the local assessment area contains wetland cover types. Wetland ecological function (i.e., wildlife habitat and plant diversity) would be altered due to vegetation clearing for permanent structures. Dry operations would result in the loss of 8 ha of estimated high value wetland area and 13 ha of moderate wetland area in the local assessment area. No vegetation and wetland land units are completely lost, and therefore no significant effects on vegetation and wetlands are predicted.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Habitat damage, including to sensitive fescue grassland and wetland ecosystems, that could result from contaminated sediment left behind from flood waters or debris.	Residual effects on vegetation and wetlands after a flood would not result in the loss of sensitive native upland and wetland plant communities, or wetland functions from the local assessment area, because no vegetation and wetland land units are completely lost, and no lasting effects to vegetation and wetlands would be anticipated as a result of a 1:10 year, 1:100 year or design flood. Effects on one rare plant - slender cress (Rorippa tenerrima) as well as the potential for effects on unidentified plant species of management concern (SOMC)[2] could occur. It is likely that habitat for plant SOMC exists elsewhere in the RAA as affected vegetation and wetland land units exist elsewhere in the RAA (see Volume 3A, Section 10.4). Effects on plant communities of management concern are not anticipated, because none were identified within the RAA.
Wildlife (see Volume 3A and 3B, Section 11)	
The Project area is an environmentally sensitive area, and includes a Key Wildlife and Biodiversity Zone and Environmentally Significant Areas.	The presence of the Key Wildlife and Biodiversity Zone (KWBZ) along the Elbow River is recognized and addressed in the EIA/EIS, as detailed below. The local and regional assessment areas selected for the assessment of effects on wildlife and wildlife habitat overlap areas identified as KWBZs (AEP 2016b), including the Elbow River to the south and the Bow River to the north. KWBZs represent areas along river valleys that are a combination of important winter ungulate (e.g., deer, elk) habitat and areas of high potential for biodiversity (ESRD 2015a; AEP 2016b). KWBZs are areas that protect productive, key ungulate winter ranges and river corridors, protect locally and regionally significant wildlife movement corridors and habitat types, and protect key hiding and thermal cover for wildlife (ESRD 2015a). Information available for the KWBZs was used in the EIA/EIS to establish the baseline conditions upon which the effects of the Project would be determined, see Volume 3A and 3B, section 11, and Volume 4, Appendix H.

[2] In Alberta, plant species of management concern (SOMC) with legislated protection include species listed federally under SARA as well as species listed as endangered or threatened under the Alberta Wildlife Act, Wildlife Regulation 143/1997. Other SOMC in Alberta are those listed as tracked or watched by the Alberta Conservation Information Management System (ACIMS) (ACIMS 2016a), or listed as "at risk", "may be at risk", or "sensitive" by the General Status of Alberta wild Species 2010 (SRD 2011). SOMC that are listed under ACIMS and the General Status of Alberta Wild Species are not protected by specific legislation, restricted timing of works or setback distances; however, they are important contributors to biodiversity in Alberta and are considered rare or uncommon.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Project may cause loss of wintering ungulate habitat and increase habitat fragmentation.	The Key Wildlife and Biodiversity Zone along the Elbow River provides key ungulate habitat. Habitat modeling undertaken for the EIA determined that approximately 74.5% of the local assessment area consists of low and very low to nil suitability winter feeding habitat for elk, with the remainder represented by 223.0 ha (4.6%) of high and 1,016.7 ha (20.9%) of moderate suitability habitat. High suitability winter feeding habitat occurs in discrete areas east and west of Highway 22 and along the Elbow River. Construction activities are predicted to result in both a permanent loss of habitat due to the infrastructure footprint and a temporary loss of ungulate habitat due to construction activities and sensory disturbance. A total of approximately 117 ha of high and 377 ha of moderate winter elk feeding habitat would be affected by the Project.
Effect on migratory bird nests and reduction of wetland habitat for breeding and nesting.	The design flood, (i.e. 1 in 200 year) is predicted to cover 816 ha in the reservoir. Flood operations during the design flood would temporarily impact 114.8% (234.2 ha) of breeding and foraging habitat in native upland vegetation, and 23.7% (70.3 ha) of wetland habitat in the LAA. Although these habitats would be temporarily unavailable to wildlife, the regional assessment area provides grassland, shrubland, tame pasture, and wetland habitat in other locations. Overall, the design flood would cover less than 3% of available native grassland (27,916 ha) and tame pasture (9,716 ha), and less than 1% of available wetland habitat (973 ha) in the regional assessment area.
Debris left after flood may result in loss of bird habitat, or contamination of bird habitat.	During a design flood, sediment modeling predicts that 3.7% (192.6 ha in the reservoir) of the local assessment area would be covered by sediment that is less than 3 cm deep, and 0.8% (37.4 ha) would be covered by sediment between 3 cm and 10 cm. Details of the sediment modeling is provided in the EIA. The quality of vegetation and wetlands post- flood would differ from baseline conditions, however, changes to overall wildlife habitat abundance and suitability would be minor under these conditions. Sediment less than 3 cm thick would have little to no effect on vegetation and wetlands, whereas sediment 3-10 cm deep could result in small shifts in plant species composition within upland ecosites, but complete changes to upland communities would not be expected. For wetlands, sediment 3-10 cm deep would likely alter plant composition and abundance resulting in wetlands changing to upland sites, however as noted above this level of sediment deposition would occur in less than 1% of the local assessment area.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Effects on culturally significant species, such as grizzly bears and bald eagles.	One bald eagle nest was observed in the local assessment area near the low-level outlet. A pre-construction survey of the area will be carried out and if the nest is active, the provincially regulated setback distance of 1000m will be observed during the nesting period. The majority (90.4%) of the local assessment area consists of low and very low to nil suitability spring feeding habitat for grizzly bear. Almost all (98.9%) of the local assessment consists of low and very low to nil suitability summer feeding habitat for grizzly bear. High suitability spring feeding habitat for grizzly bear occurs in small areas (<5% of the local assessment area) along the Elbow River, outside of the project development area. No high suitability summer feeding habitat was mapped within the local assessment area. Landowners have observed grizzly bear in the project development area. Radio collared grizzly have been observed in the local and regional assessment areas. Most observations show grizzly using areas west of the Project i.e. Bragg Creek, Jumping Pound and Sibbald Creek. Grizzly bears have large home ranges, so although the Project would reduce suitable spring and summer feeding habitat in the local assessment area, higher suitability grizzly bear habitat occurs west of the Project in the regional assessment area. The construction period will be relatively short, and portions of the construction area would be reclaimed, which would reduce residual effects on spring feeding habitat during dry operations. Most high and moderate suitability feeding habitat in the local assessment area exists along the Elbow River, with patches of moderate suitability habitat existing within the project development area. During a design flood grizzly habitat within the project development area would be temporarily unavailable. During post-flood operations, sediment left behind in the reservoir could reduce forage quality, and partial removal of sediment and sensory disturbance from other maintenance activities would result in displacement of grizzly bear from feeding habitat; however, other areas within the regional assessment area, especially west of the Project (Collister and Kansas 1997; Jorgenson 2016), would provide suitable spring feeding habitat.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Heritage Resources (See Volume 3A and 3B, Section 13)	
Concerned about the potential for the Project to adversely affect the physical and cultural heritage resources in Tsuut'ina territory.	An Historic Resources Impact Statement was conducted for the Project and submitted to Alberta Culture and Tourism who submitted Historical Resources Act conditions for the Project on November 22, 2017. Existing conditions for historic resources were determined through desktop review and field assessments for archaeology and paleontology. During the HRIA, 262 shovel tests were completed in areas of high archaeological potential and 698 surface exposures were inspected. A total of 11 precontact period sites and 11 historic period sites were assessed within the PDA. In summary, the results of the HRIA indicate that the project area does contain some sites of moderate to high heritage value that would require mitigation. However, in general terms, much of the area has been affected previously by cultivation and none of the identified sites have sufficient heritage value to mandate complete avoidance, with the possible exception of the Our Lady Peace Mission site, but that is outside the PDA. ACT considers documentation of the site locations, photography, and collection of a sample of artifacts as sufficient mitigation for sites of low to moderate heritage value. For sites of moderate to high heritage value, avoidance or additional mitigation, such as detailed recording and mitigative excavation to retrieve a larger sample of artifacts and obtain an improved understanding of the cultural affiliation may be required by ACT. Standard mitigation measures will be determined by ACT based on their review of the HRIA. The EIA found no significant effects of the Project on historic resources. A significant adverse residual environmental effect on historic resources is defined as one that results in an unauthorized project-related disturbance to, or destruction of, all or part of a historic resource considered by ACT to be of heritage value, and that is not mitigated or compensated as required by the regulators
Concerns that their artifacts are not protected.	Alberta Culture and Tourism's (ACT) independently assesses the heritage value of historic resources, determines the need for, and scope of, any avoidance or mitigation measures, and issues Project approval under the Historical Resources Act. If the Project is approved Alberta Transportation will follow all the requirements for the protection of historic resources as determined by ACT.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concern on project impacts to tipi sites, rock cairns, medicine wheel.	As noted in response to the concern above, a full assessment of the effects of the Project on historic resources was carried out and submitted to ACT. The EIA found no significant effects of the Project on historic resources. A significant adverse residual environmental effect on historic resources is defined as one that results in an unauthorized project-related disturbance to, or destruction of, all or part of a historic resource considered by ACT to be of heritage value, and that is not mitigated or compensated as required by the regulators. ACT will define the required mitigation measures required for the Project based on their review of the HRIA, and inform AT of those requirements.
The Tsuut'ina Nation have requested that they be allowed to have their Field Monitors on the SR1 site throughout the construction to ensure that any heritage sites that may be impacted would be respected.	Alberta Transportation is willing to discuss possible monitoring opportunities with the Tsuut'ina Nation.
The Tsuut'ina Nation requested that they be informed on all archaeological work being completed on the SR1.	At this time, no further archaeological work is being done on SR1. Work done to date is included in the Historic Resources Section of the revised EIA/EIS submission and will be available for review once submitted to and posted by the regulators.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Concerned about (Tsuut'ina) burial sites that would be destroyed should the reservoir be filled.	An Historic Resources Impact Statement was conducted for the Project and submitted to Alberta Culture and Tourism (ACT) who submitted *Historical Resources Act* conditions for the Project on November 22, 2017. Existing conditions for historic resources were determined through desktop review and field assessments for archaeology and paleontology. During the HRIA, 262 shovel tests were completed in areas of high archaeological potential and 698 surface exposures were inspected. A total of 11 pre-contact period sites and 11 historic period sites were assessed within the PDA. In summary, the results of the HRIA indicate that the project area does contain some sites of "moderate" to "high" heritage value that would require mitigation. However, in general terms, much of the area has been affected previously by cultivation and none of the identified sites have sufficient heritage value to mandate complete avoidance, with the possible exception of the Our Lady Peace Mission site, but that is outside the PDA. ACT considers documentation of the site locations, photography, and collection of a sample of artifacts as sufficient mitigation for sites of low to moderate heritage value. For sites of moderate to high heritage value, avoidance or additional mitigation, such as detailed recording and mitigative excavation to retrieve a larger sample of artifacts and obtain an improved understanding of the cultural affiliation may be required by ACT. Mitigation measures will be determined by ACT based on their review of the HRIA. A significant adverse residual environmental effect on historic resources is defined as one that results in an unauthorized project-related disturbance to, or destruction of, all or part of a historic resource considered by ACT to be of heritage value, and that is not mitigated or compensated as required by the regulators. The EIA found no significant effects of the Project on historic resources
Tsuut'ina requested the Historic Resources Section of the EIA/EIS for their review.	The link to the October 2017 EIA/EIS submission, including the Historic Resources section, was provided to the Tsuut'ina on November 3rd, 2017. The Tsuut'ina will also be provided with a link to the he revised EIA/EIS submission, once it is available for public viewing on the CEAA and AEP websites.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
The Tsuut'ina practiced tree burials with a cairn to mark the spot. Tsuut'ina do not want these cairns disturbed. A ceremony may be needed to properly respect those Tsuut'ina people who were part of the tree burials, but which sites cannot all be identified today.	Funding for a ceremony and feast was provided by AT in February 2018
Traditional Land and Resource Use (See Volume 3A and 3B, Section 14)	
There are plants in the SR1 area they harvest.	Alberta Transportation will provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction. Vegetation will be cleared from the project development area during construction. However, effects of the Project are not anticipated to result in the loss of traditionally used species in the local assessment area. The effects on plants and traditional use are assessed in the EIA in Volume 3A and 3B, sections 10 and 14.
Impacts to wildlife, fish and birds, as well as the exercise of our Aboriginal, Treaty, and Inherent rights.	The EIA/EIS has considered potential effects to wildlife, fish and birds, as well as the exercise of rights and traditional uses. The Project will result in direct and indirect loss of wildlife habitat during construction and dry operations; however, the amount of wildlife habitat permanently affected (168 ha) is relatively small compared to the availability of wildlife habitat remaining in the LAA (4,860 ha). Although there would be temporary displacement and disturbance to wildlife during construction, a measurable change in the abundance of wildlife in the regional assessment area is unlikely. The Project would result in temporarily unavailable wildlife habitat during flood operations and post-flood operations, with some potential permanent loss of wetlands due to sedimentation, which will result in its conversion into upland communities. Vegetation lost during floods would eventually be replaced by self-propagation of native vegetation in the surrounding area, or reestablished through hydroseeding. The amount of wildlife habitat affected is relatively small compared to the availability of wildlife habitat remaining in the regional assessment area (102,817 ha).

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
	The Project would result in direct and indirect alteration of fish habitat during construction and dry operations; however, the amount of fish habitat permanently affected (1,854 m^2) is relatively small compared to the availability of fish habitat remaining in the local assessment area (3,100,000 m^2). For the purposes of the EIA/EIS, effects on potential or established Aboriginal or Treaty rights are addressed through the assessment of the current use of lands and resources for traditional purposes. By acknowledging a link between practice-based rights and current use, the assessment accepts that adverse residual effects on the availability of traditional resources for current use, on access to traditional resources or areas for current use, or on sites or areas for current use will have a consequent effect on the ability of Indigenous groups to exercise potential or established Aboriginal and Treaty rights. In addition, a conservative assumption was made that Indigenous groups had access to the PDA to practice traditional use activities notwithstanding access to these private lands is limited.
Impact to plant harvesting, including medicinal plants that grow on sensitive riparian areas of the Elbow River.	Some plant species would be removed from the project development area during clearing activities. There is potential for a reduction in riparian and wetland areas as well as altered wetland conditions due to clearing. However, the effects of the Project are not anticipated to result in a loss of species or a loss in wetland function overall within the local assessment area. Although individual plants would be removed from the project development area, none of the traditionally used species identified, during the aboriginal engagement program and through publicly available traditional ecological knowledge reports, would be lost in the local assessment area, nor would vegetation communities supporting traditionally used plants be lost from the project development area. In the event of a flood, there would be mortality of traditional plant use species found in upland plant communities within the flooded area of the reservoir. Because these species are common and widespread, and based on visual observance of plant recovery lost as a result of previous flood events, re-establishment of these species will occur by natural recruitment over time. Therefore, permanent loss of traditional plant use species is not anticipated.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Recommend an additional traditional land use study be done within blooming season.	Alberta Transportation has provided funding to Tsuut'ina for a traditional use study. Budgets provided in July 2016 and July 2017 were approved by Alberta Transportation. To facilitate the traditional use studies, Alberta Transportation arranged and facilitated 21 site visits by Tsuut'ina within the Project Development Area (PDA) over the period between the fall of 2016 to the late summer of 2017. A TUS was not received in time to be incorporated in the EIA/EIS submitted in October 2017. A draft TUS has now been received however Tsuut'ina's permission to include the information from it in the revised EIA/EIS re-submission has not been received. Alberta Transportation has provided Tsuut'ina with the draft Traditional Land and Resource Use EIS (Volumes 3A and 3B) for review and comment under correspondence dated XX and arranged a 4-day workshop with Tsuut'ina from March 1, 5, 6 and 7th2018. The workshop was facilitated by CEAA with the goal of better understanding potential impacts to Tsuut'ina from the Project and to provide responses to the concerns raised to date. Verification of the meeting minutes from the workshops was not received prior to March 16, 2018 and therefore the TLRU section has not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIA/EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
Accidents and Malfunctions (See Volume 3D, Section 1)	
Accidents or malfunctions resulting from construction activities. The Project would intersect with several operating or inactive buried pipelines in the Project area, some of which also cross Tsuut'ina reserve. These pipelines carry a variety of substances including high pressure and low-pressure product, natural gas and sour gas. Concern about what would happen to oil pipelines that traverse the SR1 project.	The procedures for dealing with overhead and buried utilities located within constructions zones is highly regulated. All regulatory requirements will be strictly adhered to. Oil and gas pipelines operated by four companies (TransCanada Pipelines Ltd., Pengrowth Energy Corp., Veresen Inc., and Plains Midstream Canada) are located within the diversion channel, dam, and reservoir areas. Alberta Transportation are currently in contact with these utility owners and crossing agreements will be developed. Buried pipeline and overhead utilities will be relocated, moved or lowered as required. Prior to any soil disturbance, utility locate sweeps will be done and buried lines and pipelines will be flagged and marked. Pipeline crossings will be designed and maintained as required by the utility owners and in strict compliance with regulations. Daily hazard assessments will be conducted before work is undertaken in the vicinity of utilities. In the event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address pipeline emergency response. The implementation preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities. In the unlikely event of damage to existing pipelines, project personnel would contact the pipeline company's emergency contacts to address and coordinate the emergency response. The implementation of preventative measures and of daily hazard assessments will greatly reduce the risk of accidental contact with utilities
Concerned any failure of the SR1 dam or spillway during a flood could have catastrophic consequences for Tsuut'ina How the failure of any dam would affect Tsuut'ina first.	SR1 dam and structures will comply fully with the Canadian Dam Association guidelines and statistically a dam breach is unlikely. However, an emergency preparedness plan will be prepared, and advanced warning would be given in the event of a failure. Instrumentation will be installed and will provide advanced warning if failure issues are detected. The emergency spillway will prevent flood waters from overtopping the dam.

Table B-10 Tsuut'ina Nation – SR1 Project Specific Concerns and Responses

Issues, Concerns and Recommendations	Responses and Outcomes
General	
Tsuut'ina Consultation Office have concerns and made SR1 map inquiries related to the buffer zones around the SR1 Project, in particular impacts to their Reserve Lands.	The potential effects of the Project have been assessed using three geographic areas. The Project Development Area (PDA), the Local Assessment Area (LAA) and the Regional Assessment Area (RAA). The LAA is generally an area larger than the PDA and is considered to be the area where Project effects would be reasonably expected to occur and where effects can be predicted or measured with a reasonable degree of accuracy. The RAA is an area larger than the LAA and is an area within which Project effects may interact or accumulate with the effects of other projects or activities. The LAA and RAAs are generally significantly larger than the PDA to ensure that Project effects are assessed beyond the project footprint. For example, in Aquatic Ecology, the PDA is 1440 ha, the LAA is 10,364 ha and represents an area from the Elbow Falls to the inlet of the Glenmore Reservoir, and the RAA is 125,438 ha and represents the Elbow River Watershed. In this case both the LAA and RAA intersect with the Tsuut'ina Reserve. The EIA document also contains an assessment of the potential Project effects on Federal Lands (Volume 3A and 3B, Chapter 18).