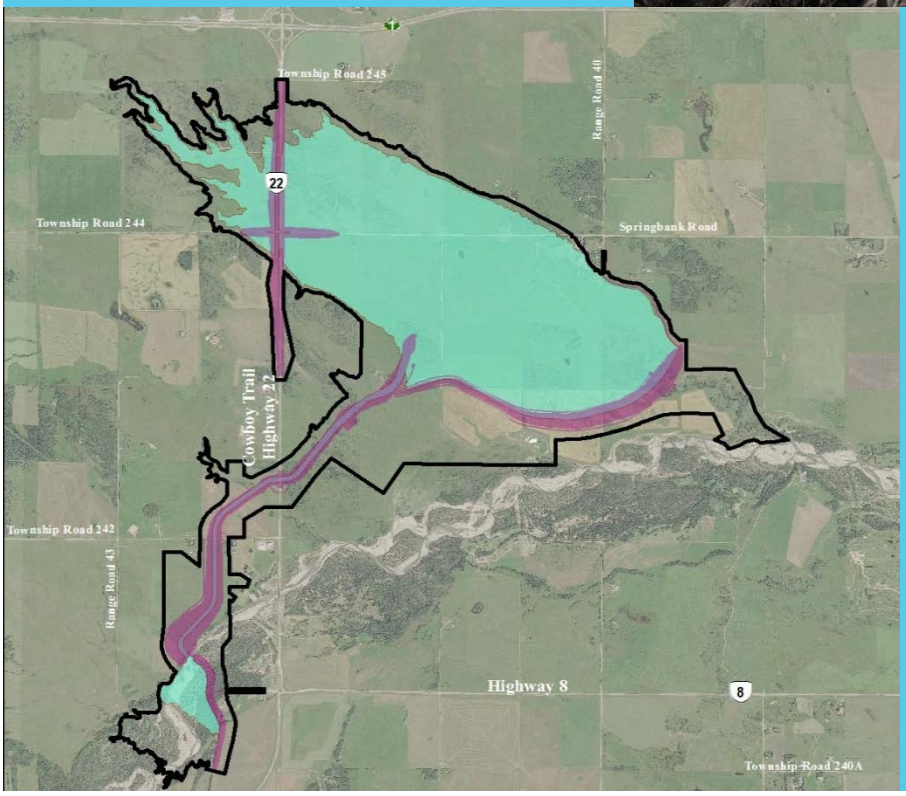
Springbank Off-stream Reservoir Project

Environmental Impact Assessment



Volume 1
Project Description

March 2018

Alberta Transportation

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ATTACHMENT A WATER MANAGEMENT PLAN

Abbreviations

AEP	Alberta Environment and Parks
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
EIA	environmental impact assessment
GOA	Government of Alberta
HRV	historic resource value
IDF	Inflow design flood
MC1	McLean Creek Dam
NRCB	Natural Resources Conservation Board
PMF	probable maximum flood
RAM	Alberta Resilience and Mitigation
SARA	*Species at Risk Act*
SOMC	species of management concern
The Project	Springbank Off-stream Reservoir Project
the Agency	Canadian Environmental Assessment Agency

1.0 INTRODUCTION AND OVERVIEW

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 then 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, water courses and people in the City of Calgary and downstream communities.

1.1 PROJECT PROPONENT

1.1.1 Proponent Contact Information

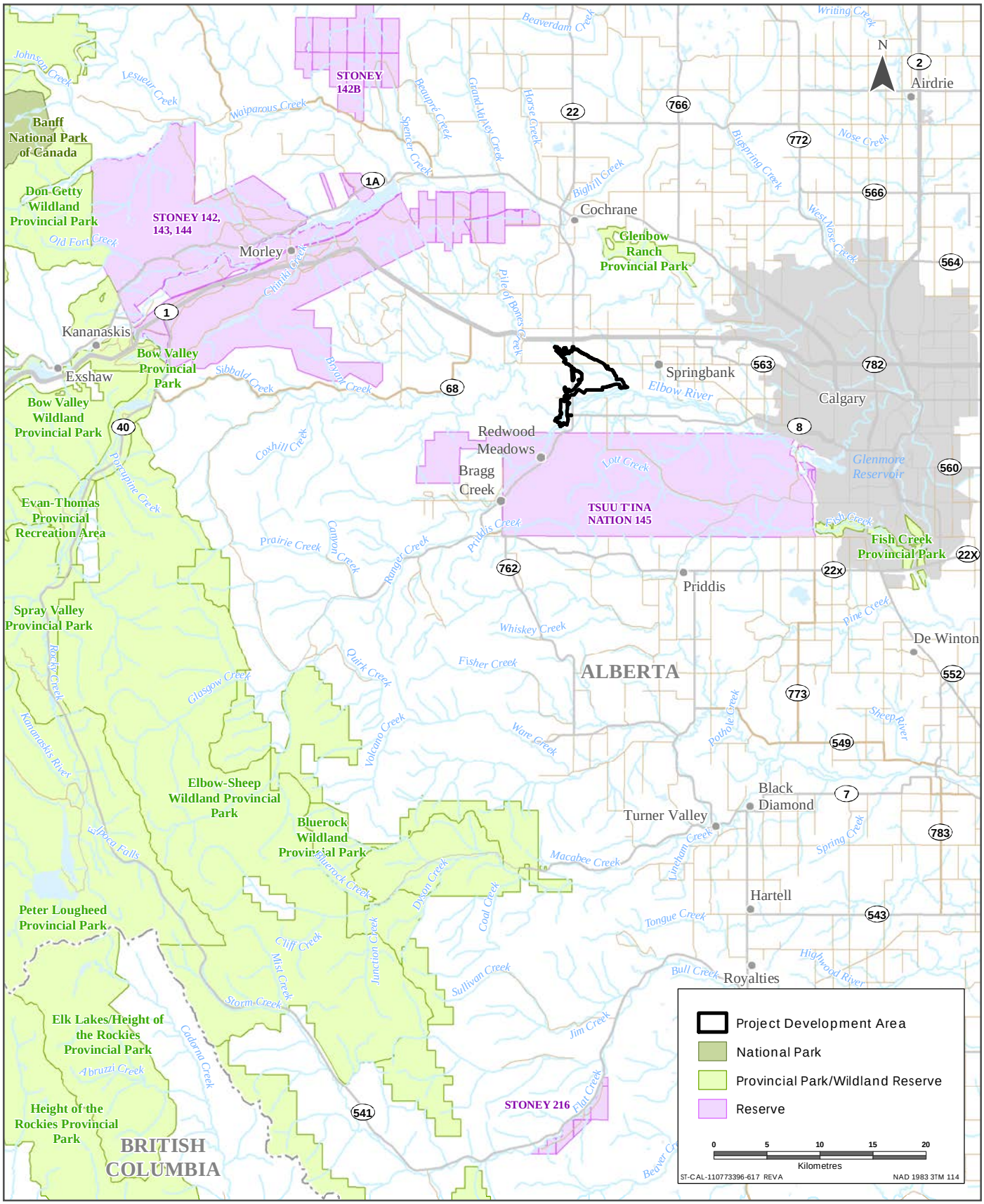
Formal name of the project: Springbank Off-stream Reservoir

Name of the proponent: Alberta Transportation

Address of the proponent:
3rd Floor Twin Atria Building
4999 – 98 Avenue
Edmonton, Alberta
T6B 2X3

Chief Executive Officer:
Syed Abbas, P.Eng.
Director Water Management Section

Principal contact person:
Mark Svenson, P.Biol.
Transportation, Environmental Coordinator
Phone: 780-644-8354
Fax: 780-422-2027
Email: mark.svenson@gov.ab.ca



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

Springbank Off-stream Reservoir Project Location

1.1.1.1 Proponent's Corporate and Management Structures

Alberta's Ministry of Transportation (Alberta Transportation) is comprised of Alberta Transportation and the Transportation Safety Board. Alberta Transportation has responsibility for the Province's extensive transportation network and water management infrastructure, including, but not limited to, highways, bridges, culverts, ferries, dams, reservoirs and canals. Alberta Transportation has a business goal of providing safe, efficient and sustainable transportation and water management infrastructure through effective planning, design, construction, rehabilitation, operation, maintenance and decommissioning.

Alberta Transportation has an Environmental Management System (EMS) which is an organized and formal approach to managing environmental issues with the goal of making environmental considerations part of daily activities. At its core, the purpose of the EMS is to identify and responsibly manage the potential environmental impacts of Alberta Transportation's activities and projects. The EMS consists of 10 chapters:

- introduction to the environmental management system
- roles and responsibilities
- regulatory requirements
- environmental practices and procedures
- spill release reporting procedures
- noncompliance and corrective and preventive action
- inspection and monitoring
- communication
- environmental training
- environmental audit program

1.2 PROJECT OVERVIEW

The Project consists of the construction and operation of an off-stream reservoir to divert and retain a portion of Elbow River flows during a flood and release the water in a controlled manner after the threat of flood has subsided. The reservoir will not hold a permanent pool of water.

The off-stream reservoir will work in tandem with the Glenmore Reservoir to limit flood flows downstream of the Glenmore Reservoir in Calgary to less than 160 m^3/s, for floods up to the design flood (2013 flood), or equivalent. 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 in excess of 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 exceeds the amount of water that overtopped Glenmore Dam during the 2013 flood and caused damage from overland flooding.

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

The primary Project components are:

- 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 retained water back to the river after the flood subsides through an existing unnamed creek channel.

Aerial photographs showing representations of the primary project components are presented as Figures 1-2 through 1-4.

Figure 1-2 Looking Southeast towards the Off-Stream Reservoir and Dam

Figure 1-3 Looking South towards the Reservoir, Dam and Diversion Channel

Figure 1-4 Looking Northeast towards the Project

Other project works are necessitated by construction of the primary components:

- new roadworks and bridges
- utility relocations

The Project is designed to mitigate potential flood damage in the City of Calgary. 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 Fisheries and Oceans Canada. The provincial government has provided funding to Redwood Meadows for flood protection.

1.2.1 Project Schedule and Implications

The Project timeline for engineering design and environmental assessment; regulatory approval; land acquisition and construction are presented in Figure 1-5. the Project is scheduled to be functionally operational (able to accommodate a 1:100 year flood) 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 floods in 2021 or beyond.

Project Timeline

* **Functionally Operational:** When the Springbank Project will be able to accomodate 1:100 year flood event.

** **Final Completion:** When the Springbank Project will be able to accommodate water volumes equal to the 2013 flood.

Figure 1-5 Project Timeline

1.3 PROJECT LOCATION

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 1-6). 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 1,200 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.

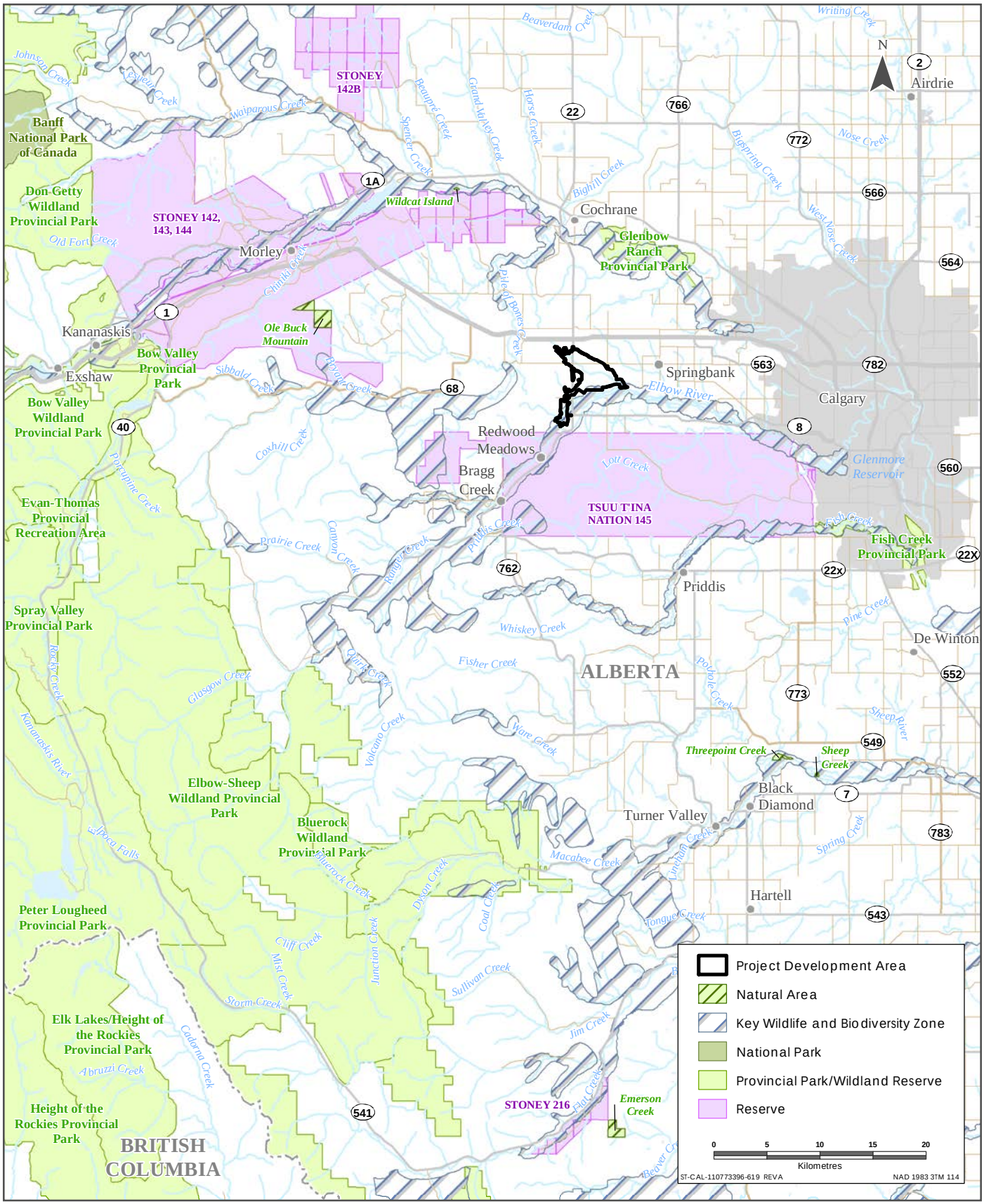
The location of the Project is determined by the capacity requirement for the off-stream reservoir. The natural basin of the Unnamed Creek that will be used for the reservoir is the only one of sufficient size to meet flood management requirements when dammed in the designed facility configuration.

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 will 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



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

Regional Features

1.3.1 Spatial Extent

The PDA occupies 1,438 ha, which is the anticipated area of temporary physical disturbance associated with the construction and operation the Project; it includes the permanent physical works, the areas of impoundment to the top of the dam and floodplain berm (above their service level).

Figure 1-6 shows the relationship of the Project with regional features. The nearest Indigenous communities (both in Treaty 7) are Tsuut'ina Nation, located 619 m south of the southernmost part of the PDA, and Stoney Nakoda Nations, 28 km to the northwest. Refer to Section 7 for additional information on Indigenous communities that have been identified for engagement on the Project.

The closest other federal land to the Project is Banff National Park, approximately 63 km to the west at the Highway 1 park entrance.

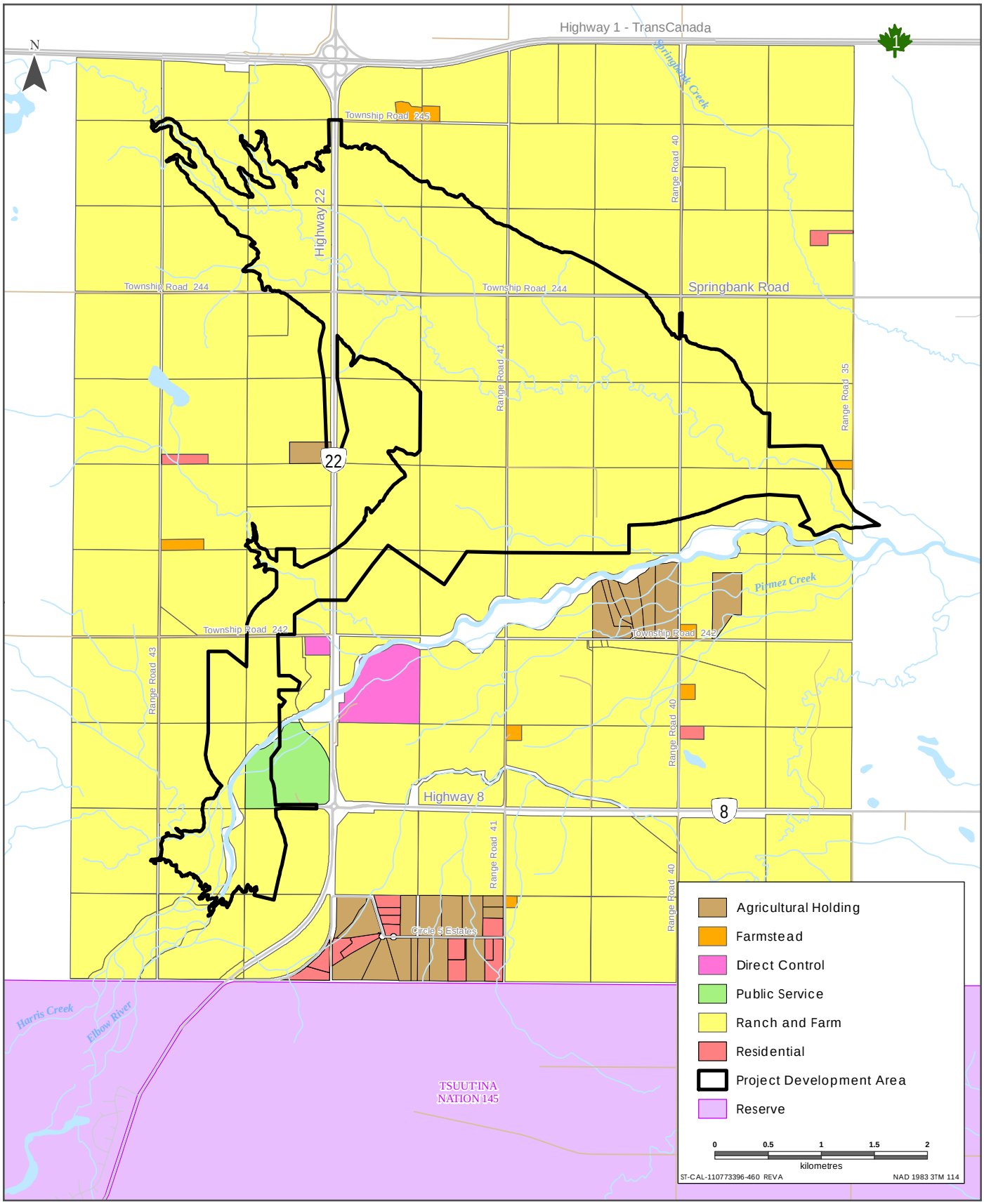
1.3.2 Land and Water Use

1.3.2.1 Land Use

Most land within or near the Project is privately owned; public land is limited to the rights-of-way for roads and road allowances, and the bed and banks of the Elbow River and its tributaries. The Government of Alberta owns three parcels of land in the PDA. The privately-owned land lies within land use districts identified by the Rocky View County Land Use Bylaw (Bylaw C-4841-97), which specifies the types of development allowed in each land use district and provides planning guidance for development in those areas. The land use districts within or near the Project (Figure 1-7) are:

- ranch and farm
- agricultural holdings
- farmstead
- residential
- public services
- direct control

The privately-owned land in the PDA is classified "ranch and farm," except for one farmstead and a small area within the Public Services District. Public service lands are owned by local organizations that use them for summer camps. Land ownership of most properties includes only surface rights; however, several landowners also hold mineral rights for their properties.



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

Existing Land Use Context

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Land Acquisition

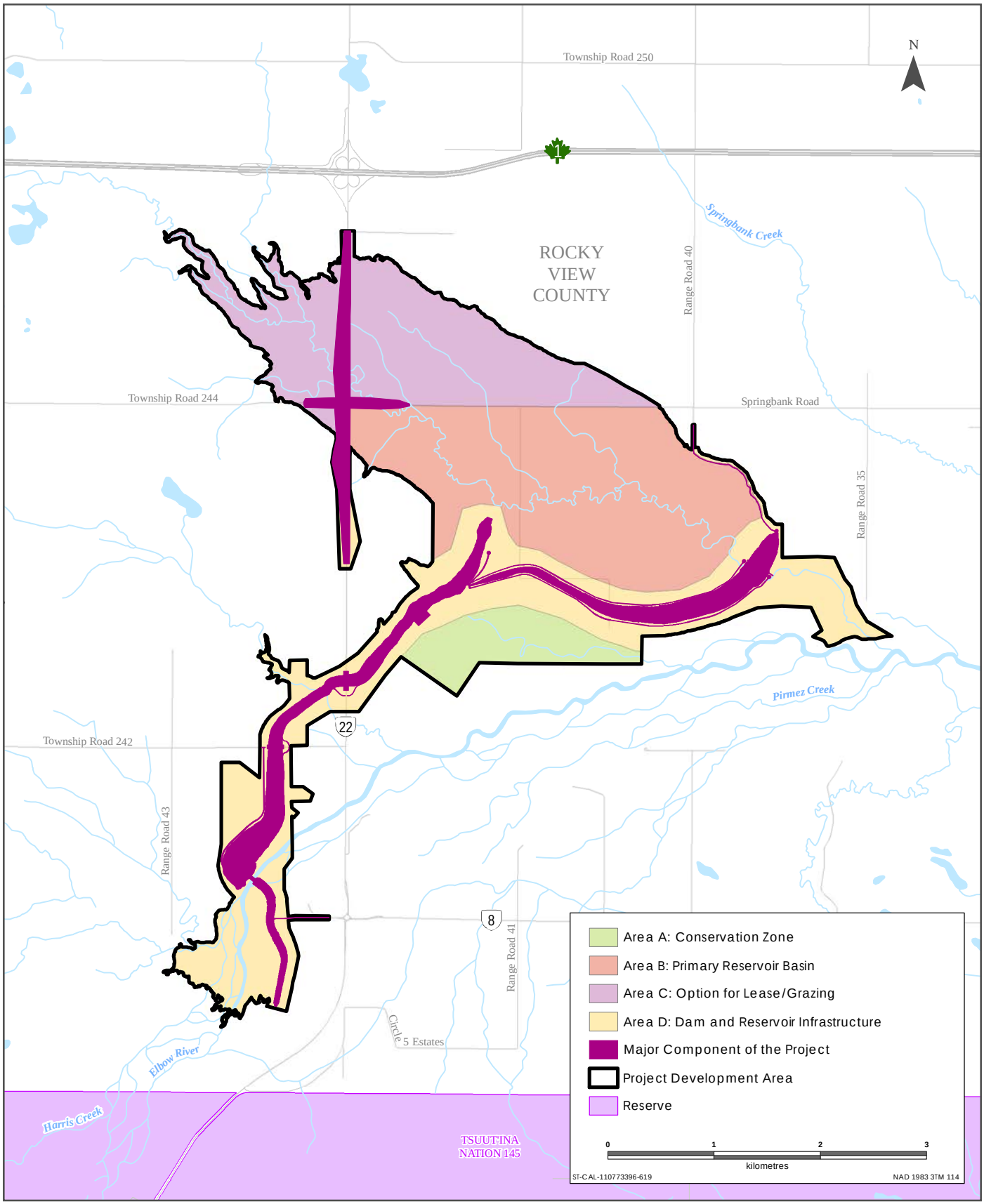
Prior to the start of construction, the Government of Alberta will acquire the privately-owned land (surface rights only) that is required for the Project and landowners will be compensated appropriately. Post-development land classifications are shown in Figure 1-8:

- 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.
- Area C: has options for grazing through public leases. The land will 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.

1.3.2.2 Water Use

The Elbow River is the source of nearly one-half of Calgary's water supply. It is also a source of water for the Springbank area. In the project area, water is used to supply domestic, livestock and irrigation needs and recreation.



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

Stantec

1.4 REGULATORY FRAMEWORK AND THE ROLE OF GOVERNMENT

1.4.1 *Provincial Regulatory* Requirements

1.4.1.1 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.

1.4.1.2 Other Provincial Regulatory Approval Requirements

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

Table 1-1 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 1-1 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.

1.4.1.3 Other Applicable Provincial Regulatory Requirements

Other applicable provincial environmental legislation that could directly affect Project activities is listed in Table 1-2.

Table 1-2 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

1.4.2 Federal Regulatory Requirements

1.4.2.1 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 (Stantec 2016a), and on August 10, 2016 the Canadian Environmental Assessment Agency (CEA Agency) issued *Guidelines for Preparation of an Environmental Impact Statement under the Act* (CEA Agency 2016). See Volume 4, Appendix A for concordance tables that identify where the requested information can be found.

1.4.2.2 Other Federal Regulatory Requirements

Other federal environmental legislation applicable to Project activities is listed in Table 1-3.

Table 1-3 Federal Legislation Applicable to the Project

Legislation	Applicable Section(s)	Resources Protected/Managed	Type of Activity	Responsible Agency	Project Phase	Project Component
Navigation Protection Act	Approval under Section 5 (assessment by Minister), Section 15 (Obstructions), and Section 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

Table 1-3 Federal Legislation Applicable to the Project

Legislation	Applicable Section(s)	Resources Protected/Managed	Type of Activity	Responsible Agency	Project Phase	Project Component
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 construction and post-flood operation, so a permit may be required. The *Migratory Birds Convention Act* will 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 will 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 purpose of the activity (Subsection 73(2)):

- is scientific research relating to the conservation of the species and conducted by qualified persons;
- the activity benefits the species or is required to enhance its chance of survival in the wild; or
- affecting 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 will 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 will apply through all phases of the Project and components, but fish, wildlife and vegetation species will be most vulnerable to effects during construction 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 will be applicable during all phases of the Project but navigation will be most likely to be affected during the construction for work in the Elbow River on the diversion structure.

1.4.2.3 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 will achieve Alberta's long-term economic, environmental and social goals
- the South Saskatchewan Regional Plan (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

1.4.3 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). See Volume 3A, Section 12 for details regarding the Municipal District of Rocky View No. 44 Municipal Development Plan (MDP).

2.0 PROJECT JUSTIFICATION AND ALTERNATIVES CONSIDERED

2.1 NEED FOR THE PROJECT

The Elbow River flood of 2013 was a devastating event socially and economically. A study by IBI Group (2017) 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.

2.1.1 Project Benefits

The principal benefit of the Project is to reduce the potential damaging effects of future Elbow River floods on the City of Calgary and downstream communities. The benefits of the Project are also discussed in the assessment section on employment and economy in Volume 3B, Section 17.

2.2 ALTERNATIVE MEANS OF CARRYING OUT THE PROJECT

The terms of reference for the environmental assessment from Alberta Environment and Parks and the guidelines from the Canadian Environmental Assessment 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* (Canadian Environmental Assessment Agency 2015).

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 were also important factors. Such as considerations for sediment control, navigation, fish movement and habitat loss. The criteria used to evaluate each Project component varied and are detailed below in Sections 2.2.2 through 2.2.5. The preferred alternatives are the basis for the EIA and they are presented in Section 3.2, Project Components.

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

Alternative means of carrying out the Project are discussed under the following subsections:

1. potential technically and economically feasible alternates are identified
2. the criteria for evaluating the alternatives are described
3. the potential of effects of the alternatives on valued components are listed
4. the preferred alternative is identified

2.2.1 Project Location Alternatives

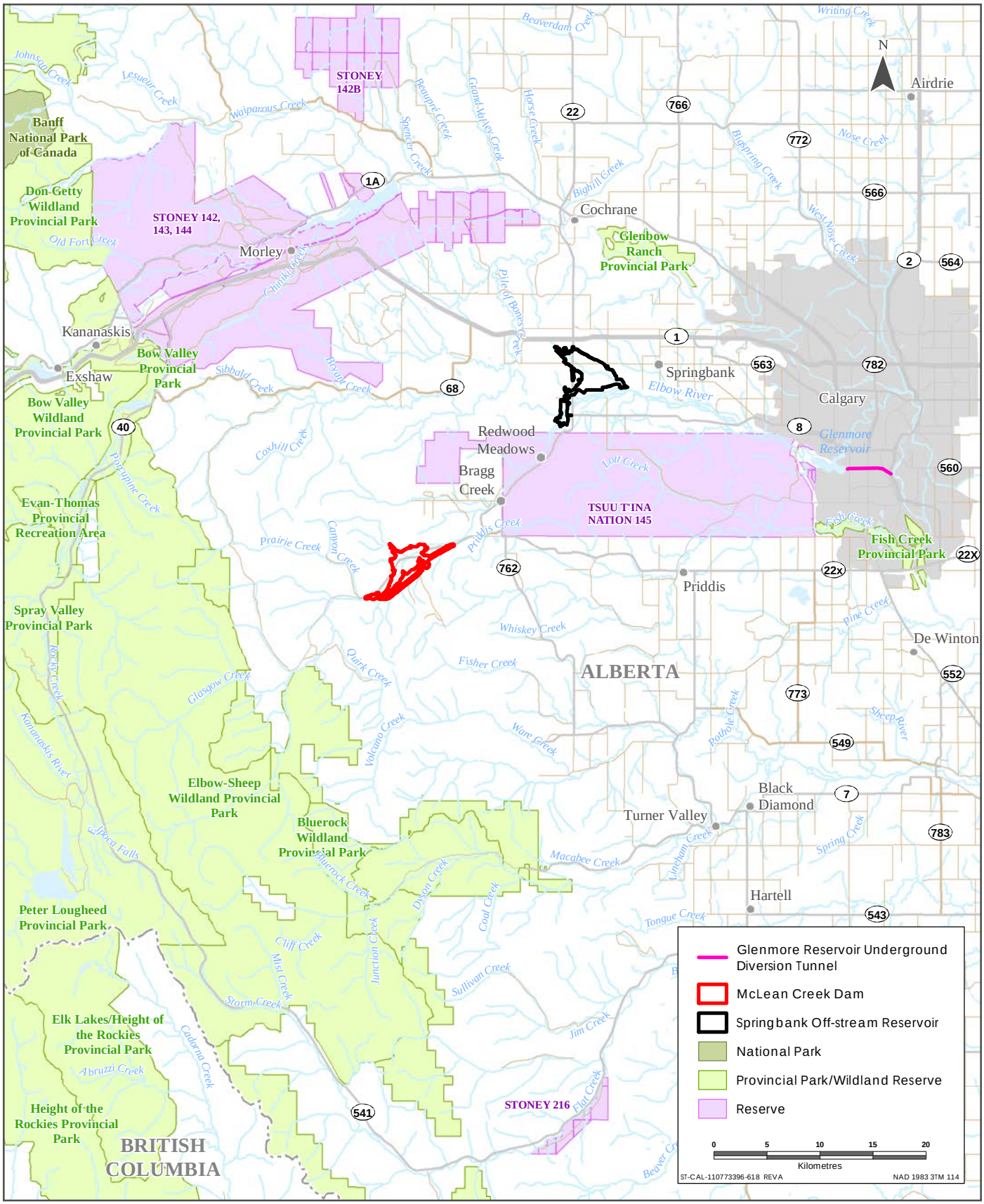
Following the floods of June 2013, the Government of Alberta (GOA) set up the Southern Alberta Flood Recovery Task Force. Five potential locations for flood mitigation measures on the Elbow River were identified (AMEC Environment and Infrastructure 2014):

- a dry dam on Quirk Creek near the upper reaches of the Elbow River
- a dry dam on Canyon Creek, also near the upper reaches of the Elbow River
- an underground diversion tunnel running east from Glenmore Reservoir and discharging into the Bow River
- 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)
- an off-stream reservoir at Springbank Road (SR1, or the Project)

The Quirk Creek option was dismissed due to slope stability concerns. The Canyon Creek option was dismissed because the volume was too small for the amount required for flood mitigation.

The three remaining sites were studied further and are described below (Figure 2-1).

In 2014, the GOA chose the off-stream reservoir as the preferred initiative for Elbow River.



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

Project Alternatives for Elbow River Flood Protection in the Calgary Area

2.2.1.1 Glenmore Reservoir Underground Diversion Tunnel

In 2015, the IBI Group (2015) was commissioned by the GOA to undertake a benefit/cost analysis of the Glenmore Reservoir underground diversion tunnel. The analysis considered two damage scenarios (high and low) and two flood scenarios (1:100 and 1:200 year return periods). The costing for the Project included the costs of additional flood mitigation to protect Bragg Creek and Redwood Meadows. Table 2-1 reports the results of the analysis.

Table 2-1 Benefit/Cost Ratio of Alternative Elbow River Flood Mitigation Projects

Mitigation Project	High Damage Scenario		Low Damage Scenario	
	1:100 Protection	1:200 Protection	1:100 Protection	1:200 Protection
Off-stream reservoir	1.87	2.07	1.32	1.32
MC1	1.43	1.65	1.01	1.05
Glenmore Reservoir diversion tunnel	1.21	1.20	0.81	0.83

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 off-stream reservoir or MC1 in all four of the scenarios. Consequently, the diversion tunnel was rejected from further consideration.

In 2017, the IBI Group updated the results for the MC1 and off-stream reservoir options based on further engineering and environmental studies IBI Group (2017).

2.2.1.2 McLean Creek Option

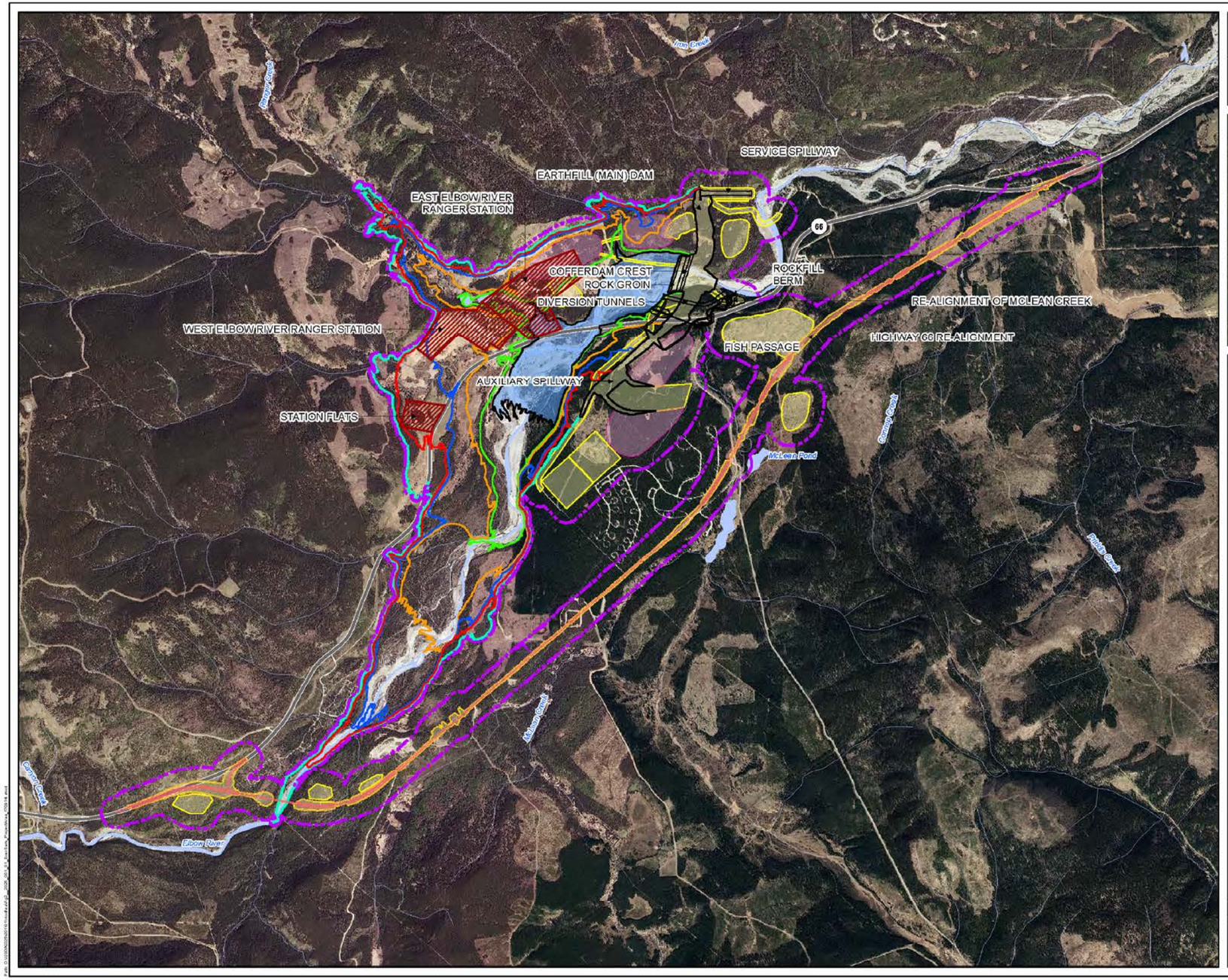
In 2016, Alberta Transportation commissioned Opus Stewart Weir (Opus) and Hemmera Envirochem Inc. (Hemmera) to carry out engineering and environmental studies of the McLean Creek Option (MC1 Option) in order to provide a more detailed comparison between the off-stream reservoir and the MC1 Option. Opus prepared a conceptual level of design report on the MC1 Option and Hemmera prepared an Environmental Impact Screening Report based on the Opus design. A summary of the Hemmera report is provided in Volume 4, Supporting Documentation, Document 2.

The MC1 Option would be located in Kananaskis Country, approximately 10 km upstream from the hamlet of Bragg Creek and 40 km west of Calgary. The MC1 Option would include an earth fill dam across the Elbow River valley, which would provide flow regulation within the river upstream of its confluence with McLean Creek. Normal river flows would be controlled through two gated, 6 m diameter, low-level diversion tunnels located along the south side of the Elbow River channel. Other elements of the MC1 Option included an ungated service spillway and an auxiliary spillway to protect the dam during more extreme floods. MC1 Option would maintain a small permanent pond of 3.5 million m^3 of water to control sediment migration to the outlet structure.

The MC1 Option would be classified as an extreme consequence dam under Alberta's Dam and Canal Safety Guidelines (Alberta Environmental Protection 1999) and is designed to withstand the probable maximum flood (PMF) of 2,770 m^3/s. The maximum reservoir volume, when passing that flood, would be 93 million m^3 and the auxiliary spillway located along the south abutment of the dam would be activated.

Sources of materials and aggregate for the construction of the MC1 Option (e.g., dam embankment) were identified along with stockpile and spoil locations. Material required for construction would be sourced from borrow areas located in the general vicinity of the MC1 components.

The layout of MC1 Option is shown in Figure 2-2.



Elbow River at McLean Creek Dam (MC1)

Option Area

Legend

- MC1 Option Area
- MC1 Option Dam
- Highway 66 Re-alignment
- Probable Maximum Flood (PMF) Level
- 2013 Flood Event (1424.1 m)
- 1:100 Flood Event
- 1:20 Flood Event
- 1:50 Flood Event
- Borrow Area
- Laydown Area/Disturbed Area
- Permanent Pond
- Existing Park Infrastructure to be Removed
- Highway
- Watercourse
- Waterbody

Notes

1. All locations and features should be considered approximate and are to be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Basedata: Government of Alberta, 2017
- Preferred Road Option and Disturbed Areas: Opus International Consultants Limited, 2017
- Dam Details: Hatch Ltd., 2017
- Aerial Imagery: SPOT 1.5 m, 2016
- Inset Basemap: ESRI Topographic Basemap

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HEMMERA

Alberta Transportation

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Sources: Original figure produced by Hemmera

2.2.1.3 Comparison of the Project (SR1) and MC1 Option

Deltares were commissioned by Alberta Environment and Parks to prepare a comparative evaluation of the MC1 Option and the off-stream reservoir. The report (Deltares 2015) is included in Volume 4, Supporting Documentation, Document 3. The report recommended the Springbank Off-stream Reservoir Project, in combination with local mitigation for Bragg Creek and Redwood Meadows, over the MC1 Option. AEP (2015) compiled a category-by-category comparison between the Project and the MC1 Option based on the results of the Deltares and AMEC (2014) reports. The AEP comparison is presented in Table 2-2.

Table 2-2 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. • The Project 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 the Project. • 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 the Project is an off-stream project, less in-stream work will be required during its construction.

Table 2-2 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. • The Project 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. • The Project 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 2-2 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. • The Project 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 (see Volume 4, Supporting Documentation, Document 3) 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, the Project 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 the Project. • Deltares recommended that compensating landowners after floods should be considered because it could be less costly than buying the land.

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

Category	Comparisons
Construction Timelines	• It is expected that the Project 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 the Project 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 construction. • Overall, the assessment and scoring for the Project 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 Project from a cost, environmental and risk basis.
SOURCE: Alberta Environment and Parks 2015	

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

In 2017, the IBI Group (2017) prepared an updated benefit/cost analysis comparing the off-stream reservoir (SR1) and MC1 based on the SR1 Interim Design Report (Stantec 2017b) and the Opus Conceptual Design Report (Opus 2017). SR1 has a better benefit/cost ratio (1.68) than the MC1 Option alternative (1.44). The IBI Group report is included in Volume 4, Supporting Documentation, Document 1.

Table 2-3 compares the Project and the MC1 Option based on the updated engineering design, environmental studies and benefit/cost analysis that have been completed since the issuance of the Deltares 2015 report.

Table 2-3 Alternative Option Comparison

Parameter	The Project (SR1)	MC1 Option
Catchment Area	• 868 km²	• 695 km²
Geohazard	• Dam embankment: low risk of earthquake damage	• Larger dam embankment and so possibly greater susceptibility to earthquake damage
Project Timeline	• Operational 2020	• Operational 5.5 years from decision to move forward
Environmental Issues	• Key Wildlife and Biodiversity Zone • Fish passage at the diversion structure may be affected by low flows in the Elbow River. • Off-stream reservoir does not affect fish habitat on the Elbow River • Flow through river structure will have minimal impact on river morphology	• Key Wildlife and Biodiversity Zone, Grizzly Bear Zone (key habitat) • The dam creates a permanent barrier to fish movement on the Elbow River include Bull Trout, a federal species at risk • The dam creates a permanent upstream pond changing the habitat from a riverine one to a lake one • Blockage of river sediment transport by the dam will result in erosion and reshaping of river downstream
Flooding Risk During Construction	• Minimal risk to downstream communities during construction	• Potentially significant risk downstream if flood were to exceed the 1:50 year flood, particularly during the first two years of dam construction
Cost	• $372 million (including the estimated $60 million the government will recover from the sale of any surplus land purchased through the acquisition options provided to landowners)	• $406 million
Geotechnical Factors	• No major foreseeable geotechnical issues. • Dam construction will be off-stream away from the geotechnical effects of the Elbow River valley	• The geotechnical issues associated with the McLean Creek option are significantly more complex than the Springbank Project
Benefit/Cost Ratio	• 1.68	• 1.44

2.2.2 Diversion System

The diversion system consists of four main elements: diversion inlet, service spillway, floodplain berm, and auxiliary spillway. An alternative location of the diversion system was also considered. Alternatives means for the diversion location, inlet, service spillway and auxiliary spillway are discussed below. Alternatives for the floodplain berm were not identified.

2.2.2.1 Diversion System Location

Potential Alternatives

Stantec reviewed potential adjustments to the diversion system location relative to the initial design concept (IDC) proposed by AMEC in 2014. 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.

Evaluation Criteria

Initial consideration was given to locations downstream of the IDC site, but these were dismissed because their location will not allow the required full supply level (FSL) elevation in the reservoir for the design flood relative to river elevations. The evaluation of the upstream and IDC locations focused around the benefits of increased channel elevations (at the upstream location) versus the shorter diversion channel (at the downstream location).

Potential Effects on Valued Components

The environmental effects of both locations will be similar for many valued components. For example, either location will affect land use, fish and fish habitat, vegetation and wetlands, wildlife habitat and movement, potential historical resource sites, and traditional land and resource use. The extent of these changes will depend on the extent or length of the diversion channel which extends from the diversion system location to the reservoir. The effects of the chosen alternative are discussed in the valued component sections in Volume 3A and Volume 3B.

Preferred Alternative

The IDC location was chosen as the preferred diversion 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.

2.2.2.2 Service Spillway

Potential Alternatives

The service spillway is designed to control Elbow River water surface elevations upstream of the diversion inlet during a flood. The spillway includes gates to control water flow downstream. Two types of gates can be used for this purpose:

- underflow gates which draw from the bottom of the water column, such as for radial and vertical lift gates and
- overflow gates which draw from the top of the water column such as for crest or 'flap' gates

Three potential gate types were considered for the service spillway:

- radial gate (underflow)
- bottom hinged steel 'flap' gate with top mounted hydraulic cylinders (overflow)
- Obermeyer crest gate (overflow)

Both underflow and overflow gates are suitable for use. Vertical lift gates were not selected because they would be more expensive to supply than equivalent sized radial gates, would require more piers for the same spillway width, and would need a higher structure for the hoist bridge than radial gates. Top mounted hydraulic cylinders were selected for the steel flap gate because under-gate cylinders would require a pit for the cylinders to lay in when the gate was lowered that would be submerged and could become filled with sediment.

Evaluation Criteria

Table 2-4 compares the three gate types. Evaluation criteria included site conditions, operational needs, environmental conditions, aesthetics and public access.

Table 2-4 Comparison of Service Spillway Gate Types Considered

Evaluation Criteria	Obermeyer Crest Gate	Bottom Hinged Steel "Flap" Gates	Radical Gates
1. Gate Operation	• Able to make fine adjustments to maintain target discharge and/or water surface	• Able to make fine adjustments to maintain target discharge and/or water surface	• Not suitable for small openings or minor position adjustments
2. Operational Reliability "Fail-Safe" Position and Failure Modes	• Fail safe gate position is open • Water weight/gravity will lower gate to pass more flow • Risk of failure to move gate from closed position to open position is unlikely • Redundant systems are available to operate gate	• Fail safe gate position is open • Water weight/gravity will lower gate to pass more flow • Risk of failure to move gate from closed position to open position is minimal, but subject to failure of exposed hydraulic actuators • Redundant systems are available to operate gate	• Fail safe gate position is closed • Gate can close under gravity without power • Most likely to bind or exhibit hoist failure when attempting to open gate to pass more flow • Hoist operation needed to open gate
3. Emergency Operation (in the event of power loss)	• Partially functional without power or remote signal assuming air accumulators[1] are supplied • Emergency generator required for long term outages	• Partially functional without power assuming hydraulic accumulators are supplied • Ability to lower gates can be maintained • Emergency generator required for long term outages and recommended for short- term outages	• Partially functional without power or remote signal • Gate can be lowered without power, but can't be raised • Emergency generator required for all outages
4. Ability to Pass Floating Debris (debris rafts and larger trees)	• Best suited system of those considered	• Potential for debris to catch on exposed actuators • Increased number of intermediate piers	• Practical limit on width of water passage is less than other systems considered • Overhead deck and hoist system required, which is not present with other systems considered

Table 2-4 Comparison of Service Spillway Gate Types Considered

Evaluation Criteria	Obermeyer Crest Gate	Bottom Hinged Steel "Flap" Gates	Radical Gates
5. Ability to Pass Bed Load Sediments (large volume of cobble, gravel, abrasives)	• Well suited for normal conditions but not flood flows • May require abrasive covering on upstream face for protection	• Well suited for normal conditions but not flood flows • May require abrasive covering on upstream face for protection • More susceptible to sediment accumulation on downstream side which could limit operation and reliability	• Best suited system of those gates considered for normal and flood flow conditions
6. Design Considerations	• Vendor has previously designed and installed multiple gates of the proposed size • Modular design • Flexible length of free opening. Pier frequency is determined by maintenance needs.	• Custom design system at high- end of common gate size • Height and length required for this site significantly increases size of leaf[2], hinges and actuators[3]	• Custom design system at middle of common gate size • Larger intermediate piers will be needed to resist gate forces • Overhead deck needed to support hoist system
7. Procurement Considerations	• Design and fabrication performed by a single source vendor	• Fabricator may need to subcontract gate design services • Longest procurement time of gates considered	• Fabricator may need to subcontract gate design services
8. Cost Implications (sourced from vender information)	• Lowest cost due to continuous leaf support and minimal added concrete structure	• Mid-range cost • More expensive than typical crest gate since this project requires gates on the high-end of the common gate size	• Most costly system due to increased concrete for water passages and hoist bridge requirements

Table 2-4 Comparison of Service Spillway Gate Types Considered

Evaluation Criteria	Obermeyer Crest Gate	Bottom Hinged Steel "Flap" Gates	Radical Gates
9. Construction Considerations	• Experience with previous design and installations of this size should reduce fit-up and interference issues • Smaller components for transportation to the site • Smaller components require smaller equipment and rigging for erection	• Unique design more susceptible to fit-up and interference issues • Size of torque tube is a transportation consideration • Component size and rigging equipment is somewhere between the other systems considered • May require field fabrication of components	• Tight tolerance for fabrication and field fit are critical for proper function • Oversize components are a transportation issue • Oversize components require large cranes and rigging for erection • May require field fabrication of components
10. Aesthetics	• Most attractive – fewer piers, pier height is lower, no overhead deck required • Gate is exposed during low flow conditions	• Somewhat less attractive – number of piers may increase, and top mounted hydraulic cylinders and piping visible • Gate is exposed during low flow conditions	• Least Attractive – multiple large piers and overhead deck is required, hoist equipment is visible • Gate is raised and visible during normal flow conditions
11. Security	• Public has access to structure • Least accessible for vandals • Fewest exposed mechanical components	• Public has access to structure • Moderately accessible for vandals • Some exposed mechanical components	• Public has access to structure, but limited access to hoists • Most accessible for vandals • Most mechanical components are exposed

Table 2-4 Comparison of Service Spillway Gate Types Considered

Evaluation Criteria	Obermeyer Crest Gate	Bottom Hinged Steel "Flap" Gates	Radical Gates
12. Inspection and Maintenance	• Inspection requires gate to be raised • Modular design means standard replacement parts available • May require an upstream cofferdam for extended maintenance	• Inspection requires gate to be raised • Custom parts for leaf and hinges; readily available parts for hydraulic operating system • May require an upstream cofferdam for extended maintenance	• Gate can be inspected during normal flow conditions • Custom parts for gate and hoists

NOTES:

[1] The accumulator is the hydraulic arm or unit to move the gate. With a bottom-hinged steel flap gate that uses hydraulics, the actuator would push or pull the gate leaf using hydraulic pressure pushing or pulling an arm.

[2] A gate leaf is a continuous gate element. In the case of the crest gates, each 24 m gate is comprised of four 6 m gate leaves that are continuously supported beneath by the bladder

[3] An accumulator is a method for storing energy (hydraulic or air pressure).

Potential Effects on Valued Components

The spillway gate alternatives are all designed to allow floating debris and bedload to pass and continue along Elbow River. As such, they will provide a positive effect on sediment transportation and lessen effects on fish and fish habitat.

Preferred Alternative

An Obermeyer crest gate is 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, thus 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.

The Obermeyer crest gate has two drawbacks. Its fail-safe position is open, which means that the gate must be raised under power at the beginning of a flood. This can be mitigated by using multiple independent modules for operation, provision of air accumulators and backup power systems, and regular inspection and exercising of the gates. Its inability to pass bed load during floods is partially mitigated with the addition of the adjacent sluiceway, which passes flow and sediment.

2.2.2.3 Auxiliary Spillway

Potential Alternatives

The auxiliary spillway is dam safety component that is reserved to convey excess flood flow without overtopping failure, or circumvention of the floodplain berm.

Three alternatives 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
- an RCC with an earthen overlay

Evaluation Criteria

The comparison of the auxiliary spillway alternatives focused on their operational capabilities. The conceptual design update included the use of an ACB placed along the crest and downstream slopes of the embankment. Hydrologic studies performed during preliminary design resulted in a substantive increase in the probable maximum flood (PMF) flow rates. These flow rates exceeded the capacity of ACBs to provide adequate armoring of the control section and slopes. ACBs were, therefore, eliminated from further consideration.

Potential Effects on Valued Components

An auxiliary spillway consisting of an ACB or RCB 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 alternative of an RCC base overlain by topsoil is more conducive to ungulate movement.

Preferred Alternative

The remaining two alternatives provided adequate hydraulic capacity and serviceability. However, the recommended RCC section with earth overlay resulted in a cost savings of $2 million over the RCC overlay. The RCC with earth overlay offered the additional benefit of providing wildlife passage over the structure.

2.2.3 Emergency Spillway

Potential Alternatives

The emergency spillway allows overflow from the diversion channel or reservoir to flow to a graded outlet channel and then overland to Elbow River.

During the early conceptual design phases of the Project, the emergency spillway was proposed at Alternate Location 1, shown on Figure 2-3, within the off-stream storage dam embankment. This location utilized a natural drainage channel to discharge the emergency spillway flows. Based on the information obtained from the subsequent geotechnical exploration, alternate spillway locations were reviewed to potentially reduce the risk of head-cutting and failure of the structure, and for potentially identifying a more economic design.

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

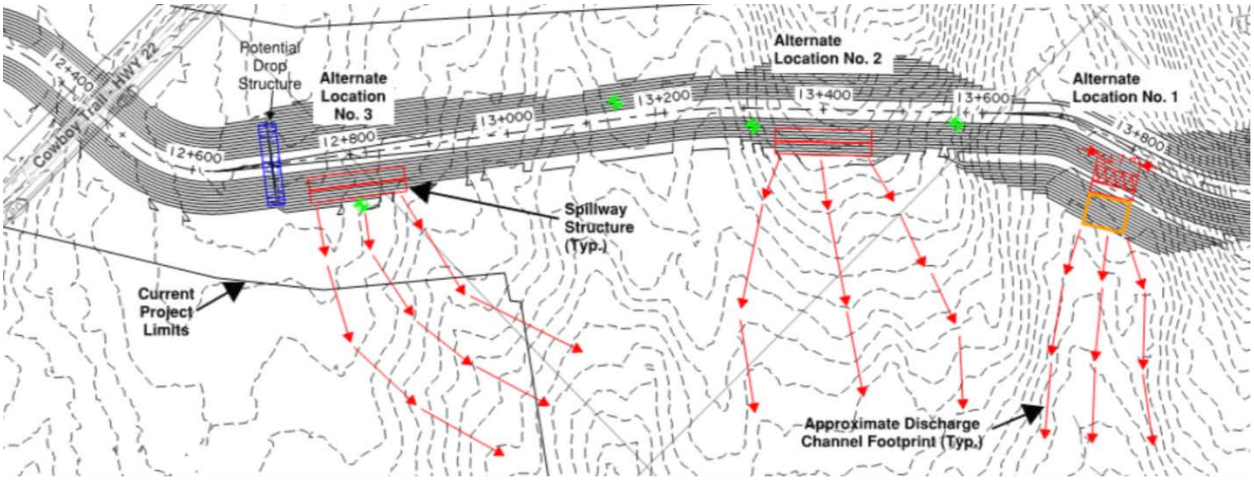


Figure 2-3 Three Proposed Alternate Spillway Locations

Evaluation Criteria

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. Location 3 appears to have more durable bedrock present than Location 2, and the structure and discharge channel will likely be cut deeper into the bedrock, which provides side-slope armoring as well. However, the discharge channel at Location 3 is also at a steeper slope, resulting in higher velocities. Alternate Location 2 has a slightly higher head-cutting potential than Alternate Location 3.

For both Location 2 and 3, a discharge channel width greater than about 120 m is required to avoid head-cutting back to the emergency spillway structure or diversion channel. Additionally, for Locations 2 and 3, the emergency spillway is located along the diversion channel rather than the dam, which results in side-channel weir hydraulics and a slightly less hydraulically efficient weir, as compared to an inline weir configuration.

The discharge channel for 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.

Potential Effects on Valued Components

The emergency spillway location alternatives affect soil, vegetation, wildlife and land use. 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 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.

Preferred Alternative

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.

2.2.4 Off-stream Dam

Potential Alternatives

The initial design concept (IDC), developed by AMEC, included a provision of 41,200 dam^3 of flood storage for protection up to the 1% annual exceedance probability flood. 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 design flood. This increased retention 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 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 flood, 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 Upstre*am*

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.

Evaluation Criteria

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. For Alternatives 1 and 2, the dam height and components would be the same as in the conceptual design. If the dam is moved upstream as described in Alternative 3, the dam height could remain the same if the design head of the spillway is decreased to reflect an increase in the reservoir pool elevation for the 2013 design storm.

Potential Effects on Valued Components

The dam toe location alternatives all have the potential to affect the soil, hydrology, water quality, aquatic resources and land uses. 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.

Preferred Alternative

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.

2.2.5 Low-level Outlet Channel

Potential Alternatives

The low-level outlet channel is designed to drain the reservoir following the diversion of the Elbow River during a flood.

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 necessary

Evaluation Criteria

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. 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. The evaluation of the two options centred on comparing the upsizing of the outlet stream now versus waiting until a flood occurred and implementing work needed to address changes to the stream at that time.

Potential Effects on Valued Components

Upsizing the existing stream during construction would result in reshaping the channel, likely to the size of a design flood. 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.

Preferred Alternative

The choice was made to delay maintenance on the channel until such a time as it may be required. The present plan would be to only regrade part of the existing stream to convey flows away from critical infrastructure and allow for the remainder of the stream and existing ecosystem to remain intact. If a flood occurred and the low-level outlet works were required to discharge substantive flows, stream restoration efforts would be completed.

2.2.6 Realignments and Modifications of 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 and Township Road 244
- Township Road 242.

The following sections discuss options investigated for each of these roads and the reasons for selecting the preferred design. No opportunities for sharing infrastructure were available in respect of the roadworks. All the bridge and road works are consistent with Alberta Transportation's Highway 22 Functional Planning Study (Alberta Transportation 2014).

2.2.6.1 Design Options for Highway 22

Highway 22 is a key north/south arterial highway and truck route located near the Project that connects the communities of Black Diamond, Turner Valley, Priddis, Bragg Creek, Redwood Meadows and Cochrane; all are west of Calgary. Highway 22 is a two-lane, undivided rural highway. Alberta Transportation has plans for twinning the highway on its current alignment, although a date for the twinning has not been set.

Highway 22 passes through the western end of the reservoir and, at its existing elevation, would be inundated during the design flood and 1:100 year flood. 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 2-4. For both options, a new bridge would be constructed where Highway 22 crosses the diversion channel. Consistent with the Highway 22 Functional Planning Study, the bridge would be built on the existing Highway 22 alignment.

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. 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 flood elevation.

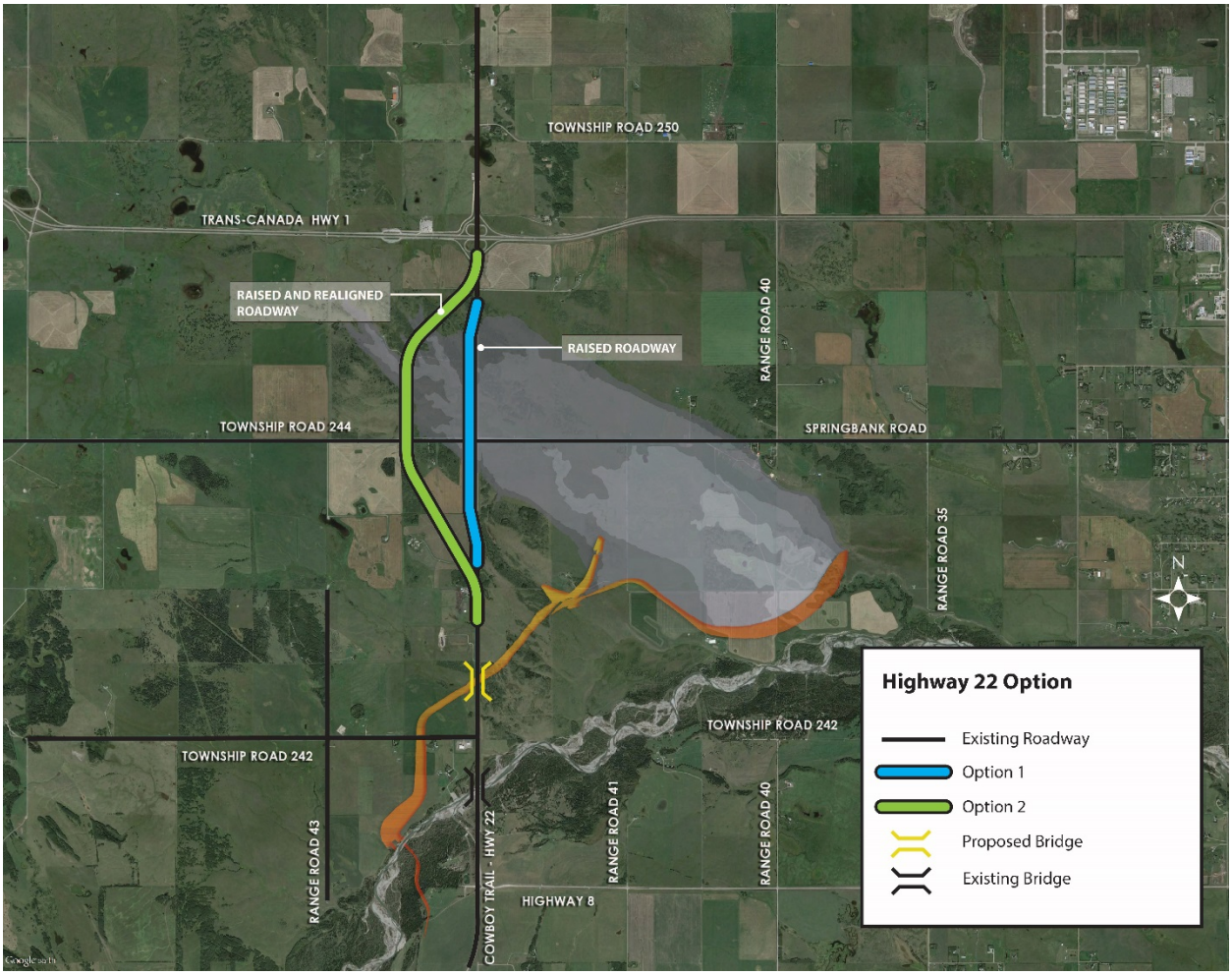


Figure 2-4 Highway 22 Options

2.2.6.2 Design Options for Springbank Road and 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. It is a key parallel access road south of Highway 1 that provides connection between Highway 22 and Old Banff Coach Road, which connects to the future Calgary Ring Road. West of Highway 22, Township Road 244 is a gravel collector roadway.

The existing Springbank Road would be affected by the design flood. The three roadway design options are shown on Figure 2-5 and described below.

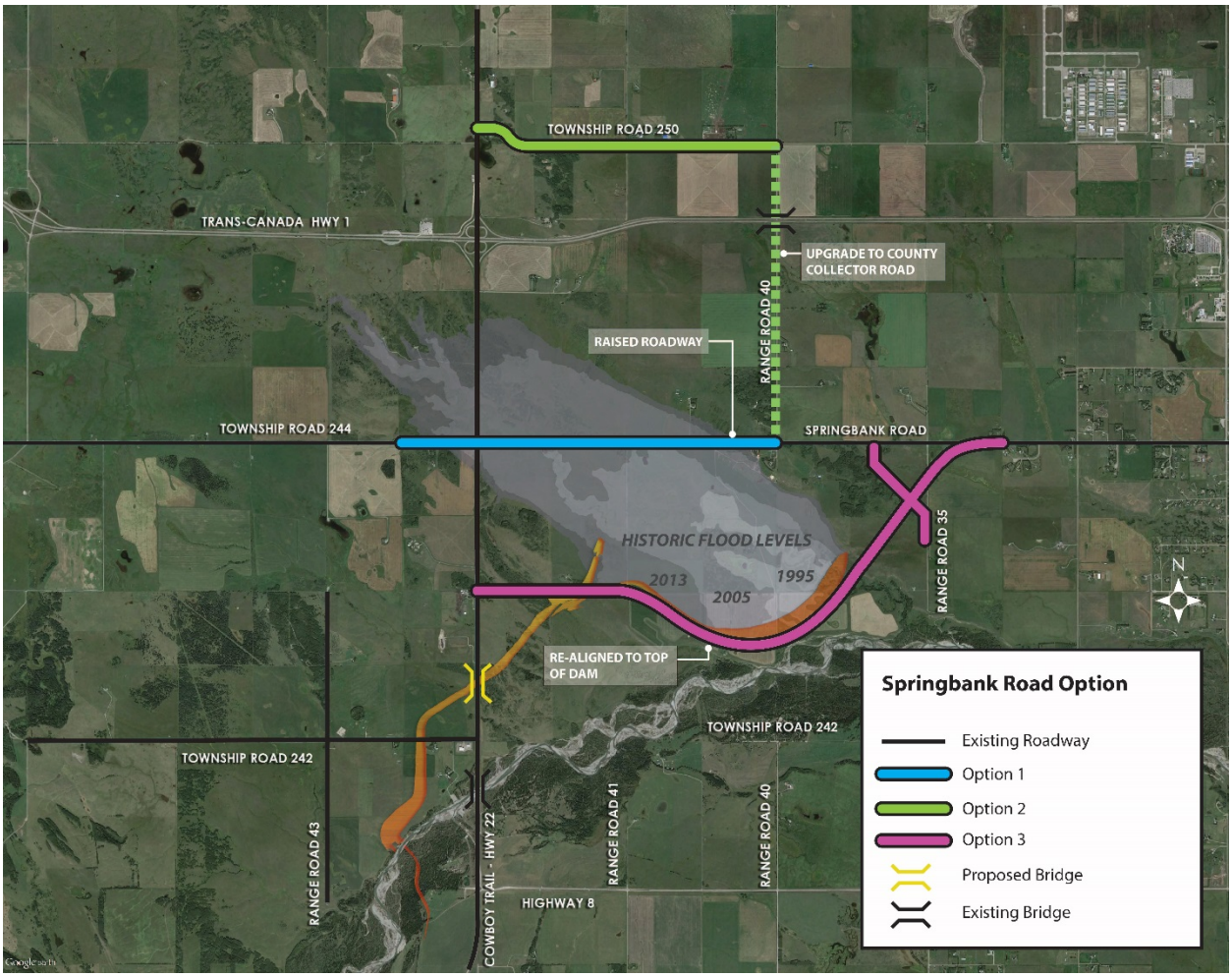


Figure 2-5 Springbank Road Options

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

- The road embankment would be classified as a dam under the Dam and Canal Safety Guidelines (Alberta Environmental Protection 1999), 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 the 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.

2.2.6.3 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 does not cross the reservoir but does intersect the diversion channel. Three roadway options are shown in Figure 2-6.

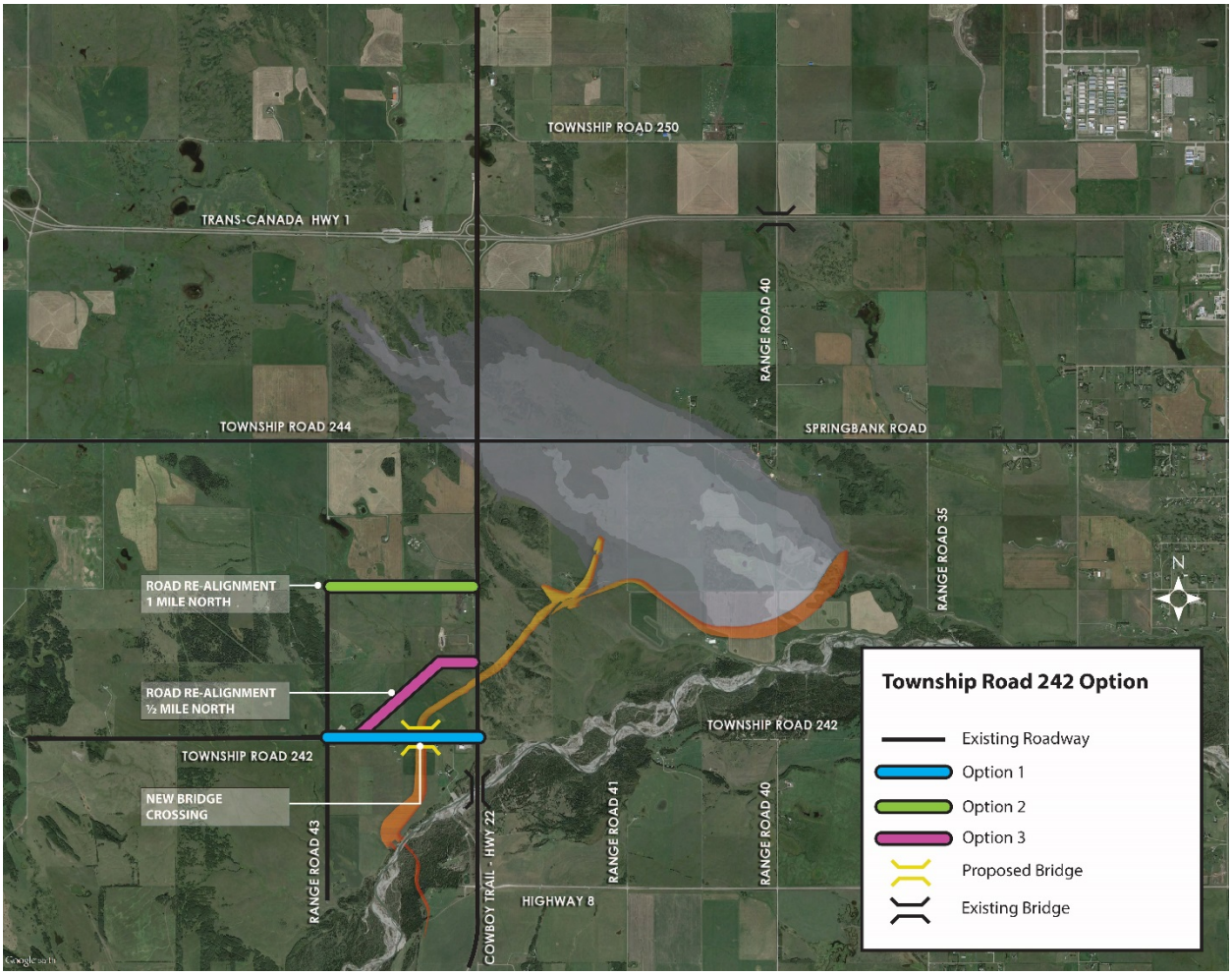


Figure 2-6 Township Road 242 Options

Design Option 1 maintains the existing Township Road 242 alignment, but with a bridge crossing over the diversion channel. Design Option 1 is the preferred option for Township Road 242.

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.

2.2.6.4 Preferred Road Network

Evaluation of the road network options were completed for Highway 22, Springbank Road and Township Road 242. 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

Based on the results of the evaluation matrices, the preferred options are:

- Design Option 1 for Highway 22
- Design Option 2 for Springbank Road
- Design Option 1 for Township Road 242

This preferred road network is shown in Figure 2-7 and has been provided to Rocky View County for review and evaluation.

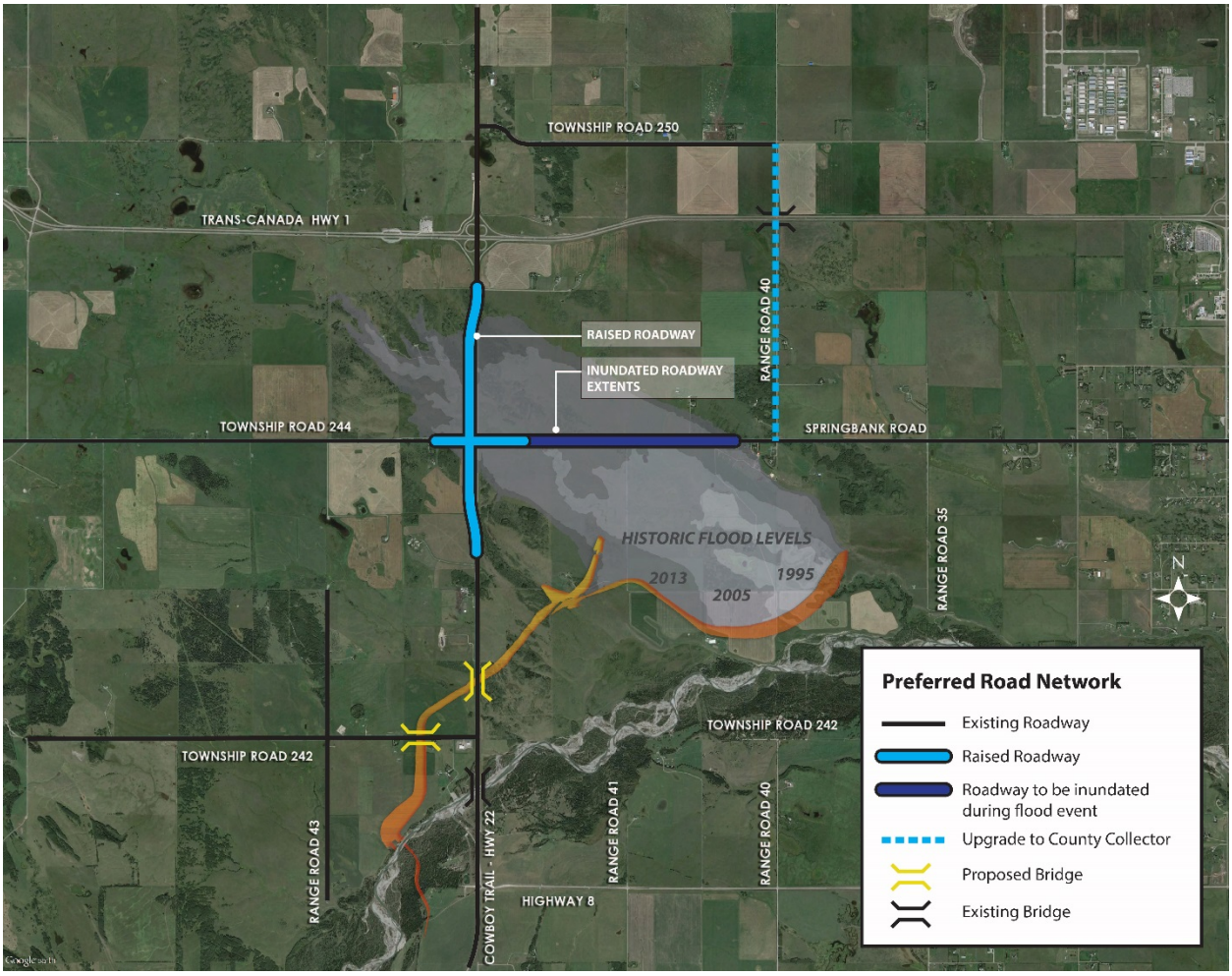


Figure 2-7 Preferred Road Network

3.0 PROJECT DESCRIPTION

3.1 DESIGN CRITERIA

The Project will provide 77,771,000 m^3 of active flood storage that can be diverted from the Elbow River at a rate of up to 600 m^3/s with an additional 10,000,000 m^3 of active flood storage at Glenmore Reservoir. The diversion capacity and combined storage of Glenmore Reservoir allows the Project to mitigate downstream flood damages and keep flows downstream of Glenmore to 160 m^3/s, which is below 170 m^3/s for floods up to the 2013 flood, or equivalent. That flood had an estimated peak flow of 1,240 m^3/s and a 7-day volume of 149,600,000 m^3. It is estimated to be slightly greater than a 1:200 year flood. Alberta Transportation defined the other design criteria as follows:

- the reservoir does not retain water between floods
- acceptable flood flow downstream of Glenmore Reservoir outlet is 170 m^3/s
  - This represents the flow rate at which overland flood damages occur downstream of Glenmore.
  - The design of the Project limits flow downstream of Glenmore to 160 m^3/s, representing a flow below the maximum flow of 170 m^3/s that can be released by Glenmore Dam's low-level outlet without causing downstream damages.
- available active flood storage at Glenmore Reservoir is 10,000,000 m^3

The Project design is based on the 2013 flood hydrograph recorded at Glenmore Reservoir's level gauge and select available hydrometric station data within the basin. The design hydrograph of the 2013 flood was then derived from the available data. The data used to develop the design hydrograph is considered preliminary data. In January 2017, Water Survey Canada (WSC) released hydrometric data for the 2013 flood that is herein referred to as "the 2013 hydrographs" and their respective monitoring stations.

Additional flood peak flow rates for the Elbow River at the proposed diversion site were used to assess the performance of the structure for floods less than and greater than the design flood. Stantec estimated frequency based flood metrics using the regression equations developed using recorded WSC data on the Elbow River peak flows and estimated the probable maximum flood (PMF) using a probable maximum precipitation (PMP) analysis and hydrologic modelling. The estimated peak flow rates of the Elbow River at the diversion site are presented for different return periods in Table 3-1.

Table 3-1 Summary of Flood Frequency Estimates at the Diversion Structure

Flood Return Period	Estimated Peak Discharge at the Diversion Structure (m^3/s)
1:2 year	70
1:5 year	140
1:10 year	200
1:100 year	765
Design flood (2013 flood)	1,240
Probable Maximum Flood (PMF)	2,770

Of the floods listed in Table 3-1, the 1:10 year, 1:100 year and 2013 flood magnitudes were selected for assessment in the EIA. Diversion of flood waters begins when flows in the river exceed 160 m^3/s, a roughly 1:7 year flood.

The off-stream dam is classified as an "extreme" consequence dam and the floodplain berm is classified as a "very high" consequence dam. As such, the system elements are designed to safely pass the required dam safety design flows; the probable maximum flood (PMF) for the off-stream dam and 1/3 between the 1:1,000 year and PMF for the floodplain berm. The PMF is defined as the flood that may be expected to result from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the drainage basin and was developed from detailed meteorological analysis and hydrologic modelling.

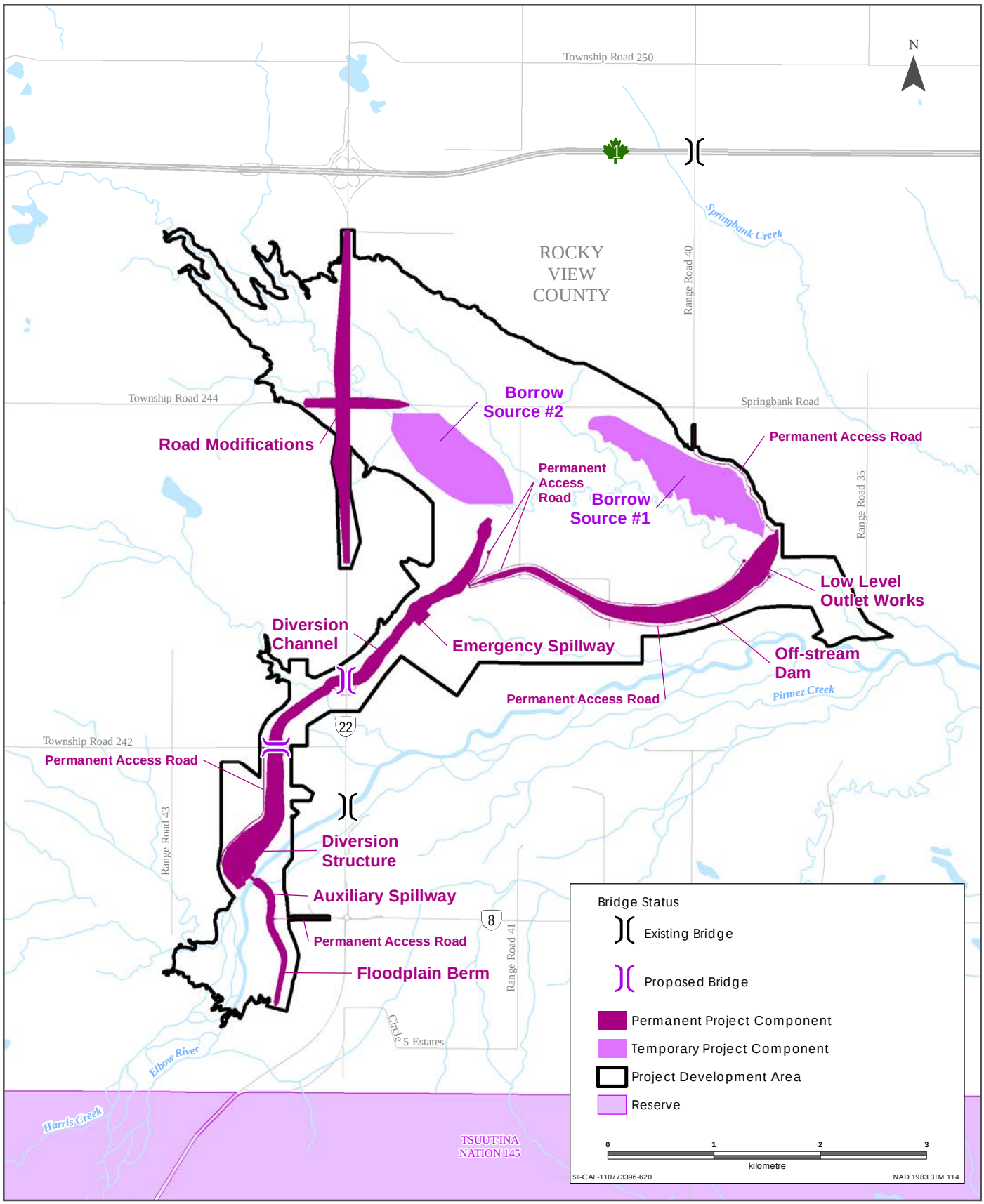
3.2 PROJECT COMPONENTS

The physical works for the Project are shown in Figure 3-1.

3.2.1 Diversion System

The diversion system consists of four main elements (Figure 3-2):

- diversion inlet
- service spillway
- floodplain berm
- auxiliary spillway



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

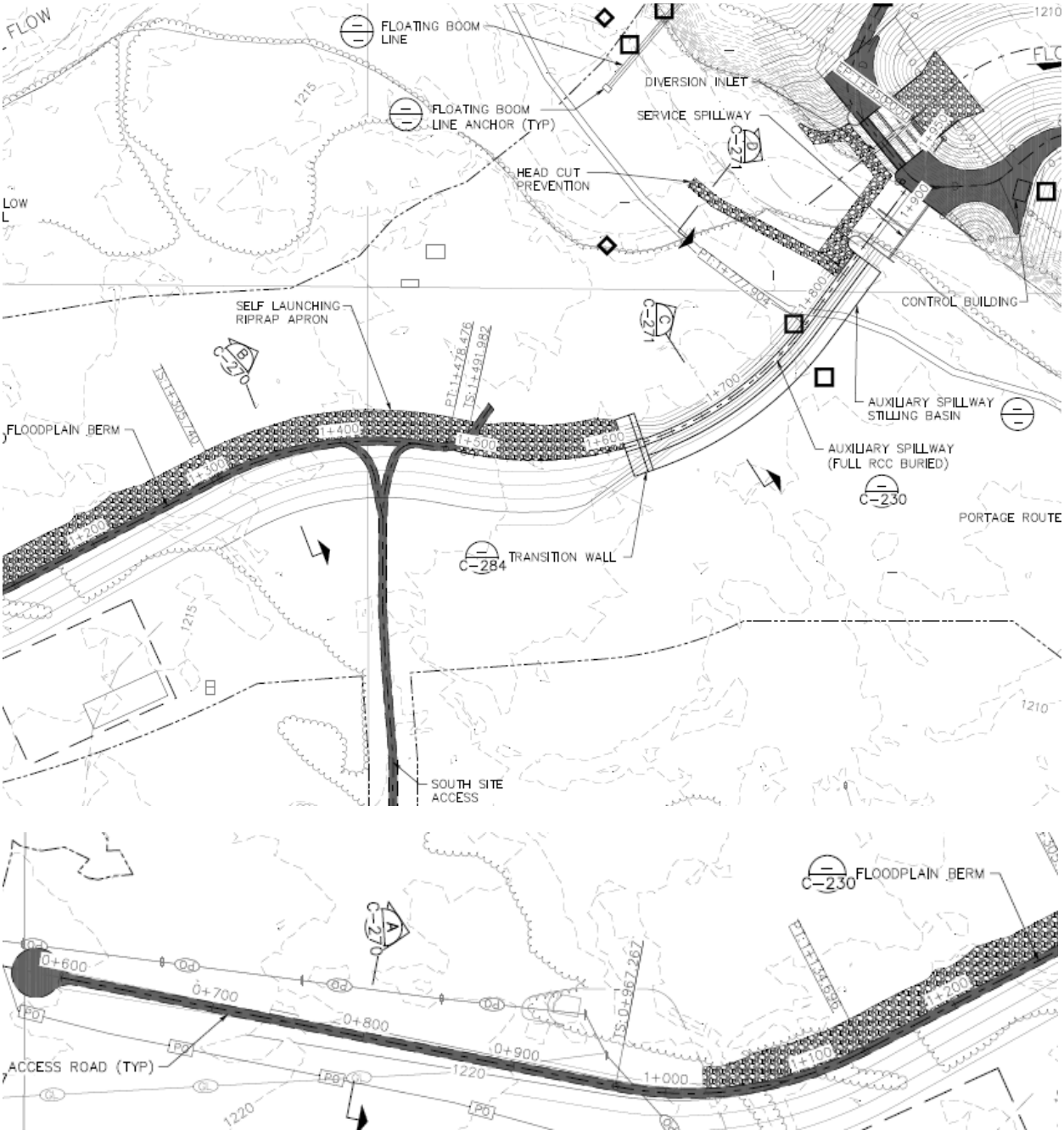


Figure 3-2 The Diversion System, North End of Floodplain Berm

The diversion inlet and service spillway are contained within a contiguous concrete structure that sits within the Elbow River channel and is referred to as the diversion structure (Figure 3-3). The auxiliary spillway is a solid concrete spillway structure that is covered with an earthen embankment and extends about 250 m south from the service spillway of the diversion structure. The floodplain berm extends another 1 km south from the end of the auxiliary spillway.

The hydraulic performance and debris management features of the diversion inlet and service spillway were refined using 2-dimensional hydraulic modelling and a 1:16 scale physical model constructed and tested by the National Research Council of Canada's Ocean Coastal and Engineering Portfolio.

Maintenance access to the diversion system components is provided as follows:

- from Highway 22 along the southeast side of the diversion channel to the diversion structure
- from Highway 22 at the Highway 8 interchange directly west to the floodplain berm

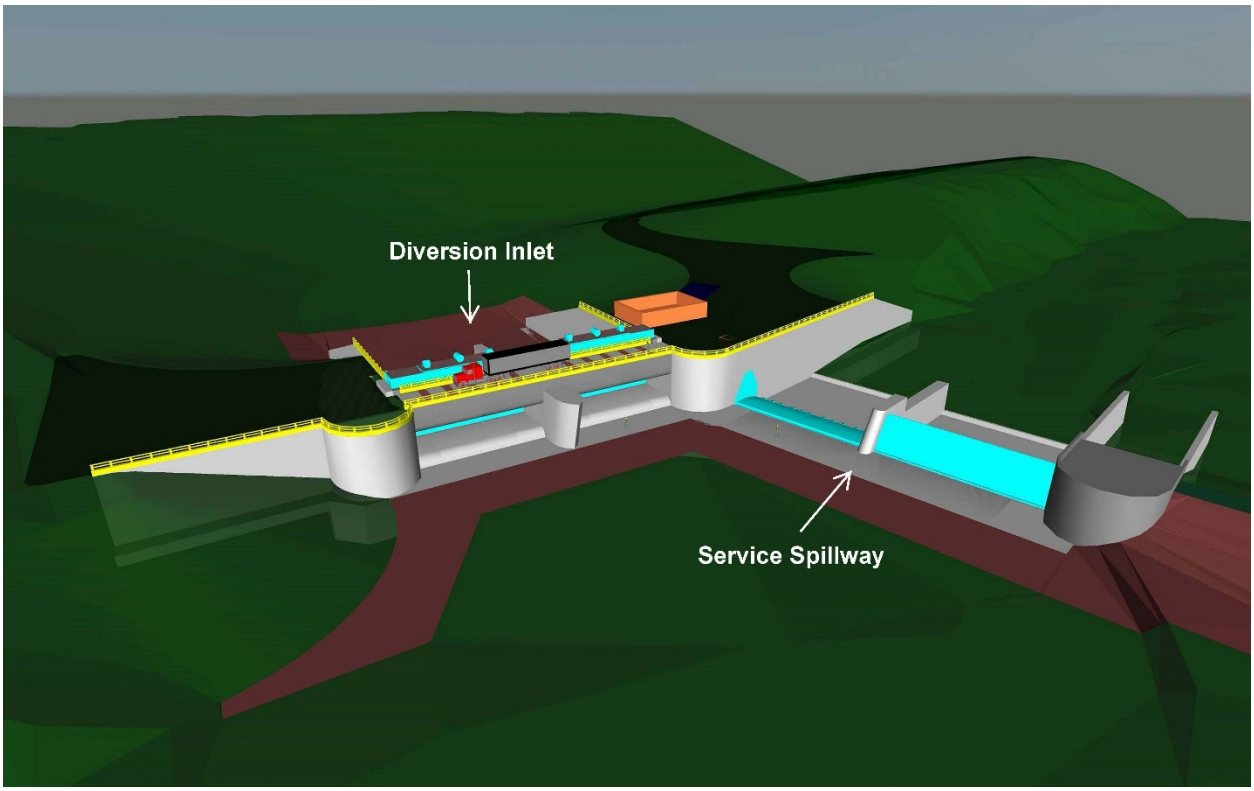


Figure 3-3 Diversion Structure

3.2.1.1 Diversion Inlet

The diversion inlet is a gated concrete structure that controls the diversion of river water into the diversion channel during floods. It is located at the entrance to the diversion channel on the north bank of the Elbow River (river left).

The structure consists of an approach channel, concrete sill surmounted by lift gates, a stilling basin and a concrete lined transition tapering to the diversion channel. The sill elevation is set approximately 1.5 m above the bed of the Elbow River and approximately the current bankfull height. Two 20 m wide by 4 m high steel lift gates are mounted over the sill on concrete walls between the passageways in the structure. A deck on top of the concrete walls supports an access road and the hoists that raise and lower the gates. Concrete walls on either side of the diversion inlet provide protection from erosion by floodwater and riprap armouring is installed across the entrance of the inlet.

Revisions to the conceptual design of the diversion inlet consisted of the following:

- The left approach wall was revised to improve the hydraulics in the left gate bay. The vertically-sloping curved approach wall from the conceptual design was replaced with a full-height semi-circular wall that reduced vertical mixing of flows and improved the transition of flows from the main river channel.
- The four 10 m gate bays were replaced with two 20 m gate bays to improve the passage of debris through the structure.
- The gate type was changed from radial gates to vertical lift gates because of increased gate bay width.
- The pier nose between the gate bays was extended upstream approximately 8 m to increase the distance between the pier face and gate slots and improve debris passage.
- The crest of the diversion inlet weir was changed from an ogee weir geometry to a broad-crested weir geometry to improve upstream hydraulics and reduce potential for sedimentation within the gate bay.

The revisions to the diversion inlet substantially improved debris passage in comparison to the conceptual design. Where the initial design would result in large debris jams forming on the face of the structure, risking interference with gate operations (closing), the revised design will pass nearly all debris. Single debris elements that were caught on the pier face will be generally dislodged and passed by subsequent debris.

These revisions also improved the flow of the Elbow River at the inlet and provide better debris flow conditions, which will improve fish passage and hydrological conditions. The full-height semi-circular wall reduced vertical mixing of flows and improved the transition of flows from the main river channel. The option of the two 20 m gate bays improved the passage of debris through the

structure. By choosing the two--gate bay option, vertical lift gates were chosen to replace radial gates because of the gate width. The pier nose between the gate bays was extended upstream approximately 8 m to increase the distance between the pier face and gate slots and improve debris passage.

3.2.1.2 Service Spillway

The service spillway is a gated concrete structure located in the Elbow River channel adjacent to the diversion inlet (Figure 3-3). It is designed to control Elbow River water surface elevations upstream of the diversion inlet during a flood. The service spillway has two air-bladder controlled crest gates that sit flush with the river bed during non-flood conditions. Laying the service spillway gates flush with the bed level limits the hydraulic gradient through the service spillway bays so that fish passage is maintained with minimal adjustments to bed grade in its downstream position (see Volume 3A, Section 8).

When flows in the Elbow River exceed 160 m^3/s, and the operators have decided to divert water, the crest gates in the service spillway are raised to build backwater at the diversion structure to help drive floodwaters into the diversion inlet and control how much water is released downstream.

The service spillway has:

- two 24 m gate bays, each consisting of a concrete apron and a concrete wall separating the two bays
- riprap aprons armouring the upstream edge of the concrete apron
- concrete structure to support a 5 m tall Obermeyer crest gate operated by an inflatable bladder (Figure 3-4)
  - Normal position for the crest gates is open, flush with the gate sill at an elevation of 1,210 m.
- concrete stilling basin backfilled with native substrate
- riprap riverbank armouring along the right side of the channel, upstream of the service spillway prevents headcutting erosion along the base of the auxiliary spillway
- riprap arrangement to stabilize thalweg and gravel bar downstream of service spillway to maintain fish passage

Riprap will consist of competent angular blast rock, likely sourced from local quarries near Exshaw, Alberta.

Figure 3-4 An Obermeyer Crest Gate in Raised Position

3.2.1.3 Control Building

The controls and instrumentation for operating the diversion inlet and service spillway gates will be in a control building situated near the diversion structure (Figure 3-2). The diversion structure and control building will be fenced with a lockable access gate and be permanently lit.

3.2.1.4 Floodplain Berm

The floodplain berm is located on the south floodplain of the Elbow River (Figure 3-2). In concert with the auxiliary spillway, it acts to constrain flow in the Elbow River and direct it to the diversion structure. It spans across several terraces of the Elbow River and prevents the diversion structure from being circumvented by flow during a flood. The height and southerly extent of its alignment, as determined by dam safety requirements for "very high" consequence dams,

prevents a circumvention by floods, up to 1/3 between the 1:1,000 year and the PMF. The design of its alignment was also determined by its connection to the existing terraces and promotes a hydraulically smooth profile when funneling flow towards the diversion inlet and service spillway.

The floodplain berm is an earth embankment approximately 1,000 m long with a maximum height of approximately 7.5 m. The side slopes are 3:1 on the river side and between 5:1 and 10:1 on the opposite side. The upstream end of the berm, which is about 400 m long, is an un-armoured structure of impervious material founded on existing ground and capped with topsoil and seeded (Figure 3-5). The main section of the floodplain berm has an impervious core founded on bedrock and is protected from erosion on the river side by riprap. The berm crest is 6 m wide and carries an access road. The crest is set at 1 m above the calculated 1:1,000 year flood elevation and will pass the probable maximum flood without overtopping.

The south site access is at the top of the main section of the floodplain berm, where it splits north and south (Figure 3-2). To the south, an access road leads to a turnaround at the upstream end of the berm. To the north, a ramp leads down the opposite side of the berm to provide access to the floodplain.

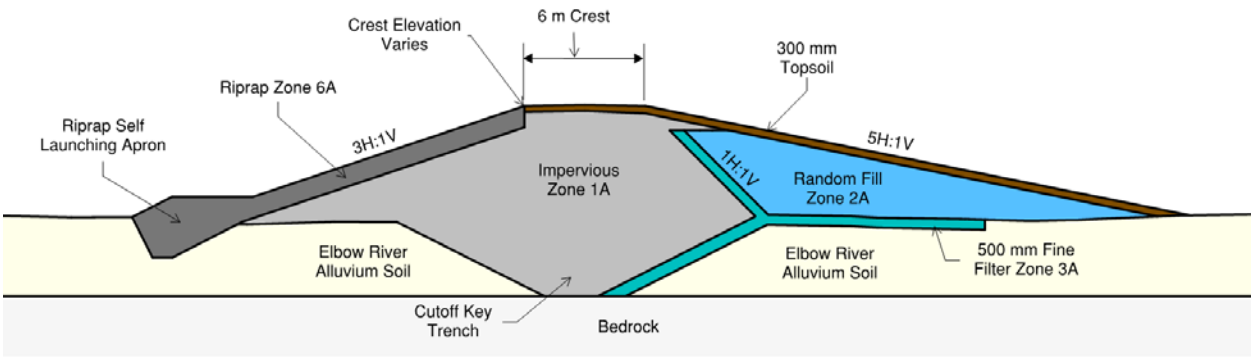


Figure 3-5 Typical section – Floodplain Berm

3.2.1.5 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. It is a is a roller compacted concrete (RCC) gravity structure founded on bedrock and covered with earth and seeded to provide wildlife passage (Figure 3-6). It has a crest set 1.8 m lower than the floodplain berm. The spillway prevents the floodplain berm from overtopping during floods larger than the design flow: it limits the river elevation upstream of the diversion structure and it allows extreme river flows to bypass the diversion structure and re-enter the river farther downstream. The auxiliary spillway is designed to withstand overtopping for floods up to 1/3 between the 1:1,000 year and the PMF with an overtopping depth of 1.5 m.

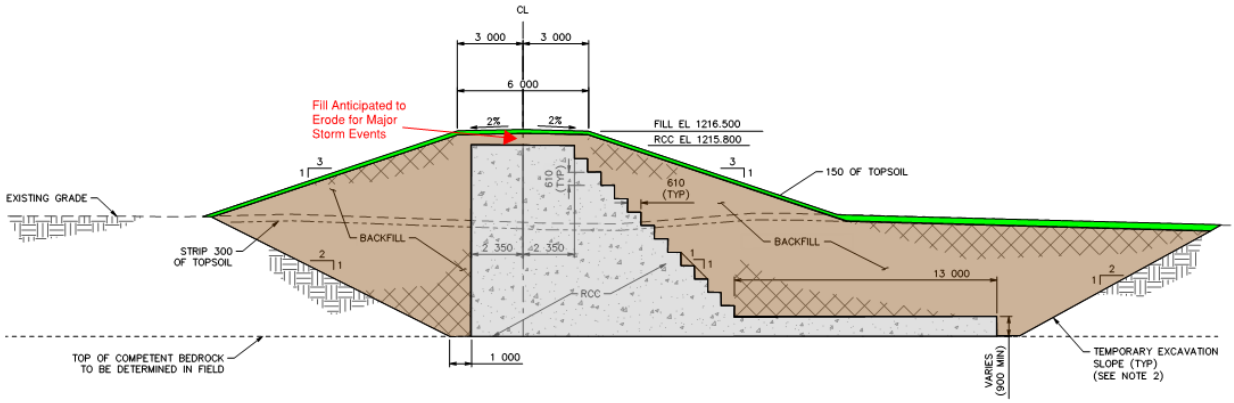


Figure 3-6 Cross-section of Auxiliary Spillway

The spillway crest will activate when incoming flow from the Elbow River exceeds 1,720 m^3/s (approximately a 1:500 year flood). The auxiliary spillway may also activate for smaller floods if the conveyance capacity is reduced by debris and sediment at the diversion inlet and service spillway and operations of the gates are not adjusted.

3.2.2 Diversion Channel

The diversion channel carries floodwater from the diversion inlet to the off-stream reservoir (Figure 3-1). 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.

Various alternatives for erosion protection were evaluated including riprap and articulating concrete block. It was determined that portions of the channel cut in the bedrock will not warrant erosion protection, except around critical elements. In areas of the channel where the cut does not reach the bedrock, the erosion and scour potential is low enough for lower diversion rates and erosion in non-critical areas during a major flood diversion will not constitute a failure.

The base of the channel varies between bedrock, grass and riprap. Channel side wall erosion protection consists variously of bedrock, riprap, or 15 cm of topsoil and grass.

3.2.3 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 retained water from overtopping the reservoir and, instead, release it in a controlled manner over the bedrock and return it to the Elbow River.

3.2.4 Off-Stream Reservoir

The off-stream reservoir uses existing topography to provide a basin within which diverted floodwater can be retained (Figure 3-1). A three-dimensional digital model was developed to determine the extent of the reservoir under a variety of floodwater storage scenarios. Table 3-2 shows the resulting reservoir volumes and areas for different flood magnitudes; Figure 3-7 shows the corresponding areas. Table 3-3 shows the reservoir filling times for hypothetical floods and the 2013 design hydrograph. Actual residence time and release rates will vary depending on conditions downstream post flood, performance of the dam while retaining water, and other factors.

Table 3-2 Reservoir Volumes and Areas for Selected Elbow River Floods

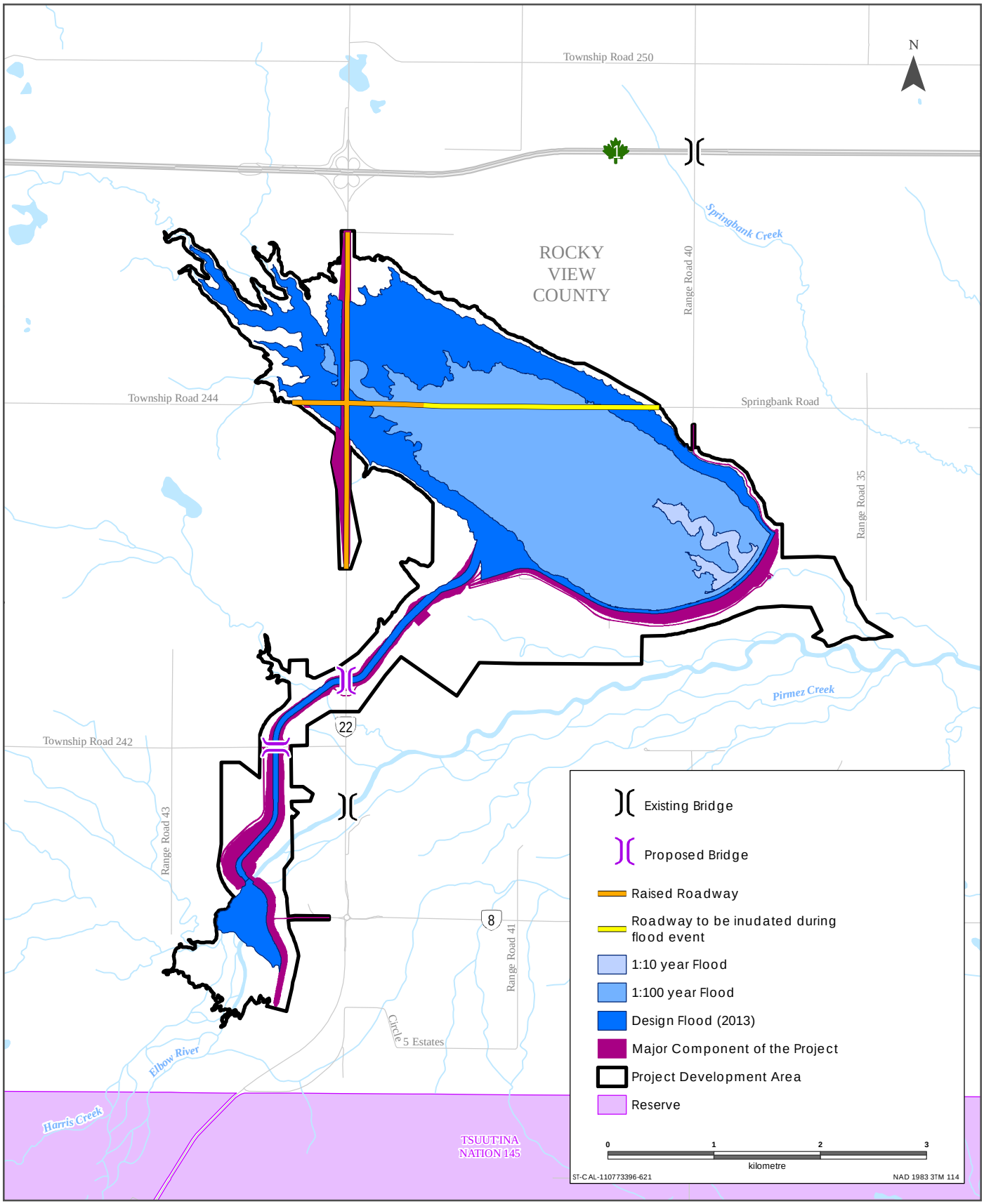
Flood Magnitude	Volume Used (dam^3)	Area of Reservoir Flooded (ha)
1:10 year	500	60
1:100 year	30,100	500
2013 Design Hydrograph	77,800	730

Table 3-3 Estimated Reservoir Filling, Residence and Release Times for Different Flood Magnitudes

Flood Magnitude	Duration of Diversion (days)	Residence Time in Reservoir (days)	Release Time (days)
1:10 year	0.38	43	30
1:100 year	1.8	43	39
2013 Design Hydrograph	3.75	20	38

Existing structures in the reservoir area will be cleared but the existing vegetative cover will be kept in place except where excavation or grading is required for internal drainage or borrow.

Should the amount of soil material generated by excavation of the diversion channel be insufficient to meet all the construction requirements for fill, the shortfall will be made up with material excavated from the borrow area in the reservoir (Figure 3-1). The preferred borrow area is close to the dam, where an estimated 945,000 m^3 of additional fill is available.



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

Flood Scenarios

Stantec

3.2.5 Off-Stream Dam

Material excavated from the diversion channel, supplemented if necessary by borrow material, will be used to construct the off-stream dam, a clay-cored earth embankment that will temporarily impound diverted floodwater in the Unnamed Creek valley (Figure 3-1).

3.2.5.1 Dam Composition

The dam includes two zoned earthen embankments to be constructed across two valleys adjacent and tributary to the Elbow River. The primary embankment is approximately 3,300 m long with a maximum embankment height of 30 m. A typical section of the embankment dam is presented in Figure 3-8. The proposed typical section consists of 3.5H:1V sideslopes with 5 m wide horizontal benches located every 10 vertical metres.

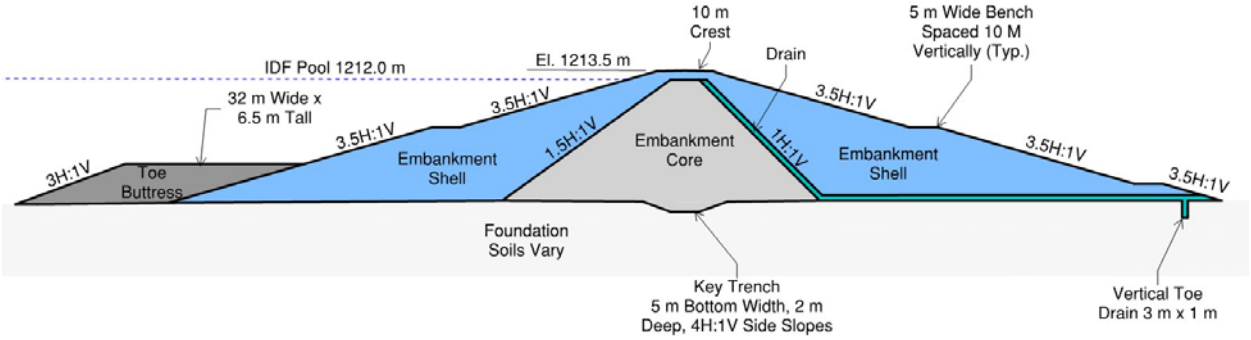


Figure 3-8 Typical Dam Section, Primary Embankment

The second embankment is approximately 400 m long with a maximum embankment height of 23 m. The upstream face of this portion of the dam forms the right descending bank of the diversion channel. A typical section of the secondary embankment is presented in Figure 3-9. The proposed typical section consists of 4H:1V side slopes without benches.

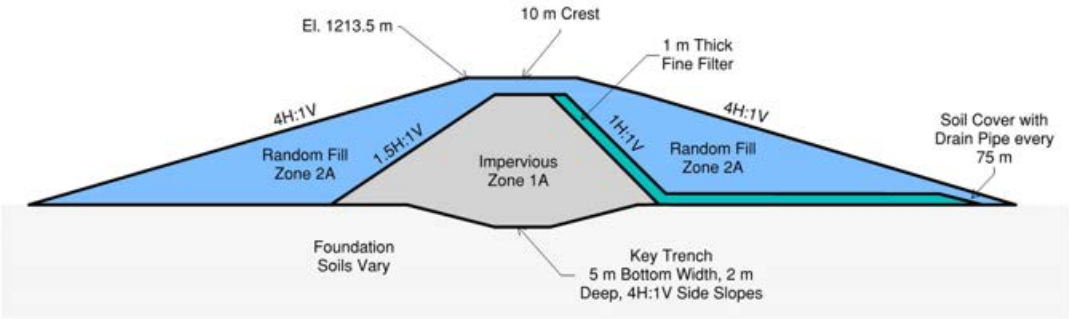


Figure 3-9 Typical Dam Section Secondary Embankment

The dam and its appurtenances are designed as an "Extreme" hazard facility in accordance with CDA Guidelines and Alberta Dam and Canal Safety Guidelines.

The earthwork materials are applied to the zones as follows:

- impervious fill zone 1A – impervious embankment core and key trench
- random fill zone 2A – embankment shell (upstream and downstream)
- fine filter zone 3A – sand and fine filter material

3.2.5.2 Slope Protection

Established turf and proposed drainage features will provide erosion protection. Maintenance to repair water erosion channels on the slope will be required until grass is established.

Since the reservoir will not have a permanent pool, wave wash protection will not be necessary. In addition, any flood pool will be a temporary condition. Erosion associated with wave action or pool drawdown may require grading maintenance or re-establishment of turf. However, this was not judged substantive enough to warrant armoring the slope with aggregate.

To control ponding and erosion due to rainfall runoff, drainage channels will be incorporated into the side slopes of the dam. These channels are proposed at 400 m intervals along the dam. Drainage channels will only be implemented for sections of the dam which include benches and are designed to convey the 100 year flood. Calculations show that a drainage channel 1 m wide with Class 1 rip rap armoring is sufficient to convey storm water and control erosion of the side slopes.

The design also includes a storm drainage channel along the toe of the dam, upstream and downstream. The channel is sized to convey runoff from the 1:100-year storm and is grass lined. The channel will have a 1 m base width, 3H:1V side slopes and varied slope depending on the topography.

3.2.5.3 Stability

Design of the dam embankment was developed in accordance with Canadian Dam Association (CDA) and Alberta Dam and Canal Safety Guidelines. Additional design criteria were established from industry standards including the United States Bureau of Reclamation (USBR) and the US Army Corps of Engineers (USACE). Table 3-4 identifies the evaluated load cases and the required factors of safety.

Table 3-4 Critical Design Load Cases for the Dam Embankment

Load Case	Reference	Reservoir	Foundation Behavior	Pore Pressures	FOS
End of Construction	CDA	None	Undrained strength parameters	Phreatic surface in foundation	1.3
End construction – multi-year construction	CDA, PFRA[1]	None	Drained strength parameters	Phreatic surface modelled in the foundation and B-bar applied to the foundation and embankment fill	1.3
Not operational - long Term	CDA	None	Drained strength parameters	Phreatic surface in foundation	1.5
Operation -Design Flood	USBR	IDF[2]	Drained strength parameters	Steady state seepage in embankment dam;	1.2
	USACE	IDF	Undrained strength parameters	Flood pool modelled as a surcharge; phreatic surface in foundation	1.4
Rapid Drawdown	CDA	IDF	Undrained strength parameters	Multi-stage phreatic surface from reservoir	1.3
Seismic – Pseudostatic	CDA	IDF	Short Term, Undrained Seismic Parameters	Flood pool modelled as a surcharge; phreatic surface in foundation	1.0
Seismic – Post Earthquake	CDA	IDF	Short Term, Undrained Seismic Parameters	Flood pool modelled as a surcharge; phreatic surface in foundation	1.3

NOTES:
[1] Prairie Farm Rehabilitation Administration
[2] Instream Design Flood

The results of slope stability analyses presented in the Interim Design Report (Stantec 2017b) show that the proposed off-stream dam meets the required criteria for all identified load cases.

3.2.5.4 Seepage

Seepage analysis was performed for input into the stability analysis and assessment of piping risk. As a reservoir with a temporary flood pool, saturation of the embankment with an elevated phreatic surface is not anticipated. However, a filter and drainage system will mitigate potential risks from piping through defects in the embankment and pressure relief in the foundation soils.

3.2.5.5 Seismic Events

The dam stability was assessed for an Earthquake Design Ground Motion (EDGM) with an Annual Exceedance Probability of 1/10,000, in accordance with CDA Dam Safety Guidelines (2007) and the Extreme hazard classification.

3.2.6 Low-Level Outlet

Floodwater is released from the reservoir to the Elbow River by means of a gated concrete structure near the east end of the dam embankment that controls discharge to an existing unnamed creek (Figure 3-1). The low-level outlet structure (Figure 3-10) consists of an approach channel, discharge gate, gatehouse, discharge conduit and outlet channel. The gate is operated locally by the gatehouse.

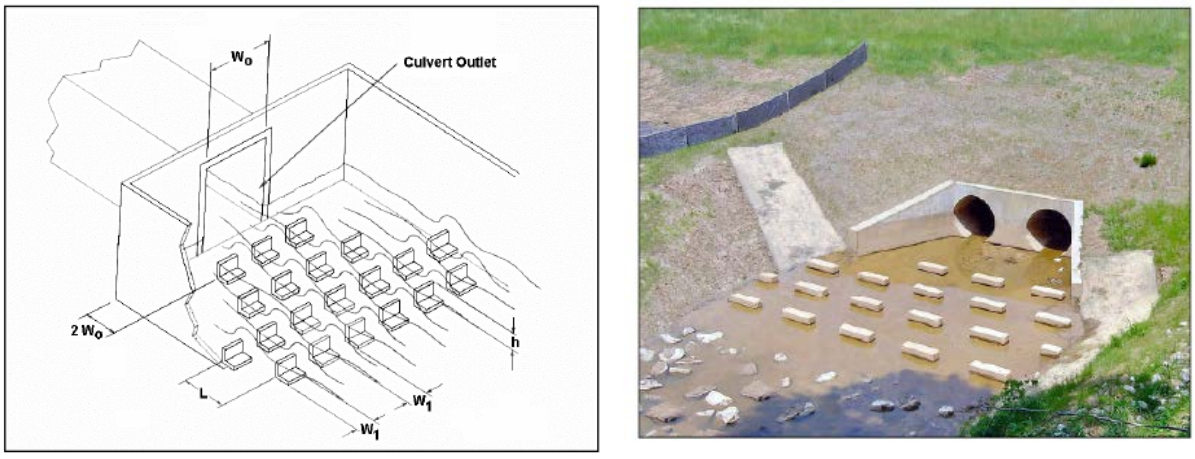


Figure 3-10 Low-level Outlet

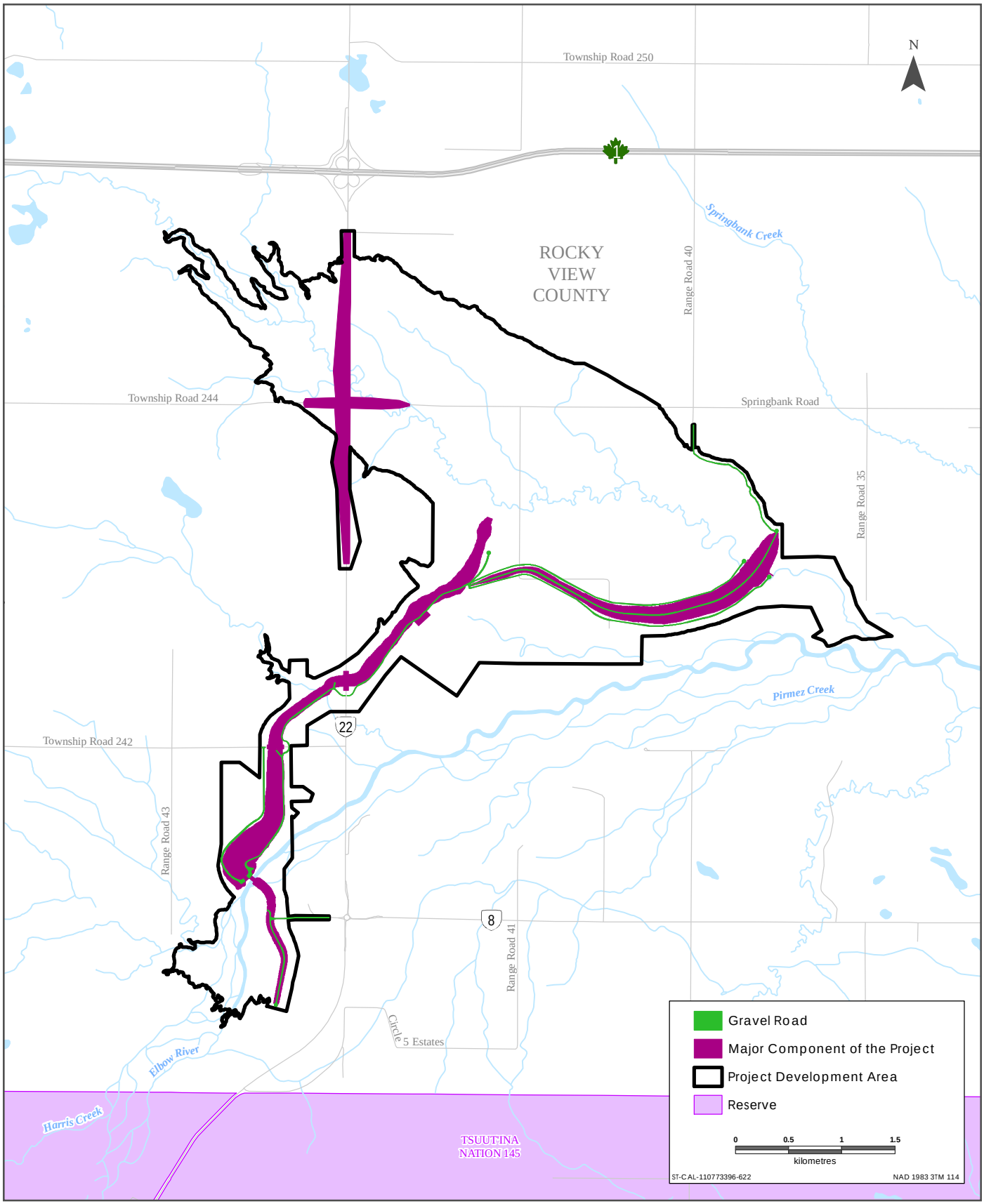
The gate system controls are situated in a lit gatehouse at the inlet to the low-level outlet. A trash rack prevents large debris from entering the discharge conduit, which consists of a 213 m long, 2700 mm wide by 2800 mm high horseshoe shaped conduit. The conduit will discharge into an 18 m long energy dissipation basin to reduce the speed of the water entering the channel. The natural channel of the unnamed creek will be filled as part of the dam construction; after the low-level outlet structure is completed, the stream will flow through the outlet structure.

3.2.7 Permanent Access Roads

The following access roads will be required for ongoing infrastructure operation and maintenance (see Figure 3-11):

- 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.



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

Permanent Access Roads

Stantec

3.2.8 Utilities

3.2.8.1 Pipelines

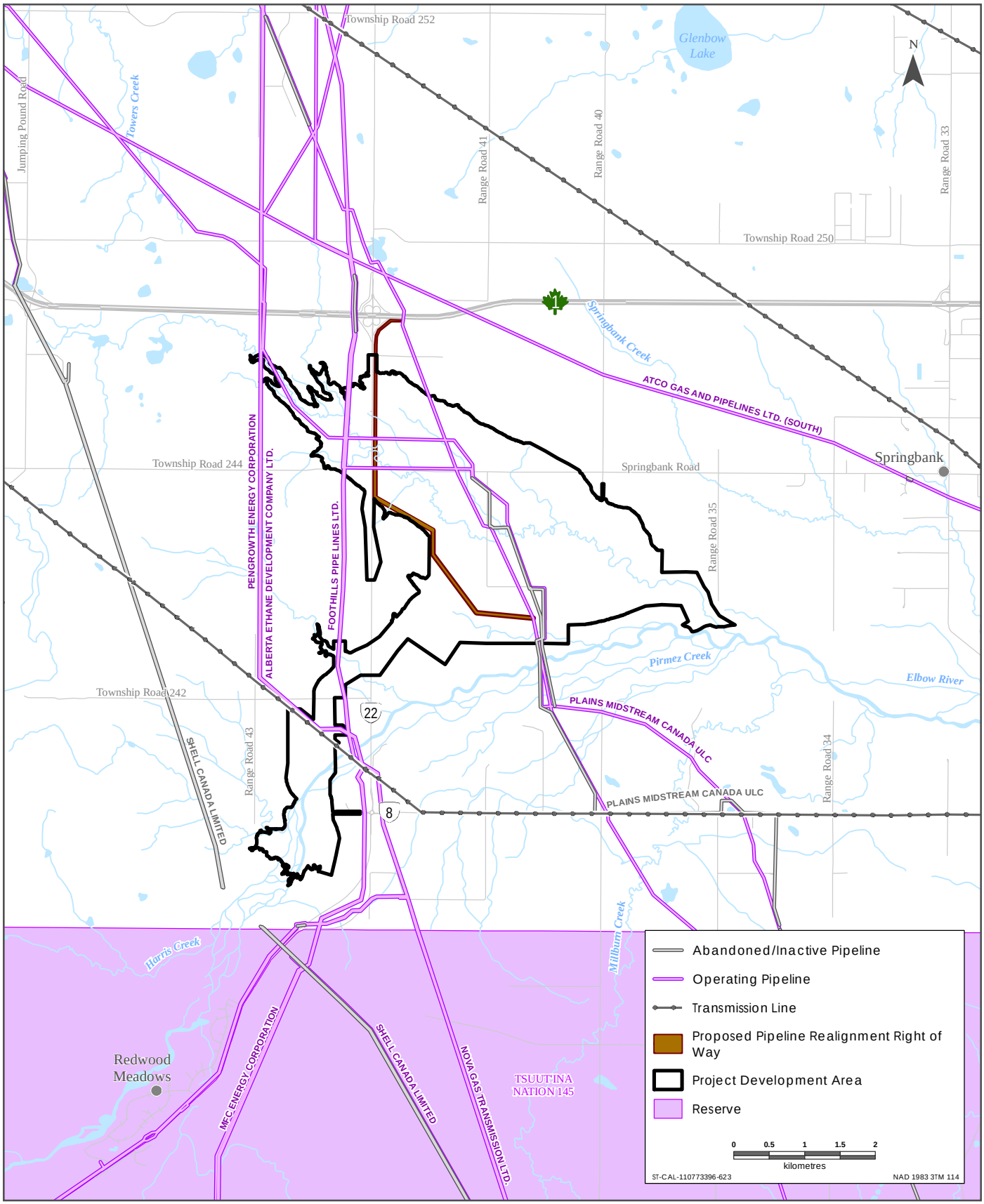
Oil and gas pipelines operated by four companies (TransCanada Pipelines Ltd., Pengrowth Energy Corp., Veresen Inc., and Plains Midstream Canada) are in the PDA (Figure 3-12). As a mitigation measure to reduce the likelihood of a potential pipeline rupture or adverse interaction with the Project, pipelines within the off-stream reservoir will be re-located or retrofitted. Activities associated with the re-location or retrofit will be executed entirely by the pipeline operators: Alberta Transportation is not responsible for the execution of any physical works associated with the pipeline relocation or retrofit. It is also the sole responsibility of the pipeline operators to develop appropriate environmental protection plans and mitigation to account for potential pipeline rupture during this activity.

TransCanada Pipelines Ltd operates two natural gas pipelines under the entities of Foothills Pipelines Ltd and NOVA Gas Transmission Ltd. Both pipes will be staying in their current right of way. The pipes in the upper reaches of the reservoir will likely be retrofitted while the section of the pipes that crosses the diversion channel will be relocated under the channel by either trenching or horizontal directional drill. Retrofitting will consist of weighting the pipes with concrete weights. The current design of the diversion channel includes provision for articulated concrete matting over these pipes within the right-of way, should it be warranted.

Pengrowth Energy Corporation and **Veresen Inc.** operate side-by-side high vapour pressure product pipelines that require relocation under the diversion channel. These pipes can remain in their current rights-of-way and will be trenched or horizontally directionally drilled to a depth that buries them below the diversion channel. The current design of the diversion channel includes provision for articulated concrete matting over these pipes within their rights-of way, should it be warranted.

Plains Midstream Canada operates three pipelines (a crude oil pipeline, a low-vapour pressure product pipeline and an abandoned pipeline) that must be relocated from their current rights-of-way within the PDA in a loop to the west and out of the deeper portions of the reservoir. See Figure 3-12 for the proposed new right-of-way within the PDA. The relocated alignment is expected to be installed by trenching and the crossing of the diversion channel by either trenching or horizontal directional drill. The existing pipes that remain within the reservoir area are expected to be retrofitted with weighting. The current design of the diversion channel includes provision for articulated concrete matting over these pipes within the right-of way, should it be warranted.

ATCO Gas services the shallow natural gas distribution in the area. Their mainlines are not affected by the Project but distribution lines to individual properties are affected. The ultimate plan for ATCO infrastructure is dependent on land acquisition and which customers they will need to continue to serve.



Sources: Base Data - ESRI, Natural Earth. Thematic Data - ERBC, GeoLOGIC (2015)

Utility Relocations

Stantec

3.2.8.2 Power Lines

AltaLink operates a transmission line that crosses the diversion channel (Figure 3-12). Power pole locations will 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.

3.2.8.3 Telephone and Internet

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 acknowledge that basic waterproofing of the existing infrastructure is not feasible given the serviceable depths of reservoir over the lines; a sealed conduit may be warranted. Lines that currently run along 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.

Fiber optic internet owned by Shaw is present along the ditch of the west side of the Highway 22 and will need to be realigned along the new ditch line of Highway 22, associated with its raising.

3.3 PROJECT CONSTRUCTION

Project construction will 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. On the north side of Elbow River, the main access to the PDA will be a gravel road on the southeast side of the diversion channel, with gated approaches on both sides of Highway 22. Other gravel access roads will reach the Project from Springbank Road and Township Road 242. On the south side of the river, access will be from Highway 22 at the Highway 8 interchange. See Figure 3-1 for the locations of temporary construction laydown areas, which typically include a site trailer, toilet facilities, and areas for parking, fueling, waste and recycling bins, and storage of equipment and materials.

Environmental protection will be managed during construction through Alberta Transportation's Environmental Construction Operations (ECO) Plan process (Alberta Transportation et al. 2017). 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 deal specifically with erosion and sediment control (Alberta Transportation 2011) and borrow excavations (Alberta Transportation 2013a, 2013b, 2013c).

Power for construction activities will be supplied by diesel engines in vehicles and equipment. Electrical energy will be supplied by portable diesel generators.

3.3.1 Component Construction

3.3.1.1 Diversion Inlet and Service Spillway

The potential construction sequence for the diversion inlet and service spillway is:

- A 460 m long curved temporary river channel will be constructed downstream right of Elbow River active channel, with excavated material being windrowed on the inside of the curve or used temporarily in the isolation berming and bagging.
- Elbow River will be diverted into a temporary river channel.
- Access to the diversion structure site will be provided from the north through the diversion channel.
- The diversion structure and floodplain berm foundations will be constructed.
- The direct material haul to the floodplain berm construction site from the diversion channel will require installation of a temporary bridge across the diversion channel.
- The structures will be constructed isolated from Elbow River.
- The temporary bridge, if one is used, will be removed.
- The temporary river diversion fill will be removed and Elbow River rerouted into its original channel and through the completed service spillway; the diversion fill will go into the temporary channel to restore the original contours.
- Additional fill will be placed as needed and the auxiliary spillway built.

3.3.1.2 Floodplain Berm

Trees and shrubs growing in the floodplain berm footprint and within 10 m on both sides will be cleared prior to construction of the floodplain berm and topsoil will be salvaged in the same area. The berm will be constructed from soil material excavated from the diversion channel and hauled to site. Fill will be placed in the berm footprint in lifts (layers) of a preset thickness and compacted before the next lift is placed. Riprap will be imported from off-site sources. Construction of the floodplain berm may occur concurrently or after construction of the service spillway and diversion inlet.

3.3.1.3 Diversion Channel

Standard earth moving equipment and techniques will be used to excavate the diversion channel where it is not in bedrock, and to construct short sections of embankment to form channel walls. Additional earthworks will be needed to redirect three ephemeral stream channels into the diversion channel.

The material excavated from the diversion channel will be used in construction of some portions of the channel side walls, the floodplain berm, and the dam embankment. Excavated material will be trucked from the diversion channel using the base of the channel and a haul road on the southeast side of the channel. Spur roads will connect the channel base with the parallel haul road, which will connect to the local road network. Rock or soil materials that are unsuitable for construction will be left as spoil near the diversion structure (see Figure 3-1).

3.3.1.4 Off-Stream Reservoir

A temporary laydown/stockpile area to support construction will be set up within the reservoir area, near the dam in a location accessible from the existing road network (Figure 3-1). A site trailer and employee parking area will also be located here.

Standard construction equipment and methods will be used for clearing and grading within the reservoir area. The borrow area construction sequence will be:

- pre-construction inspection
- stripping and stockpiling of vegetation and topsoil
- excavation and removal of required fill material
- grading of completed borrow area to achieve drainage requirements
- surface preparation, topsoil replacement and seeding to meet AEP reclamation requirements

3.3.1.5 Off-Stream Dam and Low-level Outlet

The off-stream dam will be constructed following this sequence of events:

- The foundation will be prepared. Trees and shrubs growing in the dam footprint will be cleared before construction and topsoil will be salvaged.
- The unnamed creek will be diverted.
- The low-level outlet works will be constructed.

- The unnamed creek will be directed through the low-level outlet works.
- The embankment will be constructed in horizontal lifts, generally proceeding from the lowest elevations to higher elevations. The source materials will be excavated from the diversion channel and borrow area and hauled to site.

The following items have been identified as construction considerations for the dam:

- The piezometers and depth to water encountered in each borehole indicate that generally groundwater is sufficiently deep below the ground surface to not have a large effect on the construction of the dam. However, occasional areas where depth to water was as close as 1 m to the ground surface were encountered in the lower elevations of the dam foundation. The contractor should be prepared to control groundwater when excavating for foundation preparation, if necessary.
- The geotechnical performance of the dam will be monitored throughout construction with an instrumented dam safety management system. Measured performance that does not conform to the expected behavior of the dam may require design reviews and potential modifications to the dam geometry or construction sequence.
- The rate of earthfill placement and subsequent pore pressure response in the foundation units and lower earthfill layers will be monitored throughout active and inactive construction periods. Piezometers will be installed in the glaciolacustrine and till foundation soils and lower portions of the embankment to monitor the increase in pore pressure in relation to the added load. If the pore pressure increases are greater than those, the rate of construction may be modified or other contingency measures, such as toe berms may need to be incorporated to provide adequate factors of safety against slope instability during construction
- The dam construction sequencing will be planned to account for anticipated weather conditions. The earth fill will not be placed and compacted when frozen or outside the permitted moisture content range. It is assumed embankment placement will occur in the warmer, dryer months (May through October). The stability analyses assumes two construction summer seasons and pore pressures will partially dissipate during the intervening winter break. The earthfill around the low-level outlet works will not be constructed until the cast-in place conduit was complete. The alluvium foundation materials in the unnamed creek are expected to allow pore pressure dissipation; however, increased monitoring of piezometers will be required. If pore pressures do not dissipate at the rate assumed in the analyses, the rate of construction may need to be reduced.

3.3.1.6 Roads and Bridges

The road and bridge works will be constructed using standard equipment, materials and methods codified in Alberta Transportation's standard specifications for highway construction (2013d) and standard specifications for bridge construction (2013e). Fill will be sourced from a borrow area in the reservoir (Figure 3-1). Table 3-5 presents an overview of the construction steps of the road and bridge construction.

Table 3-5 Road and Bridge Construction Steps

Roads and Highways	Bridges
surveying	surveying
signage and public safety preparation	signage and public safety preparation
installing temporary erosion & sediment controls	installing temporary erosion & sediment controls
topsoil stripping and salvage	topsoil stripping and salvage
excavation, grading and subgrade preparation	establishment of detours if necessary
culvert installation	excavation at abutments
placing of granular sub-base and base courses	construction of approach fills
asphalt or gravel surfacing	construction of abutment foundations
installation of permanent erosion control devices	construction of abutments and wing walls
installation of guardrails or post and cable barriers	backfilling
line painting	girder erection
installation of signage	construction and waterproofing of concrete deck
surface preparation of backslopes and side slopes	construction of approach slabs
topsoil replacement and seeding	paving and sealing of deck and approach slabs
installation of right of way fencing	installation of railings
	decommissioning of detours

3.3.1.7 Utilities

Pipeline and utility relocation work will be carried out using standard pipeline construction methods by contractors of the pipeline or utility company's choice.

3.3.2 Equipment Requirements

Expected vehicle and equipment requirements for Project construction are listed in Table 3-6.

Table 3-6 Equipment Requirements for Project Construction

Equipment	Number of Units								
	Off-stream Dam	Floodplain Berm	Borrow Area	Diversion Structure	River Re-route at Diversion Structure	Diversion Channel	Dam Outlet Structure	Hwy 22 Bridge, New Lanes	Hwy 22 & Twp Road 242 Bridge
Articulated dump trucks	28	4	-	-	2	2	-	20	-
Scrapers	5	-	-	-	-	5	-	3	1
Backhoes	4	-	2	-	-	2	-	2	1
Dozers	2	2	-	-	1	-	-	2	1
Excavators	-	-	-	-	2	-	-	2	1
Front end Loader	-	-	-	-	1	-	-		
Skid steers	-	-	-	-	-	-	-	2	1
Water trucks	1	-	-	-	-	-	-	2	
Graders	-	-	-	-	-	-	-	2	1
Vibratory compactors	2	-	-	-	-	-	-	2	1
Smooth drum rollers	-	-	-	-	-	-	-	2	1
Impact pile drivers	-	-	-	-	-	-	-	2	2
Truck-mounted crane	-	-	-	1	-	-	1	1	1
Concrete trucks	-	1	-	1	-	-	1	1	1
Asphalt paver	-	-	-	-	-	-	-	1	1
Roller/compactors	-	-	-	-	-	-	-	1	1
Mini backhoe	-	-	-	-	-	-	-	1	1
Portable light generator	48	-	21	-	-	-	-	9	9
Diesel generators	-	-	-	2	-	-	-	-	-

3.3.3 Workforce Management

The workforce for both the construction and operations of the Project are expected to be sourced from Calgary and vicinity and to be housed at facilities in the Calgary area. There will be no work camps.

3.3.4 Waste Management and Recycling

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

- Waste streams will be disposed 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 (Alberta Environmental Protection 1996).
- Solid waste will be either recycled or disposed through licensed companies at licensed facilities.
- Excavated rock and soil materials that are unsuitable for construction uses will be hauled to a designated spoil location within the project limits (see Figure 3-1).
- The construction contractor's ECO Plan will include a waste management plan.

Waste streams and their management methods are listed in Section 4.5.

3.3.5 Hazardous Materials Management

Hazardous materials management during construction will be the responsibility of construction contractors and will 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.

3.3.6 Commissioning

3.3.6.1 Testing and Commissioning

Off-stream Dam

The integrity of the dam will be tested during construction. There are currently no plans to test the dam with a diversion of the Elbow River when there is no flood. In lieu of testing, the off-stream dam contains sensors that will be monitored during operation. Should the monitoring reveal a problem with the dam, the diversion can be stopped and the problem addressed.

Diversion Structure

The diversion structure will be tested by the operator annually with exercising of the gates and mechanical components prior to flood season. Sensors such as water level monitors and security systems on the structure will be monitored continuously by the operator.

Low Level Outlet

The gate on the low-level outlet will be exercised on an annual basis.

Operation and Communication Systems

Operation and communication systems will be tested by the operator annually in advance of flood season.

3.3.6.2 Decommissioning

Permanent Components

None of the permanent components of the Project will be decommissioned.

Temporary Components

The river cofferdam will be removed outside of Elbow River's restricted activity period. Reclamation of the river bed at the cofferdam and the temporary diversion channel will include replacement of clean, native alluvium within the footprint of those temporary works.

Areas of additional clearing and grubbing for construction such as laydowns and temporary access routes will be top soiled and hydroseeded following construction. Native shrubs and trees may be planted in select locations of temporary disturbance where there no conflict with the permanent infrastructure, or its maintenance.

The borrow area will be graded for positive drainage and then top soiled and hydroseeded. Any material spoil piles may be left in place, if not at risk to erosion or wind transport (i.e., rock). If spoil piles contain fines or materials that are subject to erosion or wind transport, then they will be covered with topsoil and hydroseeded.

3.3.7 Reclamation

The following areas will be topsoiled and seeded at the end of construction:

- the south (non-river) side of the floodplain berm
- the upper side walls of the diversion channel
- the dam embankment
- contractor laydown areas
- borrow area
- spoil areas
- side slopes and backslopes of new roads
- areas disturbed by utility construction
- temporary construction access roads that have been decommissioned
- the decommissioned portion of Highway 22
- the temporary channel used for the diversion of the Elbow River
- all other areas disturbed by construction that are not required for operation and maintenance

Further information on reclamation is provided in Volume 4, Appendix D.

3.3.8 Construction Schedule

Table 3-7 is a generalized construction schedule, based on an April 2019 start and a November 2021 completion.

Table 3-7 Construction Schedule

	2019									2020												2021											
	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Mobilization																																	
In-Stream Work																																	
River Diversion																																	
Service Spillway Structure																																	
Floodplain Berm																																	
Diversion Channel																																	
Channel Excavation																																	
Diversion Inlet Structure																																	
Emergency Spillway																																	
Diversion Channel Outlet Structure																																	
Dam Outlet Structure																																	
Earthworks (Dam Embankment)																																	
Pipeline Crossings/ Utilities																																	

Table 3-7 Construction Schedule

	2019									2020												2021											
	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December	January	February	March	April	May	June	July	August	September	October	November	December
Raise Highway 22																																	
Culvert Construction																																	
Earthworks																																	
Base & Pave																																	
Highway 22 Bridge Construction																																	
Detour																																	
Excavation																																	
Temp Bridge Construction																																	
Construct Bridge over Haul Route																																	
Township Road 242 Bridge																																	
Build Road Detour																																	
Construct Bridge																																	

3.4 DRY OPERATION

Dry operation refers to project operation between floods.

3.4.1 Main Components of the Project

During dry operation, the diversion inlet gates will close and the service spillway gates will open (lowered). The gate system and its operation will be checked according to a routine maintenance schedule to be developed by AEP. The maintenance schedule will also include inspections of the diversion structure and the river channel upstream of it, the maintenance building, the floodplain berm, and the auxiliary spillway. Repairs and debris removal will be completed as necessary.

Surface runoff from storms or melting snow, as well as streamflow from watercourses intersected by the diversion channel, will flow into the diversion channel and travel to the reservoir. The erosion control measures protecting the walls and floor of the channel will be inspected on a regular schedule (to be determined by AEP) for erosion or other damage and repaired as necessary. The associated access roads, emergency spillway and reservoir inlet basin will be inspected at the same time and repaired if necessary.

Between floods, the dam embankment, associated access roads and low- level outlet works also will be inspected for damage on a regular schedule to be determined by AEP, and repairs will be carried out if necessary. The low-level outlet will remain open to carry the flow of the unnamed creek over which the dam was built. Water draining from the diversion channel and the drainage ditches at the base of the dam will also flow through the outlet structure.

3.4.2 Highways and Municipal Roads

Alberta Transportation will retain care and control of Highway 22 and the bridge crossing the diversion channel. Care and control of Springbank Road and other county roads affected by the Project will continue to be the responsibility of Rocky View County, with the exception that any maintenance of Springbank Road required after a flood will be the responsibility of the Government of Alberta. No incremental operation and maintenance activities are required for roads during dry operations.

3.4.3 Utilities

Operation and maintenance of the pipelines and utilities within the PDA will remain the responsibility of the pipeline and utility owners.

3.4.4 Equipment Requirements

Dry operation inspections will be carried out using light trucks. The occasional use of heavier trucks or construction equipment might be necessary when maintenance requirements are identified.

3.4.5 Waste Management and Recycling

Dry operation is expected to generate small amounts of solid waste. Management of dry operation waste is addressed in Section 4.5.

3.4.6 Workforce Management

Dry operation will require a six-person workforce. AEP Operations staff will monitor and maintain the facility with contractors brought in as-needed to execute various maintenance activates. AEP Operations staff will operate the Project.

3.5 FLOOD OPERATION

AEP Operations will be in communication with the City of Calgary in advance of and during the flood season each year, so each party will maintain an understanding of the system's status. The need for flood operations will be identified through this advanced communication, and will be informed by forecasted and measured flows on Elbow River at the diversion structure and upstream. AEP Operations staff will ultimately decide on when to divert excess flood water to the reservoir.

3.5.1 Main Components of the Project

Flood operations will begin when flows in the Elbow River exceed 160 m^3/s. At that flow, the service spillway gates will be raised to create a backwater upstream of the diversion structure, the diversion inlet gates will be opened, and flood flow will begin to divert into the diversion channel to be retained in the off-stream reservoir. The diversion inlet and service spillway gates will be operated and monitored from the adjacent control building, which will be staffed continuously during diversion of floods.

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 will be allowed downstream through the service spillway. When inflows from the Elbow River exceed 760 m^3/s, the excess flow will be allowed downstream through the service spillway, while maintaining a constant diversion rate of 600 m^3/s until the reservoir is full.

The operation of the diversion structure at different ranges of flow is summarized in Table 3-8. These operating scenarios are based on the assumption of no excess capacity being available at Glenmore Reservoir and sufficient capacity in the off-stream reservoir. The diversion inlet gates will close when the reservoir is full.

Table 3-8 Operation of the Diversion Structure at Different Ranges of Flow

Flow Rate (m^3/s)	Operation	
	Diversion Inlet	Service Spillway
< 160	gates closed	right gate raised, flow through left spillway
160-760	gates open	left gate raised in increments with increasing flow
>760	gates open	both gates lowered in increments

During a flood, the low-level outlet structure will be closed to keep floodwaters behind the dam. The gates are operated locally using the gatehouse. The gatehouse will be manned continuously during a flood.

The diverted floodwater will be held in the off-stream reservoir until the flood risk has passed and it has been determined that water can be safely released back into the Elbow River. In the case of a flood flow larger than the design flow, after the reservoir is full, the diversion inlet gates will be closed, ending the diversion and allowing the remaining flood flow in the Elbow River to continue downstream to Glenmore Reservoir.

The flow in the diversion channel will be monitored continuously. The reservoir elevation and fill rate also will be monitored, as well as the pore pressure within the dam and at its foundations.

All components will be inspected regularly during flood operations, the frequency of inspection being based on the severity of the flood.

3.5.2 Highways and Municipal Roads

Highway 22, Township Road 242 and Township Road 244 will not be affected by flood magnitudes up to and including the design flood. Springbank Road will remain above water for the 1:10 year flood and larger magnitudes up to approximately the 1:50 year flood. For floods larger than the 1:50 year flood, Springbank Road will be at least partially submerged, and traffic will be detoured to Highway 22 by means of Range Road 40 and Township Road 250.

3.5.3 Utilities

The utility revisions incorporated in the Project are designed to prevent damage to those utilities during floods, so no extra operational activities are expected. Shutdowns may be necessary, as determined by the utility owner, in the event of an emergency.

3.5.4 Equipment Requirements

The majority of the work during floods will involve operations at the diversion structure and low-level outlet works, and conducting inspections. This work can be executed using light trucks, although some heavy equipment might be brought to site in case it is needed for debris removal. AEP will be completing flood operational planning, including equipment requirements, at a later stage of planning.

3.5.5 Waste Management and Recycling

Any wastes generated during flood operation will be stored on site for disposal or recycling during the post-flood period.

3.5.6 Workforce Management

Because of the need for fast response in a flood scenario, it is assumed that those tasked with responding to flood scenarios will be locally based and there should be no need for workforce lodging. AEP's flood operational plan will address workforce considerations, but details of work schedules and transportation on site will be developed on a flood-by-flood basis.

3.6 POST-FLOOD OPERATION

3.6.1 Main Components of the Project

During post-flood operations, the diversion inlet gates will close and the service spillway gates will open (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. Table 3-9 shows the estimated reservoir draining times associated with different flood magnitudes. The outlet structure gates will remain open after the reservoir has drained.

Table 3-9 Estimated Minimum Reservoir Draining Times for Different Flood Scenarios

Flood magnitude	Minimum time to drain reservoir (days)
2013 Hydrograph	38
1:100 year	39
1:10 year	30

Post-flood repair and maintenance activities are listed in Table 3-10.

Table 3-10 Post-flood Repair and Maintenance Activities

Components	Maintenance Activities
Diversion system	• partial removal of sediment and debris to the extent necessary to maintain the flow of water into the reservoir during diversion • confirmation of gate functionality and repair if required • repair of erosion damage to the floodplain berm and auxiliary spillway where necessary
Diversion channel	• removal of debris and sediment to the degree required to maintain channel capacity • repair of flood damage to the channel, the associated access roads or the emergency spillway
Off-Stream reservoir	• partial removal of sediment so that water flow is not blocked • removal of debris from the flooded area of the reservoir if required • internal drainage regrading if required
Dam embankment	• removal of debris and sediment at the inner toe of the dam to the degree required to maintain functionality of the access road and the dam drainage ditch • repair of erosion damage or sedimentation affecting the dam faces, benches, drainage flumes and drainage ditches • repair of erosion damage to the dam access roads
Low level outlet works	• removal of debris and sediment from the outlet components to the degree required to maintain optimal functionality • confirmation of gate functionality and repair if required • inspection of outlet channel and repairs if necessary

3.6.2 Highways and Municipal Roads

Post-flood operational requirements for road infrastructure will vary with flood scenario and are summarized in Table 3-11.

Table 3-11 Post-flood Maintenance Activities

Road Infrastructure	Maintenance Activities
Diversion channel bridges	• For all floods, inspection and repair if necessary
Springbank Road	• For flood magnitudes up to the 1:50 year flood, Springbank Road will not be affected. • When a portion of Springbank Road is largely or completely submerged, Springbank Road will remain closed until necessary repairs have been completed and the roadway is deemed safe for public travel
Highway 22 and Township Road 244	• For floods at or near the design flood when the highway embankment is partially submerged, inspection and repair if necessary • For all smaller floods, no action required
Township Road 242	• Not affected by floodwaters. No action required except diversion channel bridge inspection

3.6.3 Utilities

Following floods, it is expected that the revised utility crossings of the diversion channel will be inspected for damage by the utility owners and repaired if necessary.

3.6.4 Equipment Requirements

The post-flood operational activities requiring heavy equipment will be for the removal of sediment and debris, and facility maintenance and repair. The amount of this work required, and therefore the amount of equipment required, will depend on the severity of the flood.

3.6.5 Waste Management and Recycling

Wastes generated during post-flood operations will consist primarily of sediment and debris removed from project components. These wastes will be trucked to approved landfills or other locations to be identified by AEP. Other post-flood waste materials will be landfilled or recycled, as appropriate.

3.6.6 Workforce Management

The workforce for post-flood operations will include workers remaining on site from flood operations, and contracted forces retained by AEP for clean-up and repair. Details of post-flood workforce requirements will be determined by AEP on a case-by-case basis.

3.7 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 Elbow River

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

3.8 WATER MANAGEMENT PLAN

The main objective of the Project is to manage flood flows and lessen their impacts to life and property downstream of the Project. Alberta Transportation has compiled a detailed Water Management Plan (provided in Attachment A) outlining how water will be managed through all stages of the Project (construction through post-flood) to mitigate potential adverse effects from the Project on water quality.

4.0 EMISSIONS, DISCHARGES AND WASTE

4.1 AIR EMISSIONS

There are no continuous air emissions associated with the Project. Intermittent air emissions during Project construction will consist of particulate matter and products of hydrocarbon combustion.

During construction, air emissions generated from the combustion of diesel and gasoline by heavy equipment and construction vehicles will include carbon dioxide, carbon monoxide, volatile organic compounds, nitrogen oxides, sulphur oxides and particulate matter. During operations, sources of hydrocarbon combustion emissions will be limited to periodic maintenance activities.

Particulate matter in the form of dust will be the main sources of air emissions during excavation and construction activities and vehicle traffic. During flood and post-flood operations, sources are vehicles and potential wind erosion of the sediments that will be deposited in the reservoir.

The amount of dust from the Project depends on the area of soil or sediment exposed, the amount of material moved, and the moisture content of the material. Best management practices and guidelines for dust suppression, including surface watering, will be followed.

Mitigation measures for air emissions are presented in Volume 3A, Section 3 and Volume 3B, Section 3.

4.2 LIGHT

During construction, activities are scheduled to occur around the clock. This will require lighting of work areas during the night. Construction lighting will consist of portable fixtures powered by diesel generators. Permanent lighting from the local electrical grid will be installed at the control building for the diversion structure.

Mitigation measures for light from the Project are presented in Volume 3A, Section 3 and Volume 3B, Section 3.

4.3 NOISE EMISSIONS

Noise emissions for the Project will be primarily related to the use of heavy equipment and trucks to excavate, haul, grade and compact material during construction. The Project will comply with noise level restrictions required by the County of Rocky View or potential conditions within the development permit issued by the County for the Project.

4.4 LIQUID DISCHARGES

There will be no wastewater or effluent discharges from the Project. Domestic sewage from the worksite trailers located at each of the temporary laydown and stockpile areas will be collected in a septic holding tank at each site. The contents of the holding tanks will be pumped out periodically and disposed into a licensed disposal facility.

4.5 SOLID WASTE

Waste streams are identified in Table 4-1 and will be disposed according to the applicable provisions of the Waste Control Regulation and the requirement for each waste classification outlined in the Alberta User Guide for Waste Managers (Alberta Environmental Protection 1996). Solid waste will be either recycled or disposed through licensed waste disposal companies at licensed facilities. A waste management plan will be developed as part of the ECO Plan for the Project.

Table 4-1 Wastes and Waste Management Methods

Waste Stream	Management Method
Domestic waste	Contracted waste disposal
Recyclables (wood, paper, metal)	Contracted recycling
Hazardous waste	Licensed disposal facility
Waste oil	Licensed recycler
Dry operation maintenance debris	Contracted waste disposal
Flood debris	Contracted waste disposal
Sediment from the flood	Landfill tested and either integrated into the landscape or hauled to an appropriate facility

5.0 DAM SAFETY

The design of the off-stream dam complies with Canadian Dam Association (CDA) Dam Safety Guidelines (CDA, 2007) and Technical Bulletin Nos. 1 through 9, current Alberta Transportation Design Standards, relevant Alberta Transportation Design and Construction Bulletins.

A dam safety hazard classification is required for selection of the appropriate design standards established in the CDA Dam Safety Guidelines. The hazard classification is selected based on the consequences associated with a hypothetical failure of the dam. Table 5-1 lists the CDA standards based approach for Hazard Classification.

Table 5-1 CDA Consequence Classification Ratings for Dams

Canadian Dam Association (CDA) Consequence Classification Ratings for Dams

Consequence Classification	Population at Risk	Consequences of Failure		
		Loss of Life	Environmental and Cultural Values	Infrastructure and Economics
Low	None[1]	There is no possibility of loss of life other than through unforeseeable misadventure	Minimal short-term loss or deterioration and no long-term loss or deterioration of: a) Fisheries or wildlife habitats b) Rare or endangered species, or c) Unique landscapes or sites of cultural significance	Minimal economic losses mostly limited to the dam owner's property, with virtually no pre-existing potential for development within the dam inundation zone.
Significant	Temporary only[2]	Low potential for multiple loss of life	No significant loss or deterioration of: a) Important fisheries or important wildlife habitats b) Rare or endangered species, or c) Unique landscapes or sites of cultural significance, and restoration or compensation in kind is highly possible	Low economic losses affecting limited infrastructure and residential buildings, public transportation or services or commercial facilities, or some destruction of or damage to locations used occasionally and irregularly for temporary purposes.
High	Permanent[3]	10 or fewer	Significant loss or deterioration of: a) Important fisheries or wildlife habitats b) Rare or endangered species, or c) Unique landscapes or sites of cultural significance, and restoration or compensation in kind is highly possible	High economic losses affecting infrastructure, public transportation or services or commercial facilities, or some destruction of or some severe damage to scattered residential buildings.
Very high	Permanent[3]	100 or fewer	Significant loss or deterioration of: a) Critical fisheries or wildlife habitats b) Rare or endangered species, or c) Unique landscapes or sites of cultural significance, an restoration or compensation in kind is possible but impractical	Very high economic losses affecting important infrastructure, public transportation or services or commercial facilities, or some destruction of or some severe damage to residential areas.
Extreme	Permanent[3]	More than 100	Major loss or deterioration of: a) Critical fisheries or wildlife habitats b) Rare or endangered species, or c) Unique landscapes or sites of cultural significance, and restoration or compensation in kind is impossible	Extremely high economic losses affecting critical infrastructure, public transportation or services or commercial facilities, or some destruction of or some damage to residential areas.

[1] There is no identifiable population at risk.
[2] People are only occasionally and irregularly in the dam breach inundation zone, for example stopping temporarily, passing through on transportation routes or participating in recreational activities.
[3] The population at risk is ordinarily or regularly located in the dam breach inundation zone, whether to live, work or recreate

A dam breach inundation study was completed for off-stream dam and is discussed in Section 5.2. Based on the size of the population at risk, a hazard classification of 'high' for the diversion structure and 'extreme' for the dam is justified.

The dam design parameters and construction activities that support dam safety are presented in Section 3.2.5. They are discussed in more detail in the Interim Design Report (Stantec 2017b), which includes the Interim Geotechnical Assessment Report as Appendix D.

5.1 POTENTIAL CHALLENGES TO DAM SAFETY

5.1.1 Challenges to Dam Safety During Construction

The off-stream dam will be constructed across the unnamed creek. The drainage area for the unnamed creek watershed is approximately 35 km^2. During construction of the low-level outlet works, the creek will be diverted to a temporary channel for conveyance around the construction works. This will include excavation of the diversion channel and a small diversion berm. Following completion of the low-level outlet channel, flows from the unnamed creek will be diverted through the conduit and the embankment raised. Sufficient conduit and/or bypass channel capacity is planned for passage of the local inflows without further concerns for dam safety.

Diversion of the Elbow River is planned for construction of the diversion structure. The diversion will be constructed between July 15 and September 15 and will consist of an excavated channel through the adjacent right descending bank floodplain. A temporary embankment will be constructed on the left descending bank to protect construction of the service spillway and diversion structure. The planned embankment height ranges from 2 m to 4 m and is designed to protect the construction from a 1:10 year flood on Elbow River. An earthen embankment will remain in place within the channel to prevent passage of larger flood flows into the channel and reservoir until completion of the diversion inlet structure. Failure of the cofferworks will have minimal consequence downstream of the project site, as it does not impound water upstream.

5.1.2 Challenges to Dam Safety During Operation

In general, the Project is planned to operate during floods that exceed the capacity of the Glenmore Reservoir low-level outlet. The diversion Inlet gates will be raised to allow flow in the diversion channel and reservoir. Diversion flow rates will be controlled by monitoring of the water surface elevations upstream of the diversion structure and operation of the service spillway gates. Once the reservoir capacity is reached, the service spillway gates will be lowered to a fully open position and the diversion inlet gates closed.

Challenges to dam safety during operation may manifest from operation errors, mechanical or structural failures or the effects of the environment such as sediment or debris. These challenges may result in:

- diversion Inlet gates failing to close and the diversion volume exceeding the reservoir flood waters retention capacity
- Elbow River water surface elevations upstream of the diversion structure exceeding planned operations levels
- structural issues related to the dam

For the diversion inlet, potential causes of gate closure failure and the planned mitigation measures are listed in Table 5-2.

Table 5-2 Potential Dam Safety Issues at the Diversion Inlet

Identified Risk	Mitigation Measures
Operator fails to close the diversion inlet gates.	Preventive: Reservoir levels are monitored through redundant sensors and alarms set to notify operator at multiple stages. Preventive: Communication protocols are established between operator at diversion structure and personnel at the dam and remote locations to identify potential issues. Reactive: The emergency spillway is planned to pass the diverted portion of the probable maximum flood (PMF) should the gates remain in the fully open position.
Mechanical failure prevents typical operation of gates.	Preventive: Routine inspection, operation and maintenance protocols are performed annually before flood season. Preventive: The gates and hoists planned for the diversion inlet were selected based on their mechanical reliability. Reactive: The gate hoists are planned as wire rope hoists. They will close by gravity, controlled by a braking system. Should the rope and/or brake system fail, the hoist brakes can be released and the gates lowered. Reactive: The emergency spillway is planned to pass the diverted portion of the probable maximum flood should the gates remain in the fully open position.
Debris obstructs gate closure path and prevents closure of gates.	Preventive: The diversion structure was evaluated in a physical model to study debris impacts and passage. Design of the gate system incorporated debris passage improvements, including wider gate openings and modified pier geometry. Reactive: Removable panels are provided along the access bridge of the diversion inlet structure. These openings may allow equipment to access the areas in front of the gates and clear limited debris accumulation. Reactive: The emergency spillway is planned to pass the diverted portion of the probable maximum flood should the gates remain in the fully open position.

For the service spillway, potential causes of increased Elbow River water surface elevations and the planned mitigation measures are listed in Table 5-3.

Table 5-3 Potential Dam Safety Issues at the Service Spillway

Identified Risk	Mitigation Measures
Operation of service spillway gates does not follow planned operations.	Preventive: Water surface levels are monitored through redundant sensors and alarms set to notify operator at multiple stages. Preventive: Communication protocols are established between operator at diversion structure and remote locations to identify potential issues. Reactive: The auxiliary spillway is planned to pass excess flows and maintain control of the upstream headpond.
Mechanical failure prevents typical operation of gates.	Preventive: Routine inspection, operation and maintenance protocols are performed annually before flood season. Preventive: The gates and pneumatic bladders are designed to fail open. That is, failure of the bladder will result in the gates opening and a reduced risk to dam safety. Reactive: The auxiliary spillway is planned to pass excess flows and maintain control of the upstream headpond.
Sediment and debris deposition upstream result in increased water surface elevations.	Preventive: Gate operations are based on water surface elevation monitors and can adjust operations should sediment and debris effect rating curves. Preventive: Sediment deposition simulations were performed to evaluate potential effects on water surface elevations and freeboard established appropriately. Reactive: The auxiliary spillway is planned to pass excess flows and maintain control of the upstream headpond.

For the dam embankments (floodplain berm and off-stream dam), potential dam safety issues and their related mitigation measures are listed in Table 5-4.

Table 5-4 Potential Dam Safety Issues at the Off-stream Reservoir

Identified Risk	Mitigation Measures
Dam overtopping	Preventive: Adequate freeboard has been provided in the design to account for inflows from the probable maximum flood and potential wave run-up. Reactive: Dam safety and operations programs will include monitoring of water levels to identify timing for closure of diversion inlet gates.
Hydraulic fracturing and piping of embankment materials results in internal erosion.	Preventive: Construction specifications require appropriate construction techniques including foundation preparation and material placement. Preventive: Quality assurance and quality control measures promote adherence to design standards. Reactive: Filter downstream of core included to arrest soil migration.

Table 5-4 Potential Dam Safety Issues at the Off-stream Reservoir

Identified Risk	Mitigation Measures
Slope instability	Preventive: Design incorporates adequate factors of safety for slope stability including short term (during construction), long term, during seismic events, during flood operations, and after flood drawdown. Preventive: Geotechnical instrumentation installed to identify potential triggers of instability before failure. Reactive: Inspection program enables identification of problems prior to operation of structure.
Deformation	Preventive: Dam design incorporates an overbuild" to account for anticipated settlement of crest. Reactive: Settlement gauges and slope inclinometers to be installed to monitor for deformation following construction.
Seepage	Preventive: Dam design incorporates use of low permeability soils. Reactive: Internal filter downstream of core and foundation drains provided to arrest internal erosion and lower seepage gradients.

In addition to the design and monitoring components listed, both an emergency action plan and emergency response plan will be developed for the Project. These plans will provide mitigation to downstream risk by identifying potential issues with the dam and their potential fixes, establishing communication protocols, and providing identification of at-risk populations and incorporation of evacuation plans.

5.1.3 Challenges to Dam Safety During Decommissioning of Temporary Dam Works and of the Dam

No challenges to dam safety are anticipated for decommissioning the temporary works. The temporary works will not impound water. The proposed diversion channels and flood routes will have similar capacity to convey storm flows as existing conditions. Similarly, neither structure impounds water outside of planned operations. Sequencing of decommissioning of the dams will likely occur outside of flood season and will not occur during a planned operation period.

Coffer-works for the diversion structure will only occur between July 15 and September 15.

5.2 BREACH ANALYSIS AND CASCADE FAILURE

Following guidance outlined in the CDA Dam Safety Guidelines (2013), a breach analysis and inundation mapping was completed (Stantec 2017a).

The CDA recommends the analysis of two scenarios when conducting a dam breach and inundation analysis. These will typically be a "sunny-day" failure and a "flood-induced" failure. A "sunny-day" failure is irrelevant because neither the dam nor the diversion structure is designed to have a permanent pool; instead, a post-flood failure scenario was analyzed.

Four breach scenarios were considered:

1. **Flood-induced failure of the off-stream dam.** The flood-induced failure scenario assumes a failure of the off-stream dam coincident with a flood of magnitude greater than the dam can safely pass (which is the equivalent of the 2013 flood). The off-stream dam has been designed assuming a dam classification of "extreme" and therefore is capable of safely passing an inflow design flood (IDF), equivalent to the portion of the PMF which will be diverted to the off-stream reservoir if the diversion inlet gates fail to closed when the reservoir reaches its design capacity of 1,210.75 m. The pool elevation will maintain 1.5 m freeboard to the crest of the off-stream dam under this scenario, so a failure by piping will be the only potential failure mode. Because a flood-induced failure of the off-stream dam will require the coincident failure of both operation and a piping failure during a transitory period of elevated flows, which is deemed an extremely unlikely event, this is not considered a valid failure scenario and no further analysis is required.

1. **Post-flood failure of the off-stream dam.** The post-flood failure scenario assumes a failure of the dam after the design flood as the reservoir is being slowly drained. This scenario assumes a piping failure when the reservoir is filled to the emergency spillway at elevation 1,210.75 m, representing conditions immediately after a major flood, but before significant volume can be released from the reservoir.

2. **Flood-induced failure of the diversion structure.** The flood-induced failure scenario assumes a failure of the diversion structure coincident with a flood of magnitude greater than the dam can safely pass. The diversion structure has been designed assuming a dam classification of "high." However, critical components have been designed to safely pass the PMF. This structure has been assessed in this analysis using the PMF as the IDF as a conservative assumption. During this scenario, failure is assumed to occur in the auxiliary spillway by overtopping at the maximum head elevation of 1217.8 m during the PMF.

3. **Post-flood failure of the diversion structure.** The post-flood failure scenario assumes a failure of the diversion structure after the IDF. The diversion structure does not function as a dam except during a flood, so this is not considered a valid failure scenario and no further analysis is required.

Cascade Failure Potential

Glenmore Reservoir is located approximately 28 km downstream of the Project. The Glenmore Reservoir facility is comprised of Glenmore Dam and the southeast dyke. A failure of the off-stream dam would release 77,900 dam^3 of water and has the potential to cause a cascade failure at Glenmore Reservoir.

The Glenmore Reservoir southeast dyke is an earthen embankment approximately 1.4 km long with a crest elevation of 1,080.4 m and maximum height of approximately 8.4 m. An alternative post-flood induced failure of the off-stream dam was considered where the southeast dyke fails by overtopping when Glenmore Reservoir's pool reaches elevation 1,080.4 m.

The Glenmore Dam is a concrete gravity dam approximately 280 m long with a crest elevation of 1,079.92 m and maximum height of approximately 24 m. Failure of the concrete gravity dam is considered unlikely to occur in combination with a full breach of the southeast dyke.

The results of the breach analysis and cascade failure follow.

Flood-Induced Failure of the Diversion Structure

Failure of the diversion structure auxiliary spillway during the IDF will have minimal impact downstream of the structure. According to breach routing results, such a failure would increase the peak discharge in Elbow River immediately downstream of the diversion structure from 2,770 m^3/s to a peak of 3,103 m^3/s for less than 30 minutes. The spike in flow corresponds to approximately a 0.2 m increase in the water surface elevation. By the Highway 22 bridge, which is located approximately 1 km downstream of the diversion structure, the increase in water surface elevation due to the breach is less than 0.1 m. Based on these results, inundation shows negligible change to inundation limits.

Post-Flood Failure of Off-Stream Dam

Two post-flood failure scenarios are evaluated for the off-stream dam: no cascade failure and a cascade failure of the Glenmore Reservoir southeast dyke. Table 5-5 is a summary for the results of both scenarios. All listed water surface elevations are headwater elevations.

Table 5-5 Summary of Results for Post-Flood Failure of Off-Stream Dam

Location	Arrival Time after Start of Breach (hr:min)	No Cascade Failure		Glenmore Reservoir Southeast Dyke Cascade Failure	
		WSE[1] (m)	Discharge (m^3/s)	WSE[1] (m)	Discharge (m^3/s)
Elbow River at Breach (Station 44,946)	0:00	1,180.96	17,309	1,080.96	17,309
Elbow River at Sarcee Bridge (Station 19,779)	2:20	1,086.88	10,227	1,086.88	10,227
Glenmore Reservoir Southeast Dyke Overtopping	2:40	1,082.47	2,445	1,082.23	3,314
Elbow River at Glenmore Dam (Station 11,417)	2:40	1,082.14	4,433	1,081.93	4,188
Elbow River at Elbow Drive Bridge (Station 7,206)	3:00	1,059.68	2,971	1,059.43	2,820[1]
Elbow River at 1st St (Patterson) Bridge (Station 2,954)	3:20	1,050.68	1,688	1,050.58	1,611[1]
Elbow River at 9th Ave Bridge (Station 287)	3:30	1,044.48	2,132	1,044.48	2,063[1]
Bow River at 17th Ave (Cushing) Bridge (Station 44,288)	4:00	1,037.86	4,131	1,037.33	3,730
Bow River at Glenmore Trail (Graves) Bridge (Station 37,138)	4:40	1,023.76	3,648	1,023.50	3,282
Bow River at Highway 2 Bridge (Station 18,031)	5:50	988.40	4,017	988.88	4,658[2]
Bow River at Confluence with Highwood River (Station 0)	8:10	952.99	3,865	953.43	4,608

NOTE:
[1] Water surface elevation

The breach routing model terminates at the confluence with the Highwood River. Peak discharges from the breach routing model are less than the 100-year discharge downstream of the confluence, which indicates that sufficient attenuation has occurred.

6.0 PUBLIC ENGAGEMENT PROGRAM

6.1 COMMITMENT AND APPROACH

Engagement with stakeholders, including landowners, municipalities, infrastructure companies and others has been ongoing since the fall of 2014 and will continue as the Project progresses. Alberta Transportation is committed to providing Project information to the public as the design becomes finalized and approved.

Stakeholders who are potentially affected by the Project or have expressed an interest in it are listed in Table 6-1.

Table 6-1 Affected and Interested Stakeholders

Local Landowners, Residents and Occupants	• Landowners, residents and occupants within the Project Development Area, and in western Springbank directly east of the Project
Local and Regional Businesses/Industry	• Alberta Ethane Development Company (owned by Veresen) • Altalink • ATCO Gas • Foothills Pipe Lines Limited • Fortis Alberta • Kamp Kiwanis • NOVA Gas Transmission • Pengrowth Energy Corporation • Plains Midstream Canada ULC • Telus Communications • TransCanada Pipeline Limited • Shaw Communications
Regional Associations	• Bow River Basin Council • Calgary Regional Partnership • Elbow River Watershed Partnership • Springbank Community Planning Association • Alberta Irrigation Projects Association • Pirmez Creek Irrigation Society • Bow River Irrigation District • Western Irrigation District • Kananaskis Improvement District • Calgary Community Associations (Elbow Springs, Discovery Ridge, West Springs, Aspen Woods, Springbank Hill) • WaterSmart

Table 6-1 Affected and Interested Stakeholders

Special Interest Groups	• Calgary River Communities Action Group • Don't Damn Springbank • Water Collaborative • Vulcan County

Landowners, residents and occupants include private residents, ranchers, farmers, natural gas and oil pipeline companies, electric and gas distribution utilities, various local businesses, and private recreational camps.

6.2 ENGAGEMENT ACTIVITIES

Alberta Transportation has carried out engagement activities since November 2014 and have included Project notification, meetings with landowners and with stakeholders, open houses, and other activities. These have included 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.

These consultation activities are summarized in Table 6-2. More information is provided in Volume 4, Appendix B.

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
Ongoing	Water Collaborative Meeting	Project update	• AEP
Ongoing	Meetings with landowners	Project updates and land discussions	• AT
Ongoing	Calgary River Communities Action Group (CRCAG)	Project update	• AT
2016	Landowners	EIA land access	• AT • Stantec

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
November 2014			
November 3	Rocky View County Council and Administration	meet in advance with identified Councilors and Administration of Nov 4 Policy and Priorities Committee to introduce the Project	• AT • Stantec • Communica
November 4	Rocky View County Policy and Priorities Committee	provide an initial project overview and identify initial issues of concern; Alberta Resilience and Mitigation (RAM) from AEP attended meeting	• AT • RAM • Stantec • Communica
November 13	Rocky View County Reeve	as Reeve was away for the Nov 3 meeting, provide information as shared at the November 3 and November 4 meetings	• AT • RAM • Stantec
November 26	Rocky View County Administration	kick-off meeting for the Technical Review Committee for the Highway 22 Planning Study	• AT • Stantec
November 28	Bow River Basin Council (BRBC) Legislation and Planning Committee	provide an initial project overview and pre-meeting for Dec 10 BRBC forum	• AT • RAM • Stantec • Communica
December 2014			
December 4	City of Calgary Administration	provide an overview of the Project and status in advance of the Dec 12th meeting; receive initial issues of concern and on how to best engage the City of Calgary going forward	• AT • RAM • Stantec • Communica
December 5	Potentially affected Landowner Meeting with the Minister of Environment and Sustainable Resource Development (ESRD) (now Alberta Environment and Parks (AEP))	meeting with the Minister of ESRD and a couple of landowners to discuss land negotiations	• ESRD Minister • RAM
December 10	BRBC Forum	provide an overview of the Project and status; coincide with Room for River presentation	• AT • RAM • Stantec

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
December 11	Calgary River Communities Action Group	CRCAG requesting a meeting with the project team to get an update on the Project; discuss issues of concern	• AT • RAM • Stantec • Communica
December 12	City of Calgary Recovery Operations Steering Committee	provide an overview of the Project and status; receive initial input on issues of concern and on how to best engage the City of Calgary going forward.	• AT • RAM • Stantec • Communica
January 2015			
January 15	Rocky View County Reeve and Administration	provide a project update in advance of the Open Houses	• AT • RAM • Stantec
January 15	Elbow River Watershed Partnership (ERWP)	provide a project overview and discussion with the Elbow Public Advisory Committee (EPAC)	• RAM • Stantec
January 27	SR1 Open House – Calgary, Mount Royal University	provide an overview of the Project and timelines; initial opportunity to identify additional stakeholders and document early public input on issues of concern for the EIA	• AT • RAM • AI • Stantec • Communica
January 28	SR1 Open House – Cochrane, Ranche House	provide an overview and hold technical discussions on the Project	• AT • RAM • AI • Stantec • Communica
January 28	WaterSmart	engagement on technical discussions going forward for the Project	• AT • Stantec
January 28	BRBC	engagement on technical discussions going forward for the Project	• AT • Stantec

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
February 2015			
February 10	Telus (Industry)	kick-off meeting with Stantec to discuss potential impacts to infrastructure in region	• Stantec / Communica
February 10	City of Calgary	technical discussion with Alberta Transportation, Stantec and City of Calgary	• AT • Stantec
February 11	Rocky View County	engagement by Alberta Transportation and Stantec on preliminary engineering	• AT • Stantec
February 12	Calgary Regional Partnership	provide an overview of the Project and timelines; initial opportunity to identify additional stakeholders and document early public input on issues of concern for the EIA	• AT • RAM • Stantec
February 20	Plains Midstream (Industry)	kick-off meeting with Stantec to discuss potential impacts to infrastructure in region	• Stantec • Communica
March 2015			
March 3	Meeting with affected Landowners	meeting to provide an overview of the Project, Cost Benefit Analysis, McLean Creek environmental review and to provide an opportunity for questions and answers	• ESRD • AT • IBI • AMEC • Stantec / Communica
March 5	Meeting with CRCAG	provide an update on the Project	• AT • Stantec • RAM • Communica
March 10	Open House – Pinebrook Golf and Country Club	provide an overview of flood mitigation on the Elbow River basin, Cost Benefit Analyses, the EIA and Project details; initial opportunity to identify additional stakeholders and document early public input on issues of concern for the EIA	• ESRD • AT • IBI Group • Stantec • Communica • NRCB

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
March 17	Open House – Bragg Creek Community Centre	provide an overview of flood mitigation on the Elbow River basin, Cost Benefit Analyses, EIA and Project details; initial opportunity to identify additional stakeholders and document early public input on issues of concern for the EIA	• ESRD • AT • IBI Group • Stantec • Communica • NRCB
March 17	City of Calgary Water Centre	determine the terms of reference of the Engineering and Operations Committees for the review and discussion of the Project and Glenmore Reservoir	• Stantec • ESRD • Communica
March 24	TransCanada (Industry)	kick-off meeting with Stantec to discuss potential impacts to infrastructure in region	• Stantec • Communica
April 2015			
April 1	Western Irrigation District	provide an initial project overview and identify initial issues of concern	• RAM • AT • Stantec • Communica
April 7	Rocky View Policy and Priorities Committee	project update	• Stantec • AT • RAM
April 24	Fortis (Industry)	kick-off meeting with Stantec to discuss potential impacts to infrastructure in region	• Stantec • Communica
April 15	Pengrowth (Industry)	kick-off meeting with Stantec to discuss potential impacts to infrastructure in region	• Stantec • Communica
April 30	Telus	second meeting to further discuss potential project impacts	• Stantec / Communica
November 2015			
November 17	City of Calgary Working Group	monthly meeting for information sharing on the Project and the upgrades to the Glenmore Reservoir; reviewed the Terms of Reference and discussed preliminary engineering plans for the Project	• Stantec • AT • AEP • Communica

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
December 2015			
December 1	TransCanada Pipelines	provide project status update and discuss next steps	• Stantec • Communica
December 3	ATCO Gas	project update and next steps	• Stantec • Communica
December 3	Pengrowth	provide project status update and discuss next steps	• Stantec • Communica
December 7	Shaw	provide project status update and discuss next steps	• Stantec • Communica
December 9	AltaLink	provide project status update and discuss next steps	• Stantec • Communica
December 9	CRCAG AGM	update on flood mitigation for the Elbow River, including the Project	• AEP • AT
December 10	Fortis	provide project status update and discuss next steps	• Stantec • Communica
December 15	CRCAG Board	project update	• AT • Stantec • Communica
December 16	SR1 and City of Calgary Working Group Meeting	Standing Working Group meeting	• AT • AEP • Stantec • Communica
December 16	Kamp Kiwanis	discussion on diversion channel	• AT • Stantec
January 2016			
January 20	City of Calgary Hydrology Workshop	review and discuss hydrology studies as conducted by City of Calgary and Stantec	• City of Calgary • AEP • AT • Stantec / Communica
January 21	ERWP	project update	• AT • Stantec / Communica

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
February 2016			
February 3	Pengrowth	further discuss potential project effects	• Stantec / Communica
February 17	CRCAG	project update	• AT • Stantec / Communica
March 2016			
March 8	BRBC	project update	• AT • Stantec
April 2016			
April 6	Plains Midstream (Affected industry	discussion about potential effects	• Stantec / Communica
April 18	Rocky View County Engineering	discussions about preferred options for road alterations	• AT • Stantec
April 29	RVC Highway Committee	proposed alterations to Highway 22 and Springbank Road	• Stantec • AT
May 2016			
May 2	Meeting with affected landowners – Springbank, Wild Wild West Event Centre	provide updated project information	• AT • AEP • Stantec / Communica
May 3	Rocky View County Policy and Priorities Committee	project update	• AT • Stantec / Communica
May 3	City of Calgary Bow River Flood Mitigation Information Session	project update	• AT
May 5	City of Calgary Elbow River Flood Mitigation Information Session	project update	• AT
May 10	Open House – Springbank, Wild West Centre	project update	• AT • AEP • Stantec • Communica

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
May 11	Open House – Calgary First Church of the Nazarene	project update	• AT • AEP • Stantec • Communica
May 17	SR1 and City of Calgary Working Group Meeting	Standing Working Group Meeting	• AT • AEP • Stantec / Communica
June 2016			
June 6	AltaLink (Affected industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 8	Telus (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 14	Fortis Alberta (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 16	Shaw (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 16	Alberta Ethane (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 16	TransCanada (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec • Communica
June 21	SR1 and City of Calgary Working Group Meeting	Standing Working Group Meeting	• AT • AEP • Stantec / Communica

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
June 23	Pengrowth Energy (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec/ Communica
June 29	ATCO Gas (Affected Industry)	review Alberta Transportation letter of intent, technical packages and continue to discuss preliminary plans	• Stantec/ Communica
July 2016			
July 19	SR1 and City of Calgary Working Group Meeting 10 am Water Centre	Standing Working Group Meeting	• AT • AEP • Stantec / Communica
September 2016			
September 16	Springbank Airport Authority	project overview and discussion of regulatory process	• AT • Stantec
November 2016			
November 7	Rocky View County Administration	update on regulatory process, inform decision on recommended transportation network and preferred land use option	• AT • Stantec
November 18	Bow River Basin Council	discussion on choice of the Project, land ownership issues, road systems, project design and diversion systems, modelling, EIA processes timelines, MC1 environmental assessment and land use	• AT • Stantec
November 22	Calgary River Communities Action Group	EIA and CEAA review update, road network, project design, land appraisal process, land use and flood easement options and MC1 environmental assessment	• AT • Stantec • Communica
December 2016			
December 19	Representatives of affected landowners and Tsuut'ina Nation	discussion of decision to proceed with the Project	• AT • Alberta Justice

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
August 2017			
August 15	Meeting with Affected Landowners – Springbank, Wild Wild West Event Centre	project update and overview of materials to be shared at the open house	• AT • Stantec • Communica • Hemmera • Opus • IBI
August 16	Open House – Springbank, Wild Wild West Event Centre	project update	• AT • Stantec • Communica • Hemmera • Opus • IBI
August 17	Open House – Calgary, Mount Royal University	project update	• AT • Stantec • Communica • Hemmera • Opus • IBI
August 22	Open House – Springbank, Wild Wild West Event Centre	project update	• AT • Stantec • Communica • Hemmera • Opus • IBI
August 29	Open House – Calgary First Church of the Nazarene	project update	• AT • Stantec • Communica • Hemmera • Opus • IBI

Table 6-2 Consultation and Information Activities on the Springbank Off-stream Reservoir Project (SR1)

Date	Meeting With	Purpose of Meeting	Attending
September 2017			
September 27	Meeting with Affected Landowners – Springbank, Wild Wild West Event Centre	project update	• AT • Stantec • Communica • Hemmera • Opus • IBI

6.3 ISSUES RAISED DURING PUBLIC ENGAGEMENT

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 Table 6-3.

Table 6-3 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 the Project will commence once provincial and federal approvals for the Project are obtained.
Project Alternatives (see Volume 1, Section 2 and Volume 4, Supporting Documentation, Documents 1, 2, and 3)	
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 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 is in Volume 1, Section 2. Alberta Transportation is applying for the Project. SR1 is the preferred option for environmental, technical, economic and timing reasons.

Table 6-3 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 6-3 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 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 Project 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.
What is the extra space in the Project Development Area for?	The land contained within the PDA is necessary for the safe and efficient operation, maintenance and surveillance of the Project.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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.
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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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.
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.	The Project 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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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, if required.
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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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 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.
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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
All Project lands should have public access.	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.
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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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
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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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, Documents 1,2 and 3)	
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.
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 the Project 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 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.

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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 the Project.
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 the Project.
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 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"

Table 6-3 SR1 Project Specific Concerns and Responses - Public Engagement

Issues, Concerns and Recommendations	Responses and Outcomes
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.
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 by fall 2020 and will achieve final completion and be able to accommodate water volumes equal to the 2013 flood by early 2022
Why are there no drought mitigations considered?	The Project is designed as a flood mitigation; not for drought mitigation.

6.4 PLANS FOR ONGOING ENGAGEMENT

Engagement with stakeholders, including landowners, municipalities, infrastructure companies and others has been ongoing since the fall of 2014 and will continue as the Project progresses. Alberta Transportation is committed to providing Project information to the public as the design becomes internally reviewed and approved.

7.0 INDIGENOUS ENGAGEMENT PROGRAM

7.1 OVERVIEW

The Indigenous engagement program involves engagement with First Nations and Métis groups that may potentially be adversely affected by or be interested in the Project. The purpose of the program has been to provide these groups with information on the Project and the environmental assessment process and respond to the issues and concerns raised. The input from the First Nations and Métis groups has been considered in the preparation of the EIA.

7.2 COMMITMENT AND APPROACH

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 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.

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 and Siksika Consultation Office. 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 TLRU information, concerns, and recommendations received after the EIA has been filed will be used for project planning and implementation purposes, where applicable.

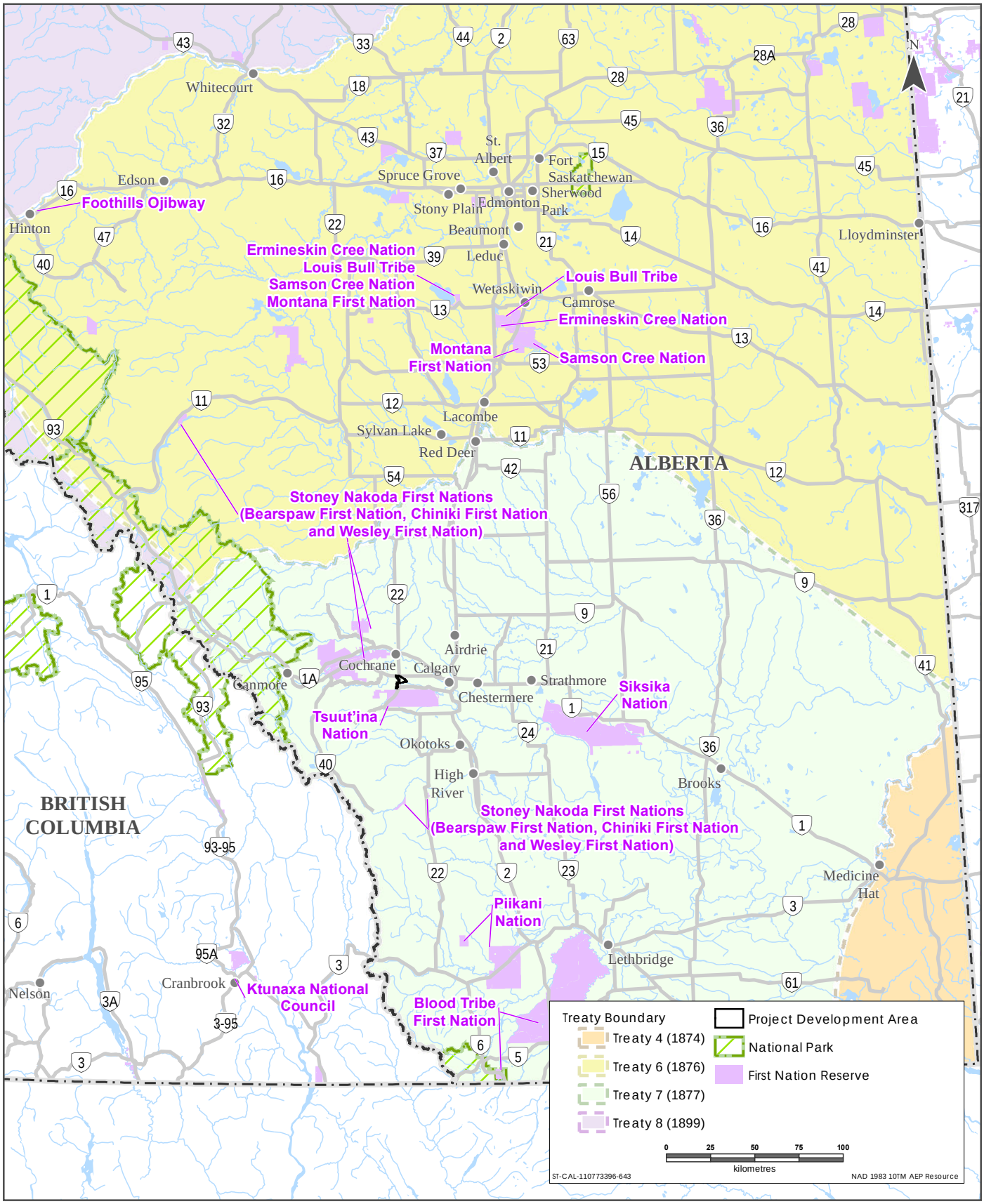
Table 7-1 lists the Indigenous groups identified for engagement on the Project. Figure 7-1 is a map showing the locations of each Indigenous group.

Table 7-1 Indigenous Groups Identified for Engagement

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

The Indigenous engagement program was conducted by DEMA Land Services on behalf of Alberta Transportation. Engagement included face-to-face meetings, workshops and field visits.

Table 7-2 summarizes Alberta Transportation's engagement efforts to March 8, 2018.



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

Locations of Indigenous Groups or Organizations

Stantec

Table 7-2 Engagement Activities with Indigenous Communities for the Project (SR1) – March 2018

Indigenous Group	# of SR1 Meetings	# of SR1 Site Visit Days	# of SR1 Logged Phone Calls (Approximate)	# of SR1 Email Exchanges (Approximate)	Comments
Tsuut'ina Nation	13	24	25	245	Draft TUS report received but permission to use has not yet been received.
Stoney Nakoda Bearspaw, Chiniki, Wesley Nations	9	11	10	134	TUS report has not yet been received.
Siksika Nation	5	7	6	118	Siksika Nation provided interim TUS report.
Piikani Nation	4	13	14	80	Piikani Nation provided TUS report.
Kainai (Blood Tribe)	6	13	7	138	Blood Tribe provided interim TUS report.
Ermineskin Cree Nation	1	0	2	23	The Ermineskin Cree Nation engaged and an SR1 Project Information meeting was held at Maskwacis on June 27, 2017.
Louis Bull Tribe	1	1	5	70	The Louis Bull Tribe engaged and an SR1 Project Information meeting was held at Port O Call in Calgary on July 12, 2017, with a site visit in the afternoon of July 12, 2017. A funding request to undertake a TLU and Cultural Impact Assessment was approved.
Montana Nation	1	0	2	27	The Montana First Nation engaged and an SR-1 Project information meeting held on January 20, 2017.
Samson Cree Nation	3	0	2	25	The Samson Cree Nation engaged and an SR-1 Project information meeting held on November 29, 2016.

Indigenous Group	# of SR1 Meetings	# of SR1 Site Visit Days	# of SR1 Logged Phone Calls (Approximate)	# of SR1 Email Exchanges (Approximate)	Comments
Foothills Ojibway	0	0	1	7	Confirmed pickup of October 13, 2016 registered Notification Letter, no response received to date.
Ktunaxa Nation Council	0	0	2	9	Spoke directly with Ktunaxa Nation Council January 9, 2017 and they confirmed that they are not interested in engaging on the SR-1 project.
Metis Nation of Alberta Region #3	3	0	1	44	The Metis Nation of Alberta Region #3 engaged and an SR-1 Project information meeting held on May 8, 2017. A funding request to undertake Historical Resource Impact Assessment Study was approved.
Metis Nation British Columbia	0	0	2	7	Confirmed pickup of October 13, 2016 registered Notification Letter, emails and follow up phone call made. Continued to provide project information but no response.

Alberta Transportation has documented and will continue to document engagement activities with Indigenous groups, as well as any issues, concerns, and recommendations raised by Indigenous communities; Alberta Transportation will prepare a final report outlining all engagement activities with each Indigenous group. Records of key issues, concerns, and recommendations shared by each Indigenous group and the follow-up responses and outcomes has been included in a confidential file submitted to AEP and the CEA Agency.

7.3 ECONOMIC OPPORTUNITIES

Alberta Transportation will encourage companies owned by Indigenous groups to bid on construction contracts for the Project. Members of Indigenous groups may be hired as monitors during construction.

7.4 ISSUES RAISED DURING INDIGENOUS ENGAGEMENT

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 the following Tables 7-3 through 7-12.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 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 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 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. Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for submission of the 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. Alberta Transportation 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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) • Volume 3B, Section 5.0 • Appendix I Hydrogeology – Hydrogeology Baseline Technical Data Report An email with a link to the draft Hydrology Report was also provided on February 9, 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. Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for submission of the 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. Alberta Transportation 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 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 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 5, 2017. Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the 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. Alberta Transportation 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 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 EIS and participate in the regulatory review process.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 Volume 1, Section 2.
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. 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 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 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 5, 2017. Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Relevant information, concerns and recommendations received after the EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 includes maintaining 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 Alberta Transportation 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 (see Volume 3B, Section 18, Figure 18-1).
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, 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. At its closest point the back-up water would be approximately 1,130 m from the Reserve (see Volume 3B, Section 18, Figure 18-1). 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.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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, 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.
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.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
Concerns regarding the entire project lying within Tsuut'ina's traditional territory.	The Tsuut'ina reserve lands with respect to the project location are now throughout the 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, Section 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 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 Volume 1.
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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will 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 will be dominated by sand, not fine silt. The sand is less prone to result in fugitive dust during dry windy meteorological conditions.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
	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 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 will not be significant. The residual effects on groundwater quantity from the Project are assessed as not significant because they will 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 will 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 will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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) will be diverted into the diversion channel. Approximately 1,200 m of the tributary will be destroyed, with the lowest 300 m being fish habitat that will 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 floods. As discussed in Volume 3B, Section 6.4.4, the presence of the Project will decrease the amount of deposition and erosion of the channel bed during extreme floods, compared to changes without the Project. Channel form and bedload (river bed particles) movement during extreme floods will 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 EIS submission that has gathered all baseline information and assesses the potential effects from the Project.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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) • Volume 3B, Section 5.0 • Appendix I Hydrogeology – Hydrogeology Baseline Technical Data Report An email with a link to the draft Hydrology Report was also provided on February 9, 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 will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
Fish and Fish Habitat (see Volume 3A and 3B, Section 8)	
Impacts to spawning beds.	The EIS addresses 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 will 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 will 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 will be no significant changes in sediment transport (Volume 3A, Section 6.5.3), and therefore that there will 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 will 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 will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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, 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will mix with Elbow River water and potentially increase water temperature in the river. If a change in temperature did occur, it will 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 will continue in Elbow River downstream of the diversion structure. These flows are considered channel forming and will shift bed materials which will 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 will 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 will be operational. The Elbow River will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
Vegetation and Wetlands (see Volume 3A and 3B, Section 10)	
Changes to wetlands functions.	During a flood, 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: 3.7 ha 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 will 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 will 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 will 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) will be altered due to vegetation clearing for permanent structures. Dry operations will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will 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)[1] 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 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 EIS to establish the baseline conditions upon which the effects of the Project will be determined, see Volume 3A and 3B, Section 11 and Volume 4, Appendix H, Wildlife and Biodiversity Technical Data Report.

[1] 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will 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 will be temporarily unavailable to wildlife, the regional assessment area provides grassland, shrubland, tame pasture, and wetland habitat in other locations. Overall, the design flood will 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 will be covered by sediment that is less than 3 cm deep, and 0.8% (37.4 ha) will 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 will differ from baseline conditions, however, changes to overall wildlife habitat abundance and suitability will be minor under these conditions. Sediment less than 3 cm thick will 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 will not be expected. For wetlands, sediment 3-10 cm deep will likely alter plant composition and abundance resulting in wetlands changing to upland sites, however as noted above this level of sediment deposition will occur in less than 1% of the local assessment area.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will be reclaimed, which will 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 will 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 will 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), will provide suitable spring feeding habitat.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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*. Alberta Transportation will follow all the requirements for the protection of historic resources as determined by ACT.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 Alberta Culture and Tourism (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 Alberta Transportation 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 the Project. Work done to date is included in the Historic Resources Section of the EIS submission and will be available for review once submitted to and posted by the regulators.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 EIS submission, including the Historic Resources section, was provided to the Tsuut'ina on November 3, 2017. The Tsuut'ina will also be provided with a link to the EIS resubmission, once it is available for public viewing on the CEAA and AEP websites.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 Alberta Transportation 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, Section 14.
Impacts to wildlife, fish and birds, as well as the exercise of our Aboriginal, Treaty, and Inherent rights.	The EIS has considers 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 will 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 will 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 will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

Issues, Concerns and Recommendations	Responses and Outcomes
	The Project will 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 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 will 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 will 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, will be lost in the local assessment area, nor will vegetation communities supporting traditionally used plants be lost from the project development area. In the event of a flood, there will 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 floods, re-establishment of these species will occur by natural recruitment over time. Therefore, permanent loss of traditional plant use species is not anticipated.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 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 re-submitted EIS 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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 will 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.	The 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 will 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 7-3 SR1 Project Specific Concerns and Responses – Tsuut'ina Nation

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 will 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, Section 18).

Table 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

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 5, 2017, Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the 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. Alberta Transportation 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 12, 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 EIS have not been updated to include information discussed. A second workshop is planned for March 20, 2018. Relevant information, concerns and recommendations received after the EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

Issues, Concerns and Recommendations	Responses and Outcomes
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 at the Project.
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 will need to be requested on an owner by owner basis.
Requested about having an on-reserve presentation on the SR1 project,	Alberta Transportation presented the 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.

Table 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

Issues, Concerns and Recommendations	Responses and Outcomes
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; Volume 4, Appendix I, Hydrogeology Baseline Technical Data Report and Hydrogeology Modelling Technical Data Report). 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 will not be significant. The residual effects on groundwater quantity from the Project are assessed as not significant because they will 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 will 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 will be limited to the local assessment area.

Table 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

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 will 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 (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 will 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 (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 will 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 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

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 proiect 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 will 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 Project will 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 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

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 will 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 will 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 7-4 SR1 Project Specific Concerns and Responses – Stoney Nakoda Nations

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 will 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 in Volume 1, Section 2. Alberta Transportation is applying for the 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 Volume 1, Section 2. The 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 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

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 will 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. Alberta Transportation will provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction

Table 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

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 will 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 will 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 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 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. 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*. Alberta Transportation will follow all the requirements for the protection of historical resources as determined by ACT.

Table 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

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. Alberta Transportation 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.

Table 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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.
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 will reach approximately 500 m 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	Alberta Transportation is willing to discuss possible monitoring opportunities with the Siksika First Nation.

Table 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 5, 2017, Alberta Transportation requested feedback on the Traditional Land and Resource Use (TLRU) sections (Volumes 3A and 3B). Project timelines for resubmission of the EIS were extended by 60 days in order to undertake further indigenous engagement activities. Alberta Transportation provided Siksika with the revised draft TLRU sections for review and comment under correspondence dated February 6, 2018. Alberta Transportation 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 26, 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 EIS have not been updated to include information discussed. Relevant information, concerns and recommendations received after the EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-5 SR1 Project Specific Concerns and Responses – Siksika Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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.	Alberta Transportation will follow government procurement policies and procedure with respect to labor, and goods and services. Alberta Transportation 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 project site visits and facilitated access to private lands with landowners on all properties the Siksika requested.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

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 will 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 will occur when suspended sediment concentrations in the Elbow River are already high. The Project will 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 will stay in reservoir during water release.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

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 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 will 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 Volume 3A, Section 10 and Volume 3B, Section 10.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 Volume 3A and 3B, Sections 10 and 14. Alberta Transportation will provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction 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 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 will affect beaver dams. The effects of the Project to wildlife and aquatic species are discussed in Volumes 3A and 3B, Sections 8 and 11.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 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 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 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*. Alberta Transportation will follow all the requirements for the protection of historic resources as determined by ACT.
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. Alberta Transportation 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.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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*. Alberta Transportation will follow all the requirements for the protection of historic resources as determined by ACT. Alberta Transportation 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 SR1 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 is in Volume 3A and 3B, Section 14. Follow up and monitoring is in Volume 3C, Section 2.

Table 7-6 SR1 Project Specific Concerns and Responses – Piikani Nation

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.	Alberta Transportation 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 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 reach approximately 500 m upstream from the diversion structure (see Volume 3B, Section 18, Figure 18-1). 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 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

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 project site visits 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 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 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 Alberta Transportation facilitate the tour. At the time of the tour, private land access was not available to all areas of the project development area (PDA).

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 review, revisions to the EIS were underway to address regulator comments. In December 2017, Alberta Transportation 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 Alberta Transportation 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 submission of the EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1 in order to meet a resubmission date of end March 2018. Relevant information, concerns and recommendations received after the EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable. Relevant information, concerns and recommendations received after the 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 5, 2018. Effects to socioeconomic conditions have been included in this 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.

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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.
Request sufficient time and resources to provide additional information regarding other areas of non-conformity.	Project timelines for resubmission of the 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 5, 2018. 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 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 Alberta Transportation 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.

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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.
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 will 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 will be obtained for disturbances to wetlands before construction, and permanent disturbance to wetlands will 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 Volume 3A and 3B, Sections 10 and 14. Alberta Transportation will 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 Volume 4, Appendix H and L; and Vol 3A Sections 10 and 11.

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 will 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 Volumes 3A and 3B, Sections 8 and 11.
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 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. 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*. Alberta Transportation 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. Alberta Transportation 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. 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*. AT will follow all the requirements for the protection of historic resources as determined by ACT

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

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 EIS.
Request for a job fair and employment opportunities for members of the Kainai First Nation	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.	AT is willing to discuss possible monitoring opportunities with the Kainai First Nation.

Table 7-7 SR1 Project Specific Concerns and Responses – Kainai First Nation

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*. 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 500 m 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 7-8 SR1 Project Specific Concerns and Responses – Ermineskin Cree Nation

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 review, revisions to the 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 EIS, and were included in the revised TLRU section sent on February 5th. Effects to socioeconomic conditions have been included in this 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 review, revisions to the 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 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-8 SR1 Project Specific Concerns and Responses – Ermineskin Cree Nation

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 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. Relevant information, concerns and recommendations received after the 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 Volume 3A and 3B, Sections 10 and 14. Alberta Transportation will provide opportunities for harvesting or relocating medicinal and ceremonial plants prior to construction

Table 7-8 SR1 Project Specific Concerns and Responses – Ermineskin Cree Nation

Issues, Concerns and Recommendations	Responses and Outcomes
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 Volume 3A, Section 11.
Maintaining the migratory patterns and game trails for wildlife.	Although the Project will 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 (Volume 3A and 3B, Section 11).

Table 7-9 SR1 Project Specific Concerns and Responses – Louis Bull Tribe

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 7-10 SR1 Project Specific Concerns and Responses – Montana First Nation

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 EIS.

Table 7-11 SR1 Project Specific Concerns and Responses – Samson Cree Nation

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.	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 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 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

Table 7-12 SR1 Project Specific Concerns and Responses – Métis Nation of Alberta Region 3

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. 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. 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 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*. AT will follow all the requirements for the protection of historic resources as determined by ACT.

Table 7-12 SR1 Project Specific Concerns and Responses – Métis Nation of Alberta Region 3

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 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. 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*. 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 will also be implemented during all phases of Project operation. This program will 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 will be inspected for damage. If repairs were necessary, Springbank Road will remain out of service until repairs were completed. Public funds will be utilized for repair.

Table 7-12 SR1 Project Specific Concerns and Responses – Métis Nation of Alberta Region 3

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?	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 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 will 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 EIS were extended by 60 days in order to undertake further indigenous engagement activities. Feedback was requested by March 1 in order to meet a resubmission date of early April. Information received after submission of the 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 EIS has been filed in March 2018 will be used for project planning and implementation purposes, where applicable.

7.5 PLANS FOR ONGOING ENGAGEMENT

Engagement with Indigenous groups will continue as the Project progresses. Alberta Transportation is committed to providing project information to Indigenous groups as the design becomes internally reviewed and approved.

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9.0 GLOSSARY

berm	a man-made earth ridge or barrier, in the current case placed to direct flood flows to the diversion structure
borrow material	soil or granular materials removed from a site for use in construction at another location
dam^3	cubic decametres (1 dam^3 = 1000 m^3); a unit of measure commonly used for large volumes of water
design flood	the peak flow the Project works are designed to manage: the 2013 Elbow River flood with estimated peak flow of 1,240 m^3/s; required flood storage capacity of 70,200 dam^3
direct control	in Rocky View county, a direct control designation is provided for developments that, due to their unique characteristics, unusual site constraints or innovative ideas, require specific regulations unavailable in other land use districts
floodplain	an area of land adjacent to a stream or river that stretches from the banks of its channel to the base of the enclosing valley walls and experiences flooding during periods of high discharge
full service level	the maximum elevation of the reservoir during a design flood
head cut	an erosional feature of some streams where an abrupt vertical drop in the stream bed occurs
inflow design flood	the flood used to design and/or modify a specific dam; particularly for sizing the spillway and outlet works, and for determining surcharge storage and height of dam requirements. The flood used for design of a safe structure.
piping failure	failure caused by water that percolates through an earth dam carrying soil particles that are free to move toward the downstream face of the dam until a continuous pipe is formed

probable maximum flood	the flood that may be expected to result from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the drainage basin under study (estimated at 2,200 m^3/s in the Elbow River at the diversion site)
riprap	large stones placed as erosion protection
spillway	a structure used to direct flowing water at a controlled rate from an area where it can be held down a smooth decline to a downstream area
thalweg	the lowest elevation or the deepest channel of a stream
topsoiling	the placement of the upper level of soil, which usually contains more organic matter than what is found at lower levels, on the land; usually done in areas of disturbed surface materials where topsoil has been stripped and stored for reclamation

Attachment A WATER MANAGEMENT PLAN

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ATTACHMENT A WATER MANAGEMENT PLAN

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A.1 INTRODUCTION

The main objectives of the Project are to manage flood flows and lessen their impacts to life and property downstream of Project. This water management discusses the maintenance of the quality of water that comes into contact with project components during each project phase.

During construction, environmental protection will be managed through Alberta Transportation's Environmental Construction Operations (ECO) Plan process (Alberta Transportation et al. 2017). An ECO Plan (see Table A-1 for overview) is a project-specific plan to identify and mitigate the environmental effects that result from construction-related activities and to support compliance with applicable guidelines, regulatory requirements, and mitigation commitments.

Other Alberta Transportation guidance documents will be directly applied to the Project to deal specifically with erosion and sediment control:

- Alberta Transportation's Erosion and Sediment Control Manual (Alberta Transportation 2011) and borrow excavations
- Guide to Reclaiming Borrow Excavations (Alberta Transportation 2013a)
- Pre-disturbance Assessment Guide for Borrow Excavations (Alberta Transportation, 2013b)
- Post-disturbance Assessment Guide for Borrow Excavations (Alberta Transportation, 2013c)

In addition, Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects (Alberta Transportation 2017a) will form the legally binding signed contract between Alberta Transportation and the selected contractor. These specifications detail how to implement, monitor, and maintain construction activities related to care of water.

Table A-1 ECO Plan Overview

ECO Plan Framework	Components	Content Requirements
Project Description	Project Overview	Description of construction project and its location.
	Site Activities	Description of the scope of work, including a list of all construction and demolition activities, and specifies the equipment that will be used during those activities.
	Project Schedule	Description of anticipated project schedule, including scheduled shut-downs, and restricted work periods due to environmental requirements.
	Site Characteristics	Description of the existing conditions of the project site.
	Environmental Sensitivities	Description of sensitive site features that could be impacted by site activities.

Table A-1 ECO Plan Overview

ECO Plan Framework	Components	Content Requirements
Potential Environment Impacts and Controls	Site Drawings	Site drawings that detail the site location, layout, erosion and sediment controls, and environmental sensitivities.
Potential Environmental Impacts and Controls	Permits, Approvals, Authorizations, and Notifications	Copies of all project permits, approvals, authorizations, and notifications. Copies of applications for all project permits, approvals, and authorizations.
	Regulatory Compliance	Description of specific regulatory requirements that are not included in project permits, approvals, authorizations, and notifications. Description of corporate policies and/or project requirements that directly impact or restrict the project.
	Potential Environmental Impacts and Mitigation	Description of all potential project-specific environmental issues and impacts. Description of procedures, controls, or best management practices (BMPs) that will be used to prevent or reduce adverse environmental impacts.
	Erosion and Sediment Control	Description of the project-specific, jurisdiction-appropriate erosion and sediment controls.
	Municipal Tree Protection	Description of project-specific, jurisdiction-appropriate municipal tree protection measures.
Hazardous Material and Waste Management	Hazardous Materials	Inventory of every hazardous material to be used, or stored on site by any Contractors. Descriptions of appropriate handling, containment, storage, and disposal methods.
	Waste Management	Inventory all anticipated hazardous and non-hazardous waste materials. Description of all jurisdiction-specific handling procedures.

Table A-1 ECO Plan Overview

ECO Plan Framework	Components	Content Requirements
ECO Plan Implementation	On-Site Representatives	Names and contract details for all Contractor's on-site representatives.
	Training & Communication	Descriptions of the procedures that will be used to train staff, and contractors in their ECO Plan responsibilities.
	Monitoring and Reporting	Descriptions of monitoring and inspection procedures that suit the nature and scale of the project and meet regulatory and contractual requirements
	Documentation	Descriptions of the environmental information and ECO Plan records that will be kept in up-to-date hard copies on the project site.
	ECO Plan Update	Descriptions of ECO plan review and updating procedures. Documentation all updates in an ECO plan revision summary table to all updated ECO plans.
Environmental Emergency Procedures	Environmental Emergency Prevention and Response	Descriptions of potential incidents that may impact the environment, and provide appropriate prevention and response procedures. List environmental emergency response contacts, and their contact information.
SOURCE: modified from ECO Plan Framework (Alberta Transportation et al. 2017)		

This water management plan outlines the mitigation that will be required in the construction contractor's ECO plan during construction and the Operations, Maintenance, and Survillance Plan that will be prepared by a consultant for use by Alberta Environment and Parks' (AEP) during the project operations. Each phase of the operation (construction, dry operations, flood operations, and post-flood operations) is associated with its own unique water management challenges; therefore, distinct water management plans have been developed for each project component and phase.

A finalized ECO plan and operation plan will need to consider the conditions of regulatory approvals, and conditions of legislated non-permit requirements.

A.2 CONSTRUCTION WATER MANAGEMENT PLAN

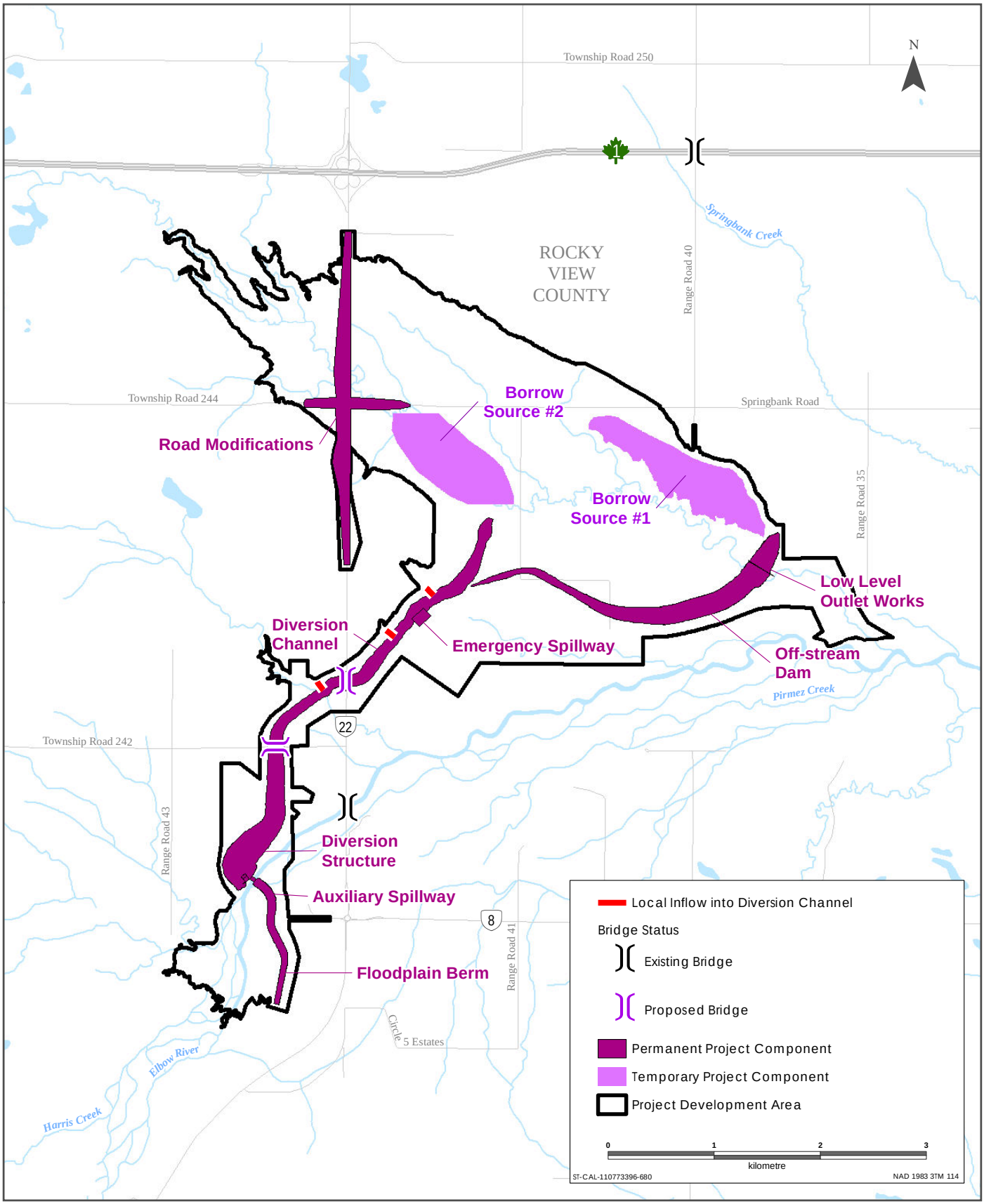
A.2.1 General

On the north side of Elbow River, the main access to the PDA will be a gravel road on the southeast side of the diversion channel, with gated approaches on both sides of Highway 22. Other gravel access roads will reach the project site from Springbank Road and Township Road 242. On the south side of the river, access will be from Highway 22 at the Highway 8 interchange.

Construction activities are divided into seven construction sequences (Table A-2). Construction component locations are shown in (Figure A-1). This figure differs from Figure 3-1 of this Project Description section in that Figure A-1 includes the local inflow location in the diversion channel and does not include access roads.

Table A-2 Construction Sequences and Associated Project Structures

Construction Sequence	Location of Detailed Description	Associated Project Structures
Diversion Structure	A.2.1.1	• diversion inlet • service spillway, a temporary river channel to re-route the Elbow River around the diversion structure during construction
Floodplain Berm	A.2.1.2	• floodplain berm and auxiliary spillway structure
Diversion Channel	A.2.1.3	• diversion channel, emergency spillway and diversion channel outfall structure
Off-Stream Reservoir	A.2.1.4	• borrow area developments, demolition and clean-up of existing structures, decommissioning existing wells
Off-Stream Dam and Low-level Outlet Structure	A.2.1.5	• off-stream earthfill dam • low-level outlet structure
Roads and Bridges	A.2.1.6	• Hwy 22, raise grade and replace under-road drainage culverts. • Hwy 22 & Twp Road 242 bridges
Re-location of Pipelines and Utilities	A.2.1.7	• To be determined



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

A.2.1.1 Diversion Inlet and Service Spillway

The anticipated construction sequence for the diversion inlet and service spillway is:

1. To allow for construction of the diversion structure and the service spillway in the 'dry', the Elbow River will be diverted to a 460 m long temporary diversion channel along the right bank, downstream side of the Elbow River.
2. Access for construction of the diversion structure site will be through Township Road 242 and along the footprint of the excavated diversion channel. Construction access to the diversion structure site will be through the existing, partially developed road allowance west of the traffic circle on Hwy #8. To permit passage over the temporary diversion channel, the installation of a temporary construction access bridge will be required.
3. The temporary river diversion will isolate the diversion structure and the floodplain berm structure from the Elbow River flows, which will allow construction to be completed in the dry.
4. If constructed, the temporary construction access bridge over the temporary diversion channel will be removed when it is no longer required for construction.
5. On completion of all in-stream construction work, Elbow River will be diverted back to its original channel along the left river bank and will flow through the newly constructed Service Spillway passage. The temporary diversion river channel will be reclaimed, and the river bed will be restored to its original lines and grades.
6. The gap left in the auxiliary spillway to accommodate the temporary river diversion channel will be filled; this will complete the diversion structure construction.

A.2.1.2 Floodplain Berm

Trees and shrubs growing in the floodplain berm footprint and within 10 m on both sides will be cleared prior to construction of the floodplain berm. Topsoil will be stripped from the berm footprint and will be temporarily stockpiled for re-use. The floodplain berm will be constructed using suitable material obtained from the diversion channel excavation. Fill will be placed in the berm footprint in lifts (layers) of a preset thickness and compacted before the next lift is placed. Riprap will be imported from offsite sources.

A.2.1.3 Diversion Channel

Diversion channel excavation will be sequenced and scheduled with fill placement operations to maximize the quantity of suitable impervious and random fil requirements. If rock is encountered, it will be mechanically removed using rippers or pneumatic or hydraulic breakers. Blasting will not be permitted.

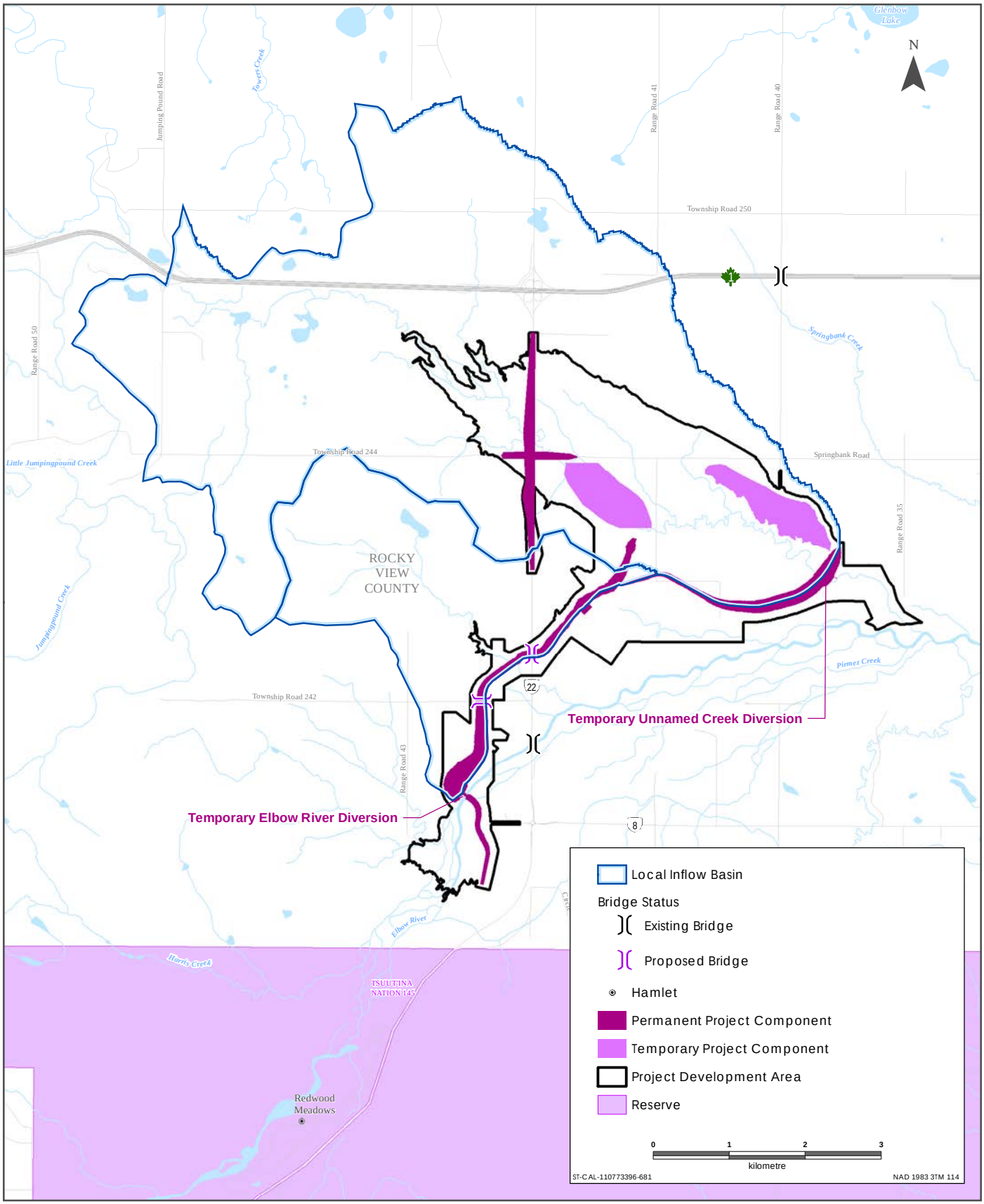
Suitable material excavated from the diversion channel will be used in construction of the diversion channel side benches, the floodplain berm, and the dam embankment. Excavated material will be trucked from the diversion channel excavation using the base of the channel and as a haul road and to the various fill placement locations on temporary designated haul roads. Rock or soil materials that are unsuitable for construction will be disposed into designated waste fill areas. Waste fill areas will be reclaimed to match existing contours in a drainage-free condition and seeded to grass. Silt fences will be constructed to control erosion and runoff.

A.2.1.4 Off-Stream Reservoir

A temporary laydown/stockpile area to support construction will be set up within the reservoir area, near the dam in a location accessible from the existing road network. A site trailer and employee parking area will also be located here.

The borrow area construction sequence will be:

1. pre-construction assessment
2. site clearing and grubbing and topsoil stripping and stockpiling
3. excavation and removal of required fill material
4. reclamation and grading of completed borrow area to tie in with existing contours and to achieve positive drainage within the relevant catchments (Figure A-2)
5. surface preparation, topsoil replacement and seeding to meet AEP reclamation requirements



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

Catchments Associated with SR1

Stantec

A.2.1.5 Off-Stream Dam and Low-level Outlet

The off-stream dam will be constructed following this sequence of events:

1. Trees and shrubs growing in the dam footprint will be cleared and grubbed and topsoil will be salvaged and stockpiled.
2. The foundation will be prepared to receive fill placement by grading, compacting and scarifying the surface
3. The unnamed creek will be diverted to allow construction of the low-level outlet structure in the dry.
4. The off-stream dam embankment will be constructed in horizontal lifts, generally proceeding from the lowest elevations to higher elevations. Suitable fill material will be obtained from the diversion channel excavation and the borrow area.
5. The low-level outlet structure will be constructed and the dam embankment will be backfilled over the completed structure.
6. The unnamed creek flow will be permanently channeled through the low-level outlet.

A.2.1.6 Roads and Bridges

The road and bridge works will be constructed using standard equipment, materials and methods codified in Alberta Transportation's Standard specifications for highway construction (Alberta Transportation 2013d) and Standard specifications for bridge construction (Alberta Transportation 2017b). Fill for the Highway 22 raising will be impervious and sourced locally from a designated borrow area within the reservoir footprint. It will be constructed using the materials and methods codified in Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects (Alberta Transportation 2017a). Table A-3 presents an overview of the construction steps of the road and bridge construction.

Table A-3 Construction Steps of Road and Bridge Construction

Roads and Highways	Bridges
1. surveying 2. establishment of detours if necessary 3. signage and public safety preparation 4. installing temporary erosion & sediment controls 5. topsoil stripping and salvage 6. excavation, grading and subgrade preparation 7. culvert installation 8. placing of granular sub-base and base courses 9. asphalt or gravel surfacing 10. installation of permanent erosion control devices 11. installation of guardrails or post and cable barriers 12. line painting 13. installation of signage 14. surface preparation of backslopes and side slopes 15. topsoil replacement and seeding 16. installation of right of way fencing 17. decommissioning of detours	1. surveying 2. establishment of detours if necessary 3. signage and public safety preparation 4. installing temporary erosion & sediment controls 5. topsoil stripping and salvage 6. excavation at abutments 7. construction of approach fills 8. construction of abutment foundations 9. construction of abutments and wing walls 10. backfilling 11. girder erection 12. construction and waterproofing of concrete deck 13. construction of approach slabs 14. paving and sealing of deck and approach slabs 15. installation of railings 16. line painting 17. installation of signage 18. decommissioning of detours

A.2.1.7 Pipelines and Utilities

Pipeline and utility relocation work will be carried out by others under separate contracts in accordance with the utility owner's requirements and applicable regulatory requirements.

A.2.2 Care of Water Provisions

Instream construction will comply with regulatory requirements in accordance with the ECO Plan, the federal Fisheries Act, the Alberta Water Act, and the Alberta Environment Protection and Enhancement Act (EPEA). Construction of instream work will be in the dry and isolated from the river flows. The river flow will be diverted by construction of a 460 m long temporary diversion channel located adjacent to the right bank of Elbow River. This temporary channel will divert the existing left side river channel flow away from the diversion inlet and service spillway work areas that are primarily located within this existing left side river channel flow. The river channel diversion will be done during periods of low flow and outside of the restricted activity period for fish.

This construction d sequence will reduce effects on fisheries by:

- avoiding sediment releases to the river during the construction period, except for small releases during the diversion of the Elbow River flow into to the temporary diversion channel and back again
- maintaining fish passage during construction

During construction phases, the water management procedures—including construction of instream isolation cofferdams, fish rescue requirements, dewatering systems and mitigations, fuel and hazardous material spill cleanup kits, erosion and sediment control barriers and monitoring—will be carried out in accordance with the Project's Environmental Construction Operations (ECO) Plan, Alberta Transportation's Erosion and Sediment Control Manual (Alberta Transportation 2011), Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects (Alberta Transportation 2017a), the Federal *Fisheries Act*, the Alberta *Water Act* and all other regulatory requirements.

During operation phases, the specific water management procedures—including equipment requirements, instream isolation procedures, fish rescue requirements, dewatering mitigations, spill preparedness, erosion and sediment control guidelines, sources of water for dust suppression and water balances—will be defined in an Operations, Maintenance and Surveillance Plan for use by AEP Bow Operations and Infrastructure Branch. These procedures will also be completed in compliance with the federal *Fisheries Act* and the Alberta *Water Act* and all other applicable regulations in accordance with their current practices. Related permitting for such activities, when required, will be obtained through the relevant regulatory authorities.

A.2.2.1 Instream Isolation

Construction will require three diversions of watercourses to facilitate the construction of three project components: temporary elbow river diversion, temporary unnamed tributary diversion, and several locations where local inflow will be permanently diverted into the diversion channel due to earthwork grading.

Temporary Elbow River Diversion

To allow construction of the diversion structure in the dry, the Elbow River flow will be temporarily diverted south of the existing river channel and through the location of the future auxiliary spillway.

During construction in-stream isolation cofferdams, fish rescue requirements, dewatering systems and mitigations, fuel and hazardous material spill cleanup kits, erosion and sediment control barriers and monitoring will be carried out in accordance with Alberta Transportation's Environmental Construction Operations (ECO) Plan, Alberta Transportation's Erosion and

Sediment Control Manual June 2011, Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects, the Federal *Fisheries Act*, the Alberta *Water Act* and all other regulatory requirements.

Care of water will be carried out using, for example, cofferdams to isolate the works, sumps, pumping systems, pipelines, channels, flumes, and drains. Silt fences and turbidity barriers will be used to control sediment and turbidity. All water that comes in contact with the work will be monitored and controlled to ensure that water affected by construction operations is equal to or better than the water quality upstream of the works. The baseline water quality will be established prior to commencement of work. Water quality will be monitored and tested for compliance during construction work.

After construction of the instream components is complete, the river will be diverted back to its original channel, and it will flow through the newly constructed service spillway passage. Once Elbow River has been diverted back through the service spillway passage, the temporary isolation berms and the riprap used for care of water and erosion control will be removed and reused either to provide additional berms to assist with the construction of the auxiliary spillway structure or as fill and armoring for construction of the flood plain berm.

Temporary Unnamed Tributary Diversion

The existing unnamed creek located near the reservoir dam east abutment will collect localized drainage from the off-stream reservoir. The low-level-outlet structure will be constructed within the creek channel located in the area of the east dam abutment and will use the creek channel downstream of the dam to return the retained water from the reservoir back into Elbow River. Construction of the low-level outlet structure in the dry will require the temporary diversion of the unnamed creek around the structure works.

During construction, in-stream isolation cofferdams, fish rescue requirements, dewatering systems and mitigations, fuel and hazardous material spill cleanup kits , erosion and sediment control barriers and monitoring will be carried out in accordance with Alberta Transportation's Environmental Construction Operations (ECO) Plan, Alberta Transportation's Erosion and Sediment Control Manual June 2011, Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects, the Federal *Fisheries Act*, the Alberta *Water Act* and all other regulatory requirements.

Care of water will be carried out using, for example, cofferdams to isolate the works, sumps, pumping systems, pipelines, channels, flumes and drains. Silt fences and turbidity barriers will be used to control sediment and turbidity. All water that comes in contact with the work will be monitored and controlled to ensure that water affected by construction operations is equal to or better than the water quality upstream of the works. The baseline water quality will be

established prior to commencement of work. The water quality will be monitored and tested for compliance during construction work.

After construction of the low-level outlet structure, the unnamed creek will be diverted back to its original channel and will flow through the newly constructed low-level outlet structure and into the Elbow River via its existing channel downstream of the reservoir.

Local Inflow into Diversion Channel

Inflows from local ephemeral streams may flow into the diversion channel during construction. The 4 km long diversion channel crosses three ephemeral streams which may produce wet conditions during the excavation of the diversion channel. The contractor will be responsible for maintaining workable conditions within the channel, managing runoff, and erosion and sediment control during the various phases of construction.

During excavation of the diversion channel, in-stream isolation cofferdams, fish rescue requirements, dewatering systems and mitigations, fuel and hazardous material spill cleanup kits, erosion and sediment control barriers and monitoring will be carried out in accordance with Alberta Transportation's Environmental Construction Operations (ECO) Plan, Alberta Transportation's Erosion and Sediment Control Manual June 2011, Alberta Transportation's Civil Works Master Specifications for Construction of Provincial Water Management Projects, the Federal *Fisheries Act*, the Alberta *Water Act* and all other regulatory Requirements.

Care of water will be carried out using, for example, cofferdams to isolate the works, sumps, pumping systems, pipelines, channels, flumes and drains. Silt fences and turbidity barriers will be used to control sediment and turbidity. All water that comes in contact with the work will be monitored and controlled to ensure that water affected by construction operations is equal to or better than the water quality upstream of the works. The baseline water quality will be established prior to commencement of work. The water quality will be monitored and tested for compliance during construction work.

Mitigation Measures

All instream isolations will be the responsibility of the construction contractor, but the following mitigation measures will be implemented:

- Ice (if present at the time of construction) will be removed prior to instream work activities in a manner that doesn't unnecessarily disturb or scour the channel bed.
- Eroding or exposed areas will be stabilized with appropriately-sized, clean rock. Rock will installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.

- The area of isolation instream footprints will be limited.
- The duration of all work done below the highwater mark of watercourses will be limited.
- Appropriate isolation materials and designs will be used to reduce disturbance to the bed and banks of the watercourse or water body.
- Before isolation and dewatering works commence, a qualified aquatic environment specialist (QAES) will be retained to obtain applicable permits for relocating fish and capture fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur.
- Water intake pipes will be screened to prevent entrainment or impingement of fish. 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. These measures should be followed for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters:
  - Screens will be placed in areas and depths of water with low concentrations of fish throughout the year.
  - Water intakes/screens will not be placed in areas of the channel that are used as migratory corridors by fish, where possible. Additional protection measures (e.g., barrier nets) may also be required.
  - Screens will be located away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
  - The screen face will be oriented in the same direction as the flow.
  - Openings in the guides and seals will be less than the opening criteria to make “fish tight” (DFO 1995).
  - Intakes will be installed in a manner that prevents the uptake or entrainment of sediment and aquatic organisms associated with the bottom area. Screens should be located a minimum of 300 mm above the bottom of the watercourse. If the water depth is less than 300 mm, additional measures may need to be implemented (e.g., using a screen basket with a solid bottom).
  - Structural support will be provided to the screen panels to prevent sagging and collapse of the screen.
  - Large cylindrical and box-type screens will have a manifold installed in them so there is equal water velocity distribution across the screen surface. The ends of the structure will be made from solid materials and the end of the manifold capped.

  - Heavier cages or trash racks may be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A 150 mm spacing between bars is typical.
  - Provisions will be made for the removal, inspection, and cleaning of screens.
  - Regular maintenance and repair of cleaning apparatus, seals, and screens will be carried out to prevent debris-fouling and impingement of fish.
  - Pumps will be shut down when fish screens are removed for inspection and cleaning.
  - When removing the isolation, the downstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle prior to removing the upstream dam.
- Pump intakes will be operated in a manner that prevents disturbance to the channel bed and entrainment or impingement of fish.
- Accumulated sediment and excess spoil will be removed from the isolated area before removing the isolation.
- Pumping systems will be sized to accommodate any expected high flows of the watercourse during the construction period.
- Pumps will be monitored, and back-up pumps should be readily available on-site in case of pump failure.
- Pump discharge area(s) will be protected to prevent erosion and the release of suspended sediments downstream. This material will be removed when the works have been completed.
- When removing the isolation, the downstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle. During the final removal of isolation, restore the original channel shape, bottom gradient and substrate at these locations.
- Flumes, dams, and wing walls (where applicable) will be installed in a manner that prevents disturbance to the channel bed.
- Flumes, dams, and wing walls (where applicable) will be sized to accommodate any expected high flows of the watercourse during the construction period.
- Flumes, including dams, and wing walls (where applicable) will be monitored, and contingency measures and materials should be developed and on site in case of a failure.
- The flume outflow area will be protected to prevent erosion and the release of suspended sediments downstream and remove this material when the works have been completed.

- Non-earthen material, such as water-inflated portable dams, pea gravel bags, concrete blocks, steel or wood wall, clean rock, sheet pile or other appropriate designs, will be used to separate the dewatered work site from flowing water.
- If granular material is used to build dams, clean or washed material that is adequately sized (i.e., moderately sized rock and not sand or gravel) to withstand anticipated flows will be used during the construction. If necessary, the outside face of dams will be lined with heavy poly-plastic to make them impermeable to water. Material to build these dams will not be taken from below the high water mark of any water body.

A.2.2.2 Fish Rescue

The construction contractor will be responsible for retaining a team or teams to conduct necessary fish rescues. Fish rescues will be required wherever fish could be present; for example, in Elbow River and its tributaries. Fish rescue activities will follow these mitigation measures:

- A fish rescue will be conducted on water that has the potential to contain fish and has been isolated from the other waterbodies as the result of construction.
- Fish rescues will be conducted in accordance with a Fish Research License (FRL), which will be obtained through AEP.
- Fish rescues will be completed following installation of isolation materials, and prior to the commencement of instream construction activities. The contractor will be notified once the rescue has been completed such that instream work can begin.
- Fish capture and release activity results will be recorded and submitted to AEP.

A.2.2.3 Dewatering

Dewatering mitigations will be the responsibility of construction contractors and will follow these mitigation measures:

- A fish rescue will be conducted prior to dewatering water that has the potential to contain fish.
- Water intakes pipes will be screened to prevent entrainment or impingement of fish, if dewatering from any water that has the potential to contain fish. For detailed screening measures see Section A2.2.1.4.
- If applicable, pump intakes will be operated in a manner that prevents disturbance to the channel bed, entrainment or impingement of fish, and reduces the suspension of sediment.

- Pump discharge area(s) will be protected to prevent erosion and the release of suspended sediments downstream. This material will be removed when the works have been completed.
- Water removed from the construction area will be discharged only if it is of an equal or better water quality than when it entered the construction area. The water will be discharged into the nearest hydrologically connected waterbody downstream of the relevant construction area (under any ice that may be present).

A.2.2.4 Spills

In the event of the release of silt or other deleterious substance into a body of water or watercourse during construction, it will be immediately reported to Alberta Environment and Parks and Fisheries and Oceans Canada (DFO) (1-800-222-6514)

In the event of a release of silt or other deleterious substance into a body of water or watercourse, all reasonable measures to contain the release and repair any damage will be taken.

In the event of spills or releases of hazardous materials and any other substances that can cause or could cause impairment of or damage to the environment or human health or safety, the incidents will be reported immediately to Alberta Environment and Parks and if a body of water or a water course is involved, the incident will be reported to Alberta Environment and Parks and to DFO. All reasonable measures will be taken to contain the spill and cleanup. Any such work will be performed in accordance with applicable legislation and regulations.

Spill response plans and preparedness during construction will be the responsibility of construction contractors, who will follow these mitigation measures:

- An emergency preparedness plan will be prepared and implemented prior to construction.
- No person will release, knowingly or otherwise, into the environment any substance in the amount/concentration/level/rate that causes or may cause an adverse effect on the aquatic environment.
- A person who releases, causes, or allows a release of a substance that does or may cause an adverse effect will report it to the QAES as soon as said individual is aware of the release.
- Spill sites will be cleaned in accordance with regulatory requirements.
- Spill kits will be on site, in construction vehicles, and in fuel and service vehicles.
- Persons trained in the use of the spill kits will be on site at all times.
- Leaks and spills will immediately be contained, cleaned up and reported in accordance with regulatory requirements.

- Spills will be immediately reported to the AEP Spill Hotline (1-800-222-6514).
- Upon notification of a release, the following information will be used to prepare a written report for AEP within seven days of the release /notification:
  - The date and time of release
  - The location of the point of release
  - The duration of the release and the release rate
  - The composition of the release
  - Detailed description of the circumstances causing the release
  - Steps taken, or will be taken, to minimize and control the release
  - Steps taken, or will be taken, to prevent reoccurrence
  - Any other information required by the Director

Spill prevention mitigation plans during construction will also be the responsibility of construction contractors and will follow these mitigation measures:

- Machinery will arrive on site in a clean condition and is maintained free of fluid leaks, invasive species, and noxious weeds.
- Containment and Spill Management Plan will be developed that describes protocols in the event of accidental spills or releases so that such spills will be prevented from entering a watercourse or water body during all phases of the project.
- Washing, refueling and servicing of machinery will be completed in such a way as to prevent any deleterious substances from entering water.
- Fuel and other materials for machinery will be stored in such a way as to prevent deleterious substances from entering water.
- All construction materials will be removed from the site upon crossing completion.
- Machinery fording of watercourses will be limited to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be installed.
- Fuel and other hazardous materials will be stored at least 30 m from any waterbody in a manner that the hazardous material cannot enter a 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.
- Hazardous waste materials, including spill wastes will be removed from the site and disposed in accordance with regulatory requirements.
- Copies of tipping fee receipts and manifests on site will be retained to verify legal disposal of hazardous wastes.

A.2.2.5 Prevention of the Spread of Invasive Species

Invasive species control measures during construction will also be the responsibility of construction contractors and will follow these measures:

- Before arriving on site, equipment will be cleaned of mud and debris, and disinfected following Alberta Environment and Parks' disinfection procedures found at: http://aep.alberta.ca/fish-wildlife/wildlife-diseases/whirling-disease/stop-the-spread.aspx
- Machinery on site will be in a clean condition and maintained free of fluid leaks, invasive species, and noxious weeds.
- Site specific procedures to prevent the invasion or spread of undesirable non-native vegetation (e.g., purple loosestrife, Eurasian milfoil) will be developed.
- Disinfection stations will be established to clean equipment before it leaves the site.

A.2.2.6 Erosion and Sediment Control

Erosion and sediment control measures during construction will also be the responsibility of construction contractors and will follow these mitigation measures:

- Effective erosion and sediment control measures such as silt fencing, silt fencing, fiber logs, and erosion control blankets will be installed before starting work (in order to prevent sediment from entering the water body):
  - Sediment control measures will be placed around all disturbed work areas, disturbed slopes, and ecologically sensitive areas such as wetlands and watercourses.
  - Inspection and maintenance of erosion and sediment control measures and structures during construction will be conducted regularly.
  - If damaged, erosion and sediment control measures and structures will be repaired
  - Non-biodegradable erosion and sediment control materials will be removed once the site is stabilized.
- Temporary structures or other practices will be used to access watercourses with steep and/or highly erodible (e.g., dominated by organic materials and silts) banks and beds.
- Measures for managing water flowing onto the site, as well as water being pumped or diverted from the site, will be such that sediment is filtered out prior to the water entering a waterbody.
- Measures for site isolation (e.g., silt boom, silt curtain) for containing suspended sediment (if work outside of the isolation is required) will be prepared, and implemented.

- Measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high-water mark of nearby watercourses and/or water bodies to prevent re-entry will be implemented.
- Subsurface drainage controls will be prepared and implemented, where appropriate, to maintain groundwater and surface water interactions and to maintain the stability of reclaimed land. The type and location of subsurface drainage controls will be determined through onsite investigation with considerations for subsurface flow potential, erodibility of backfill materials, and degree of slope.
- Removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the watercourse or water body below the high water mark will be reduced. If material is removed from the waterbody, it will be set aside and returned to its original location after construction activities are completed.
- Fertilizer will not be applied in the immediate vicinity of a watercourse unless requested by the landowner and approved by DFO or AEP.
- Areas with surface (i.e., terrestrial) disturbance will be revegetated following construction works. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
- Site specific procedures to prevent the invasion or spread of undesirable non-native vegetation (e.g., purple loosestrife, Eurasian milfoil) will be developed.
- Approaches to the watercourse or water body will be designed and constructed so that they are perpendicular to the watercourse or water body to reduce loss or disturbance to riparian vegetation.
- Clearing of riparian vegetation will be kept to a minimum; existing trails, roads or cut lines will be used wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting.
- Herbicides will not be used for clearing or maintenance of riparian vegetation unless approved by DFO or AEP.
- All necessary cofferdams, channels, flumes, drains, well points, wells, sumps, pumps, pipelines, and other temporary diversion and protection works will be maintained.
- All cold weather protective works including enclosures, insulation, and heating systems works will be maintained.
- At least one standby pump for each category of pump being used for care of water will be on site at all times.

- Standby power sufficient for operation of all required care of water equipment will be available on site at all times.
- Care of water pump and pipeline systems will be inspected at regular intervals not exceeding 12 hours and verify that the pumps are operating, there is sufficient fuel, and cold weather protection is adequate. If required, the time interval between inspection check will be decreased, as appropriate, to correspond with the type and nature of weather and the work in progress.
- Damage to any part of the work caused by water, snow, or ice due to failure of the care of water measures should be repaired immediately. Additional excavations and fill placement made necessary by water, snow, or ice will be installed.
- When no longer required, cofferdams, sumps, channels, drains, and other protective, dewatering, and temporary diversion works will be removed and finished to a leveled and neat condition.

A.2.2.7 Quality Control

The effectiveness of water management provisions will be monitored and evaluated by a turbidity monitoring program in Elbow River and the Unnamed Tributary (when water is present). Management of turbidity will be the responsibility of the construction contractor and will follow these mitigation measures:

- A QAES will be retained to oversee all data collection and provide the construction contractor with recommendations when required.
- A study will be undertaken to determine if the passage of fish is impeded as a result of instream structures.
- Turbidity sampling will be taken, using manual sampling techniques, and turbidity sondes devices that can record turbidity at predefined intervals while unattended.
- Sampling transects in Elbow River will be established by a QAES to assess the amount of sediment release within the aquatic environment:
  - upstream site (control) – at a location approximately 100 m upstream of the work area, upstream of project impacts. A minimum of three measurements will be taken across the channel.
  - downstream - transects will be located (at minimum) immediately downstream of the proposed activities (typically within 50 m depending on site hazards), 100 m, 300 m, and 500 m downstream of the proposed activities. A minimum of three sampling locations will be established across the channel along these transects. Additional transects may be required to determine the downstream extent of impacts should conditions dictate.

- Sampling transects in Unnamed Tributary will be established by a QAES to assess the amount of sediment release within the aquatic environment:
  - upstream site (control) – at a location approximately 50 m upstream of the work area, upstream of project impacts. A minimum of three measurements will be taken across the channel.
  - downstream - transects will be located (at minimum) immediately downstream of the proposed activities (typically within 50 m depending on site hazards), 100 m, 200 m, and 300 m downstream of the proposed activities. A minimum of three sampling locations will be established across the channel along these
- Water samples and measurements will be taken at approximately half the water depth or 30% depth below surface.
- Sample Timing
  - Turbidity monitoring will occur during instream construction activity, including but not limited to the construction, operation, and removal of isolation structures.
  - Manual turbidity measurements will be taken at the specified locations on a regular basis (hourly or every two hours, depending on activity) throughout the day while instream work is occurring.
  - Turbidity measurements collected using the turbidity sondes should measure turbidity every half hour.
- Water samples for analysis of total suspended solids (TSS) will be obtained if sedimentation is observed such that it is suspected to exceed established thresholds.
- A daily inspection log will be maintained throughout the contract. Data shall be submitted to the Alberta Transportation Representative on a daily basis. Information required shall include but is not limited to:
  - Date
  - General construction activities and hours of work
  - Time work was suspended
  - Suspended sediment levels (mg/L) derived from the turbidity/TSS correlation, if applicable
  - Construction activities during sampling periods
  - General river conditions
  - Potential areas for mitigation
- Turbidity will be compared the Environmental Quality Guidelines for Alberta Surface Waters turbidity guideline (ESRD, 2014), which are as follows:
  - for clear flow – maximum increase of 8 NTU from background levels for any short-term exposure (e.g., 24-h period). Maximum increase of 2 NTU from background levels for any long-term exposure (e.g., inputs lasting between 24-h and 30-d).

  - for high flow or turbid waters – maximum increase of 8 NTU from background levels at any one time when background levels are between 8 and 80 NTU. Levels should not increase more than 10% of background levels when background is greater than 80 NTU.

- The QAES and construction contractor will take the necessary measures so that water quality objectives are met during construction.

A.3 DRY OPERATIONS WATER MANAGEMENT PLAN

A.3.1 General

During dry operation, the diversion inlet gates will be closed and the service spillway gates will be open (lowered). The gate system and its operation will be checked according to a routine maintenance schedule to be developed by AEP. The maintenance schedule will also include inspections of the diversion structure and the river channel upstream of it, the maintenance building, the floodplain berm, and the auxiliary spillway. Repairs and debris removal will be completed as necessary.

Surface runoff from storms or melting snow, as well as streamflow from watercourses intersected by the diversion channel, will flow into the diversion channel and drained to the Unnamed Tributary which conveys it through the low-level outlet and to the Elbow River. The erosion control measures protecting the walls and floor of the channel will be inspected on a regular schedule (to be determined by AEP) for erosion or other damage and repaired as necessary. The associated access roads, emergency spillway and reservoir inlet basin will be inspected at the same time and repaired if necessary.

Between floods, the dam embankment, associated access roads, and low-level outlet works also will be inspected for damage on a regular schedule to be determined by AEP and repairs will be carried out if necessary. The low-level outlet will remain open to carry the flow of the unnamed creek over which the dam will be built. Water draining from the diversion channel and the drainage ditches at the base of the dam will also flow through the outlet structure.

A.3.2 Care of Water Provisions

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 following the catchments delineated in Figure A-2.

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

A.4 FLOOD OPERATIONS WATER MANAGEMENT PLAN

A.4.1 General

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

The maximum rate of diversion is 600 m^3/s. 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 will be allowed downstream through the service spillway. When inflows from the Elbow River exceed 760 m^3/s, the excess flow will be allowed downstream through the service spillway, while maintaining a constant diversion rate of 600 m^3/s until the reservoir is full.

The operation of the diversion structure at different ranges of flow is summarized in Table A-4. These operating scenarios are based on the assumption of no excess capacity being available at Glenmore Reservoir and sufficient capacity in the off-stream reservoir. The diversion inlet gates will close when the reservoir is full. Example hydrographs of flood operations for the design flood, 1:100 year flood, and 1:10 year flood are in Figures A-3, A-4, and A-5, respectively.

Table A-4 Operation of the Diversion Structure at Different Ranges of Flow

Discharge (m^3/s)	Operation	
	Diversion Inlet	Service Spillway
<160	Gates closed	right gate raised, flow through left spillway
160-760	Gates open	left gate raised in increments with increasing flow
>760	Gates open	both gates lowered in increments

During a flood, the low-level outlet structure will be closed to keep floodwaters behind the dam. The gates are operated locally using the gatehouse. The gatehouse will be manned continuously during a flood.

The diverted floodwater will be held in the off-stream reservoir until the flood risk has passed and it has been determined that water can be safely released back into Elbow River.

The flow in the diversion channel will be monitored continuously. The reservoir elevation and fill rate also will be monitored, as well as the pore pressure within the dam and at its foundations.

All components will be inspected regularly during flood operations. tTe frequency of inspection will be determined by the severity of the flood.

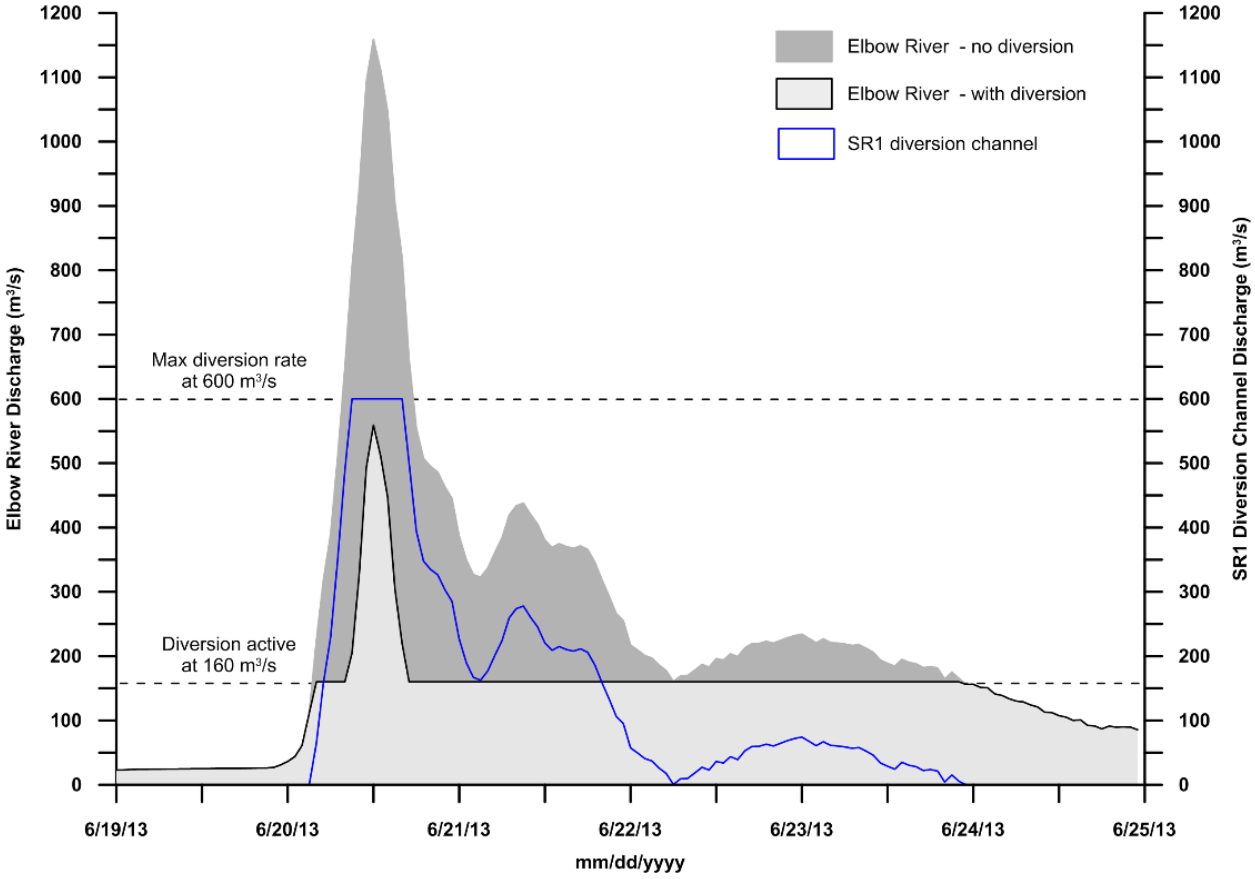


Figure A-3 Design Flood Diversion Hydrograph

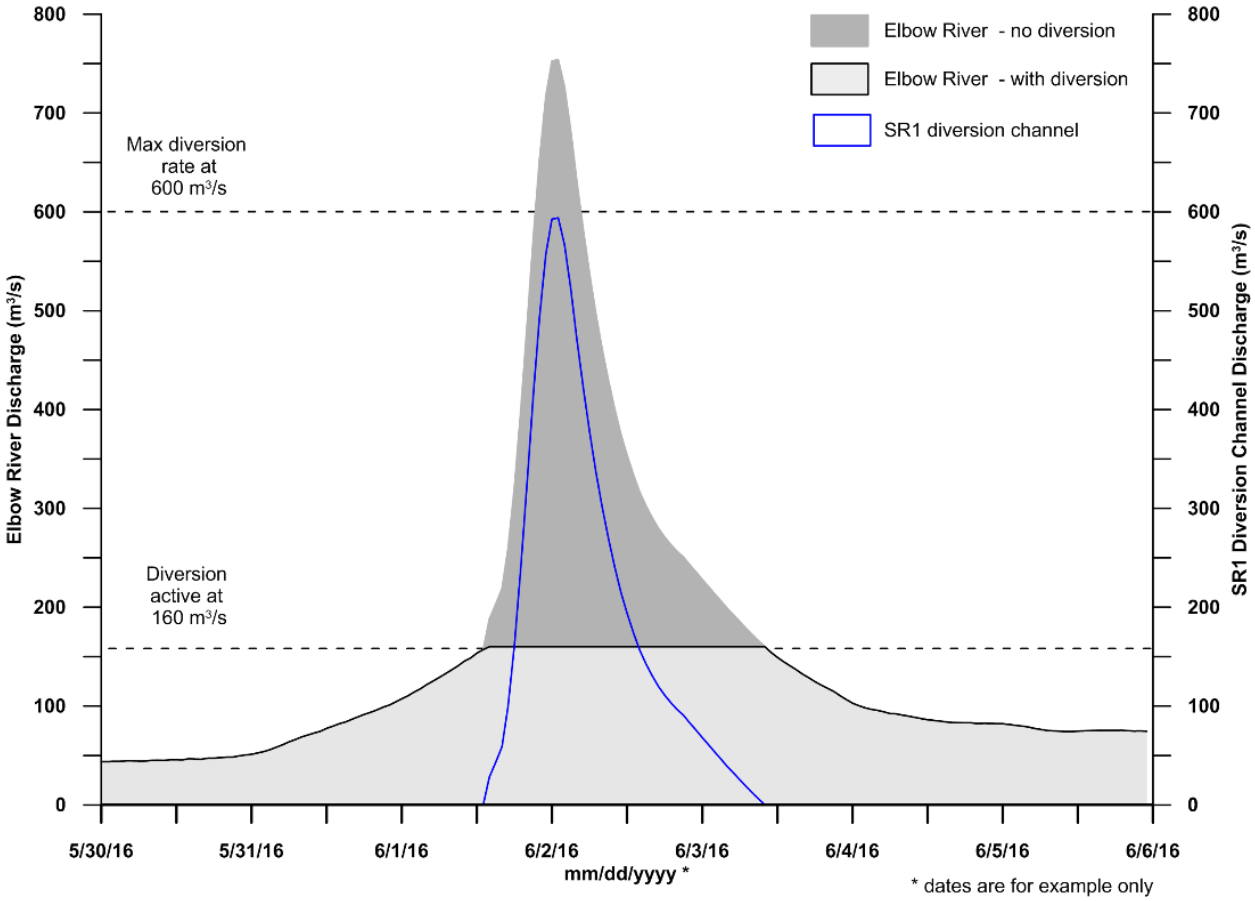


Figure A-4 1:100 Year Flood Diversion Hydrograph

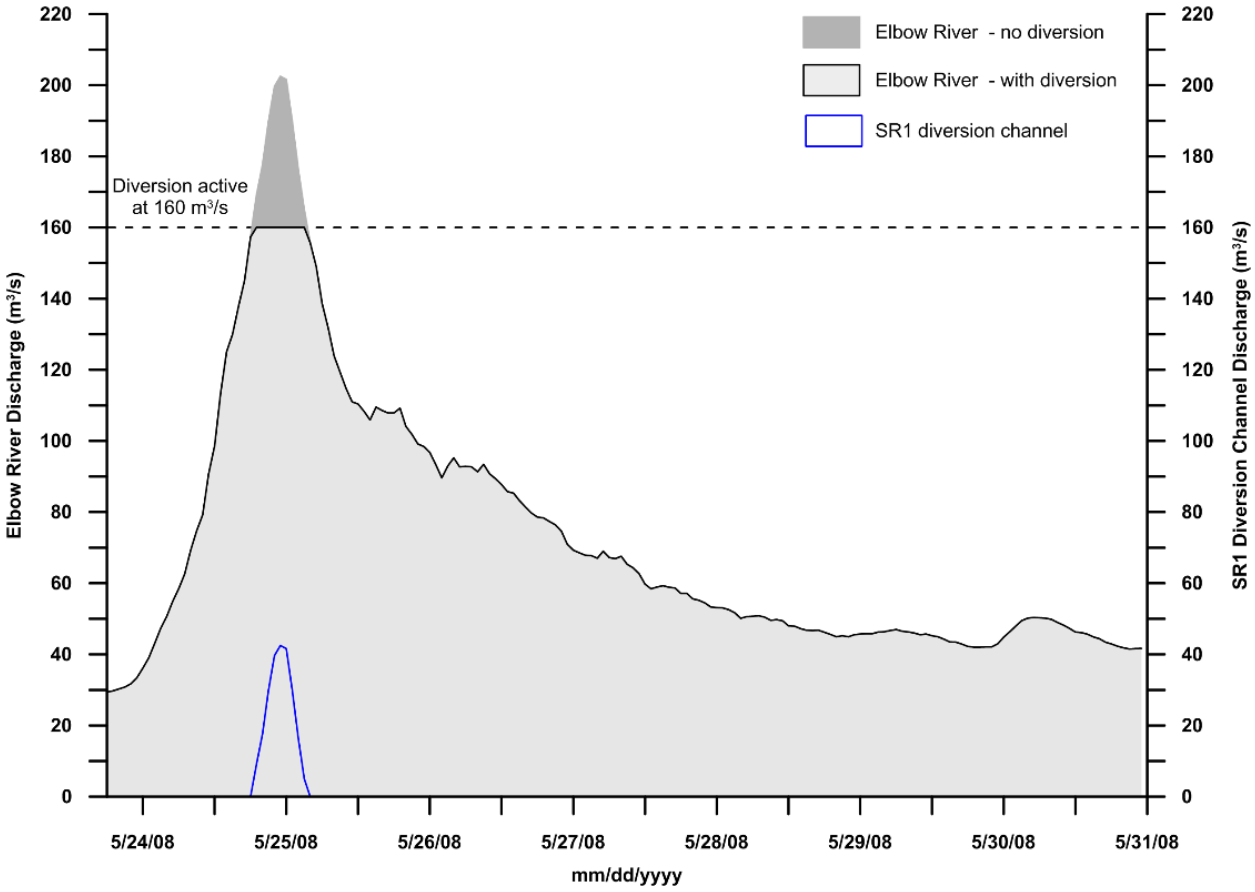


Figure A-5 1:10 Year Flood Diversion Hydrograph

A.4.2 Care of Water Provisions

During flood conditions, a portion of Elbow River is diverted down the diversion channel to be retained in the off-stream 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.

A.5 POST-FLOOD OPERATIONS WATER MANAGEMENT PLAN

A.5.1 General

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.

The timing of release of water from the off-stream reservoir will be based on two criteria.

The first criterion will be that flows in Elbow River need to be less than 20 m^3/s before release could occur. This threshold is based on a maximum design release rate of 27 m^3/s and the effective discharge for suspended sediment transport of between 35 m^3/s and 50 m^3/s (Stantec 2018).

The second criterion will be based on the length of time to drain the reservoir using the engineering design full service volume of approximately 77,200 dam^3. For this volume, the length of time to drain the reservoir is estimated to be 42 days. However, actual operational release rate from the reservoir could vary, depending on circumstances at the time of diversion and release. For example, release rates may be increased if two back-to-back floods are forecast, or decreased to minimize potential effects on mobilization of sediment in the low-level outlet and remobilization of sediment in Elbow River downstream.

Modelled release rates are illustrated in Figure A-6.

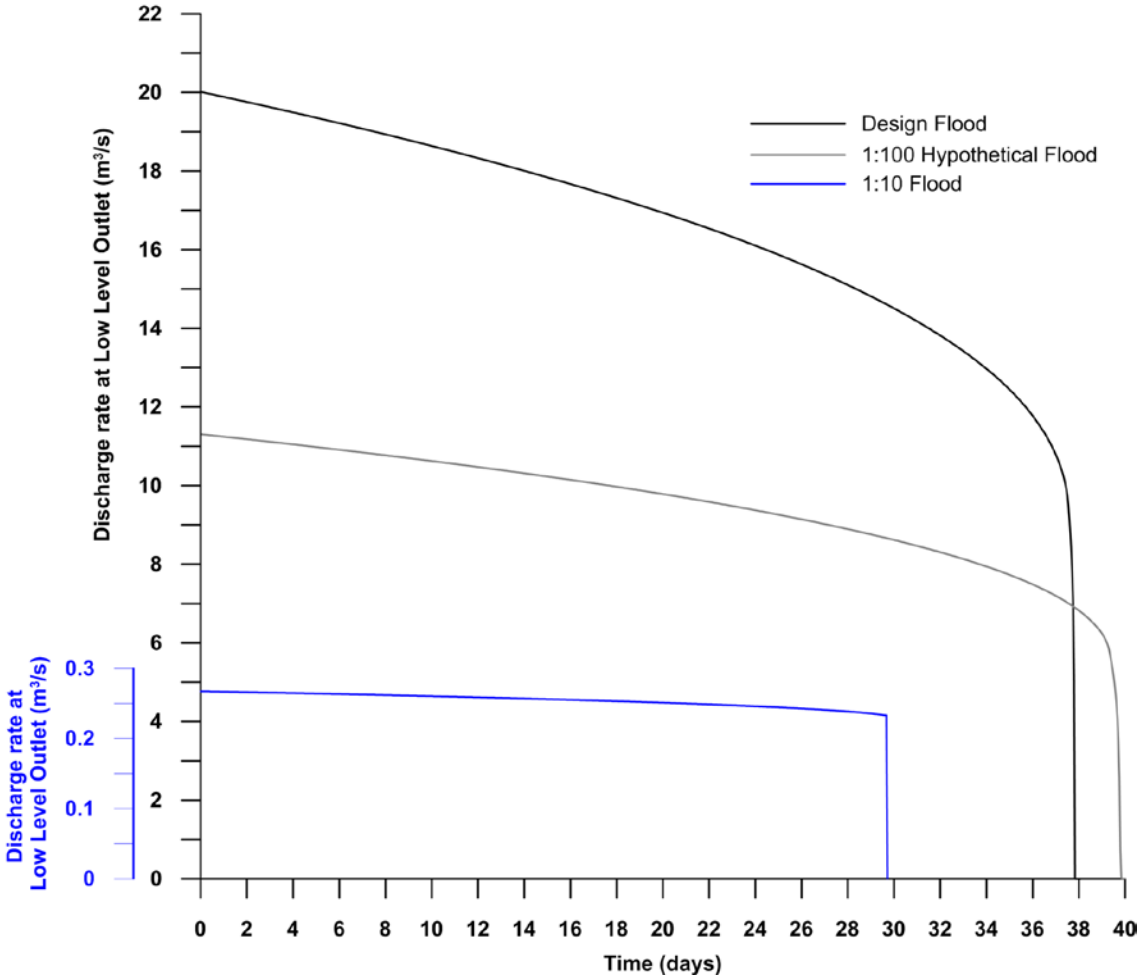


Figure A-6 Modelled Release Rates from the Off-stream Reservoir

Post-flood repair and maintenance activities are listed in Table A-5.

Table A-5 Post-flood Repair and Maintenance Activities

Components	Maintenance Activities
Diversion system	• removal of sediment and debris to the extent necessary to maintain the flow of water into the reservoir during a future diversion • confirmation of gate functionality and repair if required • repair of erosion damage to the floodplain berm and auxiliary spillway where necessary
Diversion channel	• removal of debris and sediment to the degree required to maintain channel capacity • repair of flood damage to the channel, the associated access roads or the emergency spillway
Off-Stream reservoir	• excavation of deposited sediments to allow water to drain into the low-level outlet; spoil will be spread and levelled locally • removal of debris from the flooded area of the reservoir, if required • rescue fish trapped in isolated pools, as required • internal drainage regrading, if required
Dam embankment	• removal of debris and sediment at the inner toe of the dam to the degree required to maintain functionality of the access road and the dam drainage ditch • repair of erosion damage or sedimentation affecting the dam faces, benches, drainage flumes and drainage ditches • repair of erosion damage to the dam access roads
Low level outlet works	• removal of debris and sediment from the outlet components to the degree required to maintain optimal functionality • confirmation of gate functionality and repair, if required • inspection of outlet channel and repairs, if necessary

A.5.2 Care of Water Provisions

A.5.2.1 Instream Isolation

Post-flood repair and maintenance activities that require instream work will be isolated, and done in the 'dry' wherever possible. Instream isolations will be the responsibility of maintenance contractors and will follow these mitigation measures:

- Ice (if present at the time of construction) will be removed prior to instream work activities in a manner that doesn't unnecessarily disturb or scour the channel bed.
- Eroding or exposed areas will be stabilized with appropriately-sized, clean rock. Rock will be installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- The area of instream footprints of isolations will be reduced.
- The duration of all work done below the highwater mark of watercourses will be minimized.
- Appropriate isolation materials and designs will be used to reduce disturbance to the bed and banks of the watercourse or water body.
- Before isolation and dewatering works commence, a QAES will be retained to obtain applicable permits for relocating fish and capture fish trapped within an isolated/enclosed area at the work site and safely relocate them to an appropriate location in the same waters. Fish may need to be relocated again, should flooding occur.
- Water intake pipes will be screened to prevent entrainment or impingement of fish. 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. These measures should be followed for design and installation of intake end of pipe fish screens to protect fish where water is extracted from fish-bearing waters:
  - Screens will be placed in areas and depths of water with low concentrations of fish throughout the year.
  - Water intakes/screens will not be placed in areas of the channel that are used as migratory corridors by fish, where possible. Additional protection measures (e.g., barrier nets) may also be required.
  - Screens will be located away from natural or artificial structures that may attract fish that are migrating, spawning, or in rearing habitat.
  - The screen face will be oriented in the same direction as the flow.
  - Openings in the guides and seals will be less than the opening criteria to make "fish tight" (DFO 1995).

  - Intakes will be installed in a manner that prevents the uptake or entrainment of sediment and aquatic organisms associated with the bottom area. Screens should be located a minimum of 300 mm above the bottom of the watercourse. If the water depth is less than 300 mm, additional measures may need to be implemented (e.g., using a screen basket with a solid bottom).
  - Structural support will be provided to the screen panels to prevent sagging and collapse of the screen.
  - Large cylindrical and box-type screens will have a manifold installed in them to ensure even water velocity distribution across the screen surface. The ends of the structure will be made from solid materials and the end of the manifold capped.
  - Heavier cages or trash racks may be fabricated out of bar or grating to protect the finer fish screen, especially where there is debris loading (woody material, leaves, algae mats, etc.). A 150 mm spacing between bars is typical.
  - Provisions will be made for the removal, inspection, and cleaning of screens.
  - Regular maintenance and repair of cleaning apparatus, seals, and screens will be carried out to prevent debris-fouling and impingement of fish.
  - Pumps will be shut down when fish screens are removed for inspection and cleaning.
  - When removing the isolation, the downstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle prior to removing the upstream dam.
- Pump intakes will be operated in a manner that prevents disturbance to the channel bed and entrainment or impingement of fish.
- Accumulated sediment and excess spoil will be removed from the isolated area before removing the isolation.
- Pumping systems will be sized to accommodate any expected high flows of the watercourse during the construction period.
- Pumps will be monitored at all times, and back-up pumps should be readily available on-site in case of pump failure.
- Pump discharge area(s) will be protected to prevent erosion and the release of suspended sediment downstream. This material will be removed when the works have been completed.
- When removing the isolation, the downstream dam will be gradually removed first, to equalize water levels inside and outside of the isolated area and to allow suspended sediments to settle. During the final removal of isolation, the original channel shape, bottom gradient and substrate will be restored at these locations.

- Flumes, dams, and wing walls (where applicable) will be installed in a manner that prevents disturbance to the channel bed.
- Flumes, dams, and wing walls (where applicable) will be sized to accommodate expected high flows of the watercourse.
- Flumes, including dams, and wing walls (where applicable) will be monitored at all times, and contingency measures and materials should be developed and on site in case of a failure.
- The flume outflow area will be protected to prevent erosion and the release of suspended sediments downstream, and remove this material when the works have been completed.
- Non-earthen material, such as water-inflated portable dams, pea gravel bags, concrete blocks, steel or wood wall, clean rock, sheet pile or other appropriate designs, will be used to separate the dewatered work site from flowing water.
- If granular material is used to build dams, clean or washed material that is adequately sized (i.e., moderately sized rock and not sand or gravel) to withstand anticipated flows will be used during the construction. If necessary, the outside face of dams will be lined with heavy poly-plastic to make them impermeable to water. Material to build these dams will not be taken from below the high water mark of any water body.

A.5.2.2 Fish Rescue

Maintenance contractors will be responsible for retaining a team led by a QAES to conduct necessary fish rescues. Fish rescue activities will follow these mitigation measures:

- A fish rescue will be conducted on any water that has the potential to contain fish, and has been isolated from the other waterbodies as the result of construction.
- Fish rescues will be conducted in accordance with a Fish Research License (FRL), which will be obtained through AEP.
- Fish rescues will be completed following installation of isolation materials, and prior to the commencement of instream construction activities. The QAES will notify the contractor once the rescue has been completed such that instream work can begin.
- The QAES will record fish capture and release activity results and submit to AEP.

A.5.2.3 Dewatering

Dewatering mitigations will be the responsibility of maintenance contractors and will follow these mitigation measures:

- A fish rescue will be conducted, led by a QAES, prior to dewatering any water that has the potential to contain fish.
- Any water intakes pipes will be screened to prevent entrainment or impingement of fish, if dewatering from any water that has the potential to contain fish. For detailed screening measures see Section A.5.2.1.
- If applicable, pump intakes will be operated in a manner that prevents disturbance to the channel bed and entrainment or impingement of fish, and reduces the suspension of sediment.
- Pump discharge area(s) will be protected to prevent erosion and the release of suspended sediments downstream. This material will be removed when the works have been completed.
- Water removed from the area will be discharged, only if it is of an equal or better quality than when it entered the area. It will be discharged into the nearest hydrologically connected waterbody downstream of the relevant area (under any ice that may be present).

A.5.2.4 Spills

Spill response plans and preparedness will be the responsibility of maintenance contractors will follow these mitigation measures:

- An emergency preparedness plan will be prepared and implemented prior to the operations phase.
- No person will release, knowingly or otherwise, into the environment any substance in the amount/concentration/level/rate that causes or may cause an adverse effect on the aquatic environment.
- A person who releases, causes, or allows a release of a substance that does or may cause an adverse effect will report it to the QAES as soon as said individual is aware of the release.
- Spill sites will be cleaned in accordance with regulatory requirements.
- Spill kits will be on site, in construction vehicles, and in fuel and service vehicles.
- Persons trained in the use of the spill kits will be on site at all times.
- Leaks and spills will immediately be contained, cleaned up and reported in accordance with regulatory requirements.

- Spills will be immediately reported to the AEP Spill Hotline (1-800-222-6514).
- Upon notification of a release, the following information will be used to prepare a written report for AEP within 7 days of the release /notification:
  - The date and time of release
  - The location of the point of release
  - The duration of the release and the release rate
  - The composition of the release
  - Detailed description of the circumstances causing the release
  - Steps taken, or will be taken, to minimize and control the release
  - Steps taken, or will be taken, to prevent reoccurrence
  - Any other information required by the Director

Spill prevention mitigation plans during construction will also be the responsibility of maintenance contractors and will follow these mitigation measures:

- Machinery will arrive on site in a clean condition and is maintained free of fluid leaks, invasive species and noxious weeds.
- Containment and Spill Management Plan will be implemented that describes protocols for reducing risk of accidental spills or releases from entering a watercourse or water body.
- Washing, refueling and servicing of machinery will be completed in such a way as to prevent any deleterious substances from entering the water.
- Fuel and other materials for machinery will be stored in such a way as to prevent any deleterious substances from entering the water.
- All materials will be removed from site upon completion.
- Machinery fording of watercourses will be limited to a one-time event (i.e., over and back), and only if no alternative crossing method is available. If repeated crossings of the watercourse are required, a temporary crossing structure will be installed.
- Fuel and other hazardous materials will be stored at least 30 m from any waterbody in a manner that the hazardous material cannot enter a 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.
- Hazardous waste materials, including spill wastes will be removed from site and disposed in accordance with regulatory requirements.
- Copies of tipping fee receipts and manifests on site will be retained to verify legal disposal of hazardous wastes.

A.5.2.5 Prevention of the Spread of Invasive Species

Invasive species control measures during construction will also be the responsibility of contractors and will follow these mitigation measures:

- Before arriving on site, equipment will be cleaned of mud and debris, and disinfected following Alberta Environment and Parks' disinfection procedures found at: http://aep.alberta.ca/fish-wildlife/wildlife-diseases/whirling-disease/stop-the-spread.aspx
- Machinery on site will be in a clean condition and is maintained free of fluid leaks, invasive species, and noxious weeds.
- Site specific procedures to prevent the invasion or spread of undesirable non-native vegetation (e.g., purple loosestrife, Eurasian milfoil) will be developed.
- Disinfection stations will be established to clean equipment before it leaves the site.

A.5.2.6 Erosion and Sediment Control

Erosion and sediment control measures will also be the responsibility of maintenance contractors and will follow these mitigation measures:

- Effective erosion and sediment control measures such as silt fencing, silt fencing, fiber logs, and erosion control blankets will be installed before starting work to prevent sediment from entering the water body.
  - Sediment control measures will be placed around all disturbed work areas, disturbed slopes, and ecologically sensitive areas such as wetlands and watercourses.
  - Inspection and maintenance of erosion and sediment control measures and structures during construction will be conducted regularly.
  - If damaged erosion and sediment control measures and structures will be repaired
  - Non-biodegradable erosion and sediment control materials will be removed once site is stabilized.
- Temporary structures or other practices will be used to access watercourses with steep and/or highly erodible (e.g., dominated by organic materials and silts) banks and beds.
- Measures for managing water flowing onto the site will be implemented, as well as water being pumped or diverted from the site, such that sediment is filtered out prior to the water entering a waterbody.
- Measures for site isolation (e.g., silt boom, silt curtain) for containing suspended sediment (if work outside of the isolation is required) will be prepared, and implemented.

- Measures for containing and stabilizing waste material (e.g., dredging spoils, construction waste and materials, commercial logging waste, uprooted or cut aquatic plants, accumulated debris) above the high water mark of nearby watercourses and/or water bodies to prevent re-entry will be implemented.
- Subsurface drainage controls will be implemented, where appropriate, to maintain groundwater and surface water interactions and to maintain the stability of reclaimed land. The type and location of subsurface drainage controls will be determined through onsite investigation with considerations for: subsurface flow potential, erodibility of backfill materials, and degree of slope.
- Removal of natural woody debris, rocks, sand or other materials from the banks, the shoreline or the bed of the watercourse or water body below the high water mark will be reduced. If material is removed from the waterbody, it will be set aside and returned to its original location once activities have been completed.
- Fertilizer will not be applied in the immediate vicinity of a watercourse unless requested by the landowner and approved by DFO or AEP.
- Areas with surface (i.e., terrestrial) disturbance will be revegetated. If there is insufficient time remaining in the growing season, the site should be stabilized (e.g., cover exposed areas with erosion control blankets to keep the soil in place and prevent erosion) and vegetated the following spring.
- Site specific procedures to prevent the invasion or spread of undesirable non-native vegetation (e.g., purple loosestrife, Eurasian milfoil) will be developed.
- Approaches to the watercourse or water body will be designed and constructed so that they are perpendicular to the watercourse or water body to reduce loss or disturbance to riparian vegetation.
- Clearing of riparian vegetation will be kept to a minimum; existing trails, roads or cut lines will be used wherever possible to avoid disturbance to the riparian vegetation and prevent soil compaction. When practicable, prune or top the vegetation instead of grubbing/uprooting.
- Herbicides will not be used for clearing or maintenance of riparian vegetation unless approved by DFO or AEP.
- All necessary cofferdams, channels, flumes, drains, well points, wells, sumps, pumps, pipelines, and other temporary diversion and protection works will be maintained.
- All cold weather protective works including enclosures, insulation, and heating systems works will be maintained.
- At least one standby pump for each category of pump being used for care of water will be on site at all times.

- Standby power sufficient for operation of all required care of water equipment will be available on site at all times.
- Care of water pump and pipeline systems will be inspected at regular intervals not exceeding 12 hours and verify that the pumps are operating, there is sufficient fuel, and cold weather protection is adequate. If required, decrease the time interval between inspection check to correspond with the type and nature of weather and the work in progress, to the satisfaction of the Minister.
- Damage to any part of the work caused by water, snow, or ice due to failure of the care of water measures will be repaired immediately. Additional excavations and fill placement made necessary by water, snow, or ice will be installed.
- When no longer required, cofferdams, sumps, channels, drains, and other protective, dewatering, and temporary diversion works will be removed and finished to a leveled and neat condition.

A.5.2.7 Quality Control

The effectiveness of water management provisions will be monitored and evaluated using a turbidity monitoring program in any watercourses that have the potential to be effected by maintenance and/or repair activities. Turbidity management will be the responsibility of maintenance contractors and will follow these mitigation measures:

- A QAES will be retained to oversee all data collection, and provide the contractor with recommendations when required.
- If safe to do so, a water samples will be collected from the outlet channel at the confluence between the outlet channel and the Elbow River every other day during the discharge of the off-stream reservoir, and analyzed for:
  - total suspended sediment
  - major ions
  - total and dissolved metals
  - nutrients (including total phosphorus, dissolved phosphorus, nitrate, nitrite, and ammonia)
  - methylmercury
  - hydrocarbons (CCME F1-F4)
- In situ measurements of turbidity, conductivity, pH, temperature, and dissolved oxygen will be collected at the confluence of the low-level outlet channel with Elbow River, daily, during discharge operations.
- If safe to do so, vertical profiles of in situ measurements of turbiidty, conductiivity, pH, temperature, and dissolved oxygen will be taken at eight different locations within the reservoir on a daily basis during retention and discharge.

- Turbidity sampling will be taken using manual sampling techniques and turbidity sondes devices that can record turbidity at predefined intervals while unattended.
- Sampling transects in the Elbow River will be established by a QAES to assess the extent of sediment release within the aquatic environment:
  - upstream site (control) – at a location approximately 100 m upstream of the work area, upstream of project impacts. A minimum of three measurements will be taken across the channel.
  - downstream - transects will be located (at minimum) immediately downstream of the proposed activities (typically within 50 m depending on site hazards), 100 m, 300 m, and 500 m downstream of the proposed activities. A minimum of three sampling locations will be established across the channel along these transects. Additional transects may be required to determine the downstream extent of impacts should conditions dictate.
- Sampling transects in Unnamed Tributary will be established by a QAES to assess the extent of sediment release within the aquatic environment:
  - upstream site (control) – at a location approximately 50 m upstream of the work area, upstream of project impacts. A minimum of three measurements will be taken across the channel.
  - downstream - transects will be located (at minimum) immediately downstream of the proposed activities (typically within 50 m depending on site hazards), 100 m, 200 m, and 300 m downstream of the proposed activities. A minimum of three sampling locations will be established across the channel along these.
- Water samples and measurements will be taken at approximately half the water depth or 30% depth below surface.
- Sample Timing
  - Turbidity monitoring will occur during instream construction activity, including removal of all the isolation structures.
  - Manual turbidity measurements will be taken at the specified locations on a regular basis (hourly or every two hours, depending on activity) throughout the day while instream work is occurring.
  - Turbidity measurements collected using the turbidity sondes will measure turbidity every half hour.
- Water samples for analysis of total suspended solids (TSS) will be obtained if sedimentation is observed such that it is suspected to exceed established thresholds.

- A daily inspection log will be maintained throughout the contract. Data shall be submitted on a daily basis. Information required shall include but is not limited to:
  - Date
  - General construction activities and hours of work
  - Time work was suspended
  - Suspended sediment levels (mg/L) derived from the turbidity/TSS correlation, if applicable
  - Construction activities during sampling periods
  - General river conditions
  - Potential areas for mitigation
- Turbidity will be compared the Environmental Quality Guidelines for Alberta Surface Waters turbidity guideline (ESRD 2014), which is as follows:
  - for clear flow – maximum increase of 8 NTU from background levels for any short-term exposure (e.g., 24-h period). Maximum increase of 2 NTU from background levels for any long-term exposure (e.g., inputs lasting between 24-h and 30-d).
  - for high flow or turbid waters – maximum increase of 8 NTU from background levels at any one time when background levels are between 8 and 80 NTU. Levels should not increase more than 10% of background levels when background is greater than 80 NTU.
- The QAES and contractor will take the necessary measures to meet water quality objectives.
- All water quality monitoring data will be provided to the City of Calgary water services department.

A.6 REFERENCES

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