SPRINGBANK OFF-STREAM RESERVOIR PROJECT
Surface Water Monitoring Plan

Prepared for:
Alberta Transportation

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December 2021

Table of Contents

LIST OF TABLES

LIST OF FIGURES

Abbreviations

ACO	Aboriginal Consultation Office
AEP	Alberta Environment and Parks
BRBC	Bow River Basin Council
BSP	biologically significant period
CCME	Canadian Council of Ministers of the Environment
CEAA	*Canadian Environmental Assessment Act*
CRA	Commercial, Recreational, and Aboriginal
DFO	Fisheries and Oceans Canada
EIA	Environmental Impact Assessment
ERWP	Elbow River Watershed Partnership
FRL	fish research license
LAA	local assessment area
LWD	large woody debris
m^3/s	meters cubed per second
mg/L	milligram per liter
NTU	nephelometric turbidity units
PDA	Project development area
QAES	qualified aquatic environment specialist
RAA	regional assessment area
RAP	restricted activity period
SAR	species at risk

SOMC	species of management concern
SSRB	South Saskatchewan River Basin
SWQG	surface water quality guideline
the Project	Springbank Off-stream Reservoir Project
TLRU	traditional land and resource use
TSS	total suspended sediment or total suspended solids
TUS	Traditional Use Study
VC	valued component

Glossary

bankfull	the point where a river channel is full and stream flows are at the incipient point of flooding.
bedload	the river sediments that are subject to movement from stream flows that are transport along the stream bed. Bedload moves by rolling, sliding and/or saltating near the bed the stream.
dry operations	Phase of the Springbank Project when the off-stream reservoir is empty of retained water.
geomorphology	the science of geological structures and related physical features; the geomorphology of rivers includes the science of river sediments and how they interact with stream flow.
loadform	spreadsheet formatted to be accepted into an electronic database.
methylmercury	Organic form of mercury that forms from bacterial transformation of elemental mercury bioaccumulates in aquatic organisms.
navigable water	streams and rivers that have adequate water depths and conditions for navigating a boat or water craft.
post-flood operations	Phase of the Springbank Project when the diversion inlet gates are closed, and the gates of the outlet structure are opened to allow the floodwater retained in the reservoir to drain through the outlet structure into the unnamed creek and then into Elbow River.
suspended sediment	sediment particles that can remain suspended in flowing water.

total Kjeldahl nitrogen	the sum nitrogen concentration in a water sample analyzed for organic nitrogen, ammonia and ammonium using a method developed by Johan Kjeldahl.
yield	A quantitative measure for an amount of substance (e.g., sediment) moving past a point in the river for a specified period of time.

1.0 INTRODUCTION

This document is the Surface Water Mitigation and Monitoring Plan (the Plan) for construction and operation of the Springbank Off-stream Reservoir Project (the Project). The Plan is based on the EIA conclusions, mitigation measures, and authorization conditions. A stand-alone plan for monitoring of fish health and fish rescue during flood operations has been developed. The SWMP is current as of December 2021, and is subject to change.

This Plan integrates monitoring elements of hydrology and surface water quality into a single program. Monitoring locations have been selected based on known regulatory requirements and operational needs.

1.1 GOALS AND OBJECTIVES

The objective of the Plan is to collect data needed to operate the Project (e.g., flood flow diversion), adaptively manage activities (e.g., reservoir drawdowns and water release), and maintain compliance with regulatory requirements (e.g., meet approval conditions). The hydrology and surface water quality monitoring components have overlapping but sometimes separate objectives as summarized below.

The objective of the hydrology component is to collect stream flow and water surface elevation data in Elbow River, the off-stream reservoir and low-level outlet to manage:

- the diversion of flood flows from Elbow River (e.g., collect information to know when to initiate opening and closing the service spillway gates and the diversion inlet)
- filling the off-stream reservoir
- draining the off-stream reservoir and the release of water to Elbow River

The objective of the water quality component is to determine whether the water in the off-stream reservoir will, upon release, affect Elbow River water quality in a manner that:

- meets or exceeds an implemented water quality objective or watershed management target for the Elbow River (see Section 7.4.4 for current relevant water quality objectives)
- meets or exceeds applicable water quality guideline for the protection of aquatic life (see Section 7.4.4 for current relevant water quality guidelines)
- changes the trophic status of Elbow River
- monitor changes in channel morphology of the Elbow River and outlet channel

Two types of monitoring are outlined in this Plan: construction monitoring and operational monitoring, as defined below.

Construction Monitoring

Construction monitoring is conducted when any instream construction activities are taking place. It also includes activities along the banks of Elbow River that may generate runoff and sediment through surface disturbance that may deliver to the river and potentially result in suspended sediments in the aquatic environment. Construction monitoring provides feedback on the effectiveness of proper construction practices and relevant environmental mitigations to maintain compliance with applicable sediment guidelines and approval conditions pertaining to construction (see Section 7.1.2.2 for details).

Operational Monitoring

Operational monitoring will occur in after Construction is complete, and considers elements that are outlined in regulatory criteria (e.g., water quality) or predictions in the EIA and provides feedback to manage the Project within set criteria (e.g., when Elbow River flows are high enough to initiate flow diversion or low enough to initiate slow release of water from the off-stream reservoir). Operational monitoring is characterized for Project dry operations (i.e., when Project infrastructure is not in use), flood operations (i.e., when Project infrastructure is used to divert water from the Elbow River), and post-flood operations (i.e., when water is released from the reservoir to the Elbow River).

Safety

Monitoring data will be collected according to this Plan only when safe to do so. Modifications to planned surface water monitoring locations, sampling frequency, and parameters may be required to account for safety considerations.

2.0 REGULATIONS, APPROVALS AND GUIDELINES

Alberta Transportation has prepared the Plan to meet IAAC and NRCB approval conditions and current regulatory guidance and guidelines for surface water monitoring. The approval conditions as defined by IAAC and NRCB are provided in Table 2.1. has been prepared to meet NRCB approval condition 10 as described in approval NR 2021-01. Commitments made by Alberta Transportation related to surface water monitoring throughout the regulatory approvals process have been considered.

Table 2.1 Hydrology and Surface Water Quality Monitoring Conditions for Construction and Operations

Project Phase	Reference	Approval Conditions
Construction	IAAC Condition 3.19	3.19 The Proponent shall develop and implement, in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to water quality. As part of the follow-up program, the Proponent shall: 3.19.1 monitor, at a minimum daily during construction and monthly during operation, total suspended sediment levels at a minimum three locations in the Elbow River, one location in the immediate receiving environment, one location downstream of the low level outlet, and one location at the outlet channel;
Flood Operations	IAAC Condition 3.19	3.19 The Proponent shall develop and implement, in consultation with Indigenous groups, Fisheries and Oceans Canada, Environment and Climate Change Canada and other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to water quality. As part of the follow-up program, the Proponent shall: 3.19.1 monitor, at a minimum daily during construction and monthly during operation, total suspended sediment levels at a minimum three locations in the Elbow River, one location in the immediate receiving environment, one location downstream of the low-level outlet, and one location at the outlet channel; 3.19.2 if the results of the monitoring conducted in accordance with condition 3.19.1 demonstrate higher levels of total suspended sediment than the baseline levels identified in the Response to the IAAC Information Request Technical Review Round 2 Package 4 - 01 to 04, IR4-01 (Canadian Impact Assessment Registry Reference Number 80123, Document Number 1311) during flood operation, determine if additional mitigation measures are required;

Table 2.1 Hydrology and Surface Water Quality Monitoring Conditions for Construction and Operations

Project Phase	Reference	Approval Conditions
Flood Operations	IAAC Condition 3.19	3.19.3 monitor, at a minimum daily during post-flood operation and taking into account Alberta Transportation's Turbidity and monitoring specifications, turbidity levels at sites located upstream and downstream of the outlet channel and report to relevant provincial authorities any exceedance to the Canadian Council of Ministers of the Environment's Guidelines for the Protection of Freshwater Aquatic Life;
Flood Operations	IAAC Condition 3.19	13.9.4 monitor, at a minimum weekly during flood-operation and at a minimum daily during post-flood operation, temperature and dissolved oxygen in the reservoir, except when not feasible for safety reasons, at the outlet channel, and in the Elbow River upstream, in the immediate receiving environment and downstream;
Flood Operations	IAAC Condition 3.19	3.19.5 if results of the monitoring conducted in accordance with condition 3.19.4 demonstrate warmer temperature or lower levels of dissolved oxygen from modelling predictions identified in Appendix 1-1 submitted in the Response to Information Request Round 2 Package 4 -01 to -04 (Canadian Impact Assessment Registry Reference Number 80123, Document Number 1311), implement modified or additional mitigation measures; and
Flood Operations	IAAC Condition 3.19	3.19.6 monitor surface water quality at the low-level outlet channel prior to any discharge from the reservoir. If the results of the monitoring demonstrate exceedance of parameters identified in Appendix K, Table 2-4 of the Environmental Impact Statement, for water quality of the Elbow River downstream of the outlet channel, the Proponent shall develop and implement modified or additional mitigation measures prior to any subsequent flood operation.
Flood Operations	IAAC Condition 3.20	3.20 The Proponent shall develop and implement, in consultation with Indigenous groups, Fisheries and Oceans Canada and other relevant authorities, a follow-up program to verify the accuracy of the environmental assessment and the effectiveness of the mitigation measures as it pertains to channel morphology. As part of the follow-up program, the Proponent shall monitor channel morphology of the Elbow River and outlet channel during post-flood operation.

Table 2.1 Hydrology and Surface Water Quality Monitoring Conditions for Construction and Operations

Project Phase	Reference	Approval Conditions
Construction and Operations	NRCB Decision	10. The Operator shall, subject to privacy protection requirements, make Project monitoring results for: • Aquatic ecology • Hydrology and sediment transport • Surface water quality • Groundwater quality and quantity • Vegetation • Terrain and soils • Wildlife and biodiversity • Air quality easily accessible to the public, subject to the satisfaction of Alberta Environment and Parks.
NOTE: Approval conditions listed are provided in the NRCB Board Decision (June 22, 2021) and SR1 Decision Statement issued under Section 54 of the *Canadian Environmental Assessment Act, 2012* (July 8, 2021)		

3.0 RESPONSIBILITIES AND REPORTING REQUIREMENTS

Alberta Transportation will be responsible for the implementation of the Plan during the construction phase and for a period of three years post-construction during the dry operations phase of the Project. After that, AEP will implement the Plan during both flood and dry-operations phases of the Project.

In compliance with IAAC approval condition 2.11, Alberta Transportation and AEP will prepare an annual report summarizing the monitoring results, which will be provided to IAAC and the First Nation Land Use Committee by October 31 of the reporting year to which the annual report applies. IAAC has defined the reporting year as July 1 of the calendar year to June 30 of the subsequent calendar year. (IAAC definition 1.32). The annual report, including a plain language executive summary in both official languages, will be made available to Indigenous groups and public stakeholders no later than October 31 following the reporting year to which the annual report applies (IAAC approval condition 2.13). Indigenous groups, the First Nation Land Use Advisory Committee and the Agency will be notified of the annual reports within 48 hours of their publication (IAAC approval condition 2.14). The annual reports will be available for 15 years following their publication (IAAC approval condition 2.14).

4.0 INDIGENOUS AND PUBLIC STAKEHOLDER

Since completion of the EIA, additional feedback on hydrology and surface water was received from Indigenous groups, stakeholders and the public, and through supplemental regulatory information requests and the Project hearing. All input provided to Alberta Transportation related to hydrology and surface water quality was reviewed and responses were provided back to the Indigenous groups. The input was considered in the development of the Plan.

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

5.0 PROJECT DESCRIPTION

The Project consists of the construction and operation of an off-stream reservoir to divert and retain a portion of Elbow River flows during a flood (Figure 5.1). The diverted water will be released back to Elbow River in a controlled manner after the flows in Elbow River decrease sufficiently to accommodate the release of water from the reservoir. The reservoir will not hold a permanent pool of water.

5.1 PROJECT COMPONENTS

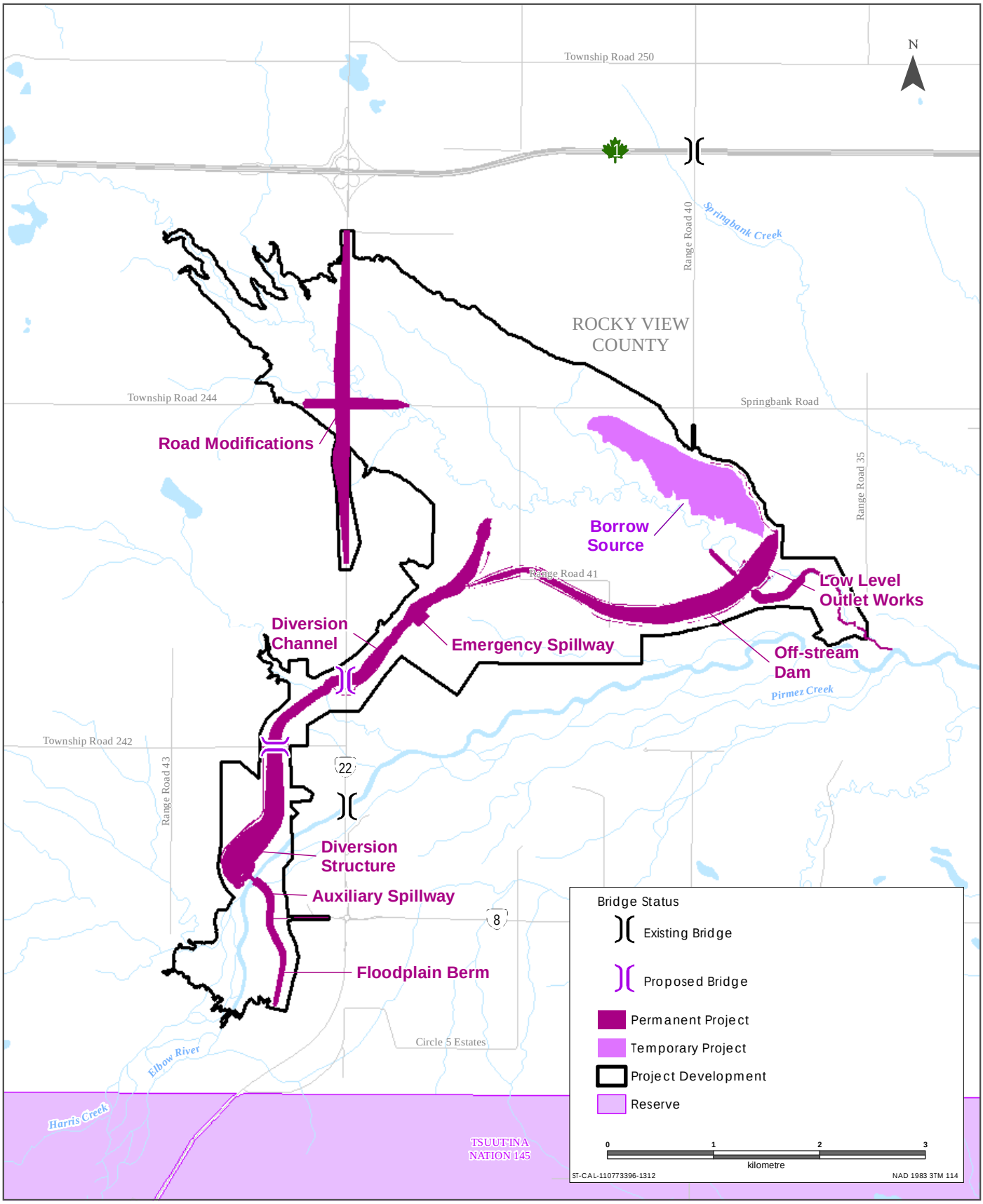
The primary Project components include:

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

These primary components are described further in the following sections and shown in Figure 5.1.

The primary Project components will be constructed and operated under four distinct phases. The surface water monitoring plan will begin during the construction phase and continue into operational phases. Specific types of monitoring will overlap each operational phase (e.g., Elbow River flow monitoring will occur during all operational phases). The four phases are as follows:

- Construction of primary Project components and facilities related to structures and activities in the aquatic environment.
- Dry operations refers to routine operations when Elbow River flows are less than flood stage and there is no water in the off-stream reservoir.
- Flood operations refers to operations when Elbow River flows are greater than 160 m^3/s and water is being partially diverted from the river into the off-stream reservoir.
- Post-flood conditions refers to operations the release of water from the off-stream reservoir and maintenance activities in the PDA to prepare the infrastructure for the next flood that would activate the reservoir.



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

5.1.1 Diversion System

The diversion system consists of five main elements (Figure 5.1):

- The debris deflector consists of vertical metal tubing on a concrete foundation to reduce the risk of infrastructure damage and operating failure of Project components, including diversion inlet, diversion channel, off-stream reservoir and dam.
- The floodplain berm is located on the south floodplain of Elbow River. In concert with the auxiliary spillway, it acts to constrain flow in the river and direct it to the diversion structure.
- The diversion inlet is a gated concrete structure that controls the diversion of river water into the diversion channel during flood events. It is located at the entrance to the diversion channel on the north bank of the river.
- The service spillway is a gated concrete structure located in the river channel adjacent to the diversion inlet.
- The auxiliary spillway is dam safety component that is reserved to convey excess flood flow without overtopping failure of the dam or circumvention of the floodplain berm. The auxiliary spillway spans the 214 m between the floodplain berm and the service spillway.

5.1.2 Diversion Channel

The diversion channel carries floodwater from the diversion inlet into the off-stream reservoir. The channel is 4,700 m long with a bottom width of 22 m, 4H:1V side slopes and a slope that varies from 0.1% to 0.2%. At the design maximum flow in the diversion channel 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 upper 700 m of the channel gradually flares out to a width of 150 m for delivery of water into the reservoir and is protected from head cut by riprap and a grade control structure where it enters the reservoir.

5.1.3 Emergency Spillway

The emergency spillway is a concrete structure approximately 135 m long that permits unregulated overflow, first to a graded channel and second, overland to Elbow River. The spillway has a crest at the reservoir full service elevation of 1,210.75 m asl and a discharge capacity (flow rate) 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 before the off-stream reservoir, and it is designed to operate during a probable maximum flood when:

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

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

5.1.4 Off-Stream Reservoir and Dam

The off-stream reservoir uses existing topography to provide a basin within which diverted floodwater can be stored. The Project has been designed to accommodate the 2013 flood, which had an estimated peak flow of 1,240 m^3/s and a 7-day volume of 149,600,000 m^3. Residence time and release rates will vary depending on conditions downstream after the flood conditions in the river are past.

The off-stream dam is a clay-cored earth embankment that would temporarily impound diverted floodwaters. The dam would be constructed of material excavated from the diversion channel, supplemented if necessary, by borrow source material.

5.1.5 Outlet Structure and Low-Level Outlet

The low-level outlet structure is a gated concrete structure near the east end of the dam embankment that controls release of retained water into the existing unnamed creek and back into Elbow River. Water released through the low-level outlet will follow a constructed channel which will convey flows back to the unnamed creek. There will also be measures to further mitigate sediment mobilization in the unnamed creek and reduce sediment input into Elbow River. The measures include vegetated riprap check structures within the creek and extending into the floodplain and some localized berming.

5.2 PROJECT PHASES

5.2.1 Construction

The Project is scheduled to be functionally operational (able to accommodate a 1:100-year flood event) after two years of construction and be completely constructed (able to accommodate the design flood) after three years of construction. Project construction may be continuous (24 hours per day), weather conditions permitting.

5.2.2 Dry Operations

Dry operations refers to post-construction and Project operation between floods. During dry operation, the diversion inlet gates will be closed, and the service spillway gates will remain open. The outlet structure will remain open to allow the flow of the unnamed creek to continue downstream to the Elbow River. The outlet gate system and its operation will be checked according to a routine maintenance schedule to be developed by AEP.

5.2.3 Flood Operations

AEP Operations will be in communication with the AEP River Engineering and Technical Services group and the City of Calgary Glenmore Dam operators in advance of and during the flood season each year. The need for flood operations will be determined through this communication, which The need for Flood Operations will be informed by forecasts, and measured flows and modelled hydrographs on the Elbow River at the diversion structure and upstream. AEP Operations staff, in communication with the City of Calgary Glenmore dam operators, will decide on when to open the diversion gates to commence partial diversion of flood water flows in excess of 160 m^3 to the off-stream reservoir. SR1 is deemed to be in flood operations when the diversion inlet gates are opened, and water is diverting from the river into the reservoir. AEP operations will remain in constant contact with City of Calgary Glenmore dam operators prior to and during flood operations.

5.2.4 Post-Flood Operations

During post-flood operations, the diversion inlet gates are closed, and the service spillway gates are open (lowered to the river bed). The gates of the outlet structure will be opened to allow the floodwater retained in the reservoir to drain through the outlet structure into the unnamed creek and then into Elbow River. The outlet structure gates at the base of the reservoir will remain open after the reservoir has drained. Following draining, the reservoir area and Project infrastructure will be inspected and maintenance conducted as the Project moves back into the dry operation phase.

6.0 MITIGATION

Environmental protection and measures to mitigate effects on hydrology and surface water quality from construction and operation of the Project have been developed based on best management practices described in the Fish Habitat Manual (Alberta Transportation 2001), the Code of Practice for Watercourse Crossings (ESRD 2019), and DFO's Measures to Avoid Causing Harm to Fish and Fish Habitat (DFO 2021). Construction contractors will also implement relevant mitigations through Alberta Transportation's Environmental Construction Operations (ECO) Plan process. The mitigation measures are presented in terms of Project-related activities (i.e., phases) and are relevant to each of hydrology and water quality (Table 6.1). Project approvals included an expectation of guideline exceedances with regards to TSS. Releases from the reservoir are planned to exceed water quality guidelines regarding TSS no mitigations are required. During operations the monitoring program will be implemented to see if exceedances are within the range modelled during the EIA.

Table 6.1 Surface Water Mitigation Measures

Mitigation	Project Mitigation Details	Project Phase
Construction Timing	• Works in water and instream activities will be timed with respect to the restricted activity periods (RAPs) wherever possible. For Elbow River, the RAP is May 01 – July 15 and September 16 – April 15. • Condition and use of restricted activity periods will be provided within further project permitting and authorization under the Fisheries Act.	Construction
Instream Construction	• All applicable regulatory notifications, permits, and authorizations including *Water Act* and the federal *Fisheries Act* and *Canadian Navigable Waters Act*, will be obtained before the start of any instream construction. • Information collected during instream construction monitoring and site inspection observations will be used to adaptively manage construction and site activities. Appropriate mitigations and response actions will be used to control site conditions to manage environmental compliance issues such as erosion and sediment runoff.	Construction
Erosion and Sediment Control	Silt fences and turbidity barriers will be used to control TSS and to ensure the water quality from care of water system discharges is made equal to or better than the initial water quality by carrying out frequent water quality testing. Erosion and sediment control measures will be submitted to IAAC before implementing them. A site-specific Erosion and Sediment Control Plan will be developed by the selected construction contractor as part of the project-specific ECO Plan and implemented during the various phases of construction and should include site-specific mitigation measures to suit the site and finalized design and construction plans. The plan would include, but not be limited to, the following practices where applicable: • Surface water around stockpiles will be managed to avoid erosion and sediment introduction to watercourses. Silt fences will be used to contain soil erosion. • Stockpiles of excavated material will be stored more than 50 m from the top of the bank of the Elbow River and in such a way as they do not enter the watercourse. • Instream work areas will be isolated from the main river flow by using cofferdams, silt fences and turbidity barriers. Turbidity will be monitored and measured in conformance with Alberta Transportation's (2021; to be updated as new guidance becomes available) specifications. • Silt fences and turbidity barriers will be used to avoid sediment releases to watercourses, and riprap materials will be used to prevent future bank erosion. • Erosion and sediment control measures will be installed before starting work to prevent sediment from entering the water body.	Construction, Dry Operations (maintenance and cleaning)

Table 6.1 Surface Water Mitigation Measures

Mitigation	Project Mitigation Details	Project Phase
Erosion and Sediment Control (cont'd)	• Erosion and sediment control measures will be regularly inspected and maintained during construction. • Erosion and sediment control measures will be repaired immediately if damage occurs. • Non-biodegradable erosion and sediment control materials will be removed once the site is stabilized. • Sediment and erosion control devices will be constructed to withstand anticipated flows during construction. If necessary, the outside face of granular berms may be lined with heavy poly-plastic to make them impermeable to water. • Riprap material will be installed along the diversion channel bottom and side slopes where the channel is excavated through soil, near the low-level outlet and where the approach channel meets the intake structure to reduce the risk of erosion. • Energy dissipation measures to control flows and erosion in the diversion will be implemented. • Isolation materials will be designed to reduce disturbance of the bed and banks of Elbow River and other watercourses. • Measures to allow sediment to settle out before returning dewatering discharge into the Elbow River will be implemented, including by removing downstream barriers first when removing isolation barriers during construction and post-flood operation • Clearing of riparian vegetation will be kept to a minimum. Bank and riparian areas disturbed during construction will be reclaimed and re-vegetated. • Weeds will be controlled during construction through multiple measures, such as herbicide, mowing, wicking, and hand picking. Herbicide will not be applied within 30 m of plant species or ecological communities of management concern, wetland or waterbody. Spot spraying, wicking, mowing, or hand picking are acceptable measures for control of regulated weeds in these areas. • After construction, disturbed areas will be stabilized and reclaimed. • Erosion and sediment control measures will be monitored until vegetation has become sufficiently reestablished.	Construction, Dry Operations (maintenance and cleaning)

Table 6.1 Surface Water Mitigation Measures

Mitigation	Project Mitigation Details	Project Phase
Water Management during Construction	• Flows in Elbow River will be maintained downstream of the Project (e.g., bypass channel). • Measures for managing water flowing onto the site, as well as water being pumped/diverted from the site will be implemented such that sediment is filtered out before the water enters a waterbody (e.g., silt fences, turbidity barriers, pumping/diverting water to a vegetated area, constructing a settling basin, or other filtration system). • Sediment laden dewatering discharge will be pumped into a vegetated area or settling basin to allow sediment to settle out before returning it to the water body. Silt fences, turbidity barriers and clean granular berms will be used to contain the sediment and other deleterious substances and to prevent it from entering a watercourse or water body. • Energy dissipaters will be used at pump outlets to prevent erosion.	Construction
Reclamation	• The top substrate from a wetted channel will be stripped and stockpiled for later use as the top layer of reclaimed instream substrate to improve the recolonization rate of sediment flora and fauna (e.g., seed-bank and invertebrate cysts) and maintain average mobile substrate sizes. • Rootwads and large boulders that have to been removed will be stored on-site for subsequent placement on reclaimed instream cover or for bank protection. • Fertilization of reclaimed areas in the immediate vicinity of a watercourse will not be allowed unless approved by DFO and AEP. • Streambanks and approach slopes will be revegetated using an appropriate native seed mix or erosion control mix.	Construction
Managing Contaminants	Potential contaminant-related effects will be mitigated through Project design (e.g., road water runoff management), implementing a spill containment and response plan, using appropriate sediment and erosion control measures, limiting the use of and following best management practices for herbicides and fertilizers in the dry reservoir or near waterbodies, and using nontoxic biodegradable hydraulic fluids in equipment for any required instream works. Activities near water will be planned and completed in the dry and isolated from watercourses to prevent materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, other chemicals or other deleterious materials from entering the watercourse.	All Phases

Table 6.1 Surface Water Mitigation Measures

Mitigation	Project Mitigation Details	Project Phase
Managing Contaminants (cont'd)	Structures will be designed so that storm water runoff and wash water from the access roads, decks, side slopes, and approaches will be directed into a retention pond or vegetated area to remove suspended solids, dissipate velocity, and prevent sediment and other deleterious substances from entering the watercourse. Other substances will be controlled on the construction site through: • Transport of hazardous materials to and from the Project site, storage, use and disposal will be in accordance with regulatory requirements. • Construction equipment will be mechanically sound with no oil leaks, fuel or fluid leaks. Equipment will be inspected daily, and any leaks will be immediately repaired. • Persons qualified to handle construction equipment fuels and lubricants will perform repairs. • Service vehicles will carry fuel spill clean-up materials. • Containment berms and impermeable liners will be used around fuel and lubricant storage tanks. • A minimum 100 m setback will be maintained between stored fuels and lubricants and rivers, streams and surface water bodies. • Building material used in watercourses, including concrete, will be handled and treated in a manner that prevents the release or leaching of substances that may be deleterious to fish into the water. • Activities near water will be planned and completed in the dry and isolated from watercourses to prevent materials such as paint, primers, blasting abrasives, rust solvents, degreasers, grout, other chemicals or other deleterious materials do not enter the watercourse.	All Phases
Herbicide Management	Herbicides would be applied according to Environmental Code of Practice for Pesticides (GoA 2010) and: • restrict herbicide mixing and loading within 30 m of an open body of water. • identify open bodies of water within the application sites. • mark or flag of open bodies of water that will not be clearly visible to the applicator. The Code of Practice specifies minimum distances that need to be maintained from open bodies of water, depending on the type of herbicide used.	Construction, Dry Operations

Table 6.1 Surface Water Mitigation Measures

Mitigation	Project Mitigation Details	Project Phase
Debris Management	• Debris will be removed from the structure and gates prior to spring freshet annually in May or June, to ensure the structure is operating properly when river flow increases and the likelihood of flooding is highest. • Where debris removal on the structure is required, debris removal will be timed to avoid disruption to sensitive fish life stages (i.e., outside the RAP), unless the debris and sediment accumulation interferes with the flow of water into and out of the reservoir (for future floods) or is a risk to the integrity of the structure or relates to an emergency (i.e., risk of structure failure). • Large woody debris taken from the structure and gates will be removed from the beds and shores of Elbow River.	Dry Operations (maintenance and cleaning)
Outflow Control	• Drainage areas within the off-stream reservoir will be graded, if required, to provide positive drainage during release of water from the reservoir	Post-Flood

7.0 MONITORING

This section provides an overview of monitoring activities as they pertain to each phase of the Project and will inform how the project adaptively manages and operates during the following phases:

- Construction
- Operational Monitoring – dry operations
- Operational Monitoring – flood operations
- Operational Monitoring – post-flood

7.1 CONSTRUCTION MONITORING

Alberta Transportation has an environmental management system (EMS) that will be applied to the Project. The EMS identifies environmental monitoring as an important component of Project activity and requires an environmental protection plan to be developed by the selected construction contractor using Alberta Transportation's ECO Plan framework.

The ECO Plan is a project-specific plan that identifies and mitigates the potential environmental effects of construction, which will include relevant mitigation measures detailed in the EIA and listed in Table 6.1, and Alberta Transportation's *Civil Works Master Specifications for Construction of Provincial Water Management Projects*. The selected construction contractor will be responsible for preparing the ECO Plan specific to the work and the Project site. Alberta Transportation and the contractor will review the ECO Plan before construction begins. The selected construction contractor will ensure the effective implementation of the ECO Plan, including the relevant mitigation measures listed Section 6.0.

At the beginning of construction, monitoring crews will meet with the Alberta Transportation site representative and the construction supervisor. Monitoring and inspection expectations will be agreed upon including:

- site safety and check in requirements
- chain of communication
- review this Plan and relevant regulatory approvals (e.g., the Alberta *Water Act* approval and the *Fisheries Act* authorization)
- monitoring frequency
- contingency planning and mitigation implementation
- reporting criteria (i.e., in the event of a water monitoring exceedance or visual plume is observed, who is responsible for reporting to the regulator)

7.1.1 Discharge and Water Level

Elbow River flow information is currently being monitored at two Water Survey of Canada (WSC) hydrometric stations; Elbow River at Bragg Creek (Station ID 05BJ004) and Elbow River at Sarcee Bridge (Station ID 05BJ010).

In addition to the WSC stations, water level (i.e., river stage) will be monitored in the Elbow River at the Highway 22 bridge, upstream of the spillway. This will require the installation of a pressure transducer with telemetry at the bridge. For discharge and water level monitoring locations during Project construction, refer to Figure 7.1. This station should be installed prior to construction taking place, given the lateral mobility of the channel at this location station will need to be monitored and maintained accordingly.

7.1.2 Turbidity and Suspended Sediment

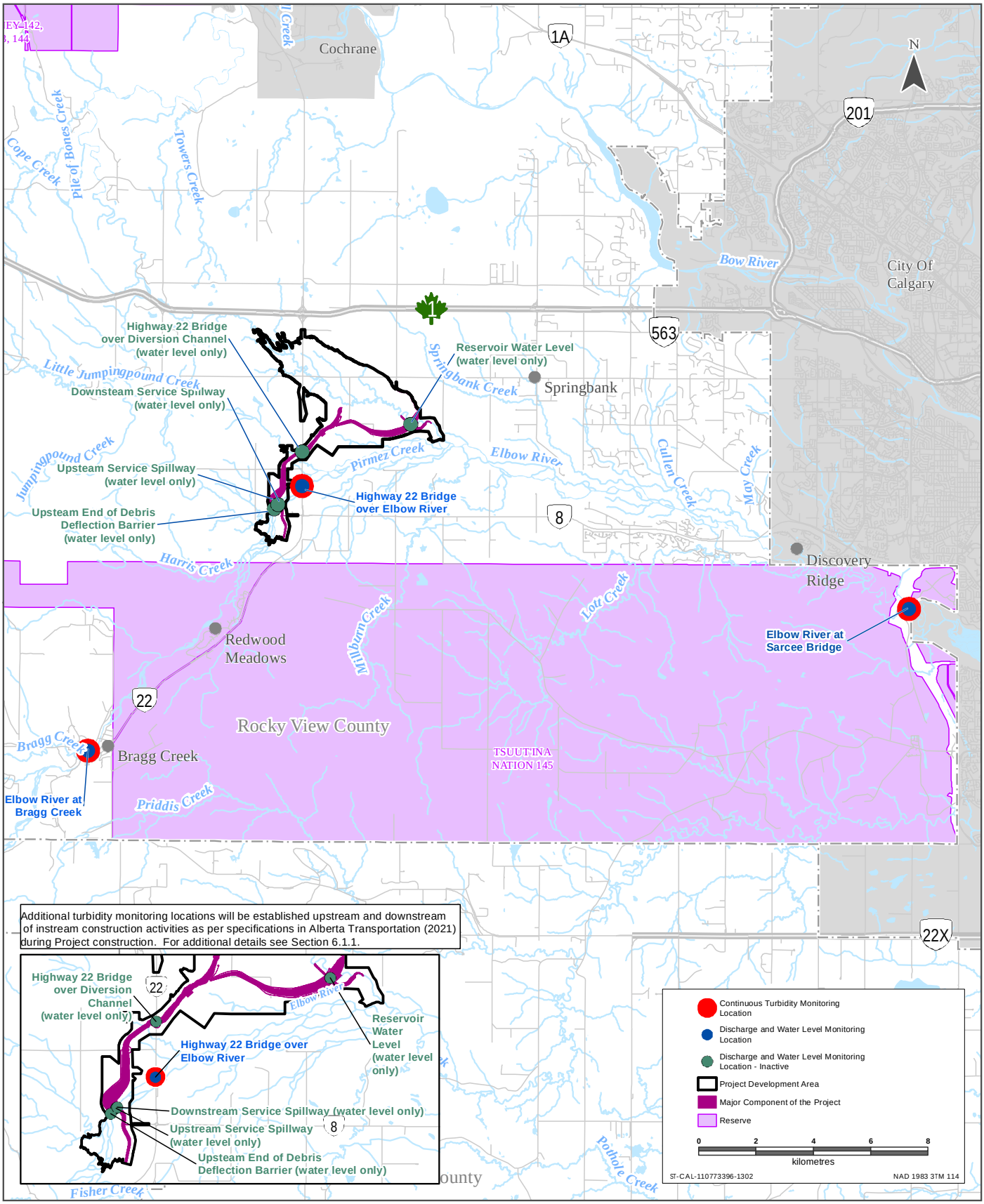
Turbidity measurements are an optical measurement of the colour or clarity of water, either due to dissolved compounds (typically particles less than two microns in diameter) or suspended sediment. the total suspended sediment (TSS) is a measurement of mass, a field sample is taken in the field and the water is then filtered and weighed in a laboratory.

Turbidity in the Elbow River will be monitored both continuously throughout Project construction as well as at discrete locations upstream and downstream of any instream construction activity within the construction footprint. Point sampling of TSS will be taken during a range of turbidity conditions to help establish a relationship between turbidity and TSS at each station.

7.1.2.1 Continuous Turbidity Monitoring

Turbidity monitoring sondes will be installed at both of the WSC flow monitoring stations (i.e., at Bragg Creek [05BJ004] and Sarcee Bridge [05BJ010]). The turbidity sondes will be used to continuously monitor turbidity at the Elbow River at Highway 22 bridge, which is downstream of the service spillway. The sondes will be set to monitor turbidity at 1-hour intervals. Turbidity monitoring equipment should be installed at these three locations to provide a long-term data set of turbidity information during open water periods. Turbidity sondes will be maintained at an interval recommended by the equipment manufacturer.

A turbidity-TSS relationship curve will be established for the Elbow River monitoring locations to determine the site-specific relationship between turbidity levels and TSS concentrations. Data required to develop this relationship will be developed prior to construction. The turbidity curve will be developed in accordance with Alberta Transportation's "Conversion Relationship Between Nephelometric Turbidity Units (NTU) into mg/L for Alberta Transportations' Turbidity Specification" (Alberta Transportation, [No Date]). The steps to establish the turbidity curve require site samples being sent to a certified lab for TSS analysis. For continuous turbidity monitoring locations during Project construction, refer to Figure 7.1.



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

Construction and Dry Operations Surface Water Monitoring Locations

Stantec

ALBERTA TRANSPORTATION SPRINGBANK OFF-STREAM RESERVOIR PROJECT ENVIRONMENTAL IMPACT ASSESSMENT

Figure 7.1

7.1.2.2 Turbidity Monitoring Upstream and Downstream of Instream Construction Activity

The following subsections include monitoring criteria and instructions from Alberta Transportation's (2017) "Special Provision – Turbidity" and from the Government of Alberta's (2005) "A Guide to Release Reporting."

All contractors, construction personal and others working in and around water must comply with regulatory standards that prevent sediment from entering a waterbody. Alberta Transportation guidance ([No Date], 2011, 2021) outlines how suspended sediment and turbidity should be monitored and mitigated during construction. Should Alberta Transportation issue updated guidance for turbidity monitoring, such guidance shall be followed.

The objective of monitoring TSS and turbidity during construction activities is to determine if sediment mitigation measures and erosion and sediment controls are effective. The monitoring results will be used to inform and adaptively manage construction activities to minimize construction related suspended sediments in Elbow River. This monitoring Plan will be modified as needed in the field to compliment the construction activities as they are developing; however, the main outline for the Plan is as follows.

Sampling Points – Transects

The sampling design must consider site specific waterbody characteristics including stream size and width, water depth, water velocity and flow (i.e., laminar flow vs turbulent flow).

Monitoring transects will be established where background and downstream water samples will be collected in a manner that captures changes in suspended sediment concentrations near the construction site. Based on Alberta Transportation (2021) transects will be placed as follows (assuming that the Elbow River is >10 m and <= 50 m in wetted width; for other river widths see Alberta Transportation 2021):

- Background transect: upstream of work area
- Transect 1: 30 m downstream from work area
- Transect 2: 60 m downstream from work area
- Transect 3: 90 m downstream from work area

Sampling points will be 25%, 50% and 75% of wetted width at each transect.

Where a visual plume is observed, a sample must be taken from the middle of the plume and as close to the source as safely possible.

Water samples will be at 50% water depth where water is less than 1 m deep. Where watercourses are greater than 1 m deep, samples will be taken at 20% and 80% of water depth at each transect sample point and results averaged.

Sampling Frequency

Sampling shall occur from 30 minutes prior to daily construction activities until 30 minutes after construction activities have been completed (Alberta Transportation 2021).

During periods of instream construction activity and any accidental occurrences, the minimum sampling frequency will be once every hour at all transects (Alberta Transportation 2021). If an exceedance or plume is observed, sampling shall be done within the plume until TSS levels have returned to acceptable background levels for two consecutive sampling events. During accidental occurrences, sampling will not proceed until it is safe to do so.

When construction activities are within isolated conditions (i.e., a section of stream channel has been isolated with a cofferdam or equivalent), samples will be collected at all transects at three-hour intervals during construction hours. If sample results have not exceeded 5 mg/L above background levels for five consecutive active construction days the sample frequency may be reduced, or halted altogether, as directed by the consultant.

Suspended Sediments – Turbidity Relationship

Suspended sediment concentration (or total suspended solids) are measured in the field indirectly by measuring Nephelometric Turbidity Units (NTU) as a surrogate for TSS. Rather than collecting samples for TSS analysis, samples are collected for measuring NTUs using a turbidity meter in the field. The relationship between turbidity and suspended sediments will be established prior to monitoring by the Contractor; this relationship will be used to infer suspended sediment concentrations from turbidity results. Additional sampling will be conducted in the laboratory using Elbow River water and sediment samples to progressively increase TSS, thereby ensuring a more robust rating curve can be developed over a wide range of TSS concentrations. This laboratory established rating relationship will be compared with data based on field-based samples. Additional details regarding the development of the site-specific relationship between TSS and NTU, please refer to Alberta Transportation's "Conversion Relationship Between Nephelometric Turbidity Units (NTU) into mg/L for Alberta Transportations' Turbidity Specification" (Alberta Transportation, [No Date]).

Compliance Criteria

Compliance criteria for construction TSS monitoring are outlined as follows in Table 7.1 (Alberta Transportation 2021; GoA 2018; CCME 2021):

Table 7.1 Maximum Allowable Increase of Suspended Sediment

Site Conditions (Background TSS)	Exceedance Levels (TSS in Excess of Normal Background Levels)
TSS < 25 mg/L	• A maximum instantaneous increase of 25 mg/L over background levels at any time. • An average increase of >5 mg/L over background levels for greater than 24 hours.
TSS 25 mg/L – 250 mg/L	• A maximum instantaneous increase of 25 mg/L from background levels at any time.
TSS > 250 mg/L	• Maximum instantaneous increases of 10% of background levels at any time.

The arithmetic mean TSS concentration (mg/L) will be calculated for each background sampling event. The arithmetic mean TSS concentration will be calculated for each monitoring transect and compared with the mean background TSS concentration. If the results for any monitoring transect exceed the limits in Table 7.1, the construction activities are not in compliance.

Record Keeping

Daily turbidity compliance monitoring records will be kept and maintained during construction and will be available on site.

7.1.3 Geomorphology

Pre-construction geomorphic information will be collected for both the Elbow River and unnamed creek. For the Elbow River, there are four main reaches of interest:

1. upstream of potential backwater effects related to the Project
2. within the backwater area of the Project, upstream of the flood gates
3. downstream of the flood gates, but upstream of the confluence with the low level outlet channel
4. downstream of low-level outlet channel

The length of reach monitored in the Elbow River will depend on the methodology taken to conduct the geomorphic assessment, but should be greater than 20 times bankfull width. For unnamed creek, the lower 200 m of the channel upstream of its confluence with the Elbow River would be surveyed.

It is recommended that annual drone photogrammetry surveys be completed during low flows in the late summer or early fall. These annual surveys can be done regardless of whether the Project operates as it will establish a baseline for when the Project does operate, while accounting for the annual geomorphic changes that may occur during peak flows of magnitudes less than the Project threshold. From the drone imagery a digital elevation model can be generated and relevant channel variables can be obtained (examples of these variables are hydraulic radius, median surface grain size, local bed and water surface slope, and reach slope. The processing of the data would not be required to occur every year, but at least occur for the year prior to operation and post-operation. The collection of the data on an annual basis allows the before operation data to be collected, as this would be unknown.

7.1.4 Reporting Requirements

7.1.4.1 Discharge and Water Level

Elbow River flows at the WSC stations will be monitored in conjunction with AEP's Environmental Monitoring Plan and River Monitoring Network. No additional reporting by the Project parties are required.

Elbow River water level data at Highway 22 bridge, including instrument maintenance and calibration records, will be included in an annual report to AEP.

7.1.4.2 Turbidity and Suspended Sediment

Information to be documented by the Contractor during construction includes:

- written and photo-documented sequence of events during construction
- changes to design and field-fitting to adapt to unanticipated field conditions (will be further discussed with DFO if important changes are observed)
- technical issues that arise and how they are addressed
- confirmation that the terms of the AEP *Water Act* Approval and DFO *Fisheries Act* Authorization are met.

A weekly summary report will be produced by the Contractor with the following:

- brief description of the works and types of construction activities completed during the sampling period
- date and time of each sample
- weather conditions at the time of each sample
- changes of depth of flow at the upstream transect
- documentation of daily NTU instrument calibrations

- turbidity (NTU) and TSS (mg/L) for each sample taken
- continuous turbidity data (NTU) from the three Elbow River stations
- daily average value (mg/L TSS) of the upstream background samples
- daily average value (mg/L TSS) for each downstream transect (all three sites per transect combined)
- documentation of all non-compliance instances, including the level of exceedance, the duration of exceedance, the mitigation measures taken, verification of the reporting of the exceedance and any related communications with regulators regarding the exceedance event, and future measures to be taken to avoid or control further exceedances.
- description of events or circumstances that may have prevented or hindered completion of the TSS monitoring Plan

Upon completion of construction activities, a final construction monitoring report with all sampling and testing data will be produced for AEP.

If a TSS sample exceeds compliance criteria or a plume of sediment is observed, all work that may have resulted in the impact (directly or indirectly) shall be stopped and mitigations put in place. The Environmental Response Hotline shall be called at 1-800-222-6514. As per established spill reporting requirements, a written report must be submitted within seven days of the initial report and submitted to:

Alberta Environment Environmental Response Centre
111 Twin Atria Building
4999 – 98 Avenue
Edmonton, AB T6B 2X3

or faxed to (780) 427-3178

Written reports will include:

- the date and time of the release
- the location of the release
- the duration of the release and the release rate
- the composition of the release for each substance, including:
  - concentration
  - total weight, quantity or amount released
- a detailed description of the circumstances leading up to the release
- the steps or procedures which were taken to minimize, control or stop the release

- the steps or procedures which will be taken to prevent similar releases
- any other information required by the Director

7.1.4.3 Geomorphology

Geomorphology data will be included in an annual report to AEP.

7.2 OPERATIONAL MONITORING – DRY OPERATIONS

Operational monitoring includes environmental components that may be directly or indirectly affected by, or will affect, Project operations. For surface water monitoring locations during Project dry operations, refer to Figure 7.1.

7.2.1 Discharge and Water Level

Discharge monitoring at the two WSC stations (Elbow River at Bragg Creek (Station ID 05BJ004) and Elbow River at Sarcee Bridge (Station ID 05BJ010) and the water level monitoring in the Elbow River at Highway 22 bridge will continue through the dry operations phase.

Elbow River stream flows will be monitored at the service spillway where a pressure transducer and staff gauge will be installed. River flow has a direct relationship with river stage (or water depth) within the cross section of the service spillway opening, which will allow operations staff to routinely monitor flows and prepare to engage the diversion inlet. Continuous data from the pressure transducer will be provided to the operator by telemetry. Routine staff gauge observations will be made during low flow periods (i.e., late summer base flow) and observations will be recorded for due diligence purposes.

In addition, the following locations along the Project infrastructure will have inactive (i.e., not active until the Project infrastructure is used during a flood) water level monitoring locations:

- upstream end of debris deflection barrier
- tailwater sensor downstream right abutment
- Highway 22 bridge over the diversion channel
- reservoir
- the low level outlet

For discharge and water level monitoring locations during Project dry operations phase, refer to Figure 7.1.

7.2.2 Turbidity and Suspended Sediments

7.2.2.1 Continuous Turbidity Monitoring

Continuous turbidity data collection will be continued during Project dry operations at both Elbow River monitoring stations (i.e., at Bragg Creek [05BJ004] and Sarcee Bridge [05BJ010] in Calgary; Figure 7.1) and in the Elbow River at Highway 22 bridge. Continuous turbidity monitoring will be conducted with turbidity measurements made at 1-hour intervals using turbidity sondes. Turbidity sondes will be maintained at an interval recommended by the equipment manufacturer.

Turbidity-TSS curves established for each continuous monitoring location in the Elbow River during the construction phase will continue to be used and updated, as necessary, to determine the site-specific relationship between turbidity levels and TSS concentrations.

7.2.2.2 Turbidity Monitoring During Cleanup and Maintenance

Regular maintenance and annual cleanup activities will include moving large woody debris and sediment from around the diversion structure and service spillway. These activities have the potential to generate suspended sediments within the river. Instream turbidity monitoring will be done as outlined in Section 7.1.2.

Monitoring associated with maintenance and clean-up activities in the diversion channel and reservoir will occur under dry conditions and are not covered under this monitoring plan.

7.2.3 Geomorphology

The geomorphic monitoring program as outlined in Section 7.1.3 should be implemented during the first low flow period immediately following the operation of the Project. The intent would be to establish changes in the geomorphology of the Elbow River as a result of operation of the facility.

7.2.4 Reporting Requirements

7.2.4.1 Discharge and Water Level

Elbow River flows at the WSC stations will be monitored in conjunction with AEP's Environmental Monitoring Plan and River Monitoring Network.

Elbow River water level data at Highway 22 bridge, including instrument maintenance and calibration records, will be included in an annual report to AEP.

7.2.4.2 Turbidity

Reporting requirements for monitoring suspended sediments during clean-up and maintenance activities are outlined above in Section 5.1.5.

7.2.4.3 Geomorphology

Reporting for geomorphic monitoring are only required during years which the Project operates.

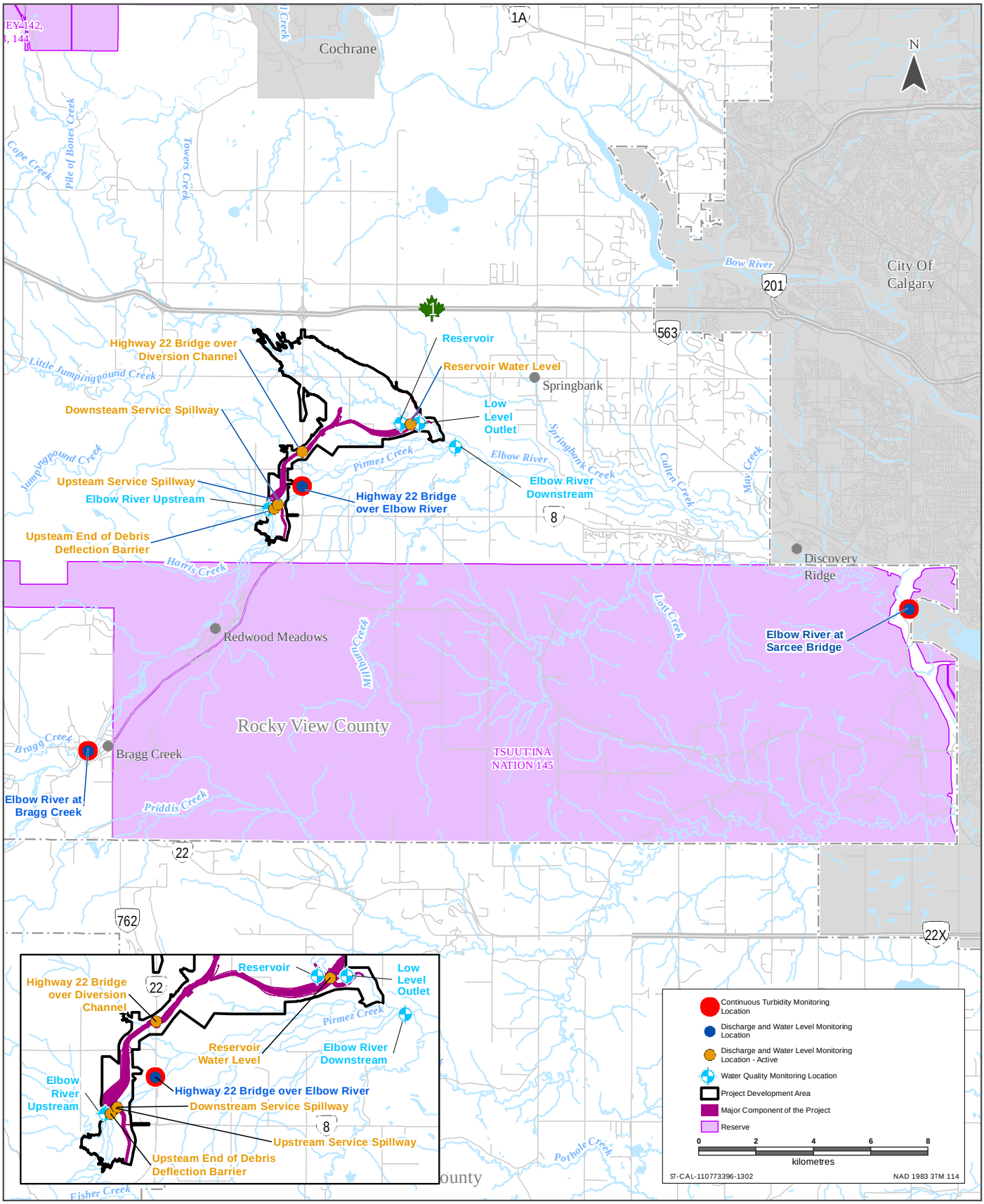
7.3 OPERATIONAL MONITORING – FLOOD OPERATIONS

7.3.1 Discharge and Water Level

Elbow River flows will be monitored at the two WSC stations (Elbow River at Bragg Creek (Station ID 05BJ004) and Elbow River at Sarcee Bridge (Station ID 05BJ010), these two stations will be used to determine whether or not to divert the flows.. Elbow River stream flow monitoring will be done to measure and monitor river discharge, and to manage the diversion intake (Figure 7.2). When the decision is made to divert flood water, the service spillway gates would be raised to create a backwater upstream of the diversion structure. This causes the water level above the diversion structure to rise up to the diversion inlet gates. The diversion inlet gates would then be opened, and the excess flood water (the amount greater than 160 m^3/s) would begin to divert into the off-stream reservoir through the diversion channel. The maximum rate of flow diversion to the reservoir is 600 m^3/s.

A transducer installed in the diversion channel will be used to monitor diversion rates and flows into the off-stream reservoir. A secondary monitoring location in the diversion channel will be used as a backup.

River flow will be monitored in conjunction with reservoir depth and volume to manage downstream flows. If the reservoir reaches its full service level, the diversion structure will be closed, and Elbow River flows will not be diverted and the water will continue downstream.



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

Flood and Post-Flood Surface Water Monitoring Locations

Stantec

7.3.2 Reservoir Depth/Volume

The off-stream reservoir water depth will be monitored as the reservoir is filled to track the reservoir's available volume and holding capacity. This will permit staff to manage water entering the off-stream reservoir.

The relationship between the off-stream reservoir volume and depth is known; therefore, water depth will be monitored to determine available reservoir volume. A monitoring station will be located near the off-stream reservoir outlet gates on the reservoir berm. The monitoring station will include two monitoring components. First, a permanent marker (i.e., staff gauge) will be installed on the reservoir berm near the outlet gate to indicate when water levels are reaching the maximum reservoir capacity. Second, a pressure transducer with remote telemetry will be installed on the berm near the outlet gate for continuous monitoring by the reservoir operator (Figure 7.2).

7.3.3 Turbidity and Suspended Sediment

Continuous turbidity monitoring will be continued during Project flood operations at both Elbow River WSC monitoring stations (i.e., at Bragg Creek [05BJ004] and Sarcee Bridge [05BJ010] in Calgary; Figure 7.1) and in the Elbow River at Highway 22 bridge. Continuous turbidity monitoring will be conducted with turbidity measurements made at 1-hour intervals using turbidity sondes. Turbidity sondes will be maintained at an interval recommended by the equipment manufacturer. Turbidity-TSS curves established for each continuous monitoring location in the Elbow River during the construction phase will continue to be used and updated, as necessary, to determine the site-specific relationship between turbidity levels and TSS concentrations.

A temporary turbidity monitoring station will be installed in the low-level outlet below the off-stream reservoir outlet gates (Figure 7.1). This monitoring station will include a turbidity sonde to capture turbidity levels as water is released from the reservoir and prior to entering Elbow River. The turbidity sonde will be installed with telemetry so turbidity monitoring results will be available in real time.. The station will be installed prior to water being released and it will remain in place until the off-stream reservoir is empty. Activities to install the monitoring equipment will be planned in a manner that ensures the safety of monitoring staff.

The turbidity curve will be developed in accordance with Alberta Transportation's "Conversion Relationship Between Nephelometric Turbidity Units (NTU) into mg/L for Alberta Transportations' Turbidity Specification" (Alberta Transportation, [No Date]).

7.3.4 Water Quality

Once the SR1 reservoir filling starts, water quality monitoring will commence and continue until the reservoir is emptied. Water quality samples will be collected at four locations weekly (i.e., once per 7 days), if conditions allow sampling in a safe manner (Figure 7.2):

- Elbow River upstream of the diversion structure
- in the off-stream reservoir (when sufficient level of water is present)
- in the low-level outlet below the reservoir outlet gate (when water is present)
- in the Elbow River downstream of the low-level outlet confluence where the low-level outlet discharge is assumed to be fully or mostly mixed (e.g., 10 times river width)

Detailed locations of the four water quality sampling sites will be determined by the operational staff. Water quality sampling will be completed following applicable provincial (AENV 2006) and federal (CCME 2011) sampling guidance, including the collection of quality control and quality assurance samples (i.e., duplicates, field blanks, and trip blanks) to confirm sampling accuracy

Water quality samples will be collected weekly from the reservoir once water levels permit safe sampling. Sampling at depth (i.e., one sample at the surface and one near the bottom) in the reservoir may be necessary, if *in situ* data indicates stratification in the reservoir. At each site and each sampling event, both *in* situ data and a grab sample for laboratory analysis will be collected.

Sampling parameters and currently relevant water quality guidelines and objectives are listed in Table 7.2. The listed parameters conform with IAAC Condition 3.19.6 and are estimated to cost approximately $1,000 per sample with the inclusion of total and dissolved methylmercury. Minimum recommended laboratory detection limits are provided for consistency with collected baseline data (Table 7.2). Laboratory detection limits should be at minimum half of a water quality guideline or objective. As new and updated guidelines and objectives are released over the life of the Project, the water quality parameters and laboratory detection limits may need to be revised. In addition to water quality sampling described here, mercury and methylmercury sampling in water will also be completed in conjunction with fish tissue sampling. The fish tissue sampling will be detailed in a standalone plan and will be developed prior to operations.

Table 7.2 Water Quality Monitoring Analytical Sample Parameters, Guidelines, Objectives, and Recommended Laboratory Detection Limits

Parameter	Type	Unit	CWQG Acute	CWQG Chronic	Federal EQG	AB WQG Short-Term	AB WQG Long-Term	Elbow River WQO Central Reach	Minimum Recommended Laboratory Detection Limit mg/L	Minimum Recommended Laboratory Detection Limit ng/L
In-Situ Parameters										
Temperature	In situ	°C	-	Narrative	-	Narrative	Narrative	18	-	-
Dissolved Oxygen	In situ	mg/L	-	Minimum 6.5	-	Minimum 5	Minimum 6.5	Minimum 6.5	-	-
Conductivity	In situ	µS/cm	-	-	-	-	-	-	-	-
pH	In situ	pH	-	-	-	-	-	-	-	-
Physical Parameters and Major Ions										
TSS	Lab	mg/L	-	Narrative		Narrative	Narrative	Narrative	3.0	-
Colour (True) by Spectrometer	Lab	CU	-	-	-	-	-	-	5.0	-
pH	Lab	pH	-	6.5-9.0	-	-	6.5-9.0	-	0.10	-
Conductivity as $CaCO_3$	Lab	µS/cm	-	-	-	-	-	-	-	-
Alkalinity, total as $CaCO_3$	Lab	mg/L	-	-	-	-	Minimum 20	-	2.0	-
Hardness as $CaCO_3$	Lab	mg/L	-	-	-	-	-	-	1.0	-
Bicarbonate (HCO_3)	Lab	mg/L	-	-	-	-	-	-	5.0	-
Carbonate (CO_3)	Lab	mg/L	-	-	-	-	-	-	5.0	-
Chloride (Cl)	Lab	mg/L	640	120	-	640	120	-	0.50	-
Fluoride (F)	Lab	mg/L	-	0.12	-	-	-	-	0.020	-
Hydroxide (OH)	Lab	mg/L	-	-	-	-	-	-	5.0	-
Potassium (K)	Lab	mg/L	-	-	-	-	-	-	0.05	-
Sodium (Na)	Lab	mg/L	-	-	-	-	-	-	0.2	-
Sulphate (SO_4)	Lab	mg/L	-	-	-	-	Varies[a]	-	0.30	-
Sulphide as S	Lab	mg/L	-	-	-	-	0.0019	-	0.0015	-
Ion Balance	Lab	N/A	-	-	-	-	-	-	-100	-
Total Dissolved Solids (calculated)	Lab	mg/L	-	-	-	-	-	-	1.0	-
Nutrients and Carbon-										
Nitrate as N	Lab	mg/L	124	3	-	124	3	-	0.020	-
Nitrite as N	Lab	mg/L	-	0.06	-	Varies[a]	Varies[a]	-	0.010	-
Nitrate and Nitrite as N (calculated)	Lab	mg/L	-	-	-	-	-	0.267	0.0050	-
Ammonia, Total as N	Lab	mg/L	-	Equation[b]	-	-	Equation[b]	0.04	0.050	-
Kjeldahl Nitrogen, Total	Lab	mg/L	-	-	-	-	-	-	0.20	-
Nitrogen, Total (calculated)	Lab	mg/L	-	Narrative	-	-	-	Narrative		-
Phosphorus, Total	Lab	mg/L	-	-	-	-	Narrative	-	0.0020	-

Table 7.2 Water Quality Monitoring Analytical Sample Parameters, Guidelines, Objectives, and Recommended Laboratory Detection Limits

Parameter	Type	Unit	CWQG Acute	CWQG Chronic	Federal EQG	AB WQG Short-Term	AB WQG Long-Term	Elbow River WQO Central Reach	Minimum Recommended Laboratory Detection Limit mg/L	Minimum Recommended Laboratory Detection Limit ng/L
Phosphorus, Dissolved	Lab	mg/L	-	-	-	-	-	0.009	0.0020	-
Organic Carbon, Total	Lab	mg/L	-	-	-	-	-	5.0	1.0	-
Organic Carbon, Dissolved	Lab	mg/L	-	-	-	-	-	-	1.0	-
Total Metals										
Aluminum (Al), Total	Lab	mg/L	-	Equation[b]	Equation[b]	-	-	-	0.001	1,000
Antimony (Sb), Total	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Arsenic (As), Total	Lab	mg/L	-	0.005	-	-	0.005	-	0.00002	20
Barium (Ba), Total	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Beryllium (Be), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Bismuth (Bi), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Boron (B), Total	Lab	mg/L	29	1.5	-	29	1.5	-	0.005	5,000
Cadmium (Cd), Total	Lab	mg/L	Equation[b]	Equation[b]	-	Equation[b]	Equation[b]	-	0.000005	5
Calcium (Ca), Total	Lab	mg/L	-	-	-	-	-	-	0.03	30,000
Cesium (Cs), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Chromium (Cr), Total	Lab	mg/L	-	0.0089	0.005	-	0.0089	-	0.0001	100
Cobalt (Co), Total	Lab	mg/L	-	-	1.0	-	Equation[b]	-	0.000005	5
Copper (Cu), Total	Lab	mg/L	-	Equation[b]	-	Equation[b]	0.007	-	0.00005	50
Gallium (Ga), Total	Lab	mg/L		-	-	-	-		0.00005	50
Iron (Fe), Total	Lab	mg/L	-	0.3	Equation[b]	-	-	-	0.001	1,000
Lead (Pb), Total	Lab	mg/L	-	Equation[b]	-	-	Equation[b]	-	0.00001	10
Lithium (Li), Total	Lab	mg/L	-	-	-	-	-	-	0.0005	500
Magnesium (Mg), Total	Lab	mg/L	-	-	-	-	-	-	0.03	30,000
Manganese (Mn), Total	Lab	mg/L	Equation[b]	Varies[a]	-	-	-	-	0.00005	50
Mercury (Hg), Total	Lab	mg/L	-	0.000026	-	0.000013	0.000005	-	0.0000001	0.10
Molybdenum (Mo), Total	Lab	mg/L	-	0.073	-	-	0.073	-	0.00005	50
Nickel (Ni), Total	Lab	mg/L	-	Equation[b]	-	Equation[b]	Equation[b]	-	0.00005	50
Rhenium (Re), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Rubidium (Rb), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Selenium (Se), Total	Lab	mg/L	-	0.001	-	0.001	0.002	-	0.00004	40
Silicon (Si), Total	Lab	mg/L		-	-	-	-	-	0.05	50,000
Silver (Ag), Total	Lab	mg/L	-	0.00025	-	-	0.00025	-	0.000005	5

Table 7.2 Water Quality Monitoring Analytical Sample Parameters, Guidelines, Objectives, and Recommended Laboratory Detection Limits

Parameter	Type	Unit	CWQG Acute	CWQG Chronic	Federal EQG	AB WQG Short-Term	AB WQG Long-Term	Elbow River WQO Central Reach	Minimum Recommended Laboratory Detection Limit mg/L	Minimum Recommended Laboratory Detection Limit ng/L
Strontium (Sr), Total	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Tellurium (Te), Total	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Thallium (Tl), Total	Lab	mg/L	-	0.0008	-	-	0.0008	-	0.000005	5
Thorium (Th), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Tin (Sn), Total	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Titanium (Ti), Total	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Tungsten (W), Total	Lab	mg/L	-	-	-	-	-	-	0.00001	10
Uranium (U), Total	Lab	mg/L	0.033	0.015	-	0.033	0.015	-	0.000001	1
Vanadium (V), Total	Lab	mg/L	-	-	0.12	-	-	-	0.00005	50
Yttrium (Y), Total	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Zinc (Zn), Total	Lab	mg/L	-	0.03	-	-	0.03	-	0.0005	500
Zirconium (Zr), Total	Lab	mg/L	-	-	-	-	-	-	0.00001	10
Dissolved Metals										
Aluminum (Al), Dissolved	Lab	mg/L	-	-	-	Equation[b]	Equation[b]	-	0.001	1,000
Antimony (Sb), Total	Lab	mg/L	-	-	-	-	-	-	0.00003	30
Arsenic (As), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Barium (Ba), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0001	100
Beryllium (Be), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Bismuth (Bi), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Boron (B), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.005	5,000
Cadmium (Cd), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Calcium (Ca), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.1	100,000
Cesium (Cs), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Chromium (Cr), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0005	500
Cobalt (Co), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Copper (Cu), Dissolved	Lab	mg/L	-	-	Variable[a]	-	-	-	0.0002	200
Gallium (Ga), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Iron (Fe), Dissolved	Lab	mg/L	-	-	-	-	0.3	-	0.03	30,000
Lead (Pb), Dissolved	Lab	mg/L	-	-	Equation[b]	-	-	-	0.00005	50
Lithium (Li), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0005	500
Magnesium (Mg), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.1	100,000

Table 7.2 Water Quality Monitoring Analytical Sample Parameters, Guidelines, Objectives, and Recommended Laboratory Detection Limits

Parameter	Type	Unit	CWQG Acute	CWQG Chronic	Federal EQG	AB WQG Short-Term	AB WQG Long-Term	Elbow River WQO Central Reach	Minimum Recommended Laboratory Detection Limit mg/L	Minimum Recommended Laboratory Detection Limit ng/L
Manganese (Mn), Dissolved	Lab	mg/L	Equation[b]	Equation[b]	-	-	-	-	0.0002	200
Mercury (Hg), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0000001	0.10
Molybdenum (Mo), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Nickel (Ni), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0002	200
Rhenium (Re), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Rubidium (Rb), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00002	20
Selenium (Se), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0002	200
Silicon (Si), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.05	50,000
Silver (Ag), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Strontium (Sr), Dissolved	Lab	mg/L	-	-	2.5	-	-	-	0.0001	100
Tellurium (Te), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Thallium (Tl), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Thorium (Th), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Tin (Sn), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0002	200
Titanium (Ti), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0002	200
Tungsten (W), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00001	10
Uranium (U), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000002	2
Vanadium (V), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.00005	50
Yttrium (Y), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.000005	5
Zinc (Zn), Dissolved	Lab	mg/L	-	-	-	-	-	-	0.001	1,000
Methylmercury										
Methylmercury as MeHg, Total	Lab	mg/L	-	0.000004	-	0.000002	0.000001	-	0.0000000020	0.0020
Methylmercury as MeHg, Dissolved	Lab	mg/L	-	-	-	-	-	-	0.0000000020	0.0020
Hydrocarbons										
Benzene	Lab	mg/L	-	0.37		-	0.04	-	0.0005	500
Ethylbenzene	Lab	mg/L	-	0.09		-	0.09	-	0.0005	500
m+p-Xylene	Lab	mg/L	-	-		-	0.03	-	0.0005	500
o-Xylene	Lab	mg/L	-	-		-	0.03	-	0.0005	500
Styrene	Lab	mg/L	-	0.072		-	0.072	-	0.0005	500
Toluene	Lab	mg/L	-	0.002		-	0.0005	-	0.00025	250
Xylenes	Lab	mg/L	-	-		-	0.03	-	0.00071	710

Table 7.2 Water Quality Monitoring Analytical Sample Parameters, Guidelines, Objectives, and Recommended Laboratory Detection Limits

Parameter	Type	Unit	CWQG Acute	CWQG Chronic	Federal EQG	AB WQG Short-Term	AB WQG Long-Term	Elbow River WQO Central Reach	Minimum Recommended Laboratory Detection Limit mg/L	Minimum Recommended Laboratory Detection Limit ng/L
F1(C6-C10)	Lab	mg/L	-	-	-	-	-	-	0.10	100,000
F1(BTEX)	Lab	mg/L	-	-	-	-	-	-	0.10	100,000
F2(C10-C16)	Lab	mg/L	-	-	-	-	-	-	0.10	100,000
F3(C16-C34)	Lab	mg/L	-	-	-	-	-	-	0.25	250,000
F4(C340C50)	Lab	mg/L	-	-	-	-	-	-	0.25	250,000

NOTES:
- = not applicable
CWQG = Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life by Canadian Council of Ministers of the Environment (CCME 2021)
Federal EQG = Federal Environmental Quality Guidelines for Freshwater (GoC 2021)
AB WQG = Surface Water Guidelines for the Protection of Freshwater Aquatic Life (GoA 2018)
ER WQO central reach = water quality objectives developed by the Elbow River Watershed Partnership for the central reach of the Elbow River (ERWP 2009)
- = no guideline

[a] Guidelines that vary based on other parameters were determined as per GoA (2018) and GoC (2021):
Sulphate AB WQG guideline varies based on hardness from 128 mg/L to 429 mg/L
Nitrite-N AB WQG varies based on chloride concentrations from 0.02 mg/L to 0.20 mg/L
Total manganese long-term CWQG calculation is provided in Appendix B of the Scientific Criteria Document for the Development of the Canadian Water Quality Guidelines for the Protection of Aquatic Life: Manganese
Dissolved copper Federal EQG is calculated using the Biotic Ligand Model Tool (ECCC 2021).

[b] Equations were used to calculate hardness, pH, and temperature-dependent guidelines as per GoA (2018), GoC (2021) and CCME (2021).
Ammonia CWQG and AB WQG is based on temperature and pH, see table for values in CCME (2021).
Total aluminum Federal EQG = $\exp^{([0.645 \times \ln(DOC)] + [2.255 \times \ln(hardness)] + [1.995 \times pH] + [-0.284 \times (\ln(hardness) \times pH)] -9.898)}$
Total cadmium chronic/long-term CWQG and AB WQG: At hardness ≥ 17 mg/L and ≤ 280 mg/L (µg/L) = $10^{\{0.83[\log10(hardness)-2.46]\}}$
Total cadmium acute/short-term CWQG and AB WQG: At hardness <5.3 mg/L, the guideline is 0.00011 mg/L. At hardness ≥ 5.3 mg/L and ≤ 360 mg/L (µg/L) = $10^{\{1.016[\log10(hardness)-1.71]\}}$. At hardness >360 mg/L, the guideline is 0.0077 mg/L.
Total chromium Federal EQG is for hexavalent Cr
Total copper chronic CWQG: When the water hardness is 0 to < 82 mg/L, the CWQG is 0.002 mg/L. At hardness ≥82 to ≤180 mg/L the CWQG is calculated as CWQG (µg/L) = 0.2 * $e^{\{0.8545[\ln(hardness)]-1.465\}}$. At hardness >180 mg/L, the CWQG is 0.004 mg/L. If the hardness is unknown, the CWQG is 0.002 mg/L.
Total copper short-term AB WQG (µg/L) = ($e^{\{0.979123[\ln(hardness)]-8.64497\}}$)*1000
Total iron Federal EQG = $\exp^{(0.671[\ln(DOC)] + 0.171[pH] + 5.586)}$
Total lead CWQG and AB WQG: When the hardness is 0 to ≤ 60 mg/L, the guideline is 0.001 mg/L. At hardness >60 to ≤ 180 mg/L the guideline is calculated as (µg/L)= $e^{\{1.273[\ln(hardness)]-4.705\}}$. At hardness >180 mg/L, the guideline is 0.007 mg/L. If the hardness is unknown, the guideline is 0.001 mg/L.
Total manganese CWQG: $\exp^{(0.878[\ln(hardness)] + 4.76)}$
Total nickel CWQG: When the water hardness is 0 to ≤ 60 mg/L, the CWQG is 0.025 mg/L. At hardness > 60 to ≤ 180 mg/L the CWQG is calculated as CWQG (µg/L) = $e^{\{0.76[\ln(hardness)]+1.06\}}$
Total nickel long-term AB WQG (µg/L) = $e^{\{0.846[\ln(hardness)]+0.0584\}}$
Total nickel short-term AB WQG (µg/L) = $e^{\{0.846[\ln(hardness)]+2.255\}}$
Dissolved aluminum AB WQG (µg/L) = {$e^{(1.6-3.327(pH)+0.402(pH)^2)}$}
Dissolved lead Federal EQG = $\exp^{(0.514[\ln(DOC)] + 0.214[\ln(Hardness)] + 0.4152)}$
Dissolved manganese CWQG: short term guideline = $\exp^{(0.878[\ln(hardness)] + 4.76)}$; long-term guideline is calculated based on CWQG calculator in Appendix B of the Scientific Criteria Document for manganese

7.3.5 Reporting Requirements

Flood operation monitoring information including staff gauge routine observations at the service inlet and off-stream reservoir, suspended sediment monitoring data, and water quality analysis will be stored electronically for due diligence purposes. This information will be made available in report form as follows.

7.3.5.1 Discharge, Water Level, and Reservoir Depth/Volume

Elbow River diversion rates, flow rates, and reservoir depth/volume will be documented and reported to:

- the City of Calgary and Glenmore Reservoir operator to assist in downstream reservoir management
- the public, subject to the satisfaction of AEP staff

7.3.5.2 Turbidity, Suspended Sediment and Water Quality

Continuous turbidity and associated suspended sediment data will be summarized weekly. Water license holders situated on Elbow River downstream of the Project, including the Glenmore Reservoir water treatment operator, will be provided continuous turbidity monitoring results to assist with water treatment management decisions.

Water quality data shall be analyzed within regular laboratory turnaround time (estimated to be 15 days due to the inclusion of special parameter (methylmercury) analysis) and the results of the weekly water quality samples will be compared to:

- background levels in Elbow River upstream from the intake structure and diversion channel
- relevant water quality guidelines and objectives (Table 7.2)

The water quality data will be reviewed to detect potential contaminants (e.g., hydrocarbons) and other parameters with applicable water quality guidelines and objectives.

These results of the continuous turbidity and weekly water quality sampling during flood operations will be provided on a weekly basis to:

- the City of Calgary and the Glenmore Water Treatment Plant as a measure of due diligence to facilitate Calgary's water treatment program
- the public, subject to the satisfaction of AEP staff

7.4 OPERATIONAL MONITORING – POST-FLOOD OPERATIONS

7.4.1 Discharge and Water Level

Elbow River streamflow data from an upstream hydrometric station will be used to determine when to release water from the off-stream reservoir into the low-level outlet and to manage reservoir drawdown operations (Figure 7.2). The combined flow from the low-level outlet and the flow in Elbow River will be managed so that flow in the river downstream of the confluence with the unnamed creek does not exceed 160 m^3/s.

Release rates from the low-level outlet will be managed so that Elbow River flows are below 160 m^3/s using the relationship between gate position indicators and water surface elevation, monitored through a water level sensor in the reservoir. Suspended sediments will also be monitored.

Elbow River stream flow monitoring details are provided in Section 7.2.1 above.

7.4.2 Reservoir Depth/Volume

Water depth of off-stream reservoir will be monitored to track the reservoir's available volume and holding capacity, assist in managing fish salvage activities in the reservoir and manage the release of water from the off-stream reservoir. Off-stream reservoir depth/volume will be done as described in Section 7.3.2 above.

7.4.3 Turbidity and Suspended Sediment

Turbidity monitoring will be continued during Project post-flood operations at both Elbow River WSC monitoring stations (i.e., at Bragg Creek [05BJ004] and Sarcee Bridge [05BJ010] in Calgary; Figure 7.1), the Elbow River at Highway 22 bridge, in the reservoir and in the low-level outlet. Continuous turbidity monitoring will be conducted with turbidity measurements made at 1-hour intervals using turbidity sondes. Turbidity sondes will be maintained at an interval recommended by the equipment manufacturer. Turbidity-TSS curves established for each continuous monitoring location in the Elbow River during the construction phase will continue to be used and updated, as necessary, to determine the site-specific relationship between turbidity levels and TSS concentrations.

The monitoring results will be compared to the applicable guidelines, and any exceedances based on the results will be reported to AEP and monitored, as required.

7.4.4 Water Quality

Weekly water quality monitoring described in Section 7.3.4 will continue during the Post-Flood Operation stage.

7.4.5 Herbicide Monitoring

Vegetation along the Project components will be maintained and weed growth managed; the application of herbicides to control weeds on site may occur.

If required, herbicides would be applied according to the Code of Practice for Pesticides (GoA 2010) which stipulates the minimum distance these chemicals can be used in proximity to a waterbody to avoid contamination in the aquatic environment. Mitigations include the following:

- restrict herbicide mixing and loading within 30 m of an open body of water
- identify open bodies of water within the application sites
- mark or flag of open bodies of water that will not be clearly visible to the applicator

Water quality samples will be analyzed as needed (e.g., if open bodies of water near application sites are present) for herbicides used on site to identify residual chemicals that may enter the Elbow River during water release from the reservoir.

7.4.6 Reporting Requirements

Operational monitoring information including staff gauge routine observations at the service inlet and off-stream reservoir, suspended sediment monitoring data, and water quality analysis will be stored electronically for due diligence purposes. This information will be made available in report form as follows.

7.4.6.1 Discharge and Water Level

Off-stream reservoir water release management activities and Elbow River flow rate (i.e., discharge from the low-level outlet combined with Elbow River discharge) will be documented and reported to the City of Calgary and Glenmore Reservoir operator to assist in downstream reservoir management.

7.4.6.2 Turbidity, Water Quality, and Reservoir Depth

Water quality data shall be analyzed with a regular turnaround time (assumed to be 15 days with the inclusion of methylmercury) and the results of the weekly water quality samples will be compared to:

- background levels in Elbow River upstream from the intake structure and diversion channel
- relevant water quality guidelines and objectives (Table 7.2)

Turbidity monitoring reports will be produced during the water release from the off-stream reservoir. These reports will include:

- a summary of Elbow River turbidity results
- a summary of Elbow River hydrology and reservoir depth
- date and environmental conditions the samples were collected

These results of the weekly water quality sampling during flood operations will be provided annually (October 31 of each year) to:

- the City of Calgary and the Glenmore Water Treatment Plant as a measure of due diligence to facilitate Calgary's water treatment program
- the public, subject to the satisfaction of AEP

8.0 REFERENCES

AENV (Alberta Environment). 2006. Aquatic Ecosystems Field Sampling Protocols. Prepared by Alberta Environment March 2006. Available at: https://open.alberta.ca/dataset/8bbadf46-6795-42b5-8324-f49b38bed799/resource/ce758929-5564-42e4-b7c7-fed08994afcb/download/7805.pdf. Accessed September 2021.

Alberta Transportation. No date. Conversion Relationship between Nephelometric Turbidity Units (NTU) into mg/l for Alberta Transportations' Turbidity specification. Available at: https://www.alberta.ca/assets/documents/tr-conversion-of-nephelometric-turbidity-units.pdf. Accessed September 2021.

Alberta Transportation. 2001. Fish habitat Manual: Guidelines and Procedures for Watercourse Crossings in Alberta (revised 2009). Edmonton. 93 pages + appendices.

Alberta Transportation. 2011. Erosion and Sediment Control Manual. Edmonton. 89 pages + appendices. June 2011. Available at: http://www.transportation.alberta.ca/Content/docType372/Production/ErosionControlManual.pdf. Accessed September 2021.

Alberta Transportation. 2021. Turbidity Monitoring Specification. January 2021. Available at: https://www.alberta.ca/transportation-and-water-project-environmental-requirements.aspx. Accessed September 2021.

CCME (Canadian Council of Ministers of the Environment). 2011. Protocols Manual for Water Quality Sampling in Canada. PN 1461. ISBN 978-1-896997- 7-0 PDF. Available at: https://ccme.ca/en/res/protocolsdocument_e_-final1.0.pdf. Accessed September 2021.

CCME. 2021. Canadian Environmental Quality Guidelines website. Available at: http://ceqg-rcqe.ccme.ca/en/index.html. Accessed September 2021.

DFO (Fisheries and Oceans Canada). 2021. Measures to Protect Fish and Fish Habitat. Available at: https://www.dfo-mpo.gc.ca/pnw-ppe/measures-mesures-eng.html. Accessed September 2021.

ECCC (Environment and Climate Change Canada). 2021. Federal Water Quality Guideline for Copper: Biotic Ligand Model (BLM) Tool and User Manual. National Guidelines and Standards Office, Environment and Climate Change Canada, 351 Saint Joseph Boulevard, Gatineau, QC K1A 0H3, Canada. For copy email: EC.RQE-EQG.EC@Canada.ca.

ESRD (Environment and Sustainable Resource Development). 2019. Code of Practice for Watercourse Crossings. Water Act and the Water (Ministerial) Regulation. Alberta Queen's Printer. Edmonton. 44 pages.

GoA (Government of Alberta). 2005. A Guide to Release Reporting: Alberta Environmental Protection and Enhancement Act. Edmonton, Alberta. 14 pages.

GoA. 2010. Environmental Code of Practice for Pesticides. Alberta Queen's Printer. Edmonton. 30 pages.

GOA. 2014. The Government of Alberta's Guidelines on Consultation with First Nations on Land and Natural Resource Management.

GoA. 2018. Environmental Quality Guidelines for Alberta Surface Waters. Water Policy Branch, Alberta Environment and Parks. Edmonton, Alberta.

GoC (Government of Canada). 2021. Federal Environmental Quality Guidelines Website. Available at: https://www.canada.ca/en/health-canada/services/chemical-substances/fact-sheets/federal-environmental-quality-guidelines.html. Accessed September 2021.