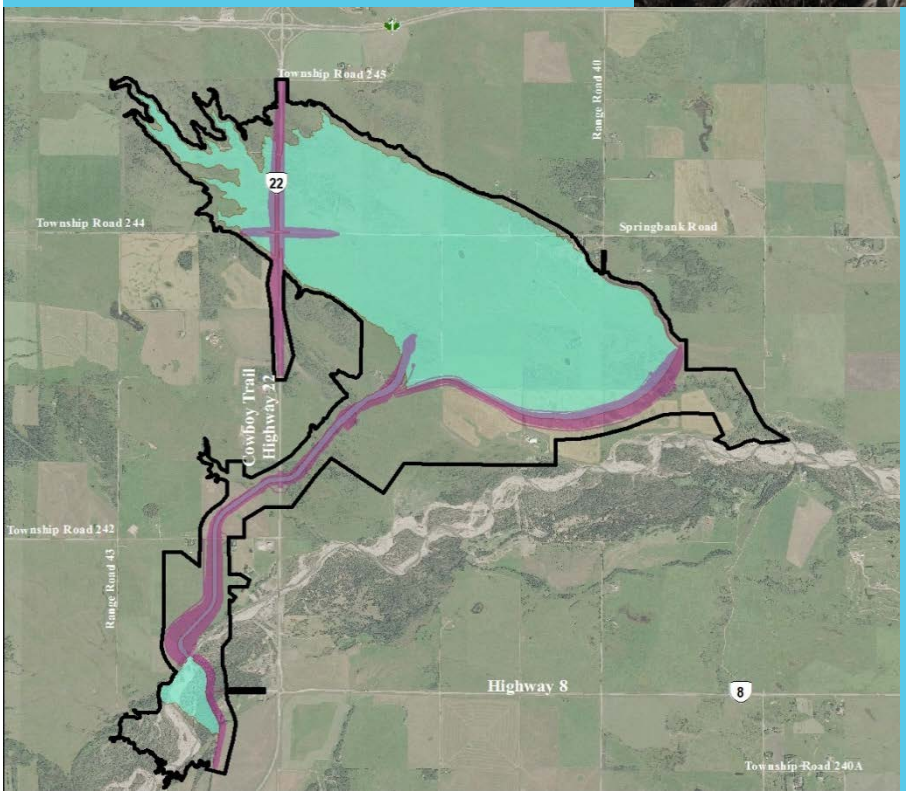
Springbank Off-stream Reservoir Project

Environmental Impact Assessment



Volume 2
Assessment Approach

March 2018

Alberta Transportation

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Abbreviations

AEP	Alberta Environment and Parks
CEAA 2012	*Canadian Environmental Assessment Act, 2012*
EIA	Environmental Impact Assessment
EPEA	Alberta *Environmental Protection and Enhancement Act*
LAA	The local assessment area - the maximum area within which Project environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence.
PDA	The project development area - the immediate area of Project activities
RAA	The regional assessment area - the area within which the Project's environmental effects may interact or accumulate with the environmental effects of other projects or activities that have been or will be carried out such that cumulative environmental effects may potentially occur.
VC	Valued Component

1.0 INTRODUCTION

The environmental assessment of the Springbank Off-Stream Reservoir Project (the Project) has been prepared as an Environmental Impact Assessment Report for Alberta Environment and Parks (AEP)[1] and an Environmental Impact Statement for the Canadian Environmental Assessment Agency (CEA Agency). The term 'EIA' is used to refer to the assessment for both agencies. This volume of the EIA presents the approach taken for the assessment, describing the assessment methods.

The EIA uses a framework developed by Stantec to meet the combined requirements of the *Canadian Environmental Assessment Act, 2012* (CEAA 2012) and the Alberta *Environmental Protection and Enhancement Act* (1993) (EPEA). These EIA methods are based on a structured approach that, particularly:

- considers the Project as a protection project to reduce the effects of future extreme flood events on infrastructure, water courses and people in the City of Calgary and downstream communities,
- considers all federal and provincial regulatory requirements for the assessment of environmental effects with specific consideration of the requirements of a) the Terms of Reference, Environmental Impact Assessment Report for Alberta Transportation's Proposed Springbank Off-Stream Reservoir Project, February 5, 2015 (Alberta Environment and Sustainable Resource Development 2015), and b) the Guidelines for the Preparation of an Environmental Impact Statement, Springbank Off-Stream Reservoir Project, August 10, 2016 (Canadian Environmental Assessment Agency 2016)
- considers the issues raised by the public, Indigenous peoples, and other stakeholders during consultation and engagement activities conducted to date
- focuses on issues of greatest concern that arise from the above considerations
- integrates engineering design and programs for mitigation and monitoring into a comprehensive environmental planning and management process

[1] Alberta Environment and Sustainable Resource Development was renamed Alberta Environment and Parks in 2015.

Both CEAA 2012 and EPEA define the term "environment" as the components of the earth including:

(a) land, water and air, including all layers of the atmosphere

(b) all organic and inorganic matter and living organisms

(c) the interacting natural systems that include components referred to in (a) and (b)

This EIA will focus on specific environmental components (called valued components or VCs) that are typically selected for assessment, based on regulatory issues, guidelines, and requirements; consultation with regulatory agencies, the public, stakeholder groups, and Indigenous peoples; field reconnaissance; and the professional judgment of the study team.

Environmental effect used in this EIA is an *adverse effect* [which means] *impairment of or damage to the environment, human health or safety or property* (EPEA, Section 1 (b)).

CEAA 2012 (Section 5) broadly refers to an environmental effect as a change in the environment in response to a project activity. Effects are those affecting components that are within federal authority, as defined in Attachment A. A change in the environment may be positive; in that situation, it is referred to as an environmental benefit.

For convenience, the term "environmental effect" as defined in CEAA 2012 will be taken to be synonymous to the term "impact" as referred to in the EPEA. The EIA will assess environmental effects and impacts as defined by the respective federal and provincial legislation.

Taken together, the definitions of environment and environmental effect in CEAA 2012 include the biophysical and human environments. Socioeconomic components that are part of the human environment are encompassed in the definition of environmental effect as defined in CEAA 2012. This is because they may be indirectly affected by changes in the biophysical environment. Thus, the term "environment" includes the biophysical, human, and socioeconomic components as defined in CEAA 2012 because both the federal and provincial regulators require them.

2.0 REGULATORY REQUIREMENTS

The Project requires an environmental assessment under both provincial and federal regulations. Under the Alberta *Environmental Protection and Enhancement Act* (Environmental Assessment Mandatory and Exempted Activities) Regulation (Alberta Regulation 111/93) the Project is a mandatory activity because it involves the construction, operation or reclamation of

(a) a dam greater than 15 metres in height when measured to the top of the dam

(i) from the natural bed of the watercourse at the downstream toe of the dam, in the case of a dam across a watercourse or

(ii) from the lowest elevation at the outside limit of the dam, in the case of a dam that is not across a watercourse;

(b) a water diversion structure and canals with a capacity greater than 1.5 cubic metres per second;

(c) a water reservoir with a capacity greater than 30 million cubic metres;

The Project meets the requirement for a mandatory activity under (c), (d) and (e) of the Regulation. Alberta Environment and Sustainable Resource Development (now Alberta Environment and Parks [AEP]) issued terms of reference for an environmental assessment report of the Project on February 5, 2015.

In Alberta, non-energy projects such as water management require an approval by the Natural Resources Conservation Board (NRCB), under the *Natural Resources Conservation Board Act*. When AEP determines that an environmental assessment report is required for a non-energy project, the NRCB must determine whether the project is in the public interest.

Under CEAA 2012, Regulations Designating Physical Activities (SOR 2012-147), the CEA Agency has classified the Project as a designated project:

... 6 The construction, operation, decommissioning and abandonment of a new structure for the diversion of 10 000 000 m^3/year [10 x 10^6 m^3/year] *or more of water from a natural water body into another natural water body.*

On June 23, 2016, the Agency decided that a federal environmental assessment of the Project was required and issued guidelines for an environmental impact statement on August 10, 2016.

3.0 OVERVIEW OF APPROACH

The environmental assessment methods address both Project-related and cumulative environmental effects. Project-related environmental effects are changes to the biophysical or human environment that are caused by a project or activity arising solely because of the proposed principal works and activities, as defined by the scope of the Project and as described in the Project Description (Volume 1). Cumulative environmental effects are changes to the biophysical or human environment that are caused by an action associated with the Project, in combination with other past, present or reasonably foreseeable future projects or activities that have been or will be carried out.

Project-related environmental effects and cumulative environmental effects are assessed using a standardized framework for each VC, with standard tables used to facilitate the evaluation. The environmental effects assessment methods used in this EIA are shown graphically in Figure 3-1.

- **Steps 1 through 4: Scoping of the Assessment –** Scoping of the assessment includes the selection of VCs and the rationale for their selection; influence of consultation and engagement on the scoping of the VC; selection of the environmental effect(s); description of measurable parameters; description of temporal and spatial boundaries; and identification of benchmarks that are used to determine the significance of environmental effects. This step relies upon the scoping undertaken by regulatory authorities; the requirements of the Terms of Reference and CEAA Guidelines; consideration of the input of the public, stakeholders, and Indigenous peoples that influenced the scope of the assessment; and the professional judgment of the Study Team.
- **Step 5: Existing Conditions –** Existing environmental conditions are established for the VC. In many cases, existing conditions implicitly include those environmental effects that may have been or may be caused by other past or present projects or activities that have been or are being carried out.
- **Step 6: Assessment of Project Environmental Effects –** Project environmental effects are assessed. The assessment includes descriptions of how an environmental effect will occur or how the Project will interact with the environment; mitigation and environmental protection measures proposed to reduce or eliminate the environmental effect; and characterization of the residual environmental effects: the environmental effects that remain after mitigation has been applied. The effects are assessed for both the construction and operation phases of the Project.

- **Step 7: Assessment of Cumulative Environmental Effects –** Cumulative environmental effects of the Project are identified in consideration of other past, present or reasonably foreseeable future projects or activities that have been or will be carried out. A review of potential interactions is completed to determine if an assessment of cumulative environmental effects is required (i.e., there is potential for an interaction) for that specific Project environmental effect that interacts with those of other projects or activities that have been or will be carried out. The residual environmental effects of the Project in combination with other projects or activities that have been or will be carried out are then evaluated for cumulative effects, including the contribution of the Project to those cumulative effects. As required by the CEAA Guidelines, the cumulative effects assessment is a stand-alone section (see Volume 3C, Section 1).
- **Step 8: Determination of Significance –** The significance of Project-related residual effects and residual cumulative environmental effects, (including the contribution of the Project to cumulative effects) are then determined, in consideration of the significance criteria.
- **Step 9: Follow-up –** Follow-up measures to verify the environmental effects predictions or to assess the effectiveness of mitigation, as well as any required monitoring, are recommended, where appropriate and applicable.
- **Step 10: Summary –** The environmental effects on the VC are summarized.
- **Step 11: Assessment of Potential Accidents and Malfunctions –** The effects of accidents and malfunctions on each VC are assessed in Volume 3D, Section 1.
- **Step 12: Assessment of the Effects of the Environment on the Project –** The effects of local conditions and natural hazards on each VC are assessed in Volume 3D, Section 2.

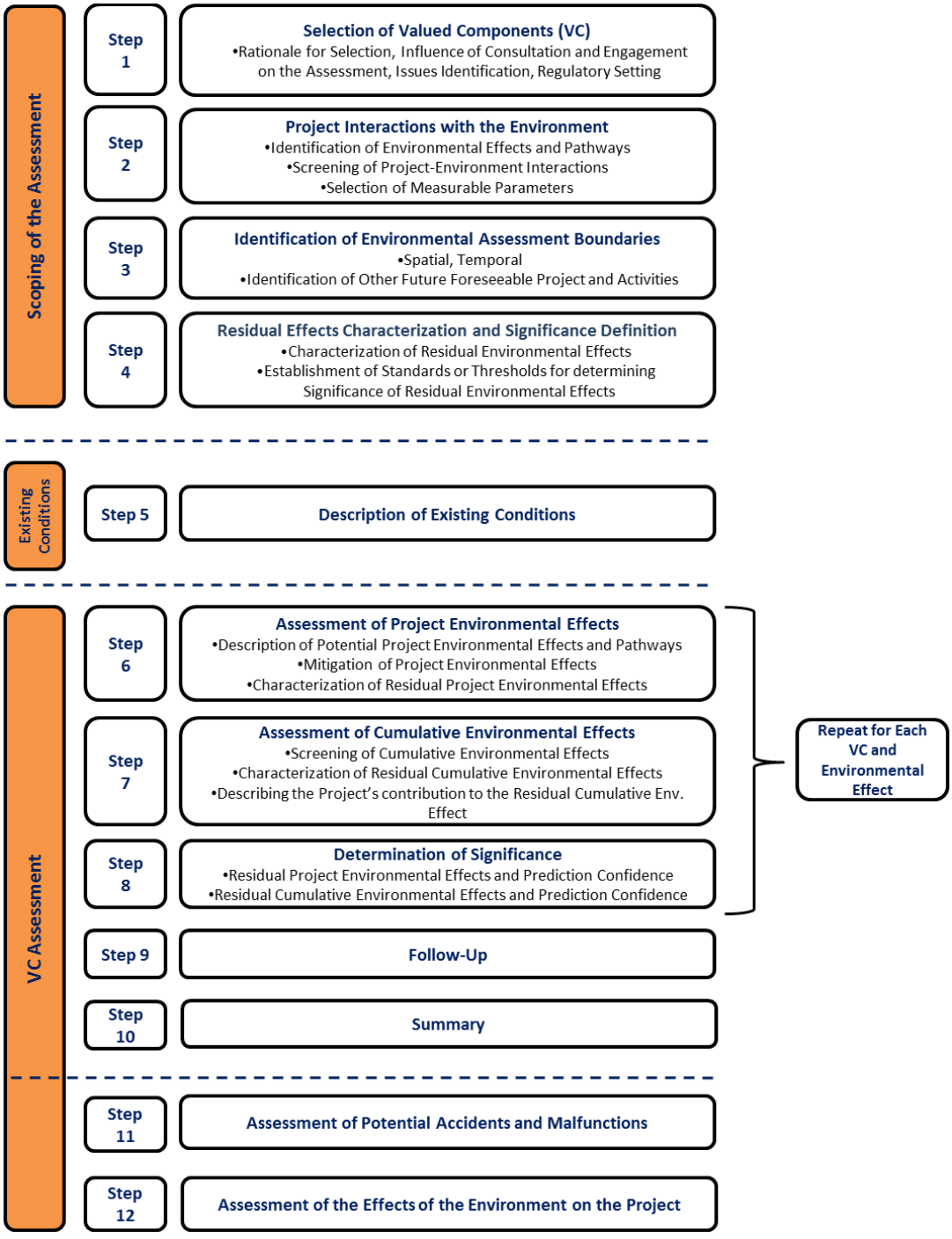


Figure 3-1 Environmental Assessment Methods

4.0 PRESENTATION OF THE ASSESSMENT

The Project can be viewed as two separate components. The first consists of the construction of the physical components of the Project and operation during dry (non-flood) conditions. The second consists of operations during flood conditions and post-flood conditions. The assessment of effects during construction of the Project and operation during dry conditions is presented in Volume 3A. The assessment of effects during flood conditions and post-flood conditions is presented in Volume 3B. Post-flood conditions are defined as the point when the water in the reservoir has been drained and the flow of the Elbow River returns to pre-flood conditions. Cumulative environmental effects and effect follow-up and monitoring are presented in Volume 3C, Section 1. Volume 3D assesses the environmental effects of accidents and malfunctions and the effects of the environment on the Project. It also contains a summary of potential environmental effects.

5.0 STEPS 1 TO 4: SCOPING OF THE ASSESSMENT

5.1 STEP 1: SELECTION OF VALUED COMPONENTS

The selection of valued components (VCs) relies on the identification of environmental issues for the Project as well as the AEP Terms of Reference and CEAA Guidelines.

5.1.1 Issues Identification

As presented in Volume 1, Project Description, concerns made and issues identified by the public (Section 6) and Indigenous peoples (Section 7) are summarized below

- Flood Mitigation and Alternatives
  - full discussion and assessment of project alternative required
  - inquiries into why the McLean Creek (MC1) alternative flood control option was not going forward;
- Consultation
  - decision for the preferred project made too quickly without proper regard to local residents, environment, or wildlife
  - lack of communication and information provided to the public
- Socio-Economics
  - no benefit to the residents of Rocky View County
  - the Project should proceed as quickly as possible.
  - MC1 alternative would not disrupt people whereas the Project does
  - Springbank Road should only be closed in the event of a flood
  - what measures will be taken to compensate landowners for their loss of business and way of life?
  - the project is lacking a thorough and consistent analysis and costing of its alternatives
  - the Project needs an impartial review
  - inquiries about Project costs, contingency amounts, and market value and number of Calgary homes saved from flooding.

- agriculture
  - heritage ranching, grazing, and hay and grain-producing lands would be lost
  - farmland, pasture, and cattle land would be impacted by the Project, as opposed to the MC1 alternative
  - project area should be used for agriculture when not storing flood waters
- wildlife
  - the project would alter migration patterns and increase vehicle collisions
  - concerns for small animal habitats, wild bird habitats
  - agriculture activities and wildlife have coexisted in the area since the 1800s
  - concerns about the impacts to wildlife by altering highway 22
- vegetation and wetlands
  - concerns for the rare Prairie willow tree, natural vegetation
  - concerns about silt smothering plant life with damaging pathogens
- land reclamation and land use
  - land would sit empty for years between floods
  - inquiries about what the land would be used for when not being utilized for flood mitigation
  - inquiries about how long the area would take to recover after a flood
  - would present landowners be able to continue to use the lands under lease agreements and would there be a subset of the area altered by the flood and deemed unusable?
  - would the land be unusable because of the silt? What area would be covered in silt?
  - concerns that the Project would permanently alter the landscape into a waste land where recreation and wildlife activities can no longer occur
- aquatics
  - concerns for aquatic wildlife
  - fish should not be the deciding factor between the Project and the MC1 alternative
  - inquiries about the annual downstream and upstream fish passage allowance for the in-stream structure on the Elbow River
  - inquiries about the salvaging of fish and other aquatic organisms from impounded water
  - inquiries about the costs for fish salvage and debris clean-up after a flood event

- surface water and groundwater
  - concerns that there will be effects to the water tables and water for farming
  - concerns about the effect of the diversion channel on underground aquifers and the water table
- air quality
  - concerns about air quality and dust from the silt left in the reservoir after a flood
- health
  - what will be done to address health issues caused by mold and dust after a flood?
  - concerns about human and plant health from dried silt and other residues
- EIA process
  - concerns about the timing of the EIA review
- safety
  - concerns about the potential of the Project failing
- Project design
  - concerns that new roads would be built on private properties and through hoodoos east of highway 22
  - Project is not needed because a flood the size of 2013 is rare
  - concerns about the impact and cost of moving affected pipelines
  - inquiries about the purpose of having an in-stream mechanical structure when a weir could passively divert floodwaters
  - inquiries about how gravels, silt, mud and other debris would be deposited in the reservoir
  - request that study be completed on: geomorphology, vegetation and wetlands, hydrogeology, geotechnical
  - concerns about the effects of a flood event larger than the Project is capable of containing
  - concerns about the environmental impact of elevating Highway 22
  - operations require further technical details of the Project regarding safety, debris management, fish habitat, water quality, flow monitoring and forecasting, lands in the reservoir, and for Project maintenance

5.1.2 Valued Components

Valued components (VCs) for the Project are selected with consideration of the AEP Terms of Reference, the CEAA Guidelines, issues identified through public and Indigenous consultation and the professional experience of the EIA team. Table 5-1 presents the VCs for the assessment and the rationale for their choice.

Table 5-1 Rationale for Valued Components Selected

Environmental Element	Rationale for Consideration	VC Selection
Air quality, climate and noise – (AEP)	• Potential for reduction in air quality from construction emissions, and particulate matter and odours from post-flood operations • Potential for Project to be sensitive to change in climate parameters • Noise from the Project may affect receptors	• Air quality and climate. • Acoustic environment. • Project sensitivity to climatic parameters not a VC; discussed in effects of the environment on the Project
Atmospheric environment – (CEAA)	• Potential for reduction in air quality • Potential for increased greenhouse gas emissions • Potential for change in ambient noise levels • Potential for odours from the reservoir • Potential for changes in night-time light levels	• Air quality and climate. • Acoustic environment. • Nighttime light levels are discussed in the air quality and climate section.
Dam safety - AEP	• The discussion of dam safety is identified in the project description. Failure of the dam could affect the biophysical and human environments.	• Dam safety is not a VC. It is addressed in the Project Description. Dam failure is discussed in the accidents and malfunctions and the effects of the environment on the Project.

Table 5-1 Rationale for Valued Components Selected

Environmental Element	Rationale for Consideration	VC Selection
Geology and geochemistry - CEAA	• The bedrock and surficial geology of the Project area may be affected by Project activities. The geochemical characteristics of the surficial materials and Elbow river sediments, especially with regard to the presence of contaminants of concern, could be altered by the Project and affect water quality. There may be sites of palaeontological or palaeobotanical interest affected by the Project.	• Geology and geochemistry are not VCs. • Bedrock and surficial geology are described in Terrain and soils and hydrogeology. • Characteristics of the surficial materials are described in terrain and soils. • Contaminants of concern are discussed in water quality. • Sites of palaeontological or palaeobotanical interest are discussed in historical resources.
Terrain and soils - AEP	• The Project could affect soil quality through physical activities during construction activities and operation flooding events. Soil quality could also be affected by contamination.	• Terrain and soils
Topography and soil - CEAA	• Soils may be susceptible to instability and erosion • Soil suitability for rehabilitation needs to be considered	• Soil susceptibility to instability and erosion and suitability for rehabilitation are considered in project design. These issues are discussed in the Project Description, in terrain and soils and in soil handling and mitigation measures.
Hydrogeology - AEP	• Potential for changes in groundwater quality, quantity and flow as a result of Project construction and of the temporary retention of floodwaters • Potential for effects on groundwater users	• Hydrogeology
Groundwater and surface water - CEAA	• Potential for changes to groundwater recharge/discharge areas and to groundwater infiltration areas • Potential for changes to water quality and quantity in the Elbow River and tributaries	• Groundwater changes are assessed in hydrogeology • Water quality and quantity are assessed in hydrology and surface water quality

Table 5-1 Rationale for Valued Components Selected

Environmental Element	Rationale for Consideration	VC Selection
Hydrology - AEP	• Potential for changes to drainage conditions, channel regime, water levels, sediment transport and yield, and open-water areas as a result of the Project	• Hydrology
Surface water quality - AEP	• Potential for the Project to effect water quality in the Elbow River and Glenmore Reservoir	• Surface water quality
Fish and fish habitat - CEAA	• The construction and operation of the diversion structure will alter fish habitat and fish life cycle activities • Construction and operation could affect fish morbidity and mortality through physical means and effects on water quality	• Aquatic ecology
Aquatic ecology - AEP	• The construction of the diversion structure will affect fish habitat • The operation of the diversion structure can result in fish stranding in the diversion channel and reservoir, fish mortality and affect fish passage	• Aquatic ecology
Vegetation - AEP	• The Project has the potential to increase fragmentation and the loss of upland, riparian and wetland habitats. • The Project has the potential for the introduction and colonization of weeds and non-native species • Project construction and operation has the potential to affect rare plants and Species at Risk vegetation	• Vegetation and wetlands
Riparian. wetland and terrestrial environments - CEAA	• Soils in the diversion channel and shorelines, banks and wetlands may be affected by the Project • Ecosystems, including those with species at risk or of special status may be sensitive or vulnerable to changes in water quality and quantity	• Effects on soils are addressed in terrain and soils • Effects on wetlands are addressed in the vegetation and wetlands • Species at Risk are addressed in the vegetation and wetlands, the wildlife and biodiversity and the aquatic ecology

Table 5-1 Rationale for Valued Components Selected

Environmental Element	Rationale for Consideration	VC Selection
Terrestrial landscape - CEAA	• The Project will affect vegetation and plant communities and may affect migratory and non-migratory bird habitat • The habitat of species at risk and of key habitat for culturally important species and species important to Indigenous peoples current use of resources may be affected by the Project	• The effects on vegetation and plant communities are assessed in vegetation and wetlands • The effects on birds are assessed in wildlife and biodiversity • The effects on species at risk and species important to Indigenous peoples use are assessed in vegetation and wetlands, wildlife and biodiversity, aquatic ecology and traditional land and resource use
Wildlife and biodiversity - AEP	• The Project may affect wildlife, wildlife habitats and biodiversity	• Wildlife and biodiversity
Migratory birds and their habitat - CEAA	• The Project may affect migratory birds or their habitat	• Wildlife and biodiversity
Species at risk - CEAA	• The Project may affect species at risk and their critical habitat	• Species at risk are assessed in vegetation and wetlands, wildlife and biodiversity and aquatic ecology
Land use and management - AEP	• The Project will alter land use in the local assessment area • Access to public and private land may change	• Land use and management
Historic resources - AEP	• Historic resources may be affected by the Project	• Historical resources
Traditional ecological knowledge and land use - AEP	• Traditional land use areas used for fishing, hunting, trapping, and plant harvesting may be affected by the Project • Traditional sites may be disturbed by the Project	• Traditional land and resource use

Table 5-1 Rationale for Valued Components Selected

Environmental Element	Rationale for Consideration	VC Selection
Aboriginal peoples - CEAA	• Traditional land use for cultural and resource harvesting may be affected by the Project • Access to traditional land use sites may be affected • Loss or destruction or changes to sites of physical and cultural heritage may occur as a result of the Project • The Project may have the potential to affect human health of the Indigenous peoples	• Traditional land use and access to sites are addressed in traditional land and resource use • Effects on physical and cultural heritage sites are addressed in historic resources • Effects on human health are assessed in public health
Public health and safety - AEP	• The Project may have implications on public health and safety	• Public health
Human environment - CEAA	• The Project may affect land use and infrastructure in the local assessment area • The Project may affect health and socio-economic conditions in the assessment area • Physical and cultural heritage sites, including palaeontological sites, may be affected.	• Effects on land use are assessed in land use and management • Effects on health are assessed in public health • Effects on socio-economic conditions are assessed in infrastructure and services and economy and employment • Effects on cultural and heritage sites, including palaeontological sites are assessed in historical resources
Socio-economics - AEP	• Construction and operation of the Project would affect landowners and local infrastructure and may affect recreational activities, agricultural productivity and First Nation and Metis • The Project is expected to reduce the financial costs of the 2013 flood • Financial costs for the Project would have to be covered by provincial and federal governments	• Effects on land use are assessed in land use and management • Effect on First Nations and Metis are assessed in traditional land and resource use • Effects on infrastructure and financial effects are assessed in infrastructure and services and economy and employment

5.2 STEP 2: IDENTIFICATION OF INTERACTIONS BETWEEN VALUED COMPONENTS AND THE PROJECT

The Project will interact with the VCs during the construction and operation phases. For the operation phase, the interactions will be different during the dry operations than they will be during flood and post-flood conditions. Table 5-2 presents the interactions.

Table 5-2 Interactions between Valued Components and the Project

Project Components and Physical Activities	Air Quality and Climate	Acoustic Environment	Hydrogeology	Hydrology	Surface Water Quality	Aquatic Ecology	Terrain and Soils	Vegetation and Wetlands	Wildlife and Biodiversity	Land Use and Management	Historical Resources	Traditional Land and Resource Use	Public Health	Infrastructure & Services	Economy & Employment
Construction															
Clearing	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Channel excavation	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Water diversion construction	✓	✓	–	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Dam and berm construction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Low-level outlet works construction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Road construction	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bridge construction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lay down areas	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	–	–	✓
Borrow extraction	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	–	✓
Reclamation	✓	✓	–		✓	✓	✓	✓	✓	✓	✓	✓	–	–	✓
Dry Operations															
Maintenance	–	–	✓	✓	✓	✓	–	✓	✓	✓	–	✓	–	–	–

Table 5-2 Interactions between Valued Components and the Project

Project Components and Physical Activities	Air Quality and Climate	Acoustic Environment	Hydrogeology	Hydrology	Surface Water Quality	Aquatic Ecology	Terrain and Soils	Vegetation and Wetlands	Wildlife and Biodiversity	Land Use and Management	Historical Resources	Traditional Land and Resource Use	Public Health	Infrastructure & Services	Economy & Employment
Flood and Post-flood Operations															
Reservoir filling	–	–	✓	✓	✓	✓	–	✓	✓	✓	–	✓	✓	✓	–
Retention of water in the reservoir	–	–	–	✓	–	–	–	–	–	–	–	–	–	–	–
Reservoir draining	–	–	✓	✓	✓	✓	✓	✓	✓	✓	–	✓	✓	✓	
Soil drainage and drying	–	–	–	–	–	–	✓	–	–	–	–	–	–	–	–
Reservoir drainage maintenance	✓	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Reservoir sediment partial cleanup	–	✓	–	✓	✓	✓	✓	✓	✓	✓	–	✓		✓	–
Drained reservoir	✓	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Channel maintenance	–	✓	–	✓	✓	✓	–	–	✓	–	–	✓	–	✓	–
Road and bridge maintenance	–	✓	–	–	–	✓	–	–	✓	✓	–	✓	–	✓	–
Flood damage cleanup and restoration	–	–	–	–	–	–	–	–	–	–	–	–	–	–	✓

NOTES:
✓ = Potential interaction
– = No interaction

5.3 STEP 3: IDENTIFICATION OF ASSESSMENT BOUNDARIES

5.3.1 Spatial Boundaries

Spatial boundaries are established for the assessment of Project environmental effects and cumulative environmental effects for each VC. The primary consideration used is the probable geographical extent of the environmental effects (i.e., the zone of influence) on the VC.

Spatial boundaries may be different from one VC to another, depending on the characteristics of the VC. Generally, the spatial boundaries are referred to as the project development area (PDA), the local assessment area (LAA), and the regional assessment area (RAA), as required.

The project development area (PDA) is the immediate area of Project activities and is the same for each VC. The PDA is limited to the anticipated area of physical disturbance associated with the construction and operation of the Project. The PDA is approximately 1,438 ha; it includes:

- the diversion structure area (0.36 ha)
- diversion channel area (64.23 ha)
- off-stream dam and low-level outlet works area (42.51 ha)
- off-stream reservoir (730 ha for design flood).
- internal access roads and borrow areas

The local assessment area (LAA) is the maximum area within which Project environmental effects can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA includes the PDA and adjacent areas where environmental effects may reasonably be expected to occur. The definition of the LAA varies from one VC to another, depending on factors such as local conditions, species abundance, socioeconomic factors, and cultural values.

The regional assessment area (RAA) is the area within which the Project's environmental effects may interact or accumulate with the environmental effects of other projects or activities that have been or will be carried out such that cumulative environmental effects may potentially occur. The RAA is defined for each VC depending on physical and biological conditions and the type and location of other past, present, or reasonably foreseeable projects or activities that have been or will be carried out.

5.3.2 Temporal Boundaries

The temporal boundaries for the assessment are based on the timing and duration of Project activities and the nature of the interactions with each VC. The purpose of a temporal boundary is to identify when an environmental effect may occur in relation to specific Project phases and activities. Temporal boundaries for the Project generally include the various phases of a Project:

- construction
- dry operation
- flood operation
- post-flood operation

The Project is expected to operate in perpetuity and is not expected to be decommissioned.

5.4 STEP 4: CHARACTERIZATION OF RESIDUAL ENVIRONMENTAL EFFECTS AND DEFINING THRESHOLDS FOR SIGNIFICANCE

5.4.1 Characterization of Residual Environmental Effects

Residual environmental effects or benefits (i.e., those that remain after mitigation or enhancement has been applied) are described during each Project phase, considering how the mitigation would alter or change the environmental effect. The analysis includes both direct and indirect interactions between the Project and the VC, and it considers mitigation measures to eliminate or reduce environmental effects or to enhance benefits. Once mitigation measures are applied, remaining effects are residual. Only residual environmental effects are assessed for significance.

The characterization of residual environmental effects is:

- direction—the long-term trend of the environmental effect (*i.e.,* positive or adverse)
- magnitude—the change in a measurable parameter or variable relative to existing conditions, defined for each VC as low, medium, high, or other qualifier as deemed appropriate
- geographic extent—the area where an environmental effect of a defined magnitude occurs, defined for each VC based on definitions of PDA, LAA, and RAA, as appropriate
- frequency—the number of times during a specific Project phase or activity that an environmental effect might occur (*e.g.*, one time or multiple times) in a specified time period
- duration—the period required until the VC returns to its existing condition (before project activities) or the environmental effect can no longer be measured or otherwise perceived (*e.g.*, short-term, mid-term, or long-term)

- reversibility—the likelihood that a measurable parameter will recover from an environmental effect, including through active management techniques (e.g., habitat restoration)
- ecological/socioeconomic context—the general characteristics of the area in which the Project is located, as indicated by past and existing levels of human activity.
- Timing - periods of time where residual effects from Project activities could affect the VC (e.g., time of day, seasonal, restricted activity periods)

Where possible, these characterizations are described quantitatively for each residual environmental effect. Where these characteristics cannot be expressed quantitatively, they are described qualitatively.

5.4.2 Thresholds for Determining Significance of Residual Environmental Effects

Threshold criteria for determining the significance of environmental effects are identified for each VC, beyond which a residual environmental effect would be considered significant. These are generally selected in consideration of provincial and federal regulatory requirements, standards, objectives and guidelines that are applicable to the VC, societal values, or other planning objectives. They have been developed in consideration of guidance and past practice and adapted to the specific conditions of the receiving environment and the nature of the environmental effects.

In some cases, and particularly where standards, guidelines or regulatory requirements do not specifically exist, thresholds can be defined for measurable parameters to support measurement that informs the determination of significance.

6.0 STEP 5: EXISTING CONDITIONS

6.1 DATA COLLECTION AND ANALYSIS

The methods used to collect and analyze the data for describing the existing conditions of the VC are described. This may include information from past research conducted in the region, traditional and ecological knowledge (if applicable and available), and knowledge gained from a literature review, qualitative and quantitative analyses, and field programs.

6.2 OVERVIEW OF EXISTING CONDITIONS

The status and characteristics of the VC within its defined spatial and temporal boundaries for the assessment are described.

7.0 STEPS 6 TO 10: EFFECTS ASSESSMENT

7.1 STEP 6: ASSESSMENT OF ENVIRONMENTAL EFFECTS

7.1.1 Assessment Cases

The assessment of environmental effects considers the following project phases:

- Construction and dry operations phase comprises clearing, channel excavation; construction of the water diversion structure, dam, berm, low-level outlet channel, roads and bridges; construction of lay down areas, borrow extraction, utility realignments and site reclamation. Construction will take place over a 27-month period. Dry operations refers to the period after construction when there are no floods that require the diversion of portions of the Elbow River into the dry reservoir. Dry operations also refers to future periods of time between floods. Activities are restricted to maintenance of the facilities.
- Flood operations and post-flood operations phase comprises reservoir filling and release of water back to the Elbow River. Post-flood operations commences when diversion of the Elbow River ceases and all retained water has been released back into Elbow River. It includes sediment partial cleanup and maintenance of the diversion channel, low-level outlet channel, roads and bridges.

For the assessment of cumulative effects, the following cases are used: Base Case, Application Case and Planned Development Case. Some VCs might not need to use all these but merely discuss changes from the Project compared to existing conditions (described before the mitigation subsection). Other VCs will use the three cases and the discussions follow the mitigation subsection.

7.1.1.1 Base Case

The Base Case describes the environmental conditions that are expected to exist prior to construction. It includes the expected conditions resulting from projects that have been approved but not yet constructed. The Base Case is the result of development and activities that have taken place in the assessment areas over time to the present day. It equates to the existing conditions for a VC.

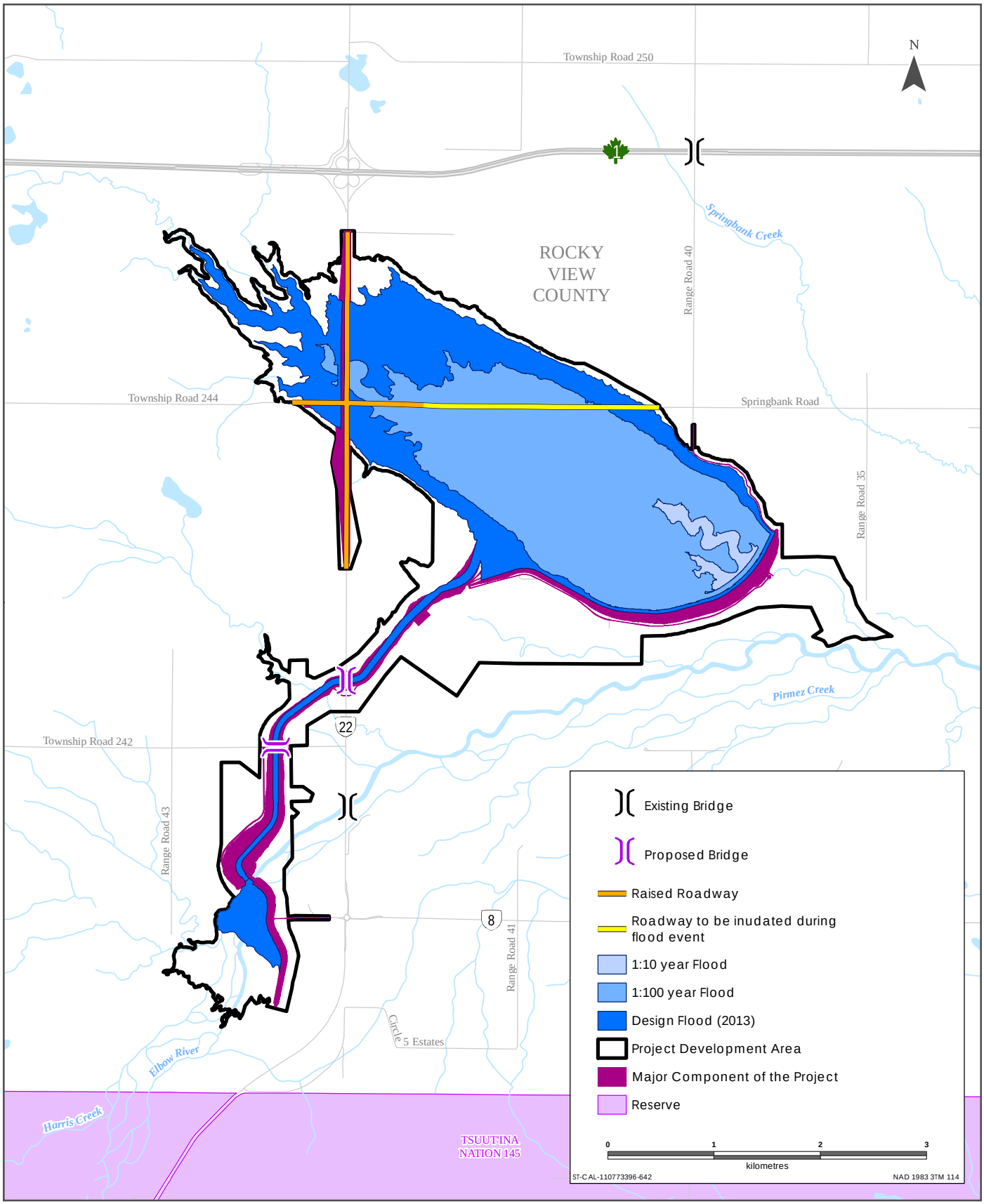
7.1.1.2 Application Case

The Application Case describes the Base Case with the effects of the Project added. The assessment of the environmental effects addresses the four project phases, as described above. The assessment of effects during the flood and post-flood phases addresses three floods (Figure 7-1):

- A 1:10 year flood
- A 1:100 year flood
- The design flood

7.1.1.3 Planned Development Case

The Planned Development Case describes the effects of the Project in concert with those of other projects and activities that have occurred are occurring and are planned to occur in the RAA. The Planned Development Case is described under the cumulative effects assessment (Volume 3C, Section 1).



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

Flood Scenarios

Stantec

7.1.2 Identification of Potential Effects and Effects Pathways

The assessment of each VC begins with a table identifying the Project components and physical activities that may interact with the VC to cause the identified environmental effects. The pathways (cause and effect relationships) whereby these components and activities could result in the environmental effect during each project phase are described. Where possible, the spatial and temporal extent of these changes (*i.e.*, where and when the environmental effect might occur) are also described.

The EIA focuses on residual environmental effects: environmental effects after mitigation has been applied. Environmental effects before mitigation are not quantified or assessed, nor is the significance of the environmental effect determined before mitigation.

7.1.3 Mitigation of Environmental Effects

Mitigation measures that may help to reduce or eliminate an environmental effect are described, with an emphasis on how these measures help to reduce the environmental effect. Mitigation is defined as a change in the temporal or spatial aspects of the Project and the means in which the Project is constructed or operated, over and above the Project design aspects described in Volume 1. In addition, mitigation can include specialized measures such as habitat compensation, replacement, or financial compensation, as well as planned environmental management and response measures (*e.g.,* environmental and social management system, management plans).

7.1.4 Characterization of Residual Effects

Residual environmental effects are described during each project phase, taking into account how the mitigation would alter or change the environmental effect. The analysis includes both direct and indirect interactions between the Project and the VC.

Environmental effects for each VC are characterized for each Project phase and activity and presented in an environmental effects summary table (Table 7-1).

Table 7-1 Example: Summary of Project Residual Effects on (Name of VC)

Residual Effect	Residual Effects Characterization								
	Project Phase	Timing	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Ecological and Socio-economic Context
Effect Name 1									
	C								
	D								
	F								
	PF								
Effect Name 2									
	C								
	D								
	F								
	PF								

Table 7-1 Example: Summary of Project Residual Effects on (Name of VC)

KEY

See Section 5.4.1 for detailed definitions

Project Phase

C: Construction

D: Dry Operation

F: Flood Operation

PF: Post-flood Operation

Timing Consideration:

T: Time of day

S: Seasonality

R: Regulatory

Direction:

P: Positive

A: Adverse

Magnitude:

N: Negligible

L: Low

M: Moderate

H: High

Geographic Extent:

PDA: Project Development Area

LAA: Local Assessment Area

RAA: Regional Assessment Area

Duration:

ST: Short-term;

MT: Medium-term

LT: Long-term

Frequency:

S: Single event

IR: Irregular event

R: Regular event

C: Continuous

Reversibility:

R: Reversible

I: Irreversible

Ecological/Socio-Economic Context:

D: Disturbed

U: Undisturbed

R: Resilient

NR: Not Resilient

7.2 STEP 7: ASSESSMENT OF CUMULATIVE ENVIRONMENTAL EFFECTS

The cumulative environmental effects of the Project in combination with other projects or activities that have been or will be carried out are assessed. The assessment of cumulative environmental effects is presented in Volume 3C, Section 1. The assessment includes a detailed discussion of how the Project may interact with other projects or activities that have been or will be carried out and interact with the environment, mitigation measures, and the characterization of residual cumulative environmental effects. In accordance with the the Canadian Environmental Assessment Agency (CEAA) Terms of Reference for the Project, a cumulative effects assessment is only required for VCs upon which the Project may result in adverse residual effects. VCs that would not be affected by the Project or would be affected positively may be omitted from the cumulative effects assessment.

Two conditions must be met to initiate an assessment of cumulative effects on a VC:

- The Project is assessed as having adverse residual environmental effects on a VC.
- The adverse residual effects from the Project overlap spatially and/or temporally with residual effects of other physical activities on a VC.

If these conditions are not met, there is no expectation that the Project will contribute cumulatively to residual effects of other projects or physical activities on the VC and further assessment is not warranted. If the two conditions are met, then an assessment of cumulative effects on the VC is initiated.

7.2.1 Identification of Other Projects or Activities

Other projects or activities that have been or will be carried out are identified for inclusion in the cumulative environmental effects assessment, based on their potential for residual environmental effects that could interact spatially and temporally with the residual environmental effects of the Project. The environmental effects of other past and present projects or activities that have been carried out are generally reflected in the existing baseline environment, and are therefore considered in the Project-related environmental effects assessment for each VC. The assessment and evaluation of the cumulative environmental effects of the Project in combination with other projects or activities that may be carried out considers the nature and degree of change from these existing conditions due to both the Project and the other projects or activities.

The screening of other projects or activities relevant to the cumulative environmental effects assessment is based on the following criteria:

- status of other project or activity: past or present project, or a project or activity that is certain, planned, or reasonably foreseeable
- potential for interaction related to timing of the project and/or activity: other project or activity must be carried out or implemented during the time frame that is relevant to the Project
- potential for a spatial interaction of environmental effect: other project or activity does not have to be located in the RAA but its effects must interact with those of the VC in the RAA

7.2.2 Cumulative Environmental Effects Pathways

The assessment of each cumulative environmental effect begins with a description of the environmental effect and the pathways whereby the project environmental effects may interact with other projects or activities in the RAA, as defined for a particular VC. Where possible, the cumulative environmental effect is quantified in terms of the degree of change in the appropriate measurable parameter(s) and the spatial and temporal extent of these changes (i.e., where and when the interactions between the Project's residual environmental effects and the residual environmental effects of other projects or activities might occur).

Because the assessment focuses on residual environmental effects, cumulative environmental effects before mitigation are not characterized nor their significance determined.

7.2.2.1 Use of Temporal Cases

Temporal cases are defined, where appropriate and helpful, to assist in the assessment of cumulative environmental effects.

The comparison of the Base Case and Application Case with the Planned Development Case allows the Project contribution to cumulative environmental effects of all past, present, and reasonably foreseeable projects or activities that have been or will be carried out to be determined.

7.2.3 Mitigation of Cumulative Environmental Effects

As with the Project's environmental effects, mitigation measures that would reduce the cumulative environmental effects are described, with an emphasis on those measures that would help to minimize the interaction of the Project-related environmental effect with similar environmental effects from other projects, activities, and actions. Three types of mitigation measures are generally considered:

- measures that can be implemented solely by Alberta Transportation
- measures that can be implemented by Alberta Transportation in cooperation with other project proponents, government, Indigenous organizations, the public, and/or other stakeholders
- measures that can be implemented independently by other project proponents, government, Indigenous organizations, the public, and/or other stakeholders

7.2.4 Characterization of Residual Cumulative Environmental Effects

Residual cumulative environmental effects are described and assessed, taking into account how mitigation will alter or change the cumulative environmental effect. Cumulative environmental effects are characterized in terms of the direction, magnitude, geographic extent, frequency, duration, reversibility, and ecological or socioeconomic context. The contribution of the Project to cumulative environmental effects is assessed where there is a potential for measurable interacting environmental effects to occur.

7.3 STEP 8: SIGNIFICANCE DETERMINATION AND PREDICTION CONFIDENCE

7.3.1 Determination of Significance of Residual Project Environmental Effects

A determination of the significance of environmental effects is made using thresholds defined for the VC, and/or the measurable parameters, beyond which a residual environmental effect would be considered significant.

The significance determination for environmental effects is based on a variety of considerations. These considerations can include criteria defined in effect characterization as well as applicable legislation, regulatory standards or other thresholds of acceptability, as described by Barnes *et al.* (2012). These determinations of significance inform decision-making under both the federal and provincial decision-making processes.

Where the environmental effects are determined to be significant, there is further consideration of the likelihood of occurrence of that significant environmental effect, based on past experience and the professional judgment of the study team.

7.3.2 Determination of Significance of Residual Cumulative Environmental Effects

A determination of the significance of residual cumulative environmental effects is then made using the same standards or thresholds for significance developed for the VC and/or the measurable parameters.

7.3.3 Prediction Confidence

The confidence in the determination of significance of effects on a VC is stated. This is described in terms of the quality or quantity of the data used in the assessment, expected effectiveness of mitigation and enhancement measures and the assumptions made in assessing the effects.

7.4 STEP 9: FOLLOW UP

A follow-up program is used, where applicable, to verify environmental effects predictions or to verify the effectiveness of mitigation measures. A monitoring program includes compliance measures used to verify that mitigation was applied or to demonstrate compliance with the requirements of environmental laws or regulations, or the conditions of permits, approvals or authorizations issued under such laws or regulations.

Appropriate follow-up measures are proposed for consideration by regulatory authorities where the scientific uncertainty of the environmental effects predictions or the effectiveness of mitigation warrants the need for such programs. Environmental monitoring measures to demonstrate compliance with legislation or to monitor environmental quality for other purposes are also described as appropriate for consideration by regulatory authorities.

Follow up and monitoring programs, where applicable, are presented in Volume 3C, Section 2.

7.5 STEP 10: SUMMARY

A summary is provided for all the factors that lead the conclusion for cumulative effects on a VC.

7.6 STEP 11: ASSESSMENT OF POTENTIAL ACCIDENTS AND MALFUNCTIONS

The assessment of accidents and malfunctions are presented in Volume 3D, Section 1. Potential accidents and malfunctions are identified based on the Project Description using historical performance data for other similar projects at a regional, provincial, national or international scale, as appropriate. Where applicable, for each accident or malfunction, one or more scenarios relating to how the accident or malfunction might occur during the life of the Project are developed. The focus of the evaluation is on accidents and malfunctions that have a reasonable likelihood of occurring during the lifetime of the Project based on the nature of the Project and the environmental effects that may occur, or for those that could result in significant environmental effects even if their likelihood of occurrence is low.

For each flood or scenario, a preliminary screening is conducted to determine if it is likely to affect each identified VC.

Cumulative environmental effects of accidents and malfunctions however, are not assessed because it is not reasonably foreseeable to have overlapping project-related accidents with those from other projects or activities that will be carried out.

The significance of the project-related environmental effects for each accident or malfunction and its likelihood of occurrence is then determined using the same thresholds as determined for the Project-related environmental effects on each applicable VC.

7.7 STEP 12: ASSESSMENT OF EFFECTS OF THE ENVIRONMENT ON THE PROJECT

The effects of the environment on the Project (i.e., flooding) is what this environmental assessment has been prepared for. Environmental factors which could potentially affect the Project include factors that could potentially result in an interruption of service or damage to infrastructure. This, in turn, could in turn result in adverse effects to VCs. Based on the consideration of the various mitigation strategies applied through design criteria and the implementation of contingency planning, the significance of these residual environmental effects is described.

8.0 REFERENCES

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Alberta Environment and Sustainable Resource Development. 2015. Terms of Reference, Environmental Impact Assessment Report for Alberta Transportation's Proposed Springbank Off-Stream Reservoir Project, February 5, 2015

Canadian Environmental Assessment Act, 2012

Canadian Environmental Assessment Agency. 2016. Guidelines for the Preparation of an Environmental Impact Statement, Springbank Off-Stream Reservoir Project, August 10, 2016

Attachment A CEAA 2012, SECTION 5, ENVIRONMENTAL EFFECTS

ENVIRONMENTAL EFFECTS

***5.** (1) For the purposes of this Act, the environmental effects that are to be taken into account in relation to an act or thing, a physical activity, a designated project or a project are*

(a) a change that may be caused to the following components of the environment that are within the legislative authority of Parliament:

(i) fish as defined in section 2 of the Fisheries Act and fish habitat as defined in subsection 34(1) of that Act,

(ii) aquatic species as defined in subsection 2(1) of the Species at Risk Act,

(iii) migratory birds as defined in subsection 2(1) of the Migratory Birds Convention Act, 1994, and

(iv) any other component of the environment that is set out in Schedule 2;

(b) a change that may be caused to the environment that would occur

(i) on federal lands,

(ii) in a province other than the one in which the act or thing is done or where the physical activity, the designated project or the project is being carried out, or

(iii) outside Canada; and

(c) with respect to aboriginal peoples, an effect occurring in Canada of any change that may be caused to the environment on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage,

(iii) the current use of lands and resources for traditional purposes, or

(iv) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

(2) However, if the carrying out of the physical activity, the designated project or the project requires a federal authority to exercise a power or perform a duty or function conferred on it under any Act of Parliament other than this Act, the following environmental effects are also to be taken into account:

(a) a change, other than those referred to in paragraphs (1)(a) and (b), that may be caused to the environment and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function that would permit the carrying out, in whole or in part, of the physical activity, the designated project or the project; and

(b) an effect, other than those referred to in paragraph (1)(c), of any change referred to in paragraph (a) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.