

**TERMS OF REFERENCE  
ENVIRONMENTAL IMPACT ASSESSMENT REPORT  
FOR ALBERTA TRANSPORTATION'S PROPOSED  
SPRINGBANK OFF-STREAM RESERVOIR PROJECT**

**Approximately 11 km west of Calgary, Alberta**

**ISSUED BY:** Alberta Environment and Sustainable Resource Development

**DATE:** February 5, 2015

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## **PURPOSE OF THE TERMS OF REFERENCE**

The purpose of this document is to identify for Alberta Transportation, landowners, Aboriginal communities and appropriate stakeholders the information required by government agencies for an Environmental Impact Assessment (EIA) report prepared under the *Environmental Protection and Enhancement Act* (EPEA) for the Springbank Off-Stream Reservoir Project (the Project).

The Springbank Off-Stream Reservoir is proposed to be located just west of Calgary approximately 18.5 km upstream of the Glenmore Reservoir. The Project is designed as a dry pond with no permanent pool of water. The Project will divert extreme flood flow from the Elbow River into an off-stream storage reservoir where it would be temporarily contained and later released back into the Elbow River after the flood peak has passed. Project components include a diversion structure constructed across the Elbow River, a diversion channel excavated through the adjacent uplands to transport flood water into an off-stream storage reservoir.

## **SCOPE OF THE EIA REPORT**

Alberta Transportation shall prepare and submit an EIA report that examines the environmental and socio-economic effects of the Project.

The EIA report shall be prepared considering all applicable provincial and federal legislation, codes of practice, guidelines, standards, policies, directives and the South Saskatchewan Regional Plan.

The EIA report shall be prepared in accordance with these Terms of Reference and the environmental information requirements prescribed under EPEA and associated regulations. The EIA report will form part of Alberta Transportation's application to the Natural Resources Conservation Board (NRCB). An EIA report summary will also be included as part of the NRCB Application.

Alberta Transportation shall refer to the *Guide to Preparing Environmental Impact Assessment Reports in Alberta* published by Alberta Environment and Sustainable Resource Development (the Guide) and these Terms of Reference when preparing the Environmental Impact Assessment report. In any case where there is a difference in requirements between the Guide and these Terms of Reference, the Terms of Reference shall take precedence.

## **CONTENT OF THE EIA REPORT**

### **1 PUBLIC ENGAGEMENT AND ABORIGINAL CONSULTATION**

- [A] Describe the concerns and issues expressed by landowners and the public. Describe the actions taken to address those concerns and issues, including the process and extent of public consultation used to arrive at the current proposal for flood mitigation and how public input was incorporated into the Project development, impact mitigation and monitoring.
- [B] Describe the concerns and issues expressed by Aboriginal communities and the actions taken to address those concerns and issues, including how Aboriginal community input was incorporated into the Project, EIA development, mitigation, monitoring and reclamation. Describe consultation undertaken with Aboriginal communities and groups with respect to traditional ecological knowledge and traditional use of land and water.

- [C] Describe plans to maintain the landowner and public engagement and Aboriginal consultation process following completion of the EIA report to ensure that the landowners, the public and Aboriginal peoples will have an appropriate forum for expressing their views on the ongoing development, operation and reclamation of the Project.

## **2 PROJECT DESCRIPTION**

### **2.1 Overview**

- [A] Provide a brief project description in sufficient detail to provide context for the EIA, including:
- a) proponent information;
  - b) need for the Project and why this project was chosen over other flood mitigation projects;
  - c) which communities would benefit from the project; and
  - d) development plan and schedule.
- [B] Provide maps and/or drawings of the Project components and activities including:
- a) total potential areas to be flooded in extreme flood scenarios;
  - b) existing infrastructure, leases and clearings;
  - c) proposed facilities, buildings and infrastructure (e.g., pipelines and utilities);
  - d) temporary structures;
  - e) transportation and access routes;
  - f) containment structures;
  - g) water wells/intakes, pipelines and storage structures;
  - h) sources of aggregate resources, borrow material and other construction material and locations of any stockpiles that will be developed; and
  - i) waste storage area and disposal sites.
- [C] Discuss the implications (positive and negative) of a delay in proceeding with the Project, or any phase of the Project, or not going ahead with the Project.
- [D] Describe the impacts and benefits of the Project, including jobs created, local training, employment and business opportunities that accrue to:
- a) landowners;
  - b) local and regional communities, including Aboriginal communities;
  - c) the local authority;
  - d) Alberta; and
  - e) Canada.
- [E] Provide the adaptive management approach that will be implemented throughout the life of the Project. Include how monitoring, mitigation and evaluation were incorporated.
- [F] Provide a list of commitments Alberta Transportation has made. This would include any mitigation, monitoring and operational commitments made as part of this assessment.

### **2.2 Constraints**

- [A] Discuss the process and criteria used to identify constraints to development, and how the Project has been designed to accommodate those constraints. Include the following:

- a) any applicable *Alberta Land Stewardship Act* Regional Plan, sub-regional plan or watershed plan;
  - b) any applicable municipal plan;
  - c) land use policies and resource management initiatives;
  - d) Aboriginal traditional land and water use;
  - e) the environmental setting;
  - f) cumulative environmental impacts in the region;
  - g) cumulative social impacts in the region; and
  - h) regional monitoring.
- [B] Discuss the selection criteria used, options considered (including McLean Creek option), and rationale for selecting the location of facilities and infrastructure.
- [C] Provide a list of Project components for which locations will be determined later. Discuss the selection criteria that will be used to determine the specific location of these.

### **2.3 Regional and Cooperative Efforts**

- [A] Describe opportunities for sharing infrastructure (e.g., access roads, utility corridors, water infrastructure). Provide rationale where these opportunities will not be implemented.

### **2.4 Transportation Infrastructure**

- [A] Describe and map the locations of any new road or intersection construction, or any improvements to existing roads or intersections, related to the development of the Project, from the boundary of the Project Area up to and including the highway access points, and:
- a) discuss the alternatives and the rationale for selection for the preferred alternative;
  - b) discuss compatibility of the preferred alternative to Alberta Transportation's immediate and future plans;
  - c) describe the impacts to local landowners and communities of the changes in transportation and infrastructure; and
  - d) provide a proposed schedule for the work.
- [B] Describe any infrastructure or activity that could have a potential impact on existing roads (e.g., pipelines or utilities crossing provincial highways, any facilities in close proximity of the highways, any smoke, dust, noise, light or precipitation generated by the Project that could impact the highway and road users).
- [C] Indicate where Crown land dispositions may be needed for roads or infrastructure required for the Project.

### **2.5 Air Emissions Management**

- [A] Discuss the selection criteria used, options considered, and rationale for selecting mitigation measures to minimize air emission and ensure air quality management.
- [B] Provide emission profiles (type, rate and source) for the Project's construction and operating emissions including point and non-point sources, area, mobile and fugitive emissions. Consider both reservoir drawdown and post flood sediment deposit conditions. Discuss:
- a) odorous and visible emissions from the Project;

- b) greenhouse gas emissions during all stages of the Project. Identify the primary sources and provide calculations;
- c) amount and nature of Criteria Air Contaminants emissions; and
- d) control technologies and mitigative measures used to reduce emissions.

## **2.6 Dam Safety**

- [A] Describe:
- a) the project components and scope;
  - b) the overall approach for design and technical specification;
  - c) any hypotheses and assumptions used;
  - d) data collection methods, models and studies;
  - e) the degree of uncertainty, reliability and sensitivity of models used to reach conclusion; and
  - f) any gaps in knowledge and understanding related to key conclusions, including steps to address these gaps.
- [B] Describe the consequence classification of the proposed dam and its appurtenant structures.
- [C] Describe:
- a) the principal dimensions of the earthfill dam and appurtenant structures;
  - b) the anticipated quantities of material used to construct the dam and appurtenant structures;
  - c) seepage control and drainage provisions;
  - d) freeboard requirements;
  - e) the field and lab testing that has been performed to determine the suitability of the materials; and
  - f) the characteristics/geotechnical properties of the in-situ and construction materials and describe their suitability for use as construction materials.
- [D] Describe the physical characteristics of the reservoir, including:
- a) normal operating range;
  - b) spatial extent/overlap into other tributaries, if any;
  - c) surface area at the maximum normal reservoir level, with the area of each tributary arm; and
  - d) normal operating water volume, and the volume between the maximum normal reservoir level and the minimum normal reservoir level.
- [E] Describe the activities for construction of the Dam, Floodplain Berm, Diversion Channel, and other appurtenant structures, including:
- a) site clearing and grubbing;
  - b) construction and operation of the temporary works required for construction (e.g., cofferdam, river diversion, etc.), if any;
  - c) excavations, slope stabilization and foundation preparation;
  - d) construction of the dam and its appurtenant structures;
  - e) placing impervious lining and erosion protection;
  - f) installation of instrumentation, mechanical and electrical equipment;
  - g) testing and commissioning the facility; and
  - h) removal of temporary construction facilities.

- [F] Describe the construction activities for reservoir preparation, including:
  - a) reservoir filling; and
  - b) methods for managing wood debris and shoreline stabilization during reservoir filling.
- [G] Describe the excavation and stockpiling of suitable material, including drilling, blasting, sorting and screening in rock quarries and moisture conditioning of impervious material.
- [H] Describe the operations phase activities, including:
  - a) operation and maintenance activities needed for the safe operation of the dam and to prolong its operational capacity;
  - b) reservoir fluctuations;
  - c) water management approach (for flood, normal and drought conditions), including reservoir operations and resulting downstream flows and water levels; and
  - d) operation and maintenance plans.
- [I] Describe the decommissioning activities, including:
  - a) decommissioning of temporary construction facilities and any associated reclamation (e.g., cofferdam); and
  - b) dam decommissioning in the future, a plan to address decommissioning and restoration in accordance with applicable regulations at that time.

## **2.7 Water Management**

### **2.7.1 Water Supply**

- [A] Describe the water supply for the Project, including:
  - a) the criteria used, options considered and rationale for selection of water sources(s);
  - b) the expected water balance during all stages of the Project. Discuss assumptions made or methods chosen to arrive at the water balances;
  - c) the process water requirements and sources for construction (including, but not limited to, road construction, winter road construction, lease construction, production well drilling and dust suppression), normal and emergency operating situations. Identify the volume of water from each source;
  - d) the location of sources/intakes and outlets and associated infrastructure (e.g., pipelines for water supply);
  - e) the variability in the amount of water required on an annual and seasonal basis as the Project is implemented; and
  - f) the expected cumulative effects on water losses/gains resulting from the Project operations.

### **2.7.2 Surface Water**

- [A] Describe the surface water management strategy for all stages of the Project, including:
  - a) design factors considered; and
  - b) permanent or temporary alterations or realignments of watercourses, wetlands and other waterbodies.
- [B] Describe and map all roadway, pipeline, powerline and any other utility crossings of watercourses or waterbodies.

### **2.7.3 Flood Control**

- [A] Describe how the project will be utilized to manage back to back storm events effectively.
- [B] Describe the operations of the project and Glenmore Reservoir together to achieve the maximum benefit of flood control.

### **2.8 Waste Management**

- [A] Discuss the selection criteria used, options considered, and rationale for waste disposal.
- [B] Characterize and quantify the anticipated dangerous goods, and hazardous, non-hazardous, and recyclable wastes generated by the Project, and describe:
  - a) plans for pollution prevention, waste minimization, recycling, and management to reduce waste quantities for all stages of the Project.

### **2.9 Conservation and Reclamation**

- [A] Provide a conceptual conservation and reclamation plan for the Project. Describe and map as applicable:
  - a) current land use and capability and proposed post-development land use and capability;
  - b) anticipated timeframes for completion of reclamation stages including an outline of the key milestone dates for reclamation and how progress to achieve these targets will be measured;
  - c) constraints to reclamation such as timing of activities, availability of reclamation materials and influence of natural processes and cycles including natural disturbance regimes;
  - d) a revegetation plan for the disturbed terrestrial, riparian and wetland areas;
  - e) reclamation material salvage, storage areas and handling procedures; and
  - f) existing and final reclaimed site drainage plans.
- [B] Discuss, from an ecological perspective, the expected timelines for establishment and recovery of vegetative communities and wildlife habitat, the expected success of establishment and recovery, and the expected differences in the resulting communities.
- [C] Describe how the Proponent considered the use of progressive reclamation in project design and reclamation planning.
- [D] Discuss uncertainties related to the conceptual reclamation plan.

## **3 ENVIRONMENTAL ASSESSMENT**

### **3.1 Air Quality, Climate and Noise**

#### **3.1.1 Baseline Information**

- [A] Discuss the baseline climatic and air quality conditions including:
  - a) the type and frequency of meteorological conditions that may result in poor air quality; and
  - b) appropriate ambient air quality parameters.



### **3.1.2 Impact Assessment**

- [A] Identify components of the Project that will affect air quality, and:
  - a) describe the potential for reduced air quality (including odours and visibility) resulting from the Project and discuss any implications of the expected air quality for environmental protection and public health;
  - b) estimate ground-level concentrations of appropriate air quality parameters;
  - c) discuss any expected changes to particulate deposition patterns;
  - d) discuss interactive effects that may occur resulting from co-exposure of a receptor to all emissions; and
  - e) describe air quality impacts resulting from the Project, and their implications for other environmental resources.
- [B] Identify stages or elements of the Project that are sensitive to changes or variability in climate parameters, including frequency and severity of extreme weather events and discuss the potential impacts over the life of the Project.
- [C] Summarize the noise assessment, and:
  - a) identify the nearest receptor used in the assessment; and
  - b) discuss the design, construction and operational factors considered for the Project.

### **3.2 Dam Safety**

- [A] Describe the expected performance of the dam and its appurtenant structures during and after extreme weather events (e.g., floods, earthquakes, etc.), including the ability of earth dams, diversion channel and flow control structures to withstand those events, potential challenges and mitigation measures.
- [B] Describe the potential challenges that could impact the safety of the proposed structure and proposed mitigation measures (e.g., during excavations, foundation/treatment, slope stabilization, materials, QA/QC, etc.)
- [C] Describe the potential challenges that could impact the safety of the proposed structure and proposed mitigation measures (e.g., during reservoir filling, debris management, operations, maintenance and surveillance philosophy, performance under extreme weather events (floods, tornados, etc.), emergency preparedness and response, etc.)
- [D] For all stages of the Project, identify potential accidents and malfunctions that could occur (e.g., cofferdam leakage or failure, sediment control failure, any other Dam Safety incidents).
- [E] Describe the effects of a dam/channel breach by tabulating the expected flood arrival time and water surface elevation at Glenmore Reservoir/Dam as well as downstream until the estimated water surface is within the estimated 100 year flood level.
- [F] Describe the possibility of cascade failure and its impacts.
- [G] Describe the potential challenges during decommissioning of the temporary dam works as well as for any future decommissioning of the proposed dam.

### **3.3 Hydrogeology**

#### **3.3.1 Baseline Information**

- [A] Provide an overview of the existing geologic and hydrogeologic setting from the ground surface down to, and including, the Base of Groundwater Protection for the area, and:
- a) present regional and Project Area geology to illustrate depth, thickness and spatial extent of lithology, stratigraphic units and structural features; and
  - b) present regional and Project Area hydrogeology describing:
    - i) the major aquifers, aquitards and aquicludes (Quaternary and bedrock), their spatial distribution, properties, hydraulic connections between aquifers, hydraulic heads, gradients, groundwater flow directions and velocities. Include maps and cross sections,
    - ii) the chemistry of groundwater aquifers including baseline concentrations of major ions, metals and hydrocarbon indicators,
    - iii) the potential discharge zones, potential recharge zones and sources, areas of groundwater-surface water interaction and areas of Quaternary aquifer-bedrock groundwater interaction,
    - iv) water well development and groundwater use, including an inventory of groundwater users,
    - v) the recharge potential for Quaternary aquifers,
    - vi) potential hydraulic connection between the aquifers and the Project (i.e. groundwater mounding), and
    - vii) the locations of major structures associated with the Project, including the reservoir, the dam and channels and describe site-specific aquifer and shallow groundwater conditions beneath these proposed structures. Provide supporting geological information.

#### **3.3.2 Impact Assessment**

- [A] Describe project components and activities that have the potential to affect groundwater resource quantity and quality at all stages of the Project.
- [B] Describe the nature and significance of the potential project impacts on groundwater with respect to:
- a) inter-relationship between groundwater and surface water in terms of both groundwater and surface water quantity and quality;
  - b) implications for terrestrial or riparian vegetation, wildlife and aquatic resources including wetlands;
  - c) changes in groundwater quality, quantity and flow;
  - d) conflicts with other groundwater users, and proposed resolutions to these conflicts;
  - e) groundwater protection including reclaiming wells in the Project area prior to construction of the Project;
  - f) potential implications of seasonal variations; and
  - g) groundwater withdrawal for project operations, including any expected alterations in the groundwater flow regime during and following project operations.

### **3.4 Hydrology**

#### **3.4.1 Baseline Information**

- [A] For the local and regional study area:
  - a) describe the rationale used to define the local and regional study areas considering the location and range of probable project and cumulative effects;
  - b) provide maps illustrating boundaries of the local and regional study areas;
  - c) describe and map the surface hydrology;
  - d) describe meteorological conditions; and
  - e) describe sediment yield.
- [B] Discuss the existing flow regime, including:
  - a) seasonal variation, low, average and peak flows for watercourses;
  - b) low, average and peak levels for waterbodies; and
  - c) natural flow contribution of the existing creek to Elbow River.
- [C] Provide an inventory of all surface water users who have existing approvals, permits or licenses in the local and regional study areas.

#### **3.4.2 Impact Assessment**

- [A] Identify Project activities that may affect surface water during all stages of the Project, including site preparation, construction, operation, decommissioning and reclamation.
- [B] Discuss potential hydrological changes (in terms of quantity, extent and duration) to watersheds due to the project implementation, including changes in:
  - a) surface and near-surface drainage conditions;
  - b) channel regime (during minimum, average and peak flows);
  - c) water levels in water bodies and water courses;
  - d) evaporation, transpiration and seepage amounts;
  - e) sediment transport and yield; and
  - f) open-water surface areas.
- [C] Discuss impacts including cumulative effects of:
  - a) diverting water from Elbow River due to construction of a diversion weir. Consider flood-flow conditions and water conservation objectives established for the Elbow River;
  - b) removing/plugging of Elbow River tributaries;
  - c) creating a reservoir due to construction of an off-stream storage dam;
  - d) returning flow from the reservoir;
  - e) constructing a diversion channel;
  - f) improving existing creek channel downstream of future low level outlet structure;
  - g) realigning Springbank road or constructing a causeway; and
  - h) changing hydrology (e.g., timing, volume, peak and minimum flow rates, river regime and reservoir levels) and sediment transport on the Elbow River, the diversion channel, new reservoir and its outlet channel watercourse.
- [D] Discuss changes in geomorphic conditions (river bed aggradation, degradation and bank erosion) that could occur as a result of changed flow regimes due to project

implementation (including all temporary and permanent stream realignments or other disturbances).

- [E] Describe impacts on other surface water users resulting from the Project. Identify any potential water use conflicts.
- [F] Identify predicted changes to existing surface and groundwater relationships within the watershed as a result of diversion from Elbow River, and construction and operation of the reservoir.

### **3.5 Surface Water Quality**

#### **3.5.1 Baseline Information**

- [A] Describe the current baseline water quality of watercourses and waterbodies (unnamed creek, Elbow River, and the Glenmore Reservoir) and their seasonal variations, temporal and spatial trends. Include water quality for high flow events (1:20-year and 1:100-year) under current conditions. Consider appropriate water quality parameters (e.g., metals, nutrients, pesticides, temperature, BOD/TOC, bacteria, aquatic and benthic invertebrates, aquatic plants, algae, dissolved oxygen, etc.) Provide a summary of existing information available from literature review(s).
- [B] Describe and map the current point and identify non-point sources in the project area.
- [C] Describe the intended water uses of the proposed Springbank Road Reservoir (e.g., flood storage, fish habitat, hydroelectric, municipal discharge, recreation, etc.)

#### **3.5.2 Impact Assessment**

- [A] Identify project components (during construction, operation and maintenance) that may influence or impact future surface water quality of the Elbow River and/or Glenmore Reservoir, including diversions out of the Elbow River and reservoir releases back to the Elbow River.
- [B] Describe and predict the potential impacts of the Project (during construction, operation, maintenance) on surface water quality of the Elbow River and Glenmore Reservoir using modelling or other scientifically defensible approach, including:
  - a) changes in water quality that may exceed the Environmental Quality Guidelines for Alberta Surface Waters, the Canadian Water Quality Guidelines for the Protection of Aquatic Life or the Water Quality Management Framework (WQMF) included in the South Saskatchewan Regional Plan;
  - b) changes in loading amounts and timing of key water quality parameters including nutrients, dissolved/total organic carbon, metals, sediment, etc. that could impact the Elbow River and Glenmore Reservoir, including:
    - i) impacts on their use as a drinking water supply, recreation, agriculture, domestic use, aesthetics, and other water uses,
    - ii) potential implications to water quality (e.g., high water temperature, low dissolved oxygen, lower dilution, etc.) on the Elbow River due to the water drawn during the initial filling of the Springbank Road Reservoir,
    - iii) implications to aquatic resources (e.g., aquatic and benthic invertebrates, biota, vegetation, algae, biodiversity, habitat),
    - iv) changes in seasonal variation,

- v) groundwater –surface water interactions,
  - vi) changes in surface runoff,
  - vii) implications to the health and extent of riparian lands,
  - viii) impact on river banks during flood events, and
  - ix) impacts in the event of a catastrophic failure of the reservoir; and
  - c) describe the level of uncertainty derived from the models and tools used in the previous analysis.
- [C] Describe the water quality expected in the proposed Springbank Off-Stream Reservoir. Discuss any limitations of expected water quality on municipal/domestic use, recreational use, fisheries, stock watering or other uses.
- [D] Describe the potential and implications for lead, arsenic, cadmium and mercury methylation in the reservoir to:
- a) enter the aquatic food chain, including downstream in the Elbow River and Glenmore Reservoir; and
  - b) impact treatment of water from Glenmore Reservoir for drinking water purposes.
- [E] Describe the potential and implications for Cyanobacteria/Microcystin in the reservoir to:
- a) impact treatment of water from Glenmore Reservoir for drinking water purposes; and
  - b) impact recreation of the Springbank Off-Stream Reservoir, Elbow River and Glenmore Reservoir.
- [F] Describe the potential and implications for release and contamination of hydrocarbons (and associated materials) from pipelines and other oil and gas infrastructure, farm infrastructure and/or contaminated surface soil or subsoil in the area, on water quality and aquatic environment.
- [G] Describe the potential and implications for nutrient management in the proposed Springbank Off-Stream reservoir, based on the proposed operating regime.
- [H] Describe any potential cumulative effects in the Bow River and the implications to the WQMF and regional initiatives such as the Bow River Phosphorus Management Plan.

### **3.6 Aquatic Ecology**

#### **3.6.1 Baseline Information**

- [A] Describe and map the fish, fish habitat and aquatic resources (e.g., riparian, aquatic and benthic invertebrates) of the Elbow River and tributaries (i.e. upstream and downstream of the reservoir) affected by the project and all ancillary project components. Describe the species composition, distribution, relative abundance, quantitative population estimate, movements and general life history parameters of fish resources at appropriate times of year, which take into account regional use of the Elbow River system (i.e., Elbow Falls to Glenmore Reservoir). Identify any species that are:
- a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development);
  - b) listed in Schedule 6 of the provincial *Wildlife Regulation*;
  - c) listed in Schedule 1 of the federal *Species at Risk Act*;
  - d) listed as “at risk” by COSEWIC; and
  - e) traditionally used species.

- [B] Describe and map existing critical or sensitive areas such as spawning, rearing, and over-wintering habitats, seasonal habitat use including migration and spawning routes.
- [C] Describe the current and potential use of the fish resources by Aboriginal, sport or commercial fisheries.

### 3.6.2 Impact Assessment

- [A] Describe and assess the potential impacts of the Project to fish and fish habitat, and other aquatic resources, including but not limited to the following:
  - a) habitat loss and alteration:
    - i) during construction and from infrastructure footprint,
    - ii) changes to hydrology on the Elbow River, including below Glenmore Reservoir, due to all aspects of water operations (e.g., low flow diversion especially during drought years), and
    - iii) of unnamed tributary to Elbow River above and below proposed reservoir;
  - b) entrainment and entrapment of fish at the diversion structure, canals, outlet structure, and reservoir, including:
    - i) measures to prevent fish entrainment,
    - ii) ability for entrained fish to return to Elbow River system;
    - iii) population level impacts from added mortality or loss from the Elbow River system, including other cumulative effects (e.g., fish mortality, habitat loss, summerkill, winterkill, competition with non-native species);
    - iv) effects of reservoir design (e.g., shape, depth) on fish stranding and mortality with respect to drawdown; and
    - v) mitigative measures to return fish to the Elbow River system in the event of stranding due to drawdown;
  - c) fish passage at the diversion weir throughout the year and across years, considering all species and life stages;
  - d) biodiversity;
  - e) a description of maintenance requirements to maintain fish passage at all times of year for spring and fall spawning species;
  - f) effects on water quality including, but not limited to:
    - i) changes to water temperature and dissolved oxygen in the Elbow River system and reservoir and potential effects of these changes on fish; and
    - ii) contaminants (e.g., methylmercury) and bioaccumulation in fish;
  - g) the current use of local and regional fisheries resources to support the assessment of potential changes in angling pressure;
  - h) increased habitat fragmentation; and
  - i) groundwater-surface water interactions.
- [B] Identify the key aquatic indicators that Alberta Transportation used to assess project impacts. Discuss the rationale for their selection.
- [C] Identify all aspects of potential serious harm to fish and fish habitat resulting from the construction and ongoing operation of all project components (i.e. operation of weir, fish entrainment via ongoing diversions to maintain Full Supply, fish kills due to dewatering of pond and thermal increases in water temperature, etc.)

- [D] Identify plans proposed to offset any loss in the productivity of fish habitat. Indicate how environmental protection plans address applicable provincial and federal policies on fish habitat including the development of a “No Net Loss” fish habitat objective.
- [E] Describe measures to ensure aquatic invasive species do not occupy or establish in the project infrastructure; describe measures to remove aquatic invasive species should they be found.
- [F] Identify/describe monitoring plans/strategies that can be implemented to evaluate potential project impacts to regional fisheries resources in the Elbow River watershed. (i.e., include population level surveys conducted at appropriate times of year which take into account regional use of the Elbow River system (i.e., Elbow Falls to Glenmore Reservoir)).

### **3.7 Vegetation**

#### **3.7.1 Baseline Information**

- [A] Describe and map the vegetation communities, wetlands, riparian lands, rare plants, invasive species and communities of rare and scarce distribution. Identify the occurrence, relative abundance and distribution and identify any species that are:
  - a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development);
  - b) listed in Schedule 1 of the federal *Species at Risk Act*;
  - c) listed as “at risk” by COSEWIC; and
  - d) traditionally used species.
- [B] Describe and quantify the current extent of natural vegetative communities, and identify the risks to those communities.

#### **3.7.2 Impact Assessment**

- [A] Describe and assess the potential impacts of the Project on vegetation communities and biodiversity, considering:
  - a) both temporary (include timeframe) and permanent impacts;
  - b) the potential for introduction and colonization of weeds and non-native invasive species;
  - c) potential increased fragmentation and loss of upland, riparian and wetland habitats; and
  - d) implications of vegetation changes for other environmental resources (e.g., terrestrial and aquatic habitat diversity and quantity, water quality and quantity, erosion potential).
- [B] Identify key vegetation indicators used to assess the Project impacts. Discuss the rationale for the indicator’s selection.

### **3.8 Wildlife and Biodiversity**

#### **3.8.1 Baseline Information**

- [A] Describe and map current and potential wildlife resources (amphibians, reptiles, birds, and terrestrial and aquatic mammals) in the area from the diversion weir to the dam and

outflow. Describe species relative abundance, distribution and their use and potential use of habitats. Also identify any species that are:

- a) listed as “at Risk, May be at Risk and Sensitive” in the *General Status of Alberta Wild Species* (Alberta Environment and Sustainable Resource Development);
- b) listed in Schedule 1 of the federal *Species at Risk Act*;
- c) listed as “at risk” by COSEWIC;
- d) traditionally used species; and
- e) migratory bird species listed under the *Migratory Birds Convention Act*.

[B] Describe and map existing wildlife habitat and habitat disturbance including assessment activities. Identify habitat disturbances that are related to existing and approved projects.

[C] Describe and map existing levels of biodiversity including a description of the biodiversity metrics, biotic and abiotic indicators used. Discuss the rationale for their selection.

### **3.8.2 Impact Assessment**

[A] Describe and assess the potential impacts of the Project to wildlife, wildlife habitats, and biodiversity considering:

- a) how the Project will affect wildlife relative abundance, habitat availability, habitat fragmentation, mortality, movement patterns, and distribution for all stages of the Project, including a prediction of future use due to habitat alteration;
- b) how improved or altered access may affect wildlife, including future prediction of wildlife use and movements;
- c) how altered habitat conditions (loss, change, fragmentation) may effect wildlife and biodiversity values. Consider habitat change (e.g., riparian), the availability of habitat and the influence of anthropogenic features and infrastructure on wildlife movements and predator-prey relationships; the contribution of the Project to changes in regional biodiversity and the impact to local and regional ecosystems;
- d) potential effects on wildlife resulting from changes to air and water quality, including both acute and chronic effects to animal health; and
- e) how the risk to wildlife and habitat can be managed.

[B] Identify the key wildlife and habitat indicators used to assess project impacts. Discuss the rationale for their selection.

## **3.9 Terrain and Soils**

### **3.9.1 Baseline Information**

[A] Describe and map the terrain and soils conditions in the Project Area.

### **3.9.2 Impact Assessment**

[A] Describe Project activities that could affect soil quality (e.g., wetting/drying/rewetting of soil, salinization, silt accumulation, soil crusting, compaction, anaerobic decomposition of organic matter, contaminants) and:

- a) indicate the amount (ha) of surface disturbance, aggregate and borrow sites and other infrastructure-related construction and operational activities;
- b) discuss the relevance of any changes for the local and regional landscapes, biodiversity, productivity, ecological integrity, aesthetics and future use; and



- c) describe potential sources of soil contamination (e.g., industry infrastructure and activities, agricultural infrastructure and activities, contaminated sites, etc.)
- [B] Discuss the potential impacts caused by the mulching and storage of woody debris considering, but not limited to, vulnerability to fire, degradation of soil quality, increased footprint.

### **3.10 Land Use and Management**

#### **3.10.1 Baseline Information**

- [A] Describe and map the current land uses in the Project Area, including all Crown land dispositions and Crown Reservations (Holding Reservation, Protective Notation, Consultative Notation).
- [B] Indicate where Crown land dispositions may be needed for roads or other infrastructure for the Project (e.g., weir, diversion, creek improvements, water intake, water outlet).
- [C] Identify and map unique sites or special features such as Parks and Protected Areas, Heritage Rivers, Historic Sites, Environmentally Significant Areas, culturally significant sites and other designations (e.g., World Heritage Sites, Ramsar Sites, Internationally Important Bird Areas).
- [D] Describe and map land clearing activities, showing the timing of the activities.
- [E] Describe existing access control measures.

#### **3.10.2 Impact Assessment**

- [A] Identify the potential impacts of the Project on land uses, including:
  - a) unique sites or special features;
  - b) changes in public and landowner access arising from the development, including secondary effects related to increased hunter, angler and other recreational access;
  - c) aggregate reserves that may be located on land under Alberta Transportation's control and reserves in the region;
  - d) compare the baseline and reclaimed percentages and distribution of vegetation communities in the Project Area;
  - e) the operations of any agricultural crown leases, provincial grazing reserves or other crown dispositions;
  - f) anticipated changes (type and extent) to the topography, elevation and drainage patterns within the Project Area; and
  - g) access control for landowners, public, regional recreational activities, Aboriginal land use and other land uses during and after development activities.
- [B] Describe how Integrated Land Management has been used.
- [C] Provide a fire control plan highlighting:
  - a) measures taken to ensure continued access for firefighters to adjacent wildland areas; and
  - b) fire prevention, detection, reporting, and suppression measures, including proposed fire equipment.

## **4 HISTORIC RESOURCES**

### **4.1 Baseline Information**

- [A] Provide a brief overview of the regional historic resources setting, including a discussion of the relevant archaeological, historic and palaeontological records.
- [B] Describe and map known historic resources sites in the Project Area, considering:
  - a) site type and assigned Historic Resources Values; and
  - b) existing site-specific *Historical Resources Act* requirements.
- [C] Provide an overview of previous Historic Resources Impact Assessments that have been conducted within the Project Area, including:
  - a) a description of the spatial extent of previous assessment relative to the Project Area, noting any assessment gap areas; and
  - b) a summary of *Historical Resources Act* requirements and/or clearances that have been issued for the Project to date.
- [D] Identify locations within the Project Area that are likely to contain previously unrecorded historic resources. Describe the methods used to identify these areas.

### **4.2 Impact Assessment**

- [A] A Historic Resources Impact Assessment is required for the Project and a summary of the results of the Historic Resources Impact Assessment must be included.
- [B] Describe all project components and activities, including all ancillary activities that have the potential to affect historic resources at all stages of the Project.
- [C] Describe the nature and magnitude of the potential project impacts on historical resources, considering:
  - a) effects on historic resource site integrity; and
  - b) implications for the interpretation of the archaeological, historic and palaeontological records.

## **5 TRADITIONAL ECOLOGICAL KNOWLEDGE AND LAND USE**

- [A] Provide:
  - a) a map and description of traditional land use areas including fishing, hunting, trapping and nutritional, medicinal or cultural plant harvesting by affected Aboriginal peoples (if the Aboriginal community or group is willing to have these locations disclosed);
  - b) a map of cabin sites, spiritual sites, cultural sites, graves and other traditional use sites considered historic resources under the *Historical Resources Act* (if the Aboriginal community or group is willing to have these locations disclosed), as well as traditional trails and resource activity patterns; and
  - c) a discussion of:
    - i) the availability of vegetation, fish and wildlife species for food, traditional, medicinal and cultural purposes in the identified traditional land use areas considering all project related impacts; and
    - ii) access to traditional lands in the Project Area during all stages of the Project.

- [B] Determine the impacts of the Project on traditional medicinal and cultural purposes and identify mitigation strategies.

## **6 PUBLIC HEALTH AND SAFETY**

### **6.1 Public Health**

- [A] Describe aspects of the Project that may have implications for public health or the delivery of regional health services. Determine quantitatively whether there may be implications for public health arising from the Project.
- [B] Document any health concerns regarding the Project raised by stakeholders during consultation.
- [C] Document any health concerns identified by Aboriginal communities or groups regarding the Project, specifically on their traditional lifestyle. Include an Aboriginal receptor type in the assessment.

### **6.2 Public Safety**

- [A] Describe aspects of the Project that may have implications for public safety. Specifically:
  - a) describe the emergency response plan including public notification protocol and safety procedures to minimize adverse environmental effects, including emergency reporting procedures for spill containment and management;
  - b) document any safety concerns raised by stakeholders during consultation on the Project;
  - c) describe how local residents will be contacted during an emergency and the type of information that will be communicated to them;
  - d) describe the existing agreements with area municipalities or industry groups such as safety cooperatives, emergency response associations, regional mutual aid programs and municipal emergency response agencies; and
  - e) describe the potential safety impacts resulting from higher regional traffic volumes.

## **7 SOCIO-ECONOMIC ASSESSMENT**

### **7.1 Baseline Information**

- [A] Describe the project alternatives considered for flood mitigation.
- [B] Describe the existing socio-economic conditions in the region and in the communities in the region.
- [C] Describe factors that may affect existing socio-economic conditions including:
  - a) population changes;
  - b) workforce requirements for all stages of the Project, including a description of when peak activity periods will occur;
  - c) planned accommodations for the workforce for all stages of the Project. Discuss the rationale for their selection;
  - d) Alberta Transportation's policies and programs regarding the use of local, regional and Alberta goods and services;
  - e) the project schedule; and
  - f) the overall engineering and contracting plan for the Project.

## **7.2 Impact Assessment**

- [A] Describe the effects of construction and operation of the Project on:
  - a) landowners;
  - b) housing;
  - c) availability and quality of health care services;
  - d) local and regional infrastructure and community services;
  - e) recreational activities;
  - f) agricultural productivity;
  - g) hunting, fishing, trapping and gathering; and
  - h) First Nations and Métis (e.g., traditional land use and social and cultural implications).
- [B] Describe the impacts of additional proposed flood mitigation projects or a combination of those projects on the effectiveness of the Project.
- [C] Describe the need for additional Crown land or private land.
- [D] Discuss opportunities to work with Aboriginal communities and groups, other local residents and businesses regarding employment, training needs and other economic development opportunities arising from the Project.
- [E] Describe the financial costs of 1:50, 1:100 and 2013 flood events to the public and local/provincial and federal governments. Indicate the extent to which these financial costs are mitigated by the project.
- [F] Provide the estimated total project cost, including a breakdown for engineering and project management, relocation of infrastructure, acquisition of land, maintenance, equipment and materials, and labour for both construction and operation stages. Indicate the percentage of expenditures expected to occur in the region, Alberta, Canada outside of Alberta, and outside of Canada.
- [G] Provide a discussion as to which communities will benefit from the proposed Project.
- [H] Describe other potential impacts and benefits of the project (e.g., recreation, open green space, aesthetics).

## **8 MITIGATION MEASURES**

- [A] Discuss mitigation measures planned to avoid, minimize or eliminate the potential impacts for all stages of the Project.
- [B] Identify the mitigation objectives for each associated impact and describe those mitigation measures that will be implemented. Provide rationale for their selection, including a discussion on the effectiveness of the proposed mitigation.

## **9 RESIDUAL IMPACTS**

- [A] Describe the residual impacts of the Project following implementation of Alberta Transportation's mitigation measures and Alberta Transportation's plans to manage those residual impacts.

## **10 MONITORING**

- [A] Describe Alberta Transportation's current and proposed monitoring programs, including:

- a) how the monitoring programs will assess any project impacts and measure the effectiveness of mitigation plans. Discuss how Alberta Transportation will address any project impacts identified through the monitoring program;
- b) how Alberta Transportation will contribute to current and proposed regional monitoring programs;
- c) monitoring performed in conjunction with other stakeholders, including Aboriginal communities and groups;
- d) new monitoring initiatives that may be required as a result of the Project;
- e) regional monitoring that will be undertaken to assist in managing environmental effects and improve environmental protection strategies;
- f) how monitoring data will be disseminated to landowners, the public, Aboriginal communities or other interested parties; and
- g) how the results of monitoring programs and publicly available monitoring information will be integrated with Alberta Transportation's environmental management system.

[B] Identify the surface water quality monitoring program that will be implemented to assess the future impacts of construction and operation (including maintenance) of the reservoir project on the Elbow/Glenmore/Bow. Consider appropriate water quality parameters (e.g., metals, nutrients, pesticides, temperature, BOD/TOC, bacteria, aquatic and benthic invertebrates, aquatic plants, algae, dissolved oxygen, etc.), and their seasonal and flow variations.