

---

To:	Matthew Hebert Alberta Transportation	From:	Lacey AuCoin Stantec Consulting Ltd
File:	11073396	Date:	April 29, 2021

---

**Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project**

Alberta Transportation is required to prepare an Offset Measures Plan for Fisheries and Oceans Canada (DFO) as part of the *Fisheries Act* authorization process for the Springbank Off-stream Reservoir Project (the Project; DFO file no. 16-HCAA-00537). Offsetting measures are required to counterbalance the potential for residual harmful alteration, disruption, or destruction (HADD) of fish habitat, or death of fish, as a result of Project activities. Alberta Transportation is committed to offsetting residual effects to fish and fish habitat, including bull trout and its critical habitat, that cannot be mitigated and is committed to developing an Offset Measures Plan that meets the conditions of both the *Species at Risk Act* and the *Fisheries Act*.

This memo presents Alberta Transportation's Conceptual Offset Measures Plan for the Project in consideration of the *Policy for applying measures to offset adverse effects on fish and fish habitat under the Fisheries Act* (DFO, 2019) and stakeholder feedback. This memo discusses:

- Offsetting Considerations
- Conceptual Offset Measures Plan Approach
  - Proposed Adaptive Offset Measures Approach
  - Potential Synergies
  - Entrainment Estimates and Death of Fish Estimates
- Proposed Offset Measures for HADD and Death of Fish Associated with the Elbow River Fish Community
- Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat
- Next Steps

Alberta Transportation understands additional design effort and assessment will be progressed following acceptance of and feedback on this conceptual plan by DFO, and this information will be included in a final Offset Measures Plan as part of the Application for Authorization under the *Fisheries Act*.

## 1 OFFSETTING CONSIDERATIONS

### 1.1 FISH AND FISH HABITAT RESIDUAL EFFECTS

The Project will result in residual effects to fish and fish habitat through both construction and operation of the Project. The Conceptual Offset Measures Plan presented herein was developed based on quantified residual effects that are presented in the Stantec memo titled *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* dated April 12, 2021 (Attachment A; Stantec, 2021). Residual effects on fish and fish habitat include the following:

- temporary and permanent HADD associated with the construction footprint
- permanent HADD associated with downstream changes to channel morphology following operation
- death of fish associated with Project operation

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

The April 12, 2021 memo presents a revised HADD estimate incorporating DFO feedback received March 3, 2021 on Alberta Transportation's October 29, 2020 version of the HADD estimates. Alberta Transportation understands that DFO will continue to provide feedback and direction on the estimation methodology used to quantify potential residual effects of the Project until the final Offset Measures Plan is authorized.

## 1.2 DFO GUIDING PRINCIPLES

The proposed offsetting measures have been developed in accordance with DFO's *Policy for applying measures to offset adverse effects on fish and fish habitat under the Fisheries Act* (DFO, 2019). The following guiding principles from DFO (DFO, 2019) have been considered in selection of suitable offsetting measures for the Project:

### 1.2.1 Guiding Principle 1: "Measures to offset should support fisheries management objectives and give priority to the restoration of degraded fish habitat."

Alberta Transportation has consulted with Alberta Environment and Parks Fisheries Management branch (AEP-FM) to identify areas that are considered valuable for offsetting within the southern Alberta region. Specifically with respect to the Elbow River (i.e., between Elbow Falls and Glenmore Dam), AEP-FM's Fishery Management Objective is to:

*"Provide and maintain a domestic and recreational fishery for native species (i.e., Bull Trout, Mountain Whitefish) and non-native species (i.e., Rainbow x Cutthroat hybrid, Brown Trout, Brook Trout and Rainbow Trout) in the watershed."* (AEP, 2021)

In addition, broader AEP-FM objectives within southern Alberta include initiatives that can increase the survival and persistence of bull trout, a species listed under Schedule 1 of the *Species at Risk Act* within the Bow River basin.

### 1.2.2 Guiding Principle 2: "Benefits from measures to offset should balance the adverse effects resulting from the works, undertakings or activities."

Offset measures will be progressed through site analyses, modeling, and design efforts to meet the required scale of predicted residual effects that are presented in the *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* (Stantec, 2021). Alberta Transportation recognizes that the estimates provided in this memo are preliminary and subject to change based on feedback from DFO. The offset measures will be scaled such that the measures are proportional to the residual effects resulting from the Project.

### 1.2.3 Guiding Principle 3: "Measures to offset should provide additional benefits to the ecosystem."

The offset measures will specifically consider the limiting variables of the local fishery. To support this effort, Alberta Transportation has developed a habitat suitability index (HSI) model of the habitat in the Elbow River between Bragg Creek and Glenmore Reservoir, including the areas that comprise of predicted HADD. HSI results of bull trout were included in Attachment A (Stantec, 2021), and a full HSI analysis (brown trout, bull trout, mountain whitefish, and rainbow trout) will be included in the Application for Authorization. This HSI model identifies limiting habitat variables within the areas affected by the Project. These limiting habitat variables in the Elbow River will inform the design of habitat features.

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

Offset measures will also consider limiting habitat variables within the broader Bow River basin, with consideration given to areas that have historical bull trout abundance and areas that have been identified for recovery in the federal bull trout recovery strategy (DFO, 2020).

**1.2.4 Guiding Principle 4:** *“Measures to offset should generate self-sustaining benefits over the long term.”*

Offset measures will strive to generate self-sustaining benefits to fish and fish habitat. Offset measures will be designed for flood resiliency, and to counterbalance the duration of the residual effects that may result from the Project.

## **2 CONCEPTUAL OFFSET MEASURES PLAN APPROACH**

Based on the considerations outlined above, offsetting measures have been considered and are proposed for two general categories of loss associated with Project activities:

- HADD and Death of Fish associated with the Elbow River fish community
- HADD and Death of Fish associated with bull trout and its critical habitat

Upon acceptance by DFO, conceptual offset measures to address these types of loss will be progressed through additional site analyses and presented in the Application for Authorization.

Alberta Transportation has identified three key approach considerations that are important to this Conceptual Offset Measures Plan and the eventual Final Offset Measures Plan: Alberta Transportation’s proposed adaptive offset measures approach, potential synergies between offset measures and the approach taken for estimating entrainment estimates and death of fish estimates. A discussion on each of these considerations follow.

### **2.1 PROPOSED ADAPTIVE OFFSET MEASURES APPROACH**

While estimating the potential Project effects on fish habitat is generally straightforward, Alberta Transportation recognizes there are uncertainties associated with entrainment estimates related to death of fish associated with the Project. Factors causing this uncertainty include the frequency of Project operations, the magnitude of flood event, the fish populations in the Elbow River at the time of flood, the effectiveness of fish exclusion measures, the number of fish entrained by Project operations, the duration from Project activation to reservoir release, the number of fish that exit the reservoir through the lower outlet channel during reservoir release, and the effectiveness of fish rescue efforts.

To address this uncertainty, Alberta Transportation is proposing an adaptive approach for offsetting Project effects related to fish entrainment and fish mortality. This will allow appropriate offset measures to be established based on initial effects estimates and post-flood monitoring in a responsive and effective manner.

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

Alberta Transportation proposes the following offsetting approach for potential effects to fish due to entrainment from the Project:

- Alberta Transportation will offset for potential entrainment effects based on an initial entrainment effects estimates due to the Project, authorized by DFO (i.e., an authorized threshold).
- Post-flood monitoring results in the reservoir and in the Elbow River will confirm whether initial entrainment effect estimates were appropriate.
- If post-flood monitoring confirms the initial entrainment effect estimates were appropriate, no additional offsetting measures would be required.
- If post-flood monitoring confirms the initial entrainment effect estimates were underestimated, additional offsetting measures will be instituted by Alberta Environment and Parks (as the reservoir operator) under authorization from DFO.
  - These additional offsetting measures will be detailed in the Final Offset Measure Plan in the forthcoming Application for Authorization to confirm the additional measures are available and feasible, in case they are required in the future.
- Throughout this process, once offset measures are established, their performance will be monitored to confirm effectiveness and success.
  - If offset measures are not performing as expected, modifications to the offset measures or additional offset measures may be required.

Alberta Transportation believes this proposed approach addresses the uncertainty related to entrainment estimates and death of fish estimates and can be effectively managed and enforced through a *Fisheries Act* authorization. Alberta Transportation looks forward to feedback on this approach from DFO.

## **2.2 POTENTIAL SYNERGIES**

Alberta Transportation recognizes that some offset measures may offset portions of the residual effects to the Elbow River fish community and at the same time offset portions of the residual effects to bull trout and its critical habitat. For the purpose of this conceptual plan, these potential synergies are not accounted for and the proposed offsetting measures for HADD and Death of Fish associated with the Elbow River fish community are presented separately from the proposed offsetting measures for HADD and Death of Fish associated with bull trout and its critical habitat. Alberta Transportation expects the final Offset Measures Plan will account for these synergies appropriately as the plan is optimized to reduce potential “double counting” of offsetting requirements.

## **2.3 ENTRAINMENT ESTIMATES AND DEATH OF FISH ESTIMATES**

Preliminary estimates of entrainment and death of fish (reflective of both the Elbow River fish community and bull trout) were presented in the *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* (Stantec, 2021). The preliminary *Bull Trout Jeopardy Assessment for the Springbank Offstream Reservoir Project* (Post, 2021) suggests that entrainment and mortality estimates for the Project may be higher than predicted in Stantec’s estimates for Death of Fish (Stantec, 2021). The factors associated with uncertainty in these estimates were discussed above.

**Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project**

More information regarding the preliminary jeopardy assessment report findings and direction from DFO is required to evaluate the potential need to revise the estimates for Death of Fish. The habitat equivalency for Death of Fish has not been established within this memo. Finalized Death of Fish Estimates, and habitat equivalency for this loss, will be presented in the final Offset Measures Plan as part of the Application for Authorization upon continued discussions with DFO. For the purposes of this Conceptual Offset Measures Plan, ranges of Death of Fish estimates are presented in the following sections for the Elbow River fish community and for bull trout.

Through discussions with DFO on April 28, 2021, it was discussed that the Death of Fish estimates could potentially be authorized assuming Project activities and effects are adaptively managed over a 10-year operating period with renewal. This approach was included as an option for Death of Fish estimates in the following sections (titled “Estimate 2” in both tables).

Finalized entrainment estimate percentages and fish quantity estimates will be provided upon further discussion with DFO related to this approach, under the assumption that the predictions will be adaptively managed throughout the life of the Project based on monitoring results. Additional offsetting will be implemented if the death of fish estimates are higher than predicted within the Authorization (i.e., if the approved ‘threshold’ is surpassed in the Authorization). This adaptive approach is reflected in Alberta Transportation’s proposed adaptive offset measures approach.

### **3 PROPOSED OFFSET MEASURES FOR HADD AND DEATH OF FISH ASSOCIATED WITH THE ELBOW RIVER FISH COMMUNITY**

HADD and Death of Fish associated with the Elbow River fish community is predicted to occur as a result of construction and operation of the Project. Consistent with the adaptive offset measures approach described above, Alberta Transportation is proposing a sequence of offsetting measures that can be included in the Authorization as needed. These offset measures are presented in Table 1, and the proposed initial offset measure for implementation, Elbow River Side Channel Habitat Creation, is further described below.

**Table 1 Proposed Offset Measures for HADD and Death of Fish Associated with the Elbow River Fish Community**

<b>Offset Measure</b>	<b>Description</b>	<b>Reference</b>	<b>Value</b>
Elbow River Side Channel Habitat Creation	A side channel to the Elbow River could be designed and constructed to influence hydrology in a manner that creates side-channel habitat features. The side channel would include a variety of fish habitat treatments such as root wads, log jams, pools, islands, riffles, that all contribute to fish habitat complexity and provide habitat for all life stages.	Subsection below in this memo	Scalable based on design, current estimate is 40,000 to 100,000 m <sup>2</sup>
Milburn Creek Tributary and Confluence Enhancements	Milburn Creek enters the Elbow River at River Spirit Golf Course and is highly modified. Habitat enhancement and creation at the confluence of Milburn Creek to provide improved refuge habitat. Milburn Creek is downstream of the Project and this option aims to enhance refuge habitat that fish will seek during a flood.	Attachment D	Design could create 10,000 to 30,000 m <sup>2</sup> of rearing or refuge habitat in the Elbow River floodplain and reduce sediment inputs into the Elbow River.

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 1 Proposed Offset Measures for HADD and Death of Fish Associated with the Elbow River Fish Community**

Offset Measure	Description	Reference	Value
Egg Incubation Boxes	Egg incubation boxes are devices that contain fish eggs for natural incubation in the river. This option would commit the Government of Alberta to instate a naturalized stocking program to rear resident trout species. The program could include a variety of trout species but there is opportunity to focus on species like bull trout. This effort would be ongoing, and not exclusive to a flood event given the time and investment required to establish the program.	Attachment D	Value would be proportional to the habitat equivalency metrics that are established for Death of Fish (i.e., 'in-kind')
Two culvert rehabilitations and erosion control within McLean Creek	<p>The McLean Creek Public Land Use Zone (PLUZ) is a very popular off-roading area. The disturbance to the creeks in the PLUZ from the off-highway vehicle (OHV) use has increased the rate of sediment release into McLean Creek, and subsequently the Elbow River.</p> <p>Offsetting at McLean Creek could include settling ponds constructed on each of the main tributaries to McLean Creek pond and immediately upstream of the pond itself. The ponds would need a considerable amount of residence time for settling because of the fine particle size of the sediment observed in the creek.</p> <p>The offsetting could also include the re-connection of the larger McLean Creek to the Elbow River by implementing culvert passage improvements at the Highway 66 and McLean Creek Trail and Highway 54. A naturalized fishway can be retrofitted to the McLean Creek pond dam and there appears to be sufficient space to do this an effective and low-cost manner.</p> <p>Erosion control measures would inherently require the closure of select trails and fordings or land use changes. Erosion and sediment control measures along would be insufficient without exclusion and enforcement. The exclusion of OHV from the entire PLUZ is a consideration; however, this consideration would be very challenging given the popularity of this site. A more localized approach to exclusion or improvement, which targets high impact areas, may be more appropriate.</p>	Discussed in April 28, 2021 meeting with DFO	Can provide high-value enhancement of the lower Elbow River watershed by reducing sedimentation sources. Option has been identified by AEP-FM in past discussions.

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

### **3.1 ELBOW RIVER SIDE CHANNEL HABITAT CREATION**

As discussed above, Alberta Transportation proposes the initial offset measure for conventional fish habitat creation be through the construction of a side channel to the Elbow River floodplain (ER-HB-01; Figure 1 in Attachment B) to counterbalance loss. This offset measure can counterbalance offsets 'in-kind' for HADD, and offsets 'out-of-kind' for death of fish.

The Elbow River side channel would be constructed near the Project location (within floodplain land between the Springbank Off-stream Reservoir dam and the river) and could be designed to influence hydrology in a manner that creates side-channel habitat features. The side channel would include a variety of fish habitat treatments such as root wads, log jams, pools, islands, riffles that all contribute to fish habitat complexity and provide habitat for all life stages of species that are present near the Project. The figure in Attachment B shows several possible locations for side channels. These alignments are historic channels that can be excavated and reactivated.

This offset measure considers the following benefits:

- Can be scaled to appropriately counterbalance permanent HADD associated with construction and operation of the Project, aligning with Guiding Principle 1
- Aligns with AEP-FM's fishery management objective for the Elbow River (i.e., between Elbow Falls and Glenmore Dam) as per Guiding Principle 2
- Can be designed to provide limiting habitat variables within the Elbow River to align with Guiding Principle 3
- Design is resilient to floods and can provide self-sustaining benefits over long term, as per Guiding Principle 4

Preliminary calculations of HADD, death of fish, and corresponding offset opportunities indicate that the Elbow River side channel can be appropriately scaled to counterbalance the equivalency requirements for fish and fish habitat loss, as discussed in the following two sections.

### **3.2 POTENTIAL HADD ASSOCIATED WITH THE ELBOW RIVER FISH COMMUNITY**

A summary of preliminary calculations for HADD, excluding Death of Fish, is presented in Table 2 below and is taken from the *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* (Stantec, 2021). Table 2 also presents the corresponding offset potential for the proposed side channel ranging from 40,000 to 100,000 m<sup>2</sup>. It is important to note that the HADD estimates in Table 2 include bull trout as part of the Elbow River fish community. As discussed above, Alberta Transportation expects the final Offset Measures Plan will account for potential synergies between offsetting options as the plan is optimized to reduce potential "double counting" of offsetting requirements.

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 2 Residual Effects on Fish and Fish Habitat as a Result of SR1 for the Elbow River Fish Community**

Phase	Description	Residual Effect	Description of HADD	Estimate of HADD, Elbow River Fish Community	Elbow River Side Channel Offset Potential Estimate	
Construction	Habitat alteration and destruction as a result of instream structures	Permanent HADD	Alteration: <ul style="list-style-type: none"> <li>three rock weirs</li> <li>vanes for fish passage</li> </ul> Destruction: <ul style="list-style-type: none"> <li>bank armouring</li> <li>debris deflector</li> <li>service spillway</li> <li>stilling basing</li> <li>bank modification</li> </ul>	1,726 m <sup>2</sup>	40,000 to 100,000 m <sup>2</sup>	
			Alteration: <ul style="list-style-type: none"> <li>unnamed tributary modifications for low-level outlet</li> </ul>	113 m <sup>2</sup>		
	<b>Subtotal Permanent HADD Due to Construction</b>			<b>1,839 m<sup>2</sup></b>		
	Habitat alteration as a result of instream temporary workspace	Temporary HADD <sup>a</sup>	Temporary Alteration: <ul style="list-style-type: none"> <li>temporary diversion channel (temporary alteration)</li> </ul>	16,761 m <sup>2</sup>		
<b>Subtotal Temporary HADD Due to Construction</b>			<b>16,761 m<sup>2</sup></b>			
Operation	Habitat alteration as a result of changes to channel morphology	Permanent HADD	Alteration: <ul style="list-style-type: none"> <li>downstream channel morphology</li> </ul>	78,747 m <sup>2</sup>		
			<b>Subtotal Permanent HADD Due to Operation</b>			<b>78,747 m<sup>2</sup></b>
<b>Total</b>				<b>99,186 m<sup>2</sup></b>		
NOTES: <sup>a</sup> Alberta Transportation has considered offsetting for temporary HADD the same equivalency as permanent HADD for the purpose of this estimate. It is expected temporary HADD may be considered differently than permanent HADD in the final Offset Measure Plan.						

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

### 3.3 POTENTIAL DEATH OF FISH ASSOCIATED WITH THE ELBOW RIVER FISH COMMUNITY

For the purposes of this Conceptual Offset Measures Plan, a range of Death of Fish (i.e., all species in the Elbow River) is presented in Table 3 below to reflect the different approaches for death of fish estimates that have been discussed to date. All estimates rely on Alberta Transportation’s Elbow River population estimates (Stantec, 2021) of 139,495 to 1,172,000. A conservative approach is taken, and all fish predicted to be entrained in the reservoir are included in the Death of Fish estimate. It is important to note that the Death of Fish estimates in Table 3 include bull trout as part of the Elbow River fish community. As discussed above, Alberta Transportation expects the final Offset Measures Plan will account for potential synergies between offsetting options as the plan is optimized to reduce potential “double counting” of offsetting requirements.

**Table 3 Range of Death of Fish Calculations for the Elbow River Fish Community**

Estimate Number	Description	Assumptions	Death of Fish <sup>a</sup> , Elbow River Fish Community
Estimate 1	100 years of project operation; Alberta Transportation’s current estimate from Stantec, 2021	Average historical flood records over 100 years comprising: <ul style="list-style-type: none"> <li>one design flood event with an entrainment estimate of 1%,</li> <li>one 1:100-year flood event with an entrainment estimate of 0.5%, and</li> <li>10 1:10-year flood events with an entrainment estimate of 0.1% for each event.</li> </ul>	3,488 to 29,300 fish
Estimate 2	10 years of project operation	Potential entrainment over a 10-year period comprising: <ul style="list-style-type: none"> <li>10-year flood event: one event with entrainment of 0.1% of fish population in Elbow River LAA (140 to 1,172 fish)</li> <li>Design flood event: one event with entrainment of 1% of fish population in Elbow River LAA (1,395 to 11,720 fish)</li> </ul> Entrainment estimates rely on Alberta Transportation’s assumptions from Estimate 1	140 to 11,720 fish
Estimate 3	10 years of project operation with Post, 2021 entrainment rates	Potential entrainment over a 10 year period comprising: <ul style="list-style-type: none"> <li>10-year flood event: one event with entrainment of 1.5% of fish population in Elbow River LAA (2,092 to 17,580 fish)</li> <li>Design flood event: one event with entrainment of 11.5% of fish population in Elbow River LAA (16,041 to 134,780 fish)</li> </ul> Entrainment estimates rely on the range of entrainment estimates presented in Post, 2021 (1.7% to 26.1%, with a median of 11.5%). Rates have been calculated using the median percentage to represent a design flood event, and have been adapted to be proportionately smaller for a 10-year event.	2,092 to 134,780 fish

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 3 Range of Death of Fish Calculations for the Elbow River Fish Community**

Estimate Number	Description	Assumptions	Death of Fish <sup>a</sup> , Elbow River Fish Community
Estimate 4	Post, 2021, single flood event	Entrainment estimates suggest a rate of 1.7 to 26.1% of the Elbow River fish population (with a median of 11.5%) could be entrained during operation (Post, 2021). Rates have been calculated using the median percentage of 11.5% over the entire Elbow River fish community population.	16,041 to 134,780 fish
NOTES: <sup>a</sup> Death of Fish estimates conservatively assume 100% of fish entrained in the reservoir do not survive.			

Alberta Transportation anticipates the design of the Elbow River side channel is scalable to account for the final HADD estimates as well as final Death of Fish estimates. Alberta Transportation will also pursue other initial offset measures shown in Table 1 to augment the overall offset potential, if required.

#### **4 PROPOSED OFFSET MEASURES FOR HADD AND DEATH OF FISH ASSOCIATED WITH BULL TROUT AND ITS CRITICAL HABITAT**

HADD and Death of Fish associated with bull trout and its critical habitat is predicted to occur as a result of construction and operation of the Project. Consistent with the adaptive offset measures approach described above, Alberta Transportation is proposing a sequence of offsetting measures that can be added to the Authorization as needed. These offset measures are presented in Table 4, and the proposed initial offset measure for implementation, Canyon Creek, is further described below.

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
Canyon Creek Stream Connectivity	Culvert rehabilitation or replacement and stream re-establishment of a pilot channel to promote fish passage to critical habitat and has become disconnected.	Subsection below in this memo and in Attachment C	175,000 m <sup>2</sup> of critical habitat becomes available to bull trout and other species in the Elbow River
Bioengineered enhancements of Canyon Creek	Additional design effort can be added to Canyon Creek to increase complexity within the system (i.e., woody debris root wads, riparian plantings).	Option would be added to the efforts described below and in Attachment C	Increase habitat value of the units described above, can add some additional area per treatment (i.e., an additional 2,000 to 10,000 m <sup>2</sup> )
Egg Incubation Boxes	Egg incubation boxes are devices that contain fish eggs for natural incubation in the river. This option would commit the Government of Alberta to instate a naturalized stocking program to rear resident trout species. The program could include a variety of trout species but there is opportunity to focus on species like bull trout. This effort would be ongoing, and not exclusive to a flood event given the time and investment required to establish the program.	Attachment D	Value would be proportional to the habitat equivalency metrics that are established for Death of Fish (i.e., 'in-kind')
Elbow River Constructed Habitat	Bioengineered enhancements can be designed along the Elbow River to increase bank habitat complexity. Features such as root wads, tree revetments, boulder clusters, and substrate improvements can be included. Locations are flexible and multiple sites can be proposed.  Alberta Transportation can rely on the habitat suitability index (HSI) model that was developed for the Project to target areas currently provide limited habitat for bull trout.	Attachment D	Can provide moderate habitat value through targeted areas where habitat quality is increased.

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
<p>Kananaskis River Realignment Enhancements</p>	<p>The Kananaskis River was straightened and armored as part of the construction of the Highway 40 corridor. The straightening has also resulted in increased flow velocities in the Kananaskis River during higher flows, and reduced habitat value through this section of the river.</p> <p>Options at this site include the construction of cover along the riprap in the straight sections of the Kananaskis River using woody debris secured with riprap. The works would be in the right bank because of the access, and would be limited to the bank structure. The channel currently has some variability and the rock and wood structures will further enhance it for passage and refuge during high flows. Overbank cover quality is good, but further bioengineering of the bank by retrofitting the disturbed area with joint planted willows could improve shade.</p> <p>The Kananaskis River is not regulated for flood control, but the Upper and Lower Kananaskis Reservoirs do inherently provide some flood control relief. That noted, this site is also downstream of some very large mountain tributaries and flood risk is still very high. Cabling woody debris must be avoided because of navigation hazards; therefore, rock and wood bracing must be used to secure the wood to the bank.</p>	<p>Attachment D</p>	<p>Design value could range from 10,000 to 50,000 m<sup>2</sup></p>
<p>Side Channel to Kananaskis River at Mount Lorette Pond</p>	<p>The Kananaskis River Realignment discussed above includes river modifications that have isolated a historic oxbow and created the Mount Lorette Pond. The pond is a popular day-use area with wheelchair accessible fishing.</p> <p>A side channel to the Kananaskis River could be designed where Mount Lorette pond currently exists. The day-use area may need to be removed or re-designed to accommodate the side channel.</p> <p>Flood resiliency considerations given above to the Kananaskis River realignment would also apply to design of this site. In addition, Highway 40 would cross the side channel at two locations and design considerations would have to be given to appropriate highway crossings.</p>	<p>Attachment D in reference to the Kananaskis River Realignment Enhancements</p>	<p>Design value could range from 30,000 to 80,000 m<sup>2</sup>. Day use re-design could provide additional value to the community with interpretative signage that speaks to the offsetting project and the Bow River basin fishery.</p>

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
Side Channel to Kananaskis River near Kananaskis Village	<p>A side channel to the Kananaskis River could be designed near Kananaskis Village. Options could include the addition of a walking trail to integrate visitor experience.</p> <p>Flood resiliency considerations given above to the Kananaskis River realignment would also apply to design of this site.</p>	Discussed in April 28, 2021 meeting with DFO	Design value could range from 30,000 to 80,000 m <sup>2</sup> . Walking trail could provide additional value to the community with interpretative signage that speaks to the offsetting project and the Bow River basin fishery.
Evan Thomas Creek	<p>Evan Thomas Creek's headwaters abut the headwaters of the Elbow River and this river experienced a considerable amount of natural damage from the 2013 floods. The location of this option is an 800 to 1,200 m long reach of the river located on the creek's alluvial plain upstream of Highway 40. Prior to the flood, this reach was designated as critical habitat for westslope cutthroat trout and supported bull trout.</p> <p>Evan Thomas Creek is now wide with multiple small, shallow channels providing poor habitat potential (e.g., no bank cover, limited depth or pool habitat, poor passage, etc.). Offsets could include converging the braided channels of the creek into a single channel with increased water depth and flow.</p> <p>A substantial amount of earth fill would be required to re-confine the channel. Vegetation re-establishment and erosion and sediment control would be an important part of the restoration goals.</p>	Attachment D in reference to the Evan Thomas Creek	Design value could range from 30,000 to 80,000 m <sup>2</sup>

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
Ghost River Re-instatement of roads or bridge fords	<p>This option is located at the far west end of the Ghost River road, where the road now terminates at a flood damaged crossing. Recreational users who aim to access the rock climbing features in the headwaters of the Ghost River currently ford the river at several AEP designated locations. This remote section of river can see a surprising amount of vehicle traffic through the river because of its popularity as a climbing destination. These ford crossings can have an impact on water quality and fish habitat (including SARA listed bull trout). The fordings are signed by AEP; however, navigation is sometimes difficult, and it is anticipated that many users ford where convenient.</p> <p>The offsetting options here could include stabilizing stream bed to facilitate or better formalize the vehicle crossing. This could reduce the amount of sediment release at the designated fordings. A more comprehensive approach to this reach of the Ghost River would be to reconstruct the low-grade service road and bridges to eliminate the conflict between the fish and the recreational users.</p> <p>In 2013 the Ghost River experienced flooding that washed out much of the floodplain. Floodwaters were highly turbulent and carrying a considerable amount of debris. These floodwaters damaged the existing road infrastructure. Fording upgrades would need to consider flood resiliency.</p>	Attachment D in reference to the Ghost River	Design can provide reduce sedimentation in the watershed and minimize direct disturbance to fish habitat. This option was also identified to be of value in Post 2021.

DRAFT

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
<p>Two culvert rehabilitations and erosion control within McLean Creek</p>	<p>The McLean Creek Public Land Use Zone (PLUZ) is a very popular off-roading area. The disturbance to the creeks in the PLUZ from the off-highway vehicle (OHV) use has increased the rate of sediment release into McLean Creek, and subsequently the Elbow River.</p> <p>Offsetting at McLean Creek could include settling ponds constructed on each of the main tributaries to McLean Creek pond and immediately upstream of the pond itself. The ponds would need a considerable amount of residence time for settling because of the fine particle size of the sediment observed in the creek.</p> <p>The offsetting could also include the re-connection of the larger McLean Creek to the Elbow River by implementing culvert passage improvements at the Highway 66 and McLean Creek Trail and Highway 54. A naturalized fishway can be retrofitted to the McLean Creek pond dam and there appears to be sufficient space to do this an effective and low-cost manner.</p> <p>Erosion control measures would inherently require the closure of select trails and fordings or land use changes. Erosion and sediment control measures along would be insufficient without exclusion and enforcement. The exclusion of OHV from the entire PLUZ is a consideration; however, this consideration would be very challenging given the popularity of this site. A more localized approach to exclusion or improvements, which targets high impact areas, may be more appropriate.</p>	<p>Discussed in April 28, 2021 meeting with DFO</p>	<p>Can provide high-value enhancement of the lower Elbow River watershed by reducing sedimentation sources. Option has been identified by AEP-FM in past discussions.</p>

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 4 Proposed Offset Measures for HADD and Death of Fish Associated with Bull Trout and its Critical Habitat**

Offset Measure	Description	Reference	Value
Barrier Dam and Flow Stabilization on Kananaskis River	<p>The Kananaskis River flows are currently driven by hydropeaking operations that have led to decreased habitat suitability for bull trout and westslope cutthroat trout. Option to modify water license and operating conditions at Barrier Dam and Kananaskis Lakes Dam to stabilize flow within the Kananaskis River and increase habitat suitability for native species. Fishways at Barrier Dam would also be constructed to connect native species to the Kananaskis River.</p> <p>This offset measure would likely result in costs and benefits far above the requirements for a single project. If the Government of Alberta were to pursue this option, Alberta Transportation expects the Project's contribution to the costs of the option to be commensurate to the offsets required for the Project. Alberta Transportation notes that this option would require third-party agreements with TransAlta and potential engagement with Indigenous groups and other stakeholders.</p>	Discussed in April 27, 2021 meeting with DFO	Flow alterations could have broad-scale benefits to the Kananaskis River watershed and increase habitat suitability for native species.

DRAFT

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

## **4.1 CANYON CREEK**

As discussed above, Alberta Transportation proposes the initial offset measure for bull trout be at Canyon Creek. Stream connectivity measures through culvert rehabilitation or replacement at Canyon Creek are proposed to counterbalance loss. This offset measure can counterbalance offsets 'in-kind' for HADD of critical habitat, and offsets 'out-of-kind' for death of bull trout. Preliminary evaluations of Canyon Creek have previously been provided to DFO and are included in Attachment C.

Canyon Creek is a tributary of the Elbow River that is designated as mapped critical habitat (DFO, 2020). Historical bull trout records exist for Canyon Creek (Fitzsimmons, 2008; Popowich and Eisler, 2008); limited data is available to suggest population trend (Sawatzky, 2016). Fish inventories in Canyon Creek in 2005 yielded 95 bull trout or a CPUE of 38 fish per kilometer of survey distance (Fitzsimmons, 2008). Continuous flow is present in the upper 10 to 15 km near the headwaters; whereas flow is intermittent in the lower portions of the creek. Aerial imagery suggests that the 2013 flood has resulted in significant lag deposits that filled in the channel creating subsurface flow in the lower 8 km of the creek. There have not been any significant flood events in the Elbow River watershed since 2013 and it is assumed that the absence of floods has prevented Canyon Creek from re-establishing its channel through these lag deposits. As a result, aquatic connectivity is limited to freshet periods when flows are higher. Subsurface flow as a result of poor connectivity occurs during low-flow periods (late summer, fall, and winter). Spring flows provide consistent flow and connectivity, and this connectivity was observed during a Stantec site reconnaissance in May 2020 and is visible in aerial photography. The culvert at Highway 66 is a barrier to fish passage and limits movement upstream from the Elbow River.

Offsetting at Canyon Creek can include rehabilitation of the culvert (i.e., removal or retrofit of the barrier) to facilitate fish passage to the upper reaches of Canyon Creek during spring high-flow conditions. Fish passage upstream during spring conditions could promote re-establishment of fish population abundance in the upper reaches of Canyon Creek, where connectivity is perennial. Re-instating passage at the culvert alone would not provide year-round connectivity because of the 2013 flood lag-deposits.

Future runoff events of moderate magnitudes are expected to channelize the lower reach of Canyon Creek over time (i.e., existing deposition would mobilize). Pending any major flood like that which occurred in 2013, or any large-scale mass wastings in the lower reach, stream connectivity will eventually re-establish such that fall passage is re-instated.

If immediate spring connectivity is preferred for purposes of to reduce time lag associated with offsetting, a pilot channel can be established along the reach of Canyon Creek that currently has subsurface flow. This option is essentially an effort to accelerate the natural processes that are necessary to re-establish connectivity in the lower-reach.

The pilot channel would be designed to promote the formation of riverine features; but the intent would be to keep its geometry relatively simple and cost-effective over this 8 km long reach. The excavated alluvial material would be placed in the overbank and not removed from the system.

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

This offset measure considers the following benefits:

- Large habitat gains are introduced through minimal intervention. The scale of the offset option can appropriately counterbalance HADD of bull trout critical habitat associated with construction and operation of the Project, aligning with Guiding Principle 1. The pilot channel also meets Guiding Principle 1 of restoring degraded habitat.
- Aligns with AEP-FM's general fishery management objective to target recovery efforts for bull trout, as per Guiding Principle 2. In addition, this option offers habitat potential to other fish species that are present in the upper reach of the Elbow River watershed, as per Guiding Principle 2.
- Efforts may specifically enhance bull trout critical habitat, which aligns with Guiding Principle 3
- Design efforts in Canyon Creek influence hydrology in manner that creates self-sustaining benefits over long-term, as per Guiding Principle 4

#### **4.2 POTENTIAL HADD AND DEATH OF FISH ASSOCIATED WITH BULL TROUT AND ITS CRITICAL HABITAT**

Preliminary calculations of HADD of bull trout critical habitat, death of bull trout, and corresponding offset opportunities in Canyon Creek indicate that the offset measures can be appropriately scaled to counterbalance the equivalency requirements for bull trout and critical habitat loss. A summary of preliminary calculations is adapted from the *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* (Stantec, 2021) and presented in Table 5 below with corresponding offset potential. As discussed above, Alberta Transportation expects the final Offset Measures Plan will account for potential synergies between offsetting options as the plan is optimized to reduce potential "double counting" of offsetting requirements.

Alberta Transportation's estimate of bull trout mortality in Table 6 is based on percent entrainment relative to the bull trout population estimates for the Project of 266 to 2,200 bull trout (fry, juveniles and adults; Stantec, 2021). A conservative approach is taken and all that are predicted to be entrained in the reservoir are included in the Death of Fish estimate.

Alberta Transportation anticipates the Canyon Creek offset measure can account for the final HADD estimates as well as final Death of Fish estimates related to bull trout and its critical habitat. Alberta Transportation can also pursue other initial offset measures shown in Table 4 to augment the overall offset potential, if required.

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 5 Residual Effects on Fish and Fish Habitat as a Result of SR1 for Bull Trout Critical Habitat**

Phase	Description	Residual Effect	Description of HADD	Estimate of HADD, Bull Trout <sup>a</sup>	Canyon Creek Offset Potential Estimate	
<b>Construction</b>	Habitat alteration and destruction as a result of instream structures	Permanent HADD	Alteration: <ul style="list-style-type: none"> <li>three rock weirs</li> <li>vanes for fish passage</li> </ul> Destruction: <ul style="list-style-type: none"> <li>bank armouring</li> <li>debris deflector</li> <li>service spillway</li> <li>stilling basing</li> <li>bank modification</li> </ul>	1,726 m <sup>2</sup>	175,845 m <sup>2</sup>	
			Alteration: <ul style="list-style-type: none"> <li>unnamed tributary modifications for low-level outlet</li> </ul>	0		
	<b>Subtotal Permanent HADD Due to Construction</b>			<b>1,726 m<sup>2</sup></b>		
	Habitat alteration as a result of instream temporary workspace	Temporary HADD <sup>b</sup>	Temporary Alteration: <ul style="list-style-type: none"> <li>temporary diversion channel (temporary alteration)</li> </ul>	16,761 m <sup>2</sup>		
	<b>Subtotal Temporary HADD Due to Construction</b>			<b>16,761 m<sup>2</sup></b>		
<b>Operation</b>	Habitat alteration as a result of changes to channel morphology	Permanent HADD	Alteration: <ul style="list-style-type: none"> <li>downstream channel morphology</li> </ul>	55,345 m <sup>2</sup>		
			<b>Subtotal Permanent HADD Due to Operation</b>			<b>55,345 m<sup>2</sup></b>
<b>Total</b>				<b>73,832 m<sup>2</sup></b>		
<p>NOTES:</p> <p><sup>a</sup> Areas are determined based on bull trout critical habitat and integrated into the HADD estimates for "All Species".</p> <p><sup>b</sup> Alberta Transportation has considered offsetting for temporary HADD to be the same equivalency as permanent HADD for this purpose of this estimate. It is expected temporary HADD may be considered differently than permanent HADD in the final Offset Measure Plan.</p>						

Reference: Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

**Table 6 Range of Death of Fish Calculations for Bull Trout**

Estimate Number	Description	Assumptions	Death of Fish <sup>a</sup> , Bull Trout
Estimate 1	Average number of events over 100 years of operation; Alberta Transportation's current estimate from Stantec, 2021	Average historical flood records over 100 years comprising: <ul style="list-style-type: none"> <li>• one design flood event with an entrainment estimate of 1%,</li> <li>• one 1:100-year flood event with an entrainment estimate of 0.5%, and</li> <li>• 10 1:10-year flood events with an entrainment estimate of 0.1% for each event.</li> </ul>	8 to 55 bull trout
Estimate 2	10 years of project operation	Potential entrainment over a 10-year period comprising: <ul style="list-style-type: none"> <li>• 10-year flood event: one event with entrainment of 0.1% of fish population in Elbow River LAA (1 to 3 fish)</li> <li>• Design flood event: one event with entrainment of 1% of fish population in Elbow River LAA (3 to 22 fish)</li> </ul> Entrainment estimates rely on assumptions from Estimate 1	1 to 22 bull trout
Estimate 3	10 years of project operation with Post, 2021 entrainment rates	Potential entrainment over a 10 year period comprising: <ul style="list-style-type: none"> <li>• 10-year flood event: one event with entrainment of 1.5% of fish population in Elbow River LAA (4 to 33 fish)</li> <li>• Design flood event: one event with entrainment of 11.5% of fish population in Elbow River LAA (31 to 253 fish)</li> </ul> Entrainment estimates rely on the range of entrainment estimates presented in Post 2021 (1.7% to 26.1%, with a median of 11.5%). Rates have been calculated using the median percentage to represent a design flood event, and have been adapted to be proportionately smaller for a 10-year event.	4 to 253 bull trout
Estimate 4	Post, 2021, single flood event	Entrainment estimates suggest a rate of 1.7 to 26.1% of the Elbow River fish population (with a median of 11.5%) could be entrained during operation (Post, 2021). Rates have been calculated using the median percentage of 11.5% over the entire Elbow River fish community population.	31 to 253 bull trout
NOTES: <sup>a</sup> Death of Fish estimates conservatively assume 100% of fish entrained in the reservoir do not survive.			

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

## 5 NEXT STEPS

Upon acceptance by DFO, the conceptual offset measures described in this memo will be progressed for submission in an Offset Measures Plan as part of the Application for Authorization under the Fisheries Act. Feedback from DFO on the HADD and Death of Fish estimates presented in *Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat* (Stantec, 2021) is required to finalize offsetting requirements for design analysis. Habitat equivalency requirements will be discussed with DFO and offsets can be scaled to counterbalance requirements for the Project activities.

**Stantec Consulting Ltd.**

**Lacey AuCoin** M.Sc., P.Biol  
Fisheries Biologist  
[Lacey.AuCoin@stantec.com](mailto:Lacey.AuCoin@stantec.com)

Attachments: Attachment A: Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat  
Attachment B: Potential Locations for Side Channel Habitat in the Elbow River Floodplain (ER-HB-01)  
Attachment C: Canyon Creek Stream Connectivity – Offsetting Opportunity  
Attachment D: Revised SR1 Offsetting Options Memo

**Reference:** Conceptual Offset Measures Plan for the Springbank Off-stream Reservoir Project

## 6 REFERENCES

- AEP (Alberta Environment and Parks). 2021. Springbank Off-stream Reservoir (SR1). PowerPoint presentation, presented by Alberta Environment and Parks to Alberta Transportation on April 22, 2021.
- DFO (Fisheries and Oceans Canada). 2019. Policy for applying measures to offset adverse effects on fish and fish habitat under the Fisheries Act. Available at: [Policy for applying measures to offset adverse effects on fish and fish habitat under the Fisheries Act \(dfo-mpo.gc.ca\)](https://www.dfo-mpo.gc.ca/policy-policy/offsetting/offsetting-fish-and-fish-habitat-under-the-fisheries-act.html). Accessed on April 27, 2021.
- DFO. 2020. Recovery Strategy for the Bull Trout (*Salvenius confluentus*), Saskatchewan-Nelson Rivers populations, in Canada (Final). Species at Risk Act Recovery Strategy Series. Fisheries and Oceans Canada, Ottawa. Viii+130 pp.
- Fitzsimmons, K. 2008. Monitoring bull trout and cutthroat trout populations in Canyon and Prairie creek drainages, Elbow River, Alberta, 2005. Data report, D-2008-010, produced by the Alberta Conservation Association, Cochrane, Alberta, Canada. 27 pp. + App.
- Popowich, R., and G. Eisler. 2008. Fluvial Bull Trout Redd Surveys on the Elbow, Sheep and Highwood Rivers, Alberta. Submitted to Trout Unlimited, Canada, Calgary AB. 16pp + Appendices.
- Post, J.R. 2021. Bull Trout Jeopardy Assessment for the Springbank Off-stream Reservoir Project. Prepared for Fisheries and Oceans Canada, April 2021.
- Sawatzky, C.D. 2016. Information in support of a recovery potential assessment of Bull Trout (*Salvenius confluentus*) (Saskatchewan – Nelson rivers populations) in Alberta. DFO Can. Sci. Advis. Sec. Res. Doc. 2016/113. V +190 p.
- Stantec. 2021. Preliminary Estimate of Predicted Residual Effects of SR1 on Fish and Fish Habitat. Memo to Alberta Transportation Dated April 12, 2021.