Klohn Crippen Berger

Water Security Agency

Crooked Lake Outlet Structure Replacement

Technical Proposal

Revision 1

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November 2023

November 10, 2023

Water Security Agency
10 – 3904 Millar Avenue
Saskatoon, SK
S7P 0B1

Ms. Nicole Zacharias, P. Eng.
Manager, Project Engineering

Dear Ms. Zacharias:

Crooked Lake Outlet Structure Replacement
Technical Proposal – Revision 1

Klohn Crippen Berger Ltd. (KCB) is pleased to submit the revised Technical Proposal for the Crooked Lake Outlet Structure Replacement project. This report is intended for submission to regulatory agencies to support the review of the project. The report, originally dated May 11, 2017, has been revised to include additional information requested by regulatory agencies.

We appreciate the opportunity to continue providing our services to the Water Security Agency of Saskatchewan. Please do not hesitate to call the undersigned at 639-637-0749 should you require further information.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

Joel Hilderman, M.Sc., P.Eng.
Senior Civil Engineer, Manager Saskatoon

JH:bb

Klohn Crippen Berger Ltd.
1729 Ontario Avenue ▪ Saskatoon SK S7K 1S9 ▪ Canada
t 306.974.1520 ▪ f 403.274.5349 ▪ www.klohn.com

Water Security Agency

Crooked Lake Outlet Structure Replacement

Technical Proposal

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EXECUTIVE SUMMARY

The Crooked Lake water control structure (existing facility) is located at the east end of Crooked Lake, approximately 135 km east of Regina, Saskatchewan, in Sunset Beach (an Organized Resort Hamlet) in the Rural Municipality of Grayson No. 184. The existing facility consists of a reinforced concrete outlet structure, stop logs, and earthen dyke at the east end of Crooked Lake. Prairie Farm Rehabilitation Administration (PFRA) constructed the existing facility in the 1940s and the structure was owned and operated by the Federal Government until 2014. The structure is now owned and operated by the Water Security Agency (WSA) and has been assessed to have surpassed its design life. The existing Crooked Lake outlet structure is in deteriorated condition, is difficult and unsafe to operate, and acts as a barrier to fish migration during normal operation. The WSA proposes to replace the existing facility.

The primary purpose of the Crooked Lake Outlet Structure Replacement Project (Project) is to replace the existing facility to allow for safer operation, better control of lake water levels, and increased fish passage potential. The Project will include a replacement outlet structure, a fishway, and a dedicated construction and maintenance access road. The replacement outlet structure will be constructed on the north side of the existing outlet structure and will be equipped with electrically or hydraulically operated gates to allow for easier and safer operation and subsequently, more reliable control of lake water levels. Fish passage will be enhanced with the construction of a weir structure in the outlet channel upstream of the existing outlet structure. Construction is expected to occur within approximately 2 years, commencing in May of Year 1 and extending to October of Year 2.

The existing biological, physical, and human environments were characterized, and an assessment of potential effects was carried out to identify constraints and opportunities for mitigation to reduce the adverse effects of the Project. After considering project alternatives and applying mitigation strategies, the Project was predicted to result in six residual effects. Adverse residual effects on vegetation and wildlife habitat are expected to occur based on a loss of 20,200 m^2 of riparian floodplain vegetation. Positive residual effects on fish and wildlife are anticipated based on a predicted net gain of aquatic habitat of approximately 2,931 m^2. A positive residual effect is also predicted related to increased fish passage potential and increased upstream distribution of fish, relative to the existing condition. Finally, the replacement of the control structure will result in the continued ability to manage and maintain water levels in the lake for recreation in the future. These residual effects were not considered to be significant.

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CLARIFICATIONS REGARDING THIS REPORT

This report is an instrument of service of Klohn Crippen Berger Ltd. (KCB). The report has been prepared for the use of Water Security Agency (Client) for the specific application to the Crooked Lake Outlet Structure Replacement project and may be published or disclosed by the Client to Fisheries and Oceans Canada, Indigenous Services Canada, and Transport Canada Navigation Protection Program.

KCB has prepared this report in a manner consistent with the level of care, skill, and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered; however, the use of this report will be at the user's sole risk absolutely and in all respects, and KCB makes no warranty, express or implied. This report may not be relied upon by any person other than the Client or [Regulator/Government Name] without KCB's written consent.

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2. The Executive Summary is a selection of key elements of the report. It does not include details needed for the proper application of the findings and recommendations in the report.
3. The observations, findings, and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.
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6. This report is electronically signed, and sealed, and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.

1 INTRODUCTION

1.1 Project Overview

The Crooked Lake water control structure (existing facility) is located at the east end of Crooked Lake, approximately 135 km east of Regina, Saskatchewan, in Sunset Beach (an Organized Resort Hamlet) in the Rural Municipality of Grayson No. 184 (Figure 1). The existing facility consists of a reinforced concrete outlet structure, stop logs, and earthen dyke at the east end of Crooked Lake (Appendix I, Photographs I-1 and I-2). The Cowessess First Nation Reserve on the south riverbank (right-hand side, looking downstream) of the Qu'Appelle River and privately owned property on the north (left) riverbank occur adjacent to the existing facility. An overview of the project location is presented in Figure 1.

Prairie Farm Rehabilitation Administration (PFRA) constructed the existing facility in the 1940s and the structure was owned and operated by the Federal Government until 2014. The structure is now owned and operated by the Water Security Agency (WSA) and has been assessed to have surpassed its design life. Due to concerns related to safety of operation and fish passage potential, the WSA proposes to replace the existing facility.

The primary purpose of the Crooked Lake Outlet Structure Replacement Project (Project) is to replace the existing facility to allow for safer operation, better control of lake water levels, and increased fish passage potential. The Project will include a replacement outlet structure, a fishway, and a dedicated construction and maintenance access road. The replacement outlet structure will be constructed on the north side of the existing outlet structure and will be equipped with electrically or hydraulically operated gates to allow for easier and safer operation and subsequently, more reliable control of lake water levels. Fish passage will be enhanced with the construction of a weir structure in the outlet channel upstream of the existing outlet structure. Passage over the weir will be facilitated through the addition of a series of downstream pools and riffles. The existing concrete outlet structure will be demolished and removed.

1.2 Project Proponent

The proponent for the Project is the Water Security Agency (WSA). The WSA is a Saskatchewan Government Treasury Board Crown corporation that is responsible for water management in the province. The WSA manages the province's water resources and regulations to ensure the sustainability and quality of Saskatchewan's surface and groundwater supplies while protecting water quality and aquatic habitat and reducing flood and drought damage.

Klohn Crippen Berger Ltd. (KCB) is a multi-disciplinary consulting firm providing engineering, geoscience, and environmental services for the Project.

Contact Information

Proponent
Nicole Zacharias, P.Eng.
Manager, Project Engineering
Water Security Agency
10 – 3904 Millar Avenue
Saskatoon, SK, S7P 0B1
Phone: (306) 229-8568
Nicole.Zacharias@wsask.ca

Project Consultant
Joel Hilderman, M.Sc., P.Eng.
Project Manager
Klohn Crippen Berger Ltd.
1729 Ontario Ave
Saskatoon, SK, S7K 1S9
Phone: (306) 974-1520
JHilderman@klohn.com

2 PROJECT DESCRIPTION

2.1 Project Need

The existing Crooked Lake outlet structure is in deteriorated condition, is difficult and unsafe to operate, and acts as a potential barrier to fish passage during normal operation. The Crooked Lake Water Management Agreement sets a schedule of desirable lake level for each month of the year to protect water quality and quantity for the benefit of the adjacent Cowessess and Zagime Anishinabek First Nations and the Province. Even with the recently installed monorail and electric hoist system, the installation and removal of stop logs to meet the monthly desirable lake level range is strenuous and time consuming. Under normal operation, the existing outlet structure is also a barrier to fish migration. Fish congregate downstream in the scour pool and are unable to pass upstream past the existing outlet structure under normal operation.

2.2 Project Site Description

The existing facility is located on the east end of Crooked Lake within the outlet channel to the Qu'Appelle River and includes a reinforced concrete outlet structure and earthen dyke. Access to the existing facility is on First Street through Sunset Beach. Sunset Beach and the Cowessess First Nation Reserve border the structure (Figure 1).

The existing 9-bay reinforced concrete outlet structure is equipped with stop logs to control the Crooked Lake water elevation. An earthen dyke, approximately 3 m high and 220 m long was constructed on the north side of the structure. The reservoir, Crooked Lake, has a live storage volume of approximately 23,000 dam^3 between its high summer operating water level of El. 451.71 m and the existing structure sill elevation of El. 450.07 m. Data for the existing outlet structure and dyke are provided in Table 2.1.

Table 2.1 Existing Crooked Lake Facility – Design Information

Description	Parameter
Lake High Summer Water Level	El. 451.71 m
Low Winter Operating Water Level	El. 450.95 m
Existing Structure Minimum Sill Elevation	El. 450.07 m
Live Storage between FSL and Minimum Sill Elevation	23,000 dam^3
Existing Earthen Dyke	
Length of Dyke	220 m (approx.)
Height of Dyke	3.35 m (maximum)
Design Top of Dyke Elevation	El. 453.54 m
Upstream Slope	3H:1V
Downstream Slope	2H:1V
Existing Outlet Structure	
No. and Width of bays	Nine bays, each approximately 2.9 m wide
Inner Bays Nos. 4, 5, 6 – Sill Elevation without Stop Logs	El. 450.07 m
Outer Bay Nos. 1, 2, 3, 7, 8, 9 – Weir Elevation without Stop Logs	El. 450.98 m
Top of Structure Elevation	El. 453.42 m

In 2015, the timber walkway across the structure was severely damaged by a flood and replaced with a new walkway comprised of structural steel supports with timber planking and a new hoist monorail complete with structural steel frame. The monorail allows for operation of an electric 2 tonne chain hoist for removal and installation of the stop logs. A portable generator is used to supply power to the hoist.

A dedicated construction and maintenance access road for the structure was constructed in 2022 (Stage 1). The permanent access road connects the outlet structure site to Lake Avenue (and thereby access to Highway 247) while avoiding the residences north of the structure along First Street. Preload fill was also placed within the footprint of the replacement outlet structure in 2022, in advance of construction, to limit total and differential settlement from the construction of the water control structure and embankments. The preload fill will be excavated when construction of the outlet structure commences and, where possible, the excavated fill will be used as backfill for other components of the work.

2.3 Scope of Work

The Project will include construction of a replacement outlet structure and a fishway. A control building near the replacement outlet structure will house electrical and mechanical equipment to operate the outlet structure. A rock spur extending approximately 30 m into Crooked Lake, on the south side of the fishway inlet, will reduce long-shore wave induced sedimentation into the fishway. An area of the Qu'Appelle Riverbank will be armoured with revetment materials to protect against erosion. Issued for Regulatory Review (IFRR) drawings of Project components have been provided separately with the regulatory application packages.

The general strategy for the Project will include the following steps:

- Remove preload fill and construct the replacement outlet structure on the north side of the existing facility including concrete structure, gates, sluiceway, and control building, and connecting channels;
- Commission the replacement outlet structure and divert lake discharge through it;
- Isolate the existing outlet structure;
- Demolish and remove the existing outlet structure;
- Construct the fishway weir and pool-and-riffle outlet;
- Install erosion protection at the confluence of the proposed fishway and outlet channels;
- Create an attraction riffle at the confluence of the proposed fishway and outlet channels;
- Commission the Project; and
- Rehabilitate and revegetate all disturbed riparian areas and temporary construction facilities.

The existing facility will be replaced with structures that have a design life of 100 years. The combined flow capacity of the replacement outlet structure and fishway at various lake level elevations will be

similar to the existing structure. Specific details of the proposed works for each component of the Project are provided in Section 4.

2.4 Proposed Schedule

The preliminary construction schedule, including the anticipated start and completion dates for the replacement outlet structure and fishway will be as follows:

- Start date of replacement outlet structure construction: May 1, Year 1;
- Replacement outlet structure construction complete, and gates dry tested: December 13, Year 1;
- Channel excavation and wet testing of the gates completed: March 26, Year 2;
- Full commissioning of the new structure and start date of fishway construction: June 1, Year 2; and
- Finish date of fishway construction, reclamation of temporary work areas, and demobilizing from site: October, Year 2.

2.5 Design Alternatives

During the conceptual stage of the Project, three potential locations were identified for the replacement outlet structure. The three locations included: i) the existing location, ii) immediately adjacent to the existing location (on the north side), and iii) the north side of Sunset Beach, approximately 430 m north of the existing outlet structure. The criteria to assess the optimal location included constructability and construction requirements, stakeholder input gathered through consultation with First Nations and the public, land access and acquisition, construction risks and safety to residents, operation and maintenance requirements, and fish passage. Based on the evaluation conducted, it was concluded that the construction of the new outlet structure on the north side of the existing structure was the correct option. The selected location would limit the construction effects to Sunset Beach residences and the continual operation of the existing facility during construction for better control of the lake elevations.

The WSA provided high-level conceptual layouts for the replacement outlet structure and a new weir/fishway (KCB 2016a). The concept consisted of providing a new reinforced concrete outlet structure equipped with vertical lift gates located north of the existing structure, and a sheet-pile weir with downstream pool and riffle arrangement for fish passage within the existing channel, located either upstream or downstream of the existing outlet structure.

In addition to reviewing WSA layouts, a high-level review of other concepts for the replacement outlet structure and fishway were carried out as the study progressed and included:

- A replacement outlet structure consisting of a labyrinth weir and smaller gated bays for winter drawdown. During normal conditions, the increased weir length afforded by the labyrinth weir would allow for maintaining the lake level at its FSL while minimizing the need to operate the gates. The merits of pursuing this concept were discussed with the WSA and their main

concerns included debris, potential blockage, and public perception associated with a narrower outlet structure. As a result, the labyrinth weir was eliminated from further consideration.

- A gated outlet structure with adjacent nature-like or man-made fishway was also conceptually assessed. Given that a nature-like fishway would require a much longer structure than a man-made fishway (i.e., vertical slot), it would be difficult to incorporate into the outlet structure as a concrete retaining wall would be required to contain the adjacent channel. As such, the shorter vertical slot fishway was identified as the better option. With this concept, a closure dyke would be provided across the existing channel and a connecting channel between the existing channel and the new channel downstream of the replacement outlet structure would be constructed to provide both fish passage and maintain flow in the existing channel. However, due to concerns that the connecting channel and existing channel would silt in over time this option was not carried forward.
- The WSA has indicated that flow within the existing channel is required to reduce siltation and maintain existing river bank limits. As such, blocking off the existing channel with a closure dyke was not assessed further and other options considered included a gated riparian structure (comprised of an inlet structure, conduits, gatewell, and outlet structure) and an uncontrolled concrete weir structure.

  Due to concerns about the relatively small discharge capacity associated with the riparian structure as well as maintenance concerns (i.e., plugging of the conduits with sediment), and limited fish passage capability this option was not considered viable. Although the concrete weir structure was considered to require the least amount of longer-term maintenance, fish passage through the existing channel would be limited and as such, this option was eliminated.
- Although ongoing maintenance will be required with a downstream pool and riffle fishway, it was decided that this was the preferred option for the second structure within the existing channel.

The potential arrangement of the outlet structure and fishway were assessed in consultation with Cowessess First Nation. Maintaining flow through the existing river channel alignment was identified as a priority for Cowessess First Nation. Placing the new outlet structure north of the existing structure would allow for construction to occur in isolation from the river and reservoir, greatly reducing constructability concerns compared to replacement within the same footprint. The advantages of locating the fishway within the existing river channel included:

- There would be more continuous flow through the fishway than in the main outlet structure;
- Cowessess First Nation land would border a more natural looking water feature;
- The fishway would be designed to attract fish, drawing them away from the outlet structure; and

- The fishway structure would incorporate a pedestrian bridge to provide Cowessess First Nation residents with access to the north side of the channel, comparable to the existing condition.

Based on the above assessments, it was concluded that two structures were required, and that these would comprise a gated outlet structure located just north of the existing structure and a weir/fishway located within the existing channel. In addition, the width of the new outlet structure must be similar to the existing structure and the combined flow capacity of the two new structures should be equal to or slightly greater than the existing outlet structure.

3 REGULATORY FRAMEWORK

3.1 Provincial

Saskatchewan Environmental Assessment Act

The submission of a Technical Proposal to the Environmental Assessment Branch (EA Branch) is the initial step in beginning the Environmental Assessment Process to determine if a project would be considered a "Development", requiring an approval from the Ministry of Environment (MoE) under the Saskatchewan *Environmental Assessment Act* (the Act) (EA Branch 2014). The Act and its related procedures exist to protect the environment and the public by ensuring that developments in the province proceed with adequate environmental safeguards while providing opportunities for public input and consultation (EA Branch 2014).

EA Branch review of the of the Project in 2018 determined that screening of the Project under the *Environmental Assessment Act* and preparation of an environmental impact assessment (EIA) would not be required (Appendix II).

Saskatchewan Acts, Regulations, Guidelines and Permitting

Provincial permits, approvals and/or licenses could potentially be required under the following legislation and consultation with the applicable regulatory agencies may be required:

- *Environmental Assessment Act* – An Act respecting the assessment of the impact on the environment of new developments (S.S. 1979-80, c E-10.1);
- *Environmental Management and Protection Act* - An Act respecting the management and protection of the environment, repealing *The Clean Air Act*, *The Environmental Management and Protection Act*, 2002, *The Litter Control Act* and *The State of the Environment Report Act* and making consequential amendments to certain Acts (S.S. 2010, c. E-10.22);
- *Fisheries Act* – An Act respecting management of fisheries in Saskatchewan (S.S. 2020, c. 23). A Special Collection Permit would be required from MoE to capture and relocate fish as required during construction;
- *Heritage Property Act* – An Act to provide for the preservation, interpretation, and development of certain aspects of heritage property in Saskatchewan, to provide for the continuance of the Saskatchewan Heritage Foundation and to provide for the naming of geographic features (S.S. 1979-80, c. H-2.2);
- *Water Security Agency Act* - An Act respecting water rights and the Water Security Agency (S.S. 2005, c W-8.1); and
- *Wildlife Act* – An Act respecting the protection of wildlife and wild species at risk and making consequential amendments to other Acts (S.S. 1998, c W-13.12).

Although specific permits, approvals or licenses are not required under the following legislation, the requirements of the legislation must be adhered to throughout the life of the Project:

- *Weed Control Act* - Specifies measures to prevent the spread of invasive and noxious weed seeds and propagules (S.S. 2010, c W-11.1).

3.2 Federal

Federal approvals and/or licenses could potentially be required under the following legislation and consultation with the applicable regulatory agencies may be required:

- *Fisheries Act* (FA): Through the administration of the fisheries protection provisions of the *Fisheries Act* (R.S.C., 1985, c. F-14), the Fisheries Protection Program manages threats to fish and fish habitat. The *Fisheries Act* prohibits causing the death of fish by means other than fishing (Section 34) and the harmful alteration, disruption, or destruction of fish habitat (Section 35), unless authorized by the Minister of Fisheries and Oceans Canada (DFO).
- *Canadian Navigable Waters Act* (CNWA): Approval will be required under the *Canadian Navigable Waters Act* (R.S.C. 1985, c. N-22). Qu'Appelle River is on the Scheduled of navigable waters. Provisions for recreational navigation to bypass the structure have been incorporated into the design based on consultation with the Navigation Protection Program of Transport Canada.

Although specific permits, approvals or licenses are not expected to be required under the following federal legislation, the requirements of the legislation must be adhered to throughout the life of the Project:

- *Impact Assessment Act* (IAA): Outlines a process for assessing the impacts of major projects and projects carried out on federal lands. As a portion of the proposed temporary works will occur on Federal land associated with the Cowessess First Nation Reserve, consultation with Indigenous Services Canada (ISC) will be required to confirm that the requirements of the *Impact Assessment Act* (S.C. 2019, c. 28, s. 1) have been met.
- *Indian Act*: States without prejudice to section 30, where an Indian or a band alleges that persons other than Indians are or have been (a) unlawfully in occupation or possession of, (b) claiming adversely the right to occupation or possession of, (c) trespassing on a reserve or part of a reserve, the Attorney General of Canada may exhibit an information in the Federal Court claiming, on behalf of the Indian or band, the relief or remedy sought. (R.S.C., 1985, c. I-5).
- *Migratory Birds Convention Act* (MBCA): States that it is prohibited to disturb, destroy, or take a nest, egg, or nest shelter of a migratory bird or deposit or permit to be deposited oil, oil wastes or any other substances harmful to migratory birds in any waters or any area frequented by migratory birds (S.C. 1994, c. 22).
- *Species at Risk Act* (SARA): States that it is prohibited to kill, harm, harass, capture, or cause destruction of habitat of any species with a designated status (S.C. 2002, c. 29).

3.2.1 Temporal Constraints

Many of the applicable regulations noted above specify temporal constraints on higher risk activities in order to limit the potential for effects during periods of increased sensitivity. A listing of seasonal constraints on construction works associated with the Project is provided in Table 3.1. The highest risk periods for construction works are the restricted activity period (RAP) for spring spawning fish and the mid-May to mid-July breeding periods for migratory birds, birds of prey, and bats. The RAPs are presented in Table 3.1.

Table 3.1 Temporal Environmental Constraints Risk

Environmental Element	Component	Activity	Habitat	Temporal Environmental Constraints Risk Associated with Construction											
				Jan.	Feb.	March	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.
Wildlife and Wildlife Habitat	Migratory Birds	Breeding	Riparian												
	Owls and Raptors	Breeding	Riparian												
	Bats	Breeding	Riparian												
	Mammals	Breeding	Riparian												
	Amphibians	Breeding	Floodplain												
	Snakes	Breeding	Riparian												
Fish and Fish Habitat	Spring Spawning Fish	Spawning	Lotic/Lentic												
	Fall Spawning Fish	Spawning	Lotic/Lentic												
Rare Plants	Federal and provincial plants of concern	Presence	Aquatic/ Terrestrial												

Low Risk (Green): There are no environmentally sensitive activities ongoing during these times.
Medium Risk (Yellow): Environmentally sensitive activities are ongoing, but can be effectively managed through construction monitoring, and implementation of recommended mitigation measures.
High Risk (Orange): Environmentally sensitive activities are ongoing and will require construction monitoring. Given the level of activity, construction works can expect significant additional costs for environmental surveys and Project delays even after application of mitigation measures.
Extreme (Red): These are regulated restricted activity periods and will require extensive biological surveys, professional justification, and a mitigation plan to support proposed works during these time periods. Will also require direct consultation with regulatory agencies and approval application.

Notes:

1. Time period restrictions for wildlife and wildlife habitat are based on the Saskatchewan Activity Restriction Guidelines for Sensitive Species (MoE 2015), the federal *Migratory Birds Convention Act*, and the provincial *Wildlife Act*.
2. Time period restrictions for rare plants are based on the Saskatchewan Activity Restriction Guidelines for Sensitive Species (MoE 2015).
3. Time period restrictions for fish and fish habitat are based on the Fisheries and Oceans Canada Saskatchewan Restricted Activity Timing Windows for the Protection of Fish and Fish Habitat (DFO 2013).

4 CONSTRUCTION AND ENGINEERING DESIGN

The proposed works to replace the existing facility will consist of the replacement control structure, fishway, and access road, as described in the Preliminary Design Report (KCB 2016b).

4.1 Replacement Control Structure

The proposed replacement outlet structure will consist of a reinforced concrete structure with five gate bays and electrically operated vertical lift gates, a bridge deck to allow passage of maintenance equipment and pedestrian traffic, upstream and downstream stop log slots, and a control building for gate operation (Drawings 102 and 104). The four outer bays, two on each side, will be 5 m wide and the middle bay will be 2 m wide (Drawings 211, 213, and 214). A 1 m wide pier will separate each bay. The middle bay will have a bottom elevation of 450.07 m (i.e., no slab), while the second and fourth bays will have a 0.43 m high sill bringing the top of the sill elevation to 450.50 m (Drawing 215). The outermost bays (#1 and #5) have a 0.88 m high sill bringing the top of the sill elevation to 450.95 m. The top of gate elevation for the outermost bays (#1 and #5) is 452.15 m, and for the three inner bays (#2 to #4) is 451.70 m.

The replacement outlet structure will be constructed to the north of the existing structure, in isolation from Crooked Lake and Qu'Appelle River (Drawings 102 and 104). The outlet structure and connecting inlet and outlet channels will be constructed within areas that are currently outside of the wetted extent of the water bodies, with the channel tie-ins constituting the only work within areas currently accessible to navigation. Temporary cofferdams will be required to establish isolation of the work areas at the channel tie-in locations (Drawing 270).

Gates and Hoists

Each vertical lift gate assembly consists of a skin plate, three horizontal beams, five vertical stiffeners, endplates, and seals on each side. The gates will move up and down on wheels, with two wheels on either end of the gate. The wheels and the beams are spaced at equal distances because the ice load will be the largest load on the gate and could be applied at any height on the skin plate. The skin plate extends horizontally past the wheels to provide a mount for the gate.

A dedicated wire rope hoist system in each bay will raise and lower the vertical lift gates. The wire rope hoist system is mounted to a welded steel frame and consists of two drums, one above each end of the gate for the four outer bays, and a single drum hoist for each of the two inner sub-bays. Each hoist drum is supported by pillow block bearings mounted in the hoist platform and 3:1 reeving between the hoist drum and gate to reduce the wire rope size. Pillow blocks and reducers are mounted to the single welded steel frame of each hoist.

Stop Logs

Slots for stop logs on the upstream and on the downstream side of the operating gates permit dewatering of each gate bay for maintenance (Drawing 215). Two stop logs will be required in each slot (upstream and downstream) to isolate a single gate bay. The stop logs will be 5.4 m wide, 1.2 m high and 0.2 m thick and will be installed and removed with monorails. The overall height of the stop

logs are designed to prevent overtopping with the lake at high summer operating level (El. 451.71 m) with a 1:2 year wind-generated wave height. The stoplogs will span the middle bay (i.e., sub-bays 3A and 3B).

Control Building

The control building will be approximately 3 m by 5 m and will be located adjacent to the new outlet structure (Drawings 201 and 210). The control building will have a suitable grounding grid as required by code for personal protection and equipment protection. A lightning protection system will also be considered for the control building. Basic HVAC will be incorporated to the building design to provide suitable temperature for proper equipment operation as per vendor recommendations. The control building will be pre-cast concrete with ventilation but no windows, to minimize targeted vandalism or unauthorized access.

Power Source

The control building will be powered by a 200-amp transmission line rated at 120V/240V, supplied by SaskPower. An emergency backup supply will include an industrial generator connected to the site electrical distribution system. Selection of the utility or backup generator will be by manual transfer switch. The generator could be a portable unit or permanently located at the site. If a portable unit is to be used, an area next to the control building will be required to be identified and used as a connection point for the power cable. Having the generator permanently located at site is preferred for emergencies unless the generator is readily available from a nearby supplier.

A 120-volt portable generator and drill pack would be used as a secondary backup to raise or lower the gates.

4.2 Removal of Existing Control Structure

The existing control structure will be removed following commissioning of the replacement structure, so that the release of water to Qu'Appelle River is not interrupted. A temporary cofferdam will be constructed upstream of the existing structure to facilitate instream works and partial dewatering during removal (Drawing 270). The monorail, fencing, and other materials that can be re-used will be salvaged. The remaining structural components and excavated material removed will be hauled to an appropriate landfill for disposal.

4.3 Fishway

Structure Type

Various fishway types were considered during preliminary design, including natural channel fishways such as rockfill ramp/boulder fill, pool and riffle, and roughened channel. A "pool and riffle" style fishway, similar to the one constructed at Makwa Lake in 2008, was identified as the preferred alternative. The Makwa fishway has performed well and over the past two decades WSA has installed over 30 rock-riffle-style fishway structures at other locations in Saskatchewan, based on consultation with and support from DFO. This style of fishway is constructed to mimic natural channel

morphological features, promoting increased habitat value in addition to facilitating fish passage. WSA has had good success with this design concept in similar settings to the proposed Crooked Lake fishway, including effective retention of water at surface to promote adequate water depth under low flows (i.e., by limiting interstitial flows with void-filled riprap) and resilience to flood conditions.

Hydraulic Design

The fishway has been designed to convey the entire lake outflow for much of the open-water season, while supporting fish passage. The design fish used to assess fish passage performance of design iterations was the adult walleye (*Sander vitreus*) of 300 mm fork length. The minimum water depth to facilitate fish passage within the fishway was considered to be 0.15 m based on WSA design guidelines used for other fishways in Saskatchewan (Pers. Comm. J. Sereda, 2017). The burst swimming speed (less than 10 seconds over 1 m distance) of this design fish is approximately 1.8 m/s and the prolonged swimming speed (less than 30 minutes over 50 m distance) is 0.75 m/s (Katopodis and Gervais 1991).

The structure will require a multi-stage weir at the upstream end with varying weir crest elevations to increase the discharge capacity for higher lake levels and limit discharge at lower levels. The elevation of the lowermost weir will be set to prevent the lake from drawing down below the minimum lake level defined in the Crooked Lake Water Management Agreement (WMA).

The design for the outlet structure and fishway has considered the optimization of fish passage potential within the significant operational constraints imposed by the lake level targets stipulated in the WMA and seasonal variability in natural inflows. During periods of low natural inflows, there will frequently be insufficient water available to pass fish at the fishway without compromising compliance with lake level targets. In WSA's experience, compliance with lake level targets has been a key focus of stakeholder groups providing feedback on operating practices during periods of low inflows. It is considered likely that there would be strong public and stakeholder opposition to any perceived effect on lake water levels resulting from the operation of the fishway. Water management is a key concern for local stakeholders, which must be considered in designing for fish passage.

Construction Materials

The materials and preparation of materials used for the construction of the pools and riffles will be consistent with the designs executed by WSA at other sites, including Ridge Creek, Saskatchewan. The proposed pool and riffle fishway will be constructed of rock and granular fill with a wide range of particle sizes, such that the smaller diameter material will partially fill the voids of the larger diameter rock to limit interstitial flow through the rock. The larger diameter rock (riprap with a D_{50} of approximately 350 mm), will result in an uneven top surface with variable flow depths and velocities, which supports fish passage. The riprap will be blended with the finer grained material and placed and compacted using an excavator and dozer.

Fishway Structure

The proposed fishway will comprise a sheet pile wall at the upstream end with notches to control inflow. The notch inverts will be set at El. 450.875 m, 451.40 m, and 451.7 m. The top of the wall will

be set at El. 453.7 m. The fishway channel will be constructed with 4H:1V side slopes and will be armoured with riprap (Drawings 251, 252, and 253). A prefabricated pedestrian bridge will be installed over the fishway. The fishway will include a series of pools and riffles downstream of the sheet pile weir, constructed of large diameter rock and designed to increase the potential for fish to pass from Qu'Appelle River into Crooked Lake during periods when passage through the outlet structure is restricted.

The cofferdam installed to isolate the existing control structure will remain in place to allow for installation of the fishway structure in isolation. A notched sheet pile weir will be installed across the inlet to the fishway structure (Drawing 251), and a series of pools and riffles will be installed to establish a transition down to the natural bed of the river channel downstream (Drawings 252 and 253). The fishway channel will be constructed of "void-filled riprap", which is a blend of riprap and granular material. The riprap , which ranges in size from 150 mm to 500 mm diameter, to promote stability of the structure.

Once commissioned, the fishway will directly connect Crooked Lake to Qu'Appelle River and navigation safety measures will be required to restrict access to the structure.

Guidance and Attraction Flows

The layout of the outlet structure and fishway will account for providing concentrated attraction flow in the vicinity of the fishway to increase the potential for fish to find and use the fishway during periods when passage is feasible.

During typical summer discharge a majority of flows will likely be conveyed by the fishway, however, during the spring spawning period, flows may also be conveyed by the outlet structure. To increase the potential for fish attraction to the fishway during the period when flow is passing through both the outlet structure and the fishway, additional pools and riffles will be incorporated into the design in the existing channel just upstream of the confluence with the replacement structure's outlet channel. This set of riffles will serve to continue the water level transition from the weir to the downstream water level (extending the hydraulic gradient over a longer distance) and will also serve to attract fish to the fishway by increasing the turbulence on the fishway side of the confluence.

A pool and riffle feature will be constructed within the fishway (existing) channel of Qu'Appelle River, directly upstream from the confluence with the new control structure outlet channel (Drawing 224). The pool and riffle sequence will be constructed of the same sized rock used for the fishway construction (void filled riprap). Temporary cofferdams will be installed to isolate the footprint of the attraction riffle during construction (Drawing 270).

4.4 Rock Spur

A rock spur will be installed within Crooked Lake, southwest of the fishway structure (Drawing 255). The rock spur is intended to interrupt longshore transport of fine sediment from the south and reduce the potential for sediment deposition within the fishway. The spur will extend 30 m from shore into Crooked Lake and has been designed with a top elevation of 452.80 m (1.1 m above Full

Supply Level), as shown on Drawing 255, to increase visibility and reduce the potential for the spur to present a hazard to navigation. Signage will also be installed, as described in Section 4.7.

The rock spur will be constructed entirely of 6C Riprap to allow for material to be placed in the wet (pushed from the shore of Crooked Lake), avoiding the need for a temporary cofferdam. The top width is set at 4 m for construction convenience, and side slopes are set at 2H:1V.

4.5 Riprap Revetment

A riprap revetment has been proposed on the right (south) bank of the Qu'Appelle River, directly opposite the confluence with the new outlet channel (Drawing 220). The structure is intended to mitigate the potential for erosion of the bank. The revetment will typically consist of 6B riprap overlying 5A bedding gravel, installed at a 2H:1V slope (Drawing 221). The existing bank will be excavated to establish a smooth grade and to reduce the level of encroachment of the revetment surface into the channel, relative to the existing bank position.

4.6 Temporary Works

4.6.1 Excavation Seepage Control

Seepage control measures will be required to facilitate excavation and construction of the outlet structure. In-excavation water control measures including sumps, pumps, ditches, and granular filters (for erosion control) are proposed for dewatering within the excavation. Discharged seepage water will be treated to reduce suspended sediment, likely using sedimentation tanks. Construction of the outlet channel downstream will cross a low-lying bench within the floodplain. The conditions at ground surface are expected to be relatively soft and wet and access of construction equipment (e.g., dozers, excavators, haul trucks) for excavation of the channel will be facilitated by frost penetration in the winter. Waste soil that is excavated from the outlet structure and channel will be hauled off-site for disposal.

4.6.2 Cofferdams

Temporary cofferdams will be required to isolate instream work areas:

- at the tie-in to Crooked Lake of the outlet channel for the replacement outlet structure;
- upstream of the existing outlet structure and proposed fishway structure within Crooked Lake; and
- upstream and downstream of the fish attraction riffle within Qu'Appelle River.

Plan and profile views of the temporary cofferdams are shown on Drawing 270. The cofferdams will typically be trapezoidal in profile, constructed with a berm of clean gravel at the outward facing surface to protect against erosion, and a layer of low permeability fill on the inside to limit seepage. The cofferdams will be installed by first placing clean gravel to create a berm, then placing fill on the protected (inward facing) side. At the inlet channel tie-in, the cofferdam will be constructed with a berm of gravel placed against the existing shoreline. Where suitable and cost-effective, the contractor

would alternatively be allowed to use geosynthetic water-filled barriers (e.g., Aquadam) or other erosion resistant isolation measures, assuming that the footprint of the structure did not exceed that shown on the drawings.

4.7 Navigation Safety

Signage will be installed to warn watercraft operators of potential hazards to navigation, both temporary and permanent in nature. Temporary signage will be installed on the cofferdams, facing in both directions of travel.

Permanent signage will be installed at the entrance of the inlet channel, upstream of the control structure, and also at the entrance to the fishway channel, warning watercraft operators on the lake of the hazard. The proposed sign format is shown on Drawing 382. The portage ramp location will also be identified with signage to direct light watercraft users that intend to bypass the control structure and fishway (Drawings 381 and 383). Floating booms will also be installed across the channels, upstream of the fishway and outlet structure to provide a visible, physical barrier to downstream travel. The location of the booms is shown on Drawings 210, 211 and 251 and details are provided in Drawing 385.

Signage will be installed at the downstream side of the outlet structure to direct portagers travelling in a downstream direction to enter the outlet channel (Drawings 381 and 383). Signage at the fishway channel will indicate that the downstream fish attraction riffle presents a potential hazard (Drawing 384) and that the adjacent outlet channel is the designated travel route (Drawing 383). Additional signage will be installed at the fish attraction riffle to provide further warning of the imminent hazard. The outlet channel downstream from the control structure is expected to provide unimpeded passage under typical conditions, including low flow when all discharge is directed through the fishway, as the outlet channel will be backflooded even when the outlet gates are closed.

Permanent signage will be installed on the downstream side of the control structure to warn watercraft operators travelling in an upstream direction of the potential hazard at the outflow of the structure (Drawing 383).

Portage ramps have been included to provide a designated egress location for watercraft operators approaching the control structure from Crooked Lake or Qu'Appelle River (Drawing 381). Hand launched watercraft such as canoes and kayaks can be portaged across the structure using the designated portage route and safely re-launched using the ramps provided. Likewise, the portage ramp will provide safe access to the lake for users crossing the pedestrian bridge over the fishway from the south.

4.8 Operation and Maintenance

4.8.1 Normal Operation

Under the Crooked Lake Water Management Plan, there are prescribed lake elevations for each month of the year. The elevation in the lake will be controlled with vertical lift gates. The gates will be

controlled either through a human machine interface (HMI), typically a touch screen panel, or a portable (local) control panel that can be plugged into a socket near each gate. Gates will also have the ability to be controlled remotely (i.e., from offsite), if WSA chooses to use this functionality of the system.

A local-off-auto switch will be located inside the control room. In local mode, the gates will be controlled by the local control panel only. In auto mode the gates will be controlled by the Programmable Logic Controller (PLC), either remotely or through the HMI. The HMI will be located inside the control building. Using the HMI, operators will be able to select a specific gate opening and then initiate gate movement from the HMI. The control system will stop the gates once the desired opening has been reached.

The portable control panel will contain all of the controls required to operate one gate at a time. The portable control panel will be placed on a stand adjacent to the gate to be operated, or on a neck strap that can be carried by the operator. A cord and plug will be used to connect the control panel to the gate to be operated. Plugs will be provided at each hoist. Wireless operation will not be provided. Consideration could also be given to a single plug and a gate selector switch on the control panel. An emergency stop button on the control panel will stop movement of all gates. When not in use, the control panel will be kept in the control building.

A video system will be provided to allow viewing of the gates and surrounding area. The video cameras will operate in low light conditions. Audible alarms and flashing lights will provide warning of possible gate operation. Each gate will be equipped with a mechanical position indicator.

4.8.2 Winter Operation

During typical operation in the winter, the gates of the outermost bays (#1 and #5) will be left in the open position, while the inner bays will remain closed, but operated as required to pass increased flows. The gates have been design for ice loading and winter operation. When the gates are required to operate in the winter, the slots and area upstream of the gates will be de-iced before operation. The gates may potentially be damaged by ice chunks if operated partially open or if ice overtops closed gates. Monitoring will be required to prevent such damage.

4.8.3 Maintenance

The incorporation of a bridge deck facilitates maintenance of the new structure. The deck will allow the passage of maintenance equipment but will be isolated from public vehicle traffic with gates or bollards. Pedestrian traffic will be accommodated across the bridge deck (Drawing 104).

General maintenance of the new structure will include semi-annual greasing of the wheel bearings, yearly inspection of the operating gates, and minor repairs to the infrastructure noted during inspections. Gate inspections are required to check the coating integrity and condition of the seals. Scheduled maintenance would be required to refurbish the bearings, wheels, and shafts, recoating the gates, and seal replacement.

Stop logs will assist maintenance activities on the bays, gates and hoists, and the fishway. Flares provided at the top of each stop log slot will facilitate installation. Stop logs will be installed and removed with balanced differential head across the stop log using a lifting beam attached to a monorail hoist. After installation, pumps will be used to remove the water between the stop logs. Either pumping or a flood valve installed in the stop logs will be used to flood the space behind the stop logs before stop log removal.

The slope of the north and south embankment of the replacement outlet structure as well as the access ramp/portage located between the outlet structure and the fishway, have design grades of 10H:1V. The access ramp/portage provides maintenance vehicle access to the upstream safety booms and the downstream turn-around.

4.9 Project Input and Output

The construction of the Project will result in the generation of waste. Potential wastes with proposed mitigation measures related to the Project are identified in Table 4.1.

Table 4.1 Projected Wastes Generated by the Project

Waste		Mitigation Plan
Emission	Engine exhaust from the operation of heavy equipment, personal vehicles, and generators.	▪ Vehicles and equipment should be inspected regularly and properly maintained to reduce emissions.
	Dust from use of access roads and construction.	▪ A dust suppression system should be implemented for staging areas, access roads, and stockpiles.
	Increased noise levels during construction.	▪ Work hours should be limited to daylight hours in compliance with any local bylaws.
	Increased light pollution	▪ Light plants should be turned off when not in use. ▪ Light plants should not direct light at residential buildings
Discharge	Hazardous and non-hazardous substances	▪ Equipment should be cleaned and in good working order prior to arriving on-site. ▪ Designated fueling and maintenance areas should be established with secondary containment and spill contingency equipment. ▪ Stationary equipment and hazardous materials should be stored within a designated secondary containment area. ▪ A spill contingency plan should be in place and spill kits should be readily accessible on-site. ▪ A secondary containment system should be installed for the glycol system

Waste		Mitigation Plan
Discharge	Groundwater control	▪ Well points or still wells with pumps should be established to capture groundwater seepage within or outside the excavation. ▪ Settling ponds or tanks should be used to settle suspended solids prior to discharge to the environment.
	Site water management	▪ An erosion and sediment control plan should be implemented to direct water away from the Project. ▪ The point of discharge from the Project should be armoured to limit scour and increased sedimentation.
Waste	Sanitary	▪ Portable toilet facilities should be isolated with secondary containment. ▪ Portable toilet facilities should be serviced weekly and waste should be disposed of at an approved waste facility.
	Domestic	▪ Domestic waste generated by the Project should be separated and where possible, materials should be recycled and reused. ▪ Domestic waste should be stored in industrial containers with locking lids. ▪ Domestic waste should be removed from the Project weekly.
	Industrial	▪ Used oil and lubricant containers and oil filters should be stored within a secondary containment and removed for proper disposal. ▪ Fuel should be stored in double walled tanks with secondary containment protected by the potential for impact by machinery. All unused fuel should be removed from the site. ▪ Flammable chemicals should be stored in a separate, well ventilated storage area, and should be transported offsite for disposal at an approved facility.

5 EXISTING ENVIRONMENT

5.1 Study Area

Crooked Lake is located in the Aspen Parkland Ecoregion, a 500 km wide north-south transition zone between the dry grasslands to the south and the boreal forest to the north (Shorthouse 2010). This ecoregion stretches in a broad arc across the prairie provinces of Canada from southwestern Alberta, northward and then eastward through central and northwestern Alberta, central Saskatchewan, and central and southern Manitoba. In its native state, the Aspen Parkland Ecoregion is characterized by a mosaic of trembling aspen, oak groves, mixed tall shrubs, and intermittent fescue grasslands (SASK Herbarium 2008). However, due to its favorable climate and fertile, warm black soils, this ecoregion has primarily been altered by farming activity since settlement began in the late 19th century and represents some of the most productive agricultural land in the Prairies (SASK Herbarium 2008; Shorthouse 2010).

Crooked Lake is located within the floodplain of the Qu'Appelle River Valley. The northern shoreline is developed with small resort communities and the south borders the Cowessess First Nation Reserve. At the eastern end of the lake, an outlet structure releases water from Crooked Lake to the Qu'Appelle River and regulates the water level in the lake. A Regional Study Area (RSA) was established to conduct a desktop review of baseline environmental information, which was also used to inform a preliminary Environmental Screening Report (ESR) (KCB 2016a). The RSA encompassed a 5 km search radius centered on the outlet structure on Crooked Lake, located at SW-08-19A-05-W2M (Figure 2).

The Study Areas for the terrestrial component of the field study are focused on the water control structure and the downstream floodplain of the Qu'Appelle River. Field investigations within the Terrestrial Study Area (TSA) focused on wildlife (herptiles, shorebirds, breeding birds, and mammals). Additional wildlife surveying extended away from the Qu'Appelle River floodplain and along the highways to target potential suitable habitats for wildlife species such as short-eared owls and common nighthawks. A smaller Soils and Vegetation Study Area (SVSA) within the TSA limited the soils, vegetation (ecosite), and rare plant surveys closer to the project construction area. The TSA and SVSA are displayed on Figure 2.

The Study Areas for the aquatic component of the field studies within the Qu'Appelle River extended from the existing control structure on the east end of Crooked Lake to approximately 40 m past the bridge crossing of Secondary Hwy 605 (Figure 2). This encompassed approximately 2.4 km of the Qu'Appelle River. Within Crooked Lake, fish sampling was focused within the immediate vicinity of the control structure and in the deeper section of the lake. The fish and fish habitat assessment conducted within the Aquatic Study Area (ASA) included fish sampling to assess fish species presence in the lake near the control structure and in the river downstream, as well as instream habitat classification and bank stability classification.

5.2 Geology

Regional Geology

The Aspen Parkland Ecoregion is underlain by Cretaceous shale and covered by undulating to kettled, calcareous, glacial till with significant areas of level lacustrine and hummocky to ridged fluvioglacial deposits (SASK Herbarium 2008). Regional geology descriptions of the Qu'Appelle Valley, based on widely spaced boreholes (Saskatchewan Soil Survey 1987), indicate that the Qu'Appelle Valley is fully eroded through the glacial till, through the Empress Formation sand aquifer and eroded approximately 50 m into the Cretaceous Pierre Shale formation. The river valley was subsequently infilled with at least 70 m thick of alluvial, colluvial, and lacustrine sediments. The Qu'Appelle Alluvium, at the surface of the current valley bottom is described as mainly silt and sand, and ranges in thickness from a thin veneer under the Qu'Appelle River to as much as 30 m thick in the central upstream parts of the valley and along most of the valley sides (Klassen 1975).

The Qu'Appelle Alluvium is underlain by the Virden Fill, which is described as beds of clay, silt, sand, and smaller proportions of gravel. The clay and silt is typically very dark grey and unoxidized (Klassen 1975). It was deposited before the most recent glaciation, likely in the Early to Mid-Wisconsin Age. The thickness of the Virden Fill along most of the Qu'Appelle valley is between 46 m and 60 m. The combined thickness of Qu'Appelle Alluvium and Virden Fill at Crooked Lake is expected to be approximately 60 m, based on the valley profile in Klassen (1975).

Local Geology

A field investigation was conducted by KCB March 3 to March 10, 2016, to characterize the local geology (KCB 2016c). The results of KCB's 2016 geotechnical drilling investigation indicated that the stratigraphy of the area surrounding the outlet structure generally consisted of:

- A discontinuous silt layer up to 0.6 m thick which contains organics; over
- A laterally continuous upper sand layer ranging in thickness from 2.0 to 5.8 m, generally well-graded and very loose to compact density; over
- A laterally continuous shallow alluvial clay layer ranging in thickness from 0.6 to 3.2 m of low to medium plasticity and soft to firm consistency; over
- Interbedded alluvial silt, sand, and clay layers of varying thickness and continuity.

5.3 Hydrogeology

A review of the WSA Water Well Database indicated that there were multiple groundwater wells utilized for domestic purposes within the RSA. Thirteen wells are located within the Sunset Beach and Greenspot communities along the north shoreline of Crooked Lake. The majority of the domestic wells are shallow, drilled to a depth between 4.5 m and 21 m below ground surface (bgs) (WSA 2015b). The deepest well was installed at a depth of 54.8 m bgs (086496) (WSA 2015b).

During the field investigation between March 3 and March 10, 2016, four boreholes were completed as monitoring wells (Figure 3). These wells were used to determine the hydraulic conductivity and assess the potential for groundwater recharge into the excavation during construction.

As part of the groundwater investigation, slug tests were conducted on each well to determine the hydraulic conductivity in the footprint of the new outlet structure. The average hydraulic conductivity ranged from 2.3×10^{-4} m/sec to 7.8×10^{-5} m/sec (KCB 2016c). This is consistent with the expected hydraulic conductivity for a clean to silty sand (Cherry & Freeze 1979).

Continuous water elevation monitoring was conducted at each monitoring well with a pressure transducer logger. The recorded water elevations mirror the fluctuations in lake level and confirm that there is a hydraulic connection between the alluvial sand and silt layers in the area of the new outlet structure (KCB 2016c). Monitoring well BH16-03, closest to the lake (Figure 3), responded to the change in lake elevation with almost no delay, while the boreholes furthest away from the lake showed a delayed response of several days. Monitoring wells BH16-01, BH16-04, and BH16-05 are influenced by both the lake and river elevations (KCB 2016c).

On May 19, 2016, the monitoring wells were sampled for routine parameters. Each monitoring well was purged with a detected weighted bailer for a minimum of three well volumes or until chemical stabilization was achieved for three or more *in-situ* parameters: pH, electrical conductivity (EC), temperature, dissolved oxygen (DO), and oxidation-reduction potential (ORP) were recorded. Samples were collected in dedicated laboratory supplied bottles, placed on ice, and submitted to ALS Environmental laboratories in Calgary, Alberta under standard chain of custody protocol.

A summary of the routine water chemistry analyses is provided in Table 5.1. There are no guidelines for routine water chemistry parameters in the WSA interim surface water quality objective (WSA 2015c). In general, the groundwater is slightly acidic to neutral and in the reduction phase given *in-situ* pH and ORP values. The water is hard, with hardness concentrations ranging from 481 mg/L as calcium carbonate ($CaCO_3$) at monitoring well BH16-03 and 683 mg/L $CaCO_3$ at monitoring well BH16-05. Concentrations for nitrate and nitrite were reported below method detection limits.

Table 5.1 Groundwater Quality Results

Sample ID		BH16-01	BH16-04	BH16-05	BH16-03
Date Sampled		19-May-2016	19-May-2016	19-May-2016	19-May-2016
Time Sampled		13:21	13:49	14:15	14:42
Parameter	Units				
In-situ					
Temperature	°C	4.51	4.06	4.59	4.92
Electrical Conductivity	µS/cm	828	796	837	841
pH		6.75	7.07	7.11	7.64
Dissolved Oxygen	mg/L	5.58	6.76	3.93	7.85
Oxidation-Reduction Potential	mV	-106.4	-94.9	-98.1	-190.8
Anions and Nutrients (Water)					
Alkalinity, Total (as CaCO3)	mg/L	416	378	386	391
Bicarbonate (HCO3)	mg/L	508	461	471	477
Carbonate (CO3)	mg/L	<5.0	<5.0	<5.0	<5.0
Chloride (Cl)	mg/L	31.7	30.4	34.7	58.8
Conductivity (EC)	µS/cm	1510	1490	1500	1500
Fluoride (F)	mg/L	0.11	0.11	<0.10	<0.10
Hardness (as CaCO3)	mg/L	624	658	683	481
Hydroxide (OH)	mg/L	<5.0	<5.0	<5.0	<5.0
Nitrate and Nitrite (as N)	mg/L	<0.11	<0.11	<0.11	<0.11
Nitrate (as N)	mg/L	<0.10	<0.10	<0.10	<0.10
Nitrite (as N)	mg/L	<0.050	<0.050	<0.050	<0.050
pH	pH	7.58	7.48	7.56	7.74
TDS (Calculated)	mg/L	1020	1010	1040	982
Sulfate (SO4)	mg/L	416	442	456	368
Dissolved Metals (Water)					
Calcium (Ca)-Dissolved	mg/L	131	134	131	85.4
Magnesium (Mg)-Dissolved	mg/L	72.0	78.6	86.4	64.9
Potassium (K)-Dissolved	mg/L	8.39	7.70	8.88	18.6
Sodium (Na)-Dissolved	mg/L	111	90.0	89.3	152

5.4 Climate and Hydrology

The climate in the Aspen Parkland Ecoregion is marked by short, warm summers and long, cold winters with continuous snow cover.

The Broadview station, climate ID 4010879, is located 25 km from the RSA. According to data collected at the station between 1981 and 2010 (Government of Canada 2016a), the average daily temperature was 2.5°C. The lowest mean monthly temperature reported to be -14.2°C in January, and the highest mean monthly temperature in July at 18.1°C. The total annual precipitation was reported to be an average of 424.7 mm with the majority falling as rain (362.3 mm). The frost-free period is approximately 107 days.

The lower Qu'Appelle watershed includes the Qu'Appelle River and its tributaries between the Village of Craven and the confluence with the Assiniboine River at St. Lazare, Manitoba (WSA 2013). The

watershed covers an approximate area of 17,800 km^2 and flows through six major lakes (WSA 2013). The Qu'Appelle River is confined by the Qu'Appelle Valley and has a low gradient, broad floodplain, and freely developed meanders (WSA 2013). The main tributaries to the Qu'Appelle River include Loon, Jumping Deer, Pheasant, Kaposvar, Pearl, Indianhead, Redfox, Ekapo, Cutarm, and Scissor Creeks (WSA 2013).

The nearest water survey gauge, WSA 05JM006, is located on Crooked Lake within the Crooked Lake Provincial Park. Data has been collected from the gauge since 1942. The mean daily water elevation recorded at the gauge ranges from El. 450.89 m recorded for February 27 to El. 451.90 m for May 8 (WSA 2015d). Figure 4 illustrates the mean and historical water levels recorded at 05JM006.

5.5 Terrestrial

5.5.1 Soils and Terrain

Soils described in the Aspen Parkland Ecoregion are a mixture of Black and Dark Brown Chernozems under grassland vegetation and Dark Grey Chernozems and Luvisolic soils under the moister aspen woodlands. Dark Brown Chernozems also occur under woodland vegetation on sandy (fluvial) parent materials (Shorthouse 2010). Poorly drained Gleysolic soils support willow (*Salix* spp.) and sedge (*Carex* spp.) species (SASK Herbarium 2008).

The Qu'Appelle Valley has a relatively flat bottom with steep side slopes and varies from 1.6 km to 3.2 km in width at the valley bottom (WSA 2013). The valley originated as a glacial spillway for Glacial Lake Regina and runs the entire length of the watershed (WSA 2013).

The soils within the RSA are associated with stream floodplains and drainage channels, occurring primarily along the Qu'Appelle River (Saskatchewan Soil Survey 1987). These neutral to moderately alkaline soils, have developed in materials derived from a variety of sources and thus vary markedly in color, texture, and composition. The provincial mapping has described two dominant soils in the RSA, Calcareous Alluvium (Regosols and Gleysols) and Black Chernozems, developed on fluvial deposits (Saskatchewan Soil Survey 1987). The soil map unit surrounding the Crooked Lake outlet structure (Av6) was classified as carbonated Alluvium soils and saline poorly drained soils within the RSA, which are associated with gently sloping floodplains cut by abandoned stream channels (Saskatchewan Soil Survey 1987). However, saline soils were not located during the field soil inspection conducted in 2016 by KCB.

Soil-terrain patterns within the SVSA were characterized by a soil inspection conducted in May and July 2016 by KCB. Topsoil, upper subsoil, and lower subsoil horizons were investigated at 14 inspection sites using a shovel and hand auger (Figures 5a and 5b). Soil profiles were investigated to a depth of approximately 1 m or auger refusal for mineral soils. Organic soils were not discovered during the soil survey inspections.

The soils inspected during the field survey correlated with the presence of Alluvium soils with calcareous properties. Alluvium soils are poorly drained soils associated with the floodplains of the Qu'Appelle River as they occur on very gently to gently sloping, nearly level and undulating

floodplains cut by meandering stream channels. Soil inspection locations revealed calcareous Alluvium (Regosols and Gleysols) and Black Chernozem soils developed on fluvial deposits consistent with the Av38 map unit (Saskatchewan Soil Survey 1987). These mineral soils consisted co-dominantly of Chernozems (Orthic Black), Regosols (Gleyed Cumulic) and Gleysols (Rego and Rego Humic) developed on coarse to medium textured fluvial material. The soils are located on a confined floodplain with 1% to 2% slope interspersed with depressions holding water.

The topsoil (A horizon) textures, where present, ranged from loamy sand to loam to peaty silty loam. The topsoil depths ranged between 5 cm and 25 cm. However, there were areas where no topsoil was identified. The subsoil (B or C horizons) consisted of gravelly sand to silty clay loam with layers of silt in places.

The Alluvium soils (Av38 map unit) comprise 86.7 % (5.43 hectares [ha]) of the 6.26 ha SVSA (Figures 5a and 5b). There is a small area (0.2% or 0.01 ha) consisting of an old topsoil stockpile located on the south side of the Qu'Appelle River that is loamy sand in texture and has mature trees growing (e.g., Manitoba maple [*Acer negundo*] and elm [*Ulmus* spp.]). The disturbed areas (13.1% or 0.82 ha of SVSA) comprise of roads or trails and the existing outlet structure and dyke and do not have any topsoil.

The soils within the SVSA were characterized based on field assessment (Appendix III: Table III-1) and laboratory analyses (Appendix III: Table III-2) as being slightly to highly calcareous, with low salinity, and low to moderate sodicity in poorly drained locations. These soils have a range of organic matter content in the topsoil due to the frequent flooding events and range from 3.6% to 13%, which aids in the fertility of the native forage vegetation around Crooked Lake.

The agricultural capability of Alluvium soils ranges from Class 2 to Class 6 but in this area are potentially Class 4 to Class 6 (Saskatchewan Soil Survey 1987). This range of class is mainly the result of varying degrees of calcareousness and wetness. While topsoil textures vary, they usually range from loamy sand to silt loam, providing adequate water holding capacity. The subsoil textures vary and range from gravelly sand to silty clay loam. The high organic matter content of the surface horizons results in reasonable fertility but poor soil structure and consistency (tilth). Stones are rarely a problem. Wind erosion is not likely to be a concern except during very dry seasons. However, water erosion and flooding are concerns based on occurrence within the Qu'Appelle River floodplain and the potential for mobilization by stormwater runoff. These soils have little potential for cropland and are used mainly for forage production or pasture. The agricultural capacity of the Av38 is a Class 6WF indicating that the soils in this map unit are capable of producing native forage crops only (Saskatchewan Soil Survey 1987). The landscape subclass limitation (W) of this map unit suggests that excessive water may occur as a result of poor soil drainage, a high groundwater table, or seepage and local runoff. The soil subclass limitation of this map unit (F) suggests that high alkalinity may affect crop growth or the range of crops that can be grown.

5.5.2 Vegetation

The SVSA is located in the Melville Plain Ecodistrict of the Aspen Parkland Ecoregion of the Prairie Ecozone (Acton et al. 1998). The ecoregion varies from large grasslands interspersed with small aspen

stands to dense aspen woodlands with small grassland openings (Riley et al. 2007). The vegetation community surrounding Crooked Lake transitions from herbaceous forbs and grasses within the floodplain, to grass and shrubland, to trembling aspen (*Populus tremuloides*) forests on the valley slopes.

The Saskatchewan Conservation Data Centre (SKCDC) was queried to identify rare plants previously identified or potentially occurring within the RSA. The search returned five rare plant species listed by SKCDC (SKCDC 2015a). The provincial conservation rank shown in Table 5.2 is based on Provincial (S) conservation concern with rarity, trend, and threat factors (SKCDC 2015b). None of the species identified have been assigned a rank under the SARA (S.C. 2002, c. 29) based on a query of the Species at Risk Public Registry (SARPR).

Table 5.2 Rare Plant Species of Conservation Concern that Potentially Occur within the SVSA

Common Name	Scientific Name	Conservation Status Rank (SKCDC 2015a)	Provincial Listing (S.S. 1998, c W-13.12)	Federal Listing (S.C. 2002, c. 29)
Pale Bulrush	*Scirpus pallidus*	S3	No Status	No Status
Hairy Germander	*Teucrium canadense* var. *occidentale*	S3	No Status	No Status
White Lettuce	*Prenanthes alba*	S3	No Status	No Status
Big Bluestem	*Andropogon gerardii*	S4	No Status	No Status
Western False Gromwell	*Onosmodium molle* var. *occidentale*	S2	No Status	No Status

Rare plant surveys were conducted in May and July 2016 within the 6.26 ha SVSA (Figures 5a and 5b) with the exception of most northern portion of the SVSA as the access road was added to the design after the surveys were initiated. A total of 76 species were identified during the surveys, including six noxious weeds and two nuisance weeds as designated by Minister's Order under *The Weed Control Act* (Table 5.3). No rare plant species were observed. The complete list of species found in the SVSA is presented in Appendix IV: Table IV-1.

Table 5.3 Weed Species of Concern Identified in the SVSA

Common Name	Scientific Name	*Weed Control Act* Designation
Common Burdock	*Arctium minus*	Noxious
Canada Thistle	*Cirsium arvense*	Noxious
Leafy Spurge	*Euphorbia esula*	Noxious
Perennial Sow-thistle	*Sonchus arvensis*	Noxious
Scentless Chamomile	*Tripleurospermum inodorum*	Noxious
Common Dandelion	*Taraxacum officinale*	Nuisance
Fox-tail Barley	*Hordeum jubatum*	Nuisance

The SVSA is comprised of two ecosites, Overflow and Wet Meadow (Thorpe 2014) and areas of disturbed land, some of which has been allowed to revegetate naturally (Figures 5a and 5b). The Overflow ecosite occurs along the floodplains of streams where the soil is moister and more productive than the adjacent higher elevations. The Wet Meadow ecosite is a wetland flooded

perennially each spring where graminoid species (grasses, sedges, and rushes) dominate and scattered willows grow in drier areas of the ecosite. Evidence of vegetation disturbance and anthropogenic influence was noted throughout the SVSA including the removal of trees and/or shrubs from the Overflow and Wet Meadow ecosites. The Overflow and Wet Meadow ecosites encompass 21.9% (1.37 ha) and 64.8% (4.05 ha) of the 6.26 ha SVSA, respectively. The remaining area, 13.3% or 0.83 ha, is disturbed land comprised of sparsely vegetated roads/trails, the revegetated, weedy existing dyke, and an old topsoil stockpile (0.01 ha) that contains a mix of native, non-native, and weed species. Photographs of the ecosites are presented in Appendix I.

5.5.3 Wildlife

Amphibians and Reptiles

The slow-moving Qu'Appelle River and floodplain provide suitable terrestrial and aquatic habitat for herptiles (amphibians and reptiles) that require aquatic environments for part of their life cycles. There are eight known amphibian species in Saskatchewan and 14 reptilian species (SKCDC 2015c). A summary of the potentially occurring amphibian and reptile species that have a listed conservation status is provided in Table 5.4. The SARPR lists these three species as Schedule 1 species of 'Special Concern' meaning the wildlife species may become threatened or endangered because of a combination of biological characteristics and identified threats (SARPR 2016). Provincially, the SKCDC lists the species as S3. S3 listed species are at moderate risk of extinction or extirpation due to restricted range, relatively few populations, recent and widespread declines, threats, or other factors (SKCDC 2015b)

Table 5.4 Amphibian and Reptile Species of Conservation Concern that Potentially Occur within the TSA

Common Name	Scientific Name	Potential for Occurrence	Conservation Status Rank (SKCDC 2015c)	Provincial Listing (S.S. 1998, c W-13.12)	Federal Listing (S.C. 2002, c. 29)
Great Plains Toad	*Anaxyrus cognatus*	Yes	S3	No Status	Schedule 1, Special Concern
Northern Leopard Frog	*Lithobates pipiens*	Yes	S3	No Status	Schedule 1, Special Concern
Snapping Turtle	*Chelydra serpentina*	May occur	S3	No Status	Schedule 1, Special Concern

The herptile assessment included daytime visual inspections for eggs, tadpoles and adults. Where feasible and safe, potentially affected wetland habitats were walked and a dipnet was used to capture adults or young of the year for identification, in accordance with the requirements of Research Permit 16FW108. Night-time auditory surveys were also conducted in conjunction with yellow rail surveys to detect calling frogs and toads. Herptiles were surveyed over three separate survey periods in May, June, and July.

Great plains toads and snapping turtles were not detected within the TSA during the three survey periods. However, northern leopard frogs were observed during the May and June survey periods. During the May survey period, a northern leopard frog was found on the shoreline of the river while electrofishing near the east edge of the TSA, downstream of the Highway 605 bridge crossing over the Qu'Appelle River (Figure 6b). During the June survey period, four additional northern leopard frogs were observed in a wetland approximately 250 m west of the outlet structure on the shoreline of Crooked Lake. A red-sided garter snake (*Thamnophis sirtalis*) was also observed at the edge of this wetland. During the same survey period, a northern leopard frog was observed on the floodplain of the left bank of the Qu'Appelle River immediately downstream of the outlet structure (Appendix I: Photograph I-9.)

Northern leopard frogs have diverse habitat requirements for overwintering, breeding, and foraging (Government of Canada 2016b). The observed declines in northern leopard frog populations have been attributed to habitat loss, degradation and fragmentation (Government of Canada 2016b). Crooked Lake and the Qu'Appelle River below the outlet structure provide suitable overwintering conditions for northern leopard frogs because they are well-oxygenated bodies of water that do not freeze to the bottom. Additionally, the floodplains of the Qu'Appelle River and surrounding ponds and marshes provide suitable breeding habitat for the species.

Boreal chorus frogs (*Pseudacris maculate*) were detected during night-time auditory surveys and day-time shorebird surveys in May. Calls were recorded using an index adapted from the widely accepted protocol developed by Mossman et al. (1998) (Table 5.5). The abundance calling index ranged between 1 and 2 where boreal chorus frogs were detected.

Table 5.5 Amphibian Abundance Calling Index

Calling Index	Description
0	No amphibians of a given species calling.
1	Individual calls, not overlapping (estimate of 1-5 individuals calling at a site).
2	Calls are overlapping, but individuals are still distinguishable (estimate of 6-10 individuals calling at a site).
3	Numerous calls can be heard; chorus is constant and overlapping (estimate of more than 10 individuals).

Birds

The TSA is designated as a migratory bird concentration site and a locally significant area for staging American white pelicans (Appendix I: Photograph 10), gulls, and terns (SKCDC 2015d). The floodplain and open water of Crooked Lake provide foraging and nursery habitat for multiple species. There are 320 species of birds that have been recorded in the Aspen Parkland ecoregion (Acton et al. 1998). The majority of the birds that breed in the aspen parkland are migratory species. Year-round resident species include:

- black-capped chickadee (*Poecile atricapillus*);

- black-billed magpie (*Pica hudsonia*);
- downy woodpecker (*Picoides pubecens*);
- hairy woodpecker (*Picoides villosus*);
- ruffed grouse (*Bonasa umbellus*);
- sharp-tailed grouse (*Tympanuchus phasianellus*);
- blue jay (*Cyanocitta cristata*); and
- great horned owl (*Bubo virginianus*).

Sources such as e-Bird and SKCDC were queried to identify species specific to the TSA. The SKCDC listed all the birds recorded in Saskatchewan and e-bird listed 63 species near the Crooked Lake Provincial Park (e-Bird 2015). A summary of the potentially occurring species that have a designated conservation status is provided in Table 5.6.

Table 5.6 Bird Species of Conservation Concern that Potentially Occur within the TSA

Common Name	Scientific	Potential for Occurrence	Conservation Status Rank (SKCDC 2015c)	Provincial Listing (S.S. 1998, c W-13.12)	Federal Listing (S.C. 2002, c. 29)
Barn Swallow	*Hirundo rustica*	May occur	S5B, S5M	No Status	Threatened
Bobolink	*Dolichonyx oryzivorus*	May occur	S5B	No Status	Threatened
Common Nighthawk	*Chordeiles minor*	May occur	S4B, S4M	No Status	Special Concern
Loggerhead Shrike (prairie subspecies)	*Lanius ludovicianus excubitorides*	May occur	S3B	No Status	Threatened
Red Knot (*rufa* subspecies)	*Calidris canutus rufa*	Migration only	S2M	No Status	Endangered
Red-headed Woodpecker	*Melanerpes erythrocephalus*	May occur	S1B, S1M	No Status	Endangered
Sage Thrasher	*Oreoscoptes montanus*	Limited occurrence	S1B	No Status	Endangered
Short-eared Owl	*Asio flammeus*	May occur	S3B, S2N	No Status	Special Concern
Turkey Vulture	*Cathartes aura*	May occur	S2B, S2M, S2N	No Status	No Status
Yellow Rail	*Coturnicops noveboracensis*	May occur	S3B, S2M	No Status	Special Concern

Species-specific surveys were conducted in the TSA for the following bird species:

- red knot;
- common nighthawk;
- loggerhead shrike;
- short-eared owl; and
- yellow rail.

Red knot *rufa* subspecies (*Calidris canutus rufa*) is a migratory species and may be present in the TSA in April and May, then again in September and early October. This species is provincially ranked as a S2M species. The SARPR lists the *rufa* subspecies as Schedule 1 'Endangered'. At the time of the May 2016 survey for red knots, it was noted that no suitable habitat was present within the TSA for this species. No red knots were observed in May or June.

Two breeding bird surveys were conducted in June 2016 at 12 pre-determined point count stations throughout the TSA. As a result of these surveys, as well as incidental observations during other surveys, a total of 72 of birds were detected within the TSA. A table of the bird species detected within the TSA and their respective provincial and federal conservation statuses is provided in Appendix V: Table V-1

Of the potentially occurring species of conservation concern, American white pelican, barn swallow, bobolink, great blue heron, turkey vulture, and common nighthawk were detected. Of these species, the common nighthawk is the only species that has a federal status, as this species is listed as 'Special Concern' under Schedule 1 of the SARA (S.C. 2002, c. 29).

Common nighthawk surveys were conducted at six pre-determined survey stations throughout the TSA. During the survey conducted on June 15, 2016, a common nighthawk was visually detected greater than 100 m away over the ridge of the valley to the north of Highway 247 at Maple Street. The individual was also heard calling and diving with accompanying wing-booms. During the survey conducted on July 19, 2016, a common nighthawk was visually detected less than 100 m away within the residential area of Sunset Beach at the intersection of Maple Street and Highway 247. The individual was very vocal throughout the 6-minute survey; however, only displayed a dive and wing-boom once during the extent of the survey.

Yellow rails were not detected within the TSA and the occurrence of suitable nesting habitat was considered to be limited. Yellow rails require large wet meadows or shallow marshes dominated by sedges and grasses (Kaufman 1996). Yellow rails begin nest building within these shallow marshes in May and by mid-June have a clutch of eggs (Bookhout 2015). Suitable habitat for the construction of nests within the TSA was not present during the May and June field surveys. Much of the floodplain area surrounding the Qu'Appelle River downstream of the outlet structure was bare and dry with limited vegetation cover. Yellow rails were detected outside of the TSA during the survey events in both June and July. They were calling near the intersection of Highways 47 and 247 in sedge meadow habitat upstream of the TSA in the Qu'Appelle River floodplain. Based on the presence of concurrently calling yellow rails in the region, it was concluded that they were not present within the TSA.

Mammals

The riparian habitat and valley slope forests along the Qu'Appelle Valley provide uncommon animal habitats (Acton et al. 1998). There are 55 species noted to occur in the aspen parkland ecoregion (Acton et al. 1998). The potential for federally and provincially listed mammal species to occur within the TSA is limited by geographic range and the suitability of the habitat available within the TSA.

None of the mammalian species observed during the three survey events in 2016 are of conservation concern. The following species were observed:

- white-tailed deer (*Odocoileus virginianus*);
- beaver (*Castor canadensis*)
- red fox (*Vulpes vulpes*);
- red squirrel (*Sciurus vulgaris*)
- coyote (*Canis latrans*); and
- least chipmunk (*Tamias minimus*).

5.6 Fisheries and Aquatics

5.6.1 Fish Species Occurrence

Existing Information

An historical account of fish and fish habitat resources of the Qu'Appelle River within the vicinity of the project was established by reviewing available information. The review included internal project reports, reference materials, air photo interpretation, and the SKCDC database. Thirty-four fish species have been identified in the Qu'Appelle River watershed (SKCDC 2015d). The bigmouth buffalo (*Ictiobus cyprinellus*) is the only species with a federal designation of 'Special Concern' under Schedule 1 of the *Species at Risk Act* (SARA) (S.C. 2002, c. 29). Bigmouth buffalo have been noted as "Probably Extirpated" from Round Lake, based on historic sampling, and "Extant" within Crooked Lake (COSEWIC 2019; DFO 2019). This species is therefore considered more likely to occur within Crooked Lake than in the Qu'Appelle River downstream.

Provincially, rock bass (*Ambloplites rupestris*) and channel catfish (*Ictalurus punctatus*) have a conservation status of S2, and black bullhead (*Ameiurus melas*), quillback (*Carpiodes cyprinus*), chestnut lamprey (*Ichthyomyzon castaneus*), bigmouth buffalo, river shiner (*Notropis blennius*), sand shiner (*Notropis stramineus*), and blacknose dace (*Rhinichthys obtusus*) are identified as S3 (SKCDC 2015b). None of the potentially occurring fish species have a designated protective status under the Saskatchewan *Wildlife Act* (S.S. 1998, c W-13.12) or the Federal SARA (S.C. 2002, c. 29).

Fish Sampling Methods

Fish sampling was conducted to assess species presence in Crooked Lake with gill nets, while sampling within the Qu'Appelle River was conducted using fyke and seine nets and a backpack electroshocker.

The gill nets were set within the littoral and limnetic zones to target fish movement near the existing outlet structure on May 17, 2016. The gill nets were experimental nets designed for the fall walleye index netting (FWIN) method, comprised of ten panels consisting of the following mesh sizes: 13 mm, 19 mm, 25 mm, 38 mm, 51 mm, 64 mm, 76 mm, 102 mm, 127 mm, and 152 mm. Gill nets set in the littoral zone had the 13 mm panel anchored to the shoreline while the remainder of the net was

drifted into the limnetic zone of the lake perpendicular to the shoreline. Bottom set nets in the limnetic zone were weighted with anchors. Buoys at the end of the nets were marked with flags and a placard identifying the fish research licence number and consultant contact information.

The fyke nets were constructed of 63 mm knotless mesh and consisted of a square 1 m x 1 m trap, two wings, a leader, a triple hooped funnel, and tied cod end. Where possible, the depth of water at the sampling location was less than 0.8 m. The wings and leader were anchored to the shoreline. The funnel was stretched out and the cod end was anchored to prevent the funnel from collapsing. Two fyke nets were set overnight from May 18 to May 19, 2016. Seining was conducted downstream of the existing structure in July 2016 with a 20 m x 1.5 m double leaded seine with 1.5 m x 1 m x 1 m central pouch with tow bars. Electrofishing was conducted on May 19, 2016, to identify species in a side-channel habitat downstream of the ASA, using a Smith-Root LR-24 backpack electroshocker.

Length information was measured for each fish. Weights were collected for smaller fish that could be accurately weighed on a digital scale. The handling of the adult species was limited in May as nuptial tubercles were noted on the anal fins of some of the male shorthead redhorse (Photograph II-13) and white suckers.

A summary of the sampling locations is provided in
Table 5.7 and illustrated on Figure 7.

Table 5.7 Summary of Fish Sampling Locations

Net Type	Easting	Northing
May 2016		
Gill (G1)	665235	5606637
Gill (G2)	665145	5606616
Gill (G3)	665188	5606808
Gill (G4)	665199	5606673
Gill (G5)	664490	5607669
Gill (G6)	664291	5608095
Fyke (F1)	665406	5606536
Fyke (F2)	665589	5606632
July 2016		
Seine (S1)	665344	5606522
Seine (S2)	665366	5606501
Seine (S3)	665308	5606502
Seine (S4)	665354	5606525
Seine (S5)	665385	5606522

Fish Capture Results

Fourteen fish species were captured within the ASA as a result of sampling (
Table 5.8). Fish sampling effort in May 2016 resulted in the identification of 10 species. Abundant white sucker and shorthead redhorse were observed congregating at the downstream side of the outlet structure in May and June 2016 and a wide variety of spring spawning species was captured. A second sampling event was conducted in July 2016 to collect additional species data downstream of the existing structure. The scour pool downstream of the structure is frequently accessed by the public for recreational fishing and electrofishing was not considered feasible as it posed safety risks to

the public. In July 2016, seining was conducted in the habitat in the vicinity of the scour pool which resulted in the identification of five additional fish species. Of the species captured, none spawn in the fall. Fish species captured during the sampling are summarized in
Table 5.8, and catch per unit effort (CPUE) per species is summarized in Table 5.9. Fork length and weight data are provided in Appendix VI: Table VI-1 for Crooked Lake and Table VI-2 for the Qu'Appelle River.

Table 5.8 Fish Species Captured in the Aquatic Study Area

Common Name	Scientific Name	Conservation Status Rank (SKCDC 2015d)	Provincial Listing (S.S. 1998, c W-13.12)	Federal Listing (S.C. 2002, c. 29)
Blackside Darter	*Percina maculate*	S3	No Status	No Status
Common Carp	*Cyprinus carpio*	SNA	No Status	No Status
Common Shiner	*Luxilus cornutus*	S3	No Status	No Status
Emerald Shiner	*Nortropis antherinoides*	S5	No Status	No Status
Iowa Darter	*Etheostoma exile*	S5	No Status	No Status
Johnny Darter	*Etheostoma nigrum*	S5	No Status	No Status
Lake Chub	*Couesius plumbeus*	S5	No Status	No Status
Northern Pike	*Esox lucius*	S5	No Status	No Status
Pearl Dace	*Margariscus margarita*	S5	No Status	No Status
River Shiner	*Notropis blennius*	S3	No Status	No Status
Rock Bass	*Ambloplites rupestris*	S2	No Status	No Status
Sand Shiner	*Notropis stramineus*	S3	No Status	No Status
Shorthead Redhorse	*Moxostoma macrolepidotum*	S4	No Status	No Status
Spottail Shiner	*Notropis hudsonius*	S5	No Status	No Status
Walleye	*Sander vitreus*	S5	No Status	No Status
White Sucker	*Catostomus commersoni*	S5	No Status	No Status
Yellow Perch	*Perca flavescens*	S5	No Status	No Status

Four gill nets were set in the shallow littoral area of Crooked Lake near the inlet to the existing structure (Figure 7). The most abundant species captured in the littoral zone were shorthead redhorse and white sucker with a catch per unit effort (CPUE) of 8.15 fish/net hour each (Table 5.9). A large northern pike was captured in G1 (Figure 7) with a length of 1000 mm (Photograph II-16).

Two deep gill net sets were conducted in the limnetic area of Crooked Lake (Figure 7). Yellow perch and walleye were the only sport fish species captured. The CPUE for yellow perch (Photograph II-17) was 3.66 fish/net hours and walleye (Photograph II-18) was 1.37 fish/net hours (Table 5.9).

Two fyke nets were set in the Qu'Appelle River (Figure 6a). The nets were set overnight to capture fish moving through the river. Fyke 1 (F1) was set for 22.5 hours and 49 fish were captured. The fish captured included 47spottail shiner, one northern pike, and one rock bass (Photograph II-19). In F2, 21 fish were captured, including 20 spottail shiner and a rock bass. Rock bass have a provincial conservation status rank of S2 and are known to inhabit the Qu'Appelle River system. They feed on aquatic insects, minnows, yellow perch and crayfish (SWA 2000).

A backpack electroshocker was used to sample in side-channel habitat downstream of the ASA. The substrate of the side-channels made it difficult to sample the habitat effectively. Re-suspended fine substrates clouded the water quickly and the samplers spent more time freeing themselves from the substrates than fishing. Four blackside darters and two spottailed shiners were captured (Figure 6b).

In July 2016, seining was conducted to supplement the data collected in May 2016. Seining was conducted in five (5) locations (Figure 6a). The first pull, S1, resulted in the capture of 535 fish (Photograph II-18). White sucker occurred in greatest abundance with a catch per unit effort of over 23 fish per 100 m^2 reported (Table 5.10). To limit stress on the fish and to accelerate processing, the average weight and length of the spottail shiner, young of the year white sucker, sand shiner, and Johnny darter species were taken. Weights and lengths were collected for yellow perch, walleye, common carp, shorthead redhorse, and adult white sucker (Appendix VI, Table VI-2).

Table 5.9 Crooked Lake Fish Catch per Unit Effort

Species	Gill Net (fish/hr)
Littoral	
Common Carp	1.11
Emerald Shiner	1.11
Northern Pike	0.74
Shorthead Redhorse	8.15
White Sucker	8.15
Spottail Shiner	1.11
Limnetic	
Spottail Shiner	0.92
Walleye	1.37
Yellow Perch	3.66

Table 5.10 Qu'Appelle River Fish Catch per Unit Effort

Species	Fyke Net (fish/hr)	Electrofisher (fish/100 sec)	Seine (fish/100 m^2)
Blackside Darter	0	0.46	0
Common Carp	0	0	0.20
Common Shiner	0	0	0.20
Iowa Darter	0	0	0.15
Johnny Darter	0	0	4.04
Northern Pike	0.02	0	0
Pearl Dace	0	0	1.31
River Shiner	0	0	0.41
Rock Bass	0.04	0	0
Sand Shiner	0	0	0.99
Shorthead Redhorse	0	0	0.03
Spottail Shiner	1.49	0.23	4.74
Walleye	0	0	0.55
White Sucker	0	0	23.04
Yellow Perch	0	0	0.55

5.6.2 Fish Habitat Assessment

Fish habitat was assessed on May 19, 2016. Habitat classification and mapping was carried out based on procedures outlined for habitat unit delineation by O'Neil & Hildebrand (1986) and substrates were classified according to the methods described by Overton et al. (1997). Representative photographs were also taken to document the existing aquatic habitat (Appendix I). The habitat assessment was supported by air photograph review, review of existing information, and experience from other projects on the Qu'Appelle River in the general vicinity.

Fish species known to occur in the ASA were used as representative species for assessing fish habitat suitability with respect to spawning, rearing, and overwintering potential. Habitat connectivity for migration was also assessed, with any barriers or disturbed areas described, recorded, and geo-referenced with a global positioning system (GPS). A habitat map depicting the location of fish habitat units, approximate meanders of the watercourse, and disturbance features was prepared based on O'Neil & Hildebrand (1986).

Fish habitat in the forebay of the existing outlet structure in Crooked Lake was characterized as shallow littoral habitat sloping down gradually to limnetic habitat. The substrates within the littoral zone consisted primarily of fines, with gravel and occasional cobble occurring near the shoreline. The deeper limnetic areas were characterized entirely by deposited fine substrates. Emergent aquatic vegetation was limited in the vicinity of the outlet structure, though dense sandbar willow and grasses occurred along the margin of the lake, presumably at or above the FSL. Submerged aquatic vegetation was sparse in the shallow sloping, wind exposed littoral area in the vicinity of the outlet structure, as noted during site visits conducted in May, June, July, and September. However, pond weed species were noted to occur in the deeper channel leading into the outlet structure and at greater depths of the littoral zone subjected to less wave action than the shallow near-shore areas. The lack of near-shore aquatic vegetation and exposure to wave action would limit the suitability of this area as spawning habitat for northern pike, yellow perch, bigmouth buffalo, and other species that deposit their eggs on aquatic vegetation. Limited structural cover was available for juvenile rearing. The forebay of the outlet structure was also considered to have low suitability as a potential spawning habitat for walleye, lake whitefish, and other species that broadcast eggs over coarse substrates, as there was a low concentration of coarse cobble substrates noted.

The fish habitat features mapped within the Qu'Appelle River portion of the ASA are illustrated on Figures 6a and 6b. The channel was unconfined with an irregular meander pattern. A large scour pool had formed immediately downstream from the existing outlet structure. Fish were visually observed upstream and downstream of the structure in May 2016 (Photograph II-11). At the time of the assessment, aquatic and riparian vegetation was still in senescence. Erosion was observed on the right (south) bank downstream of the structure and along the outside bends of the river throughout the length of the ASA (Photograph II-12). A small mid-channel gravel bar occurred downstream of the scour pool that constricted flow, creating a shallow riffle habitat (Photograph II-13). The dominant habitat within the Qu'Appelle River was moderate to deep run with occasional pools downstream of

obstructions and meander bends (Photograph II-14). Snye habitat was located occasionally at the margins of the channel. Fines dominated the substrate throughout the ASA.

Potential spawning habitat for northern pike and bigmouth buffalo was identified within the seasonally flooded low-lying floodplain areas at the margins of the channel, including the flooded flat on the north side of the channel immediately downstream of the existing structure. Seasonally flooded areas would also provide structural cover for nursery and rearing habitat. The shallow riffle habitat dominated by coarse substrate that was identified downstream of the outlet structure could provide potentially suitable spawning habitat for walleye and sucker species. Abundant white sucker and shorthead redhorse were observed congregating at the downstream side of the outlet structure in May and June 2016 that were attempting to migrate upstream to access spawning habitat. It is expected that spawning likely occurs in the pool and riffle habitat downstream from the structure when further upstream movement is impeded.

5.7 Socio-economic Environment

5.7.1 Land Use and Ownership

Most of the land surrounding Crooked Lake in the vicinity of the outlet structure is either part of the Cowessess Indian Reserve No. 73 or owned by the Province of Saskatchewan (much of it recently purchased from private landowners). It is noted that the right (south) bank of the Qu'Appelle River downstream of Crooked Lake represents the natural north boundary of the Cowessess First Nation (Figure 1). The land south of the structure is Cowessess First Nation land with an access easement for WSA. Additional land will be transferred to Cowessess First Nation to facilitate future access to the new structure and the shorelines upstream and downstream of the new structure. WSA will retain an access easement on the transferred land.

The land use within the RSA includes agriculture, tourism, and oil and gas development. Distinct features of the RSA include the Crooked Lake Provincial Park (195 ha) located to the northwest of the outlet structure on the north shore of Crooked Lake (Figure 1). The park provides a recreation use area with 123 registered campsites (SaskParks 2016).

5.7.2 Nearby Communities

To the north of the outlet structure is Sunset Beach, an organized resort hamlet along the shoreline of the northeast corner of Crooked Lake. Sunset Beach Resort is located along Criddle Ave within Sunset Beach, equipped with 50 campsites and three cabins. South of the outlet structure and Qu'Appelle River is Cowessess Indian Reserve No. 73 and the community of Cowessess (Figure 1). The Zagime Anishinabek First Nations is situated adjacent to the Cowessess First Nation and may also be affected by the operation of the proposed structure.

5.7.3 Existing Infrastructure

Crooked Lake water levels and releases are currently controlled by the existing nine-bay reinforced concrete outlet structure equipped with stop logs located within the original Qu'Appelle River. An approximately 3 m high, 220 m long earthen dyke was constructed on the north side of the outlet

structure to contain the reservoir. Access to the existing outlet structure is along First Street that runs parallel to the lake shoreline. A gravel-surfaced vehicle turnaround is located at the end of First Street on the north side of the outlet structure. This area is used by the public for parking near the structure. Local residential houses are located on either side of First Street. No houses are within the project footprint. A public beach and boat launch is located at the intersection of First Street and Criddle Ave to the north of the outlet structure.

Two abandoned and one in-service telephone line run beneath the project footprint. An overhead powerline runs parallel to First Street but ends north of the project footprint. Additionally, a gas line and electrical utility line run parallel to First Street but do not intersect the project footprint.

5.7.4 Historical Resources

A Historical Resources Impact Assessment (HRIA) was conducted by KCB's subconsultant Bison Historical Services Ltd (Bison). The HRIA was required as outlined in a direction letter issued by the Saskatchewan Heritage Conservation Branch (SHCB) to the WSA on June 13, 2012, based on the assessed potential for historical resources to occur within the vicinity of the Project. The HRIA work identified no historical resources and recommended that no further investigation was required. The HRIA is included in Appendix VII.

6 ASSESSMENT OF EFFECTS

6.1 Approach and Scope

The assessment of effects for the Technical Proposal was conducted through a four-step evaluation process. The first step was defining the spatial and temporal boundaries of potential Project related effects. This was followed by an assessment of what effects the Project activities may have on environmental components. The third step included an evaluation of the identified potential effects to determine whether or not residual effects were likely to occur following application of recommended mitigation measures and industry standard practices. If mitigation measures can be effectively implemented and there is either no permanent change or a negligible change in the environmental component, then no residual effect is anticipated, and the potential effect would not be carried forward in the evaluation. The final step in the assessment was a detailed evaluation of any identified residual effects to determine character and significance. All residual effects were evaluated with respect to the criteria provided in Table 6.1.

Significance was defined as a prediction of the overall impact of the effect based on evaluation of residual effect ratings. Residual effects were classified as either significant (S) or not-significant (NS). A significant effect was one that meets any of the following criteria:

- Any negative effect predicted to be detrimental to individuals or populations of endangered, listed, or protected species, or a species of special management concern;
- Any negative effect that is determined to be detrimental to or result in the impairment of the function or integrity of sensitive habitat; and
- Any effect that is determined to have a moderate to high magnitude, regional to provincial extent, a long-term or far-future duration, and that is also continuous and irreversible.

Table 6.1 Residual Effect Rating Descriptors

Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Positive (P): The anticipated effect will be positive	Negligible (N): No detectable change from baseline conditions	Local (L): Effect is limited to Project footprint or Study Area	Short-Term (ST): Effect lasts < 1 season following Project completion	One Time (OT): Effect is confined to one discrete period in time	Short-Term (ST): Effect can be reversed within 10 years
Neutral (Ne): The anticipated effect is neutral	Low (L): Differs from the average value for baseline conditions, but within the range of natural variation	Regional (R): Effect extends to region	Medium-Term (MT): Effect lasts up to 25 years	Sporadic (S): Effect occurs rarely and at sporadic intervals	Medium-Term (MT): Effect can be reversed within between 10 to 25 years

Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility
Negative (N): The anticipated effect will be negative	Moderate (M): Differs from the average value for baseline conditions and approaches the limits of natural variation	Provincial (P): Effect extends to province	Long-Term (LT): Effect lasts between 25 and 50 years	Regular (R): Effect occurs on a regular basis	Long-Term (LT): Effect can be reversed within between 25 to 50 years
Unknown (Unk): Insufficient information to determine direction	High (H): Predicted to differ from baseline conditions or a guideline or threshold value so that there will be a detectable change beyond the range of natural variation		Far Future (FF): Effect lasts more than 50 years	Continuous (C): Effect occurs constantly during, and potentially beyond, the construction phase	Irreversible (IR): Effect cannot be reversed

6.1.1 Spatial and Temporal Boundaries

The spatial and temporal extents were defined as the areas and timeframes within which potential effects from Project activities can be measured. The spatial extents included the Project Area footprint (e.g., works, access, and laydown area) as well as areas of potential indirect influence within the vicinity of the project (e.g., instream areas of sediment transport. The Study Area boundaries for each environmental element were detailed in Section 5.1. The temporal extent for the assessment included the periods of active construction, monitoring, and operation. Decommissioning was not considered relevant for this Project as the lifespan of the Project is 100 years.

6.2 Potential Effects and Mitigation Measures

The potential effects of the proposed Project were identified and characterized to determine whether residual effects could reasonably be expected to occur following application of mitigation measures. Anticipated potential effects are discussed in the following sections and are summarized, along with proposed mitigation measures, in Table 6.3. The effects assessment evaluated potential effects on the following environmental components:

- Geology and Hydrogeology
- Climate and Hydrology
- Soils and Terrain
- Vegetation
- Wildlife
- Fish and Aquatic Habitat

- Socio-economic Environment
- Historical Resources

6.2.1 Geology and Hydrogeology

The proposed works are local in scale and are not expected to extend below alluvial deposits; therefore, no adverse effects on geology are anticipated.

Measurement of groundwater elevations and hydraulic conductivity at monitoring wells in the vicinity of the proposed outlet structure indicate that the groundwater table is directly influenced by lake water surface elevation. The excavation required to install the structure will occur below the groundwater table and temporary measures will be required to isolate the excavation and reduce groundwater infiltration. Groundwater that seeps into the excavation will be collected in a well point and discharged to the river channel downstream continuously, but there is not expected to be an effect on groundwater quantity based on the high recharge rate observed at the monitoring wells. Likewise, groundwater quality is not expected to be affected as groundwater interactions will be minimized by isolating the excavation area.

6.2.2 Climate and Hydrology

The proposed works will have limited potential to affect climate or hydrology. Construction will specifically be staged to allow for continued management of water levels in Crooked Lake in accordance with the Crooked Lake Water Management Plan and water will be released from the lake according to the typical operating regime. As a result, there is no anticipated effect on surface water volume in the lake or in the Qu'Appelle River downstream.

6.2.3 Soils and Terrain

Development of site access corridors, laydown areas, and other temporary workspaces may result in disturbance and compaction of site soils, affecting soil structure, agricultural capability, and erodibility. Soils exposed because of clearing and grading, may be subject to erosion if not protected. Stripped materials that will be stockpiled for use during site reclamation can be damaged if not handled and stored appropriately. Adhering to standard construction practices for handling of soils will limit the potential for adverse effects to occur.

Potential pollutants that may be released into soils during construction include gasoline, diesel fuel, hydraulic fluids, lubricants, coolant, and other deleterious substances. Pollutants may be released into the environment as a result of equipment being in poor repair, mechanical failure, damage sustained during operation, poor fuelling practices, or inadequate means of containment during storage. The potential for release of pollutants into the environment is considered to be low and can be further controlled through application of mitigation measures (Table 6.3).

6.2.4 Vegetation

The Project will occupy 20,200 m^2 of the terrestrial environment, resulting in a permanent loss of the plants and their habitat within the project footprint. Approximately one quarter of the Project

(26.6%) will be situated in areas of previous vegetation disturbance with the remaining footprint located in the Overflow (31.4%) and Wet Meadow (41.9%) ecosites. Areas of vegetation disturbance for both temporary facilities such as laydown areas as well as temporary work areas around the footprint will be reclaimed to pre-disturbance vegetation conditions. This is not considered a permanent loss. The development of the Project is not anticipated to create long-term effects to the soil moisture and nutrient regime; therefore, permanent effects to the vegetation communities surrounding the Project are not anticipated.

No rare plants were observed within the project footprint during field survey. If targeted rare plant surveys have not been completed in areas to be disturbed by construction activities, pre-constructions surveys will be conducted to determine the presence of rare plants.

Construction activities and vegetation removal could result in introduction of weeds that are not currently present at the Project. Weed propagules (seed, spores, rhizomes etc.) could be transported onto the site on unwashed vehicles or machinery or within unclean fill material. The failure to control existing noxious and nuisance weed infestations will expose disturbed soil in the construction zone to colonization of these weeds in addition to any potentially introduced weeds. The proper management of weeds for the duration of the Project is anticipated to decrease the quantity of listed weed in the vicinity of the project (Table 6.3).

6.2.5 Wildlife

As identified in Section 6.2.4, a permanent loss of 20,200 m^2 of vegetated area is expected to occur as a result of the Project. The areas that will be affected primarily include riparian vegetation within the floodplain of Qu'Appelle River that could provide suitable nesting and or foraging habitat for birds and foraging habitat for amphibians. The portion of this area within the footprint of the access road and existing structures includes disturbed or partially disturbed vegetation. There is expected to be a net increase in the quantity of aquatic habitat available for wildlife.

Disturbance of wildlife can potentially occur as result of construction noise and activity making habitat unsuitable for wildlife occupation or passage. It is expected that a short-term disruption of wildlife habitat use may occur within the immediate vicinity of the Project during active construction. Construction scheduling will consider avoidance of the sensitive nesting and natal period for wildlife to reduce the potential magnitude of this effect (Table 6.3).

Physical barriers and disruptions can also impede the movement of wildlife. The physical presence of roadways and temporary fences are not expected to affect the majority of wildlife movements as compared to baseline conditions. The disruptions associated with the construction traffic and activities will create temporary barriers that may prevent wildlife from moving between patches of suitable habitat. Temporary barriers and not expected to have significant, long-term effects on wildlife movements or populations.

Direct mortality of wildlife could occur as a result of clearing and grubbing during the nesting or natal period. Direct mortality of wildlife will be limited by scheduling clearing to occur outside of the period of greatest sensitivity. The nesting and natal period for wildlife begins in February when owl nests

may be established in mature trees and extends to the end of August when juvenile birds have fledged and are able to avoid disturbance. Clearing is proposed to occur in November of Year 0 to avoid this sensitive period (Table 6.3). Increased vehicle traffic associated with construction may result in direct mortality by increasing the number of animals involved in vehicle-wildlife collisions. Improper storage of garbage and attractants can increase the potential for the trapping and destruction nuisance animals.

Pre-construction assessments will be required to determine if amphibians are present in the active construction area. If amphibians are noted, the MoE will be contacted to determine appropriate mitigations, such as translocation of amphibians from within the active work area.

6.2.6 Fish and Aquatic Habitat

Change in Habitat Quantity or Suitability

The anticipated permanent and temporary gain, loss, and alteration of aquatic habitat associated with the proposed Project components is summarized in Table 6.2.

Table 6.2 Summary of Change in Habitat Quantity and Suitability

Change in Habitat	Duration	Effect	Area (m^2)
Quantity	Permanent	Gain	4,339
		Loss	-1,973
		Net Change	**2,366**
	Temporary	Loss	-4,864
Suitability	Permanent	Alteration	4,223

There is expected to be a permanent decrease in fish habitat quantity of 1,973 m^2 associated with installation of the fishway within the existing outlet channel, infilling to create the rock spur near the inlet to the fishway channel, and the construction of the permanent access road. However, there is expected to be a 1,150 m^2 gain of habitat as a result of excavation of the new outlet channel upstream from the structure, and transition of 3,189 m^2 of seasonally flooded habitat to permanently wetted within the outlet channel downstream from the structure. There is expected to be a net increase of 2,366 m^2 in the quantity of fish habitat permanently available.

An area of 4,223 m^2 of fish habitat is expected to be altered as a result of excavation and armouring of seasonally flooded habitat within the side slopes of the new outlet channel, infilling at the toe of the rock spur, and the addition of coarse substrates associated with bank armouring and creation of the fish attraction riffle at the fishway channel outlet. Coarse substrates occur in limited quantity within the Study Area and may provide additional suitable spawning habitat for species such as walleye, white sucker, and shorthead redhorse, as well as a source of cover for rearing fish. The character of the fish habitat in the river downstream from Crooked Lake will also be altered relative to the existing condition as discharge will be split between two channels. The fishway channel will receive less discharge during periods of high flow in comparison, which may reduce velocities in the riffle habitat downstream from the outlet and could affect the suitability of this area as spawning habitat. However, the fish attraction riffle that will be constructed at the confluence of the two

channels will be an area of increased velocity that could provide potential spawning habitat. The functional capacity of the habitat downstream from the control structure to support potentially occurring fish species is not expected to change.

Temporary cofferdams will be constructed to isolate the instream construction area for removal of the existing outlet structure and construction of the fishway. Likewise, it is expected that temporary isolation will be required to facilitate installation of the fish attraction riffle and bank revetments. The footprint of the isolation structures will result in temporary loss of approximately 3,255 m^2 of habitat for the duration of instream works. An additional 1,428 m^2 of seasonally flooded habitat within the floodplain downstream from the structure will be temporarily lost within the footprint of the pre-load area and associated temporary access road. The total temporary loss of habitat anticipated is 4,684 m^2. These temporary losses will be short-term in duration and will affect habitat types that are abundantly available within the Study Area. Therefore, residual effects on fish populations are not predicted.

Introduction of Sediment or other Deleterious Substances

Construction-related sediment mobilization and transport can affect water quality and aquatic habitat in both the immediate construction zone and in downstream areas. Sediment suspended in the water column can affect aquatic organisms both directly and indirectly. Erosion and sedimentation can have effects in both the short- and long-term. Construction activities have the potential to result in mobilization and transport of sediment in the watercourse through surface runoff over disturbed work areas or direct input of sediment during installation of isolation measures and commissioning of the new structures. Long-term effects could include runoff over disturbed areas that have not been successfully re-vegetated.

Introduction of deleterious substances could occur in several ways and may result in negative effects on fish and fish habitat. Hydrocarbon based fuels, hydraulic fluids, and lubricants will be used in construction machinery working within the floodplain of the river and spills or leaks may occur. These substances may enter the watercourse directly or be deposited in the riparian area and be transported into the watercourse by surface runoff.

Vehicles and construction equipment, particularly tracked machinery, may also transport biological contaminants to the site. These could include invasive aquatic vegetation such as Didymo algae or diseases such as whirling disease. Invasive species have the potential to cause loss of biodiversity, degradation of water quality, and disruption of ecosystem functions.

Direct Harm to Fish

Instream construction activities during the periods of spawning, egg incubation, or fry emergence could result in reduced spawning success as a result of direct disturbance or sediment mobilization and deposition on downstream spawning areas. Most of the fish species that are expected to occur within the Study Area spawn during the spring and construction will be scheduled to avoid the sensitive spring spawning period (April 1 to May 31). No fall spawning fish species were captured during sampling, though lake whitefish (*Coregonus clupeaformis*) and cisco (*Coregonus artedii*) are

expected to occur in Round Lake downstream and could potentially occur in Qu'Appelle River. Construction of the new outlet structure is proposed to occur during the spawning and incubation period for fall spawning species but will be conducted in isolation. An earthen plug and/or temporary cofferdam will be maintained to allow for construction of the outlet structure and excavation of the inlet and outlet channels to occur in isolation. Dewatering of the excavations within the isolated work area will likely be required. The temporary isolation structures will be removed prior to the spring spawning window (beginning April 1). The inlet and outlet channels will fill with water as the water level equalizes across the isolation structure, but the outlet will not be commissioned, and no discharge will be released through the structure during that spring. Commissioning of the new outlet structure is expected to result in mobilization and downstream transport of sediment. The new outlet will be commissioned in June, after the spring and fall spawning window has passed, and prior to isolating the existing outlet structure to begin construction of the fishway.

Isolation of the instream work area associated with the existing outlet structure and the fishway may result in stranding of fish within the isolated work footprint, posing a physical threat to fish and requiring fish rescue. Fish rescue will be conducted to relocate stranded fish from isolated work areas. In addition, the pumps used to dewater isolated work areas or to divert water around the isolation area could impinge or entrain fish and pumps will be equipped with an intake screen, as per established guidelines (DFO 1995).

Change in Fish Passage Potential

The potential for upstream fish passage from the Qu'Appelle River into Crooked Lake is expected to improve as a result of the Project. The existing outlet structure is passable only when the gates are entirely open (i.e., no stop logs in place within a gate) and velocity through the gates is low enough to allow for passage. The proposed fishway and re-configured outlet structure will increase the proportion of time that passage is favourable. The fishway will facilitate passage of the indicator species (adult walleye) while the outlet structure gates are closed when discharge from the lake is great enough to provide sufficient depth for fish to pass within the fishway. However, there are expected to be periods when low flows will naturally restrict fish passage. Fish passage potential may also be reduced during periods when the volume of water discharged from the outlet structure is greater than in the fishway, and fish passage through the outlet structure is not feasible, as fish may be attracted to the outlet channel instead. Riffle features have been incorporated to increase turbulence and attraction flow at the confluence of the channels. The influence of these fish attraction measures has conservatively not been accounted for in the fishway performance analysis.

The analysis carried out to support design of the fishway indicated that favorable fish passage is estimated to be possible either through the fishway or through the outlet structure for approximately 49% of the open water operating season (April 1 – October 31). During the spring spawning period (April 1 to May 31), fish passage is estimated to be favorable 61% of the time. It is expected that fish passage potential within the fishway will be greater than conservatively predicted by the analysis described above and that this will represent an improvement relative to the existing condition. The fishway has been designed based on design practices used by WSA to successfully implement nature-like fishway structures at other sites in Saskatchewan.

6.2.7 Socio-economic Environment

The Project has the potential to disrupt and disturb residents of the communities of Sunset Beach and Cowessess during the construction process by increasing traffic, stirring up dust and depositing construction materials on roadways, and increasing noise levels. Mitigation measures have been proposed to reduce the potential for these effects to occur (Table 6.3), including development of a dedicated construction access road to reduce the need for construction traffic to occur on the primary access road for Sunset Beach.

It is expected that construction activities over the two-year construction period will result in incidental benefits to the regional economy through increased patronage of the hospitality industry. In addition, replacement of the control structure will provide a long-term benefit through continued recreational use (e.g., fishing, boating, swimming) for visitors and local residents. The alternative to replacing the structure would be continued deterioration to the point where water is no longer retained at the currently managed water levels.

6.2.8 Historical Resources

HRIA field investigations, which included visual inspection and hand excavations of sedimentary deposits within the proposed project area, were carried out on November 9, 2015. The HRIA work did not identify any heritage materials and consequently recommended that the potential for effects on historical resources was low and that no further archaeological investigations were required for the project. A copy of the HRIA report was submitted to the SHCB and they have indicated that they have no further concerns with the project proceeding as planned. Based on these findings, a Letter of Clearance for the project was obtained from the SHCB. A copy of the HRIA report and SHCB letter of clearance are included in Appendix VII.

6.2.9 Summary of Project Effects Assessment

Potential Project effects were identified and characterized to assess whether residual effects could be expected to occur following application of mitigation measures. The results of the assessment of effects are provided in Table 6.3.

Table 6.3 Summary of Project Effects Assessment

Project Activity	Effect Description	Proposed Mitigation and Management	Residual Effect
Soils and Terrain			
Site Access Corridors	Disturbance of site soils	▪ An Environmental Protection Plan (EPP) should be developed and implemented for the Project prior to start of construction. ▪ Access corridors should be selected and marked to minimize encroachment on undisturbed areas. ▪ Disturbance of established vegetation should be limited ▪ An Erosion and Sediment Control (ESC) Plan should be developed by the construction contractor prior to start of construction. Exposed slopes and soils should be protected from erosion as outlined in the ESC Plan. ▪ Prior to revegetation, compacted areas should be mitigated and/or remediated. ▪ During adverse weather and when soils are wet, equipment travel and operation should be suspended or modified to prevent alteration of soil structure. ▪ If required by the seeding contractor, soil amendments (organic and inorganic) should be applied to improve success of revegetation as approved by the Government of Saskatchewan ▪ Topsoil should be salvaged and stockpiled in a dry and accessible location. ▪ In areas of native grassland, topsoil should be salvaged, stockpiled and replaced separately from other areas, to protect the seedbed and enhance revegetation.	Negligible
Operation of equipment and storage of hazardous materials	Introduction of contaminants to soils	▪ Equipment should be cleaned and in good working order prior to arriving on-site. ▪ Designated fueling and maintenance areas should be placed outside the limits of the riparian area with appropriate secondary containment and spill contingency equipment. Activities within these areas should be conducted in a manner that minimizes the potential for contaminants to enter the watercourse. ▪ Stationary equipment and hazardous materials should be stored within a designated secondary containment area. ▪ A spill contingency plan should be in place and spill kits should be readily accessible on-site.	Negligible
Stripping and grading of laydown areas	Erosion of exposed soils	▪ An ESC Plan should be developed and implemented for the Project prior to start of construction. ▪ Topsoil should be salvaged and stockpiled in a dry and accessible location. ▪ In areas of native grassland, topsoil should be salvaged, stockpiled and replaced separately from other areas, to protect the seedbed and enhance revegetation. ▪ Topsoil salvage should only be undertaken during daylight hours to ensure depth of topsoil can be identified. ▪ Topsoil should be stripped and replaced under non-frozen and non-saturated soil conditions. If topsoil must be stripped under frozen and/or saturated soil conditions due to timing constraints or site conditions, a topsoil handling plan specific to the locations and conditions encountered should be prepared prior to commencing topsoil stripping activities. ▪ When handling wet or saturated topsoil, extra care should be taken to minimize damage to the soil structure. ▪ Excavations should be isolated with ESC measures when working within 30 m of the Qu'Appelle River and Crooked Lake. ▪ Areas used for the disposal of brush, timber or logs removed in the clearing operation should not obstruct drainage patterns and runoff from the disposal areas should not cause siltation of any water bodies. ▪ An undisturbed vegetation buffer of 10 m should be retained between the construction site and watercourse to reduce the potential for sedimentation, where feasible. The buffer should be fenced to prevent equipment and machinery from encroaching into protected areas. ▪ Disturbance of established vegetation should be limited. ▪ Reclamation should be implemented with an approved seed mix and native plant species.	Negligible
Soil stockpiling	Erosion of stockpiled materials	▪ As per the ESC Plan, the Contractor should protect soil stockpiles from erosion. Where persistent high winds are eroding soil piles, or removing topsoil from the construction area, contingency measures to stabilize the soil should be implemented. ▪ Topsoil should be stockpiled separately from subsoil stockpiles by a minimum of 3 m. ▪ Large rocks, roots, stumps, slash or debris should be removed from the topsoil prior to completion of the work prevent impediments to the proper placement of soil.	Negligible
Soil stockpiling	Weeds and invasive plants	▪ Imported fill material should be clean and free of weed seeds and propagules. Government approved sources are available. ▪ Preconstruction weed surveys should be conducted within the Project area to identify any areas of concern, and if required, a weed management strategy should be developed. Traffic through these areas should be limited if possible. ▪ Reclaimed/revegetated areas should be inspected for presence of prohibited, noxious, or nuisance weeds. Identified weeds should be controlled using methods that do not jeopardize the health of desired plant species.	Negligible
Vegetation			
Build temporary facilities such as laydown areas, soil stockpiles, or site access	Temporary reduction in vegetation cover	▪ The footprint of disturbance should be limited. ▪ Laydown areas and temporary roads should be located in previously cleared/disturbed areas. ▪ If facilities are built outside of the SVSA, preconstruction assessments should be conducted to search for rare plants. If required, a rare plant mitigation plan can be developed. ▪ Areas of disturbance should be revegetated with an approved seed mix. ▪ Salvaged soil (topsoil and upper subsoil) from the project footprint should be used for reclamation where possible to retain the local seedbank within the soil, taking into consideration any weed management objectives identified.	Negligible
Construction of new outlet structure and access road	Permanent loss of 20,200 m^2 of vegetated area	▪ The footprint of disturbance should be limited where possible. ▪ Access corridors and project extents should be marked to minimize encroachment on undisturbed areas. ▪ Salvaged soil (topsoil and upper subsoil) from the project footprint should be used for reclamation where possible to retain the local seedbank within the soil, taking into consideration any weed management objectives identified.	**Yes**

Project Activity	Effect Description	Proposed Mitigation and Management	Residual Effect
Use of construction equipment within the work area	Introduction of or spread of noxious weeds or invasive weed species	▪ Soils should be removed from vehicles and equipment, including tracks and tires. All equipment and materials should be clean of weeds and weed propagules before arriving on site. ▪ If required, imported fill material should be clean and free of weed seeds and propagules. ▪ Preconstruction weed surveys should be conducted within the Project area to identify any areas of concern, and if required, a weed management strategy should be developed. Traffic through these areas should be limited if possible. ▪ Reclaimed and revegetated areas should be inspected for presence of prohibited, noxious, and nuisance weeds. Identified weeds should be controlled using methods that do not jeopardize the health of desired plant species.	Negligible
Wildlife			
Site preparation, soil stockpiling, laydown areas, easements, and temporary site access roads	Temporary disturbance to or loss of habitat	▪ The footprint of disturbance should be limited where feasible. ▪ Disturbed areas should be re-vegetated with an approved seed mix.	Negligible
Construction of new water control structure, fishway, access road, gravel armour revetment, and rock spur	Loss of 20,200 m^2 of terrestrial wildlife habitat	▪ The quantity of terrestrial habitat predicted to be lost is negligible in comparison to the habitat available in the surrounding floodplain and banks of the Qu'Appelle River.	**Yes**
	Increase in quantity of aquatic wildlife habitat of 2,931 m^2	▪ Effect is positive.	**Yes**
Vegetation clearing and construction	Direct mortality of wildlife during clearing and grubbing	▪ The sensitive breeding season for nesting birds is between February and August. If clearing during the nesting period is required, discussions would be conducted with Andy Cook from the MoE for prescribed mitigation measures. Andy Cook Senior Ecological Protection Specialist Ministry of Environment, Landscape Conservation 306-519-8702 Andy.Cook@gov.sk.ca ▪ Should pre-disturbance nest sweeps be prescribed by Mr. Cook, special attention should be made to observing evidence of breeding behaviour (territorial behaviour; calling to competing male, mate or young; singing; courtship displays; carrying food or nest material; and or presence of nest or young found incidentally) to reduce the effects of disturbance. ▪ Additional pre-construction surveys and on-site construction monitoring may be required to identify the presence of hibernacula and dens when earthworks commence. ▪ If exemptions are not received, species-specific setback distances will be implemented in the event that breeding wildlife are identified in the area to be cleared (MoE 2015). ▪ As per a MoE approved mitigation strategy, the worksite will be isolated with silt fence prior to spring or fall movements to prevent amphibians from entering the work site.	Negligible
	Direct mortality of amphibians during clearing and grubbing	▪ As per an MoE approved mitigation strategy, the worksite will be isolated with silt fence prior to spring or fall movements to prevent amphibians from entering the work site. ▪ A search will be conducted for amphibians within the work area. If identified, translocation will be conducted to relocate amphibians, in consultation with MoE. WSA has a translocation permit from the Committee on Animal Care (PCAC) in place.	Negligible
Construction activity and traffic	Direct mortality as a result of wildlife/human interactions	▪ Vehicle collisions with wildlife should be reported to the local RCMP. ▪ Immediate notification should be made if any species protected under the *Wildlife Act* is injured, dies, or requires euthanasia, transportation to a veterinarian, or translocation from within the project footprint. Contact can be made at centre.inquiry@gov.sk.ca or 1-800-567-4224. ▪ Traffic should be controlled and a reduced speed limit should be implemented on site. ▪ Open excavations, fencing, and the placement of construction equipment should be monitored to limit the potential for entrapment of wildlife.	Negligible
Construction activity, traffic, and noise	Disruption of wildlife	▪ Construction personnel should not interfere with wildlife. ▪ No firearms, pets, hunting, trapping, or fishing should be allowed on the Project site. ▪ Active wildlife breeding sites should not be moved, disturbed, or destroyed, including but not limited to bird nests, raptor nests, amphibian breeding ponds, and snake hibernaculum. ▪ If required following pre-constructions surveys, appropriate setback measures should be adopted to limit disruption to breeding wildlife. ▪ Traffic should be controlled and a reduced speed limit should be implemented on site. ▪ Noise complaints should be logged by the construction contractor foreman to monitor for excessive noise generation. ▪ Artificial lighting should be turned off when not required.	Negligible
Construction waste storage	Disturbance as a result of wildlife/human interactions	▪ Construction waste should be stored in wildlife proof containers and removed from site on a regular basis. ▪ There should be no burning of wastes on the project site. ▪ Non-recyclable, non-hazardous construction wastes should be removed from site on an as required basis for disposal at an approved waste disposal site. ▪ Waste oils, lubricants and rags should be stored in a labelled tank or drum and recycled/disposed at an approved facility. ▪ Portable washrooms should be cleaned on a regular basis.	Negligible
Fish and Aquatic Habitat			
Use of equipment within the vicinity of the riparian area and watercourse	Introduction of deleterious substances	▪ Equipment should be cleaned and in good working order (inspected) prior to arriving on-site. ▪ Stationary equipment and hazardous materials should be stored within a designated secondary containment area. ▪ A spill contingency plan should be in place and spill kits should be readily accessible on-site. ▪ Lubricants for gates and hoists should be applied sparingly, wiping off excess or old lubricant. ▪ The portable glycol unit should be stored within a secondary containment and the glycol tank will be double walled. ▪ If dewatering is required during curing of concrete, discharge water should be diffused with carbon dioxide to decrease the pH to between 6.5 and 9 before discharge to the environment.	Negligible

Project Activity	Effect Description	Proposed Mitigation and Management	Residual Effect
Use of equipment within the vicinity of the riparian area and watercourse	Introduction or mobilization of sediment	▪ ESC measures should be implemented prior to works commencing and will be inspected and maintained during the Project. ▪ Damaged or non-functional ESC measures should be repaired as soon as possible and operations should cease until repairs are completed. ▪ Erodible soils should be stabilized following disturbances. ▪ ESC materials should be kept in adequate supply levels onsite. ▪ Surface water runoff should be directed to vegetation or designed containment areas. ▪ A construction inspection and monitoring program should be implemented to evaluate ESC measures. ▪ Installed ESC measures should be inspected and evaluated subsequent to storm events. ▪ Instream works that are not contained within cofferdams or sheet pile walls should be isolated from the Qu'Appelle River and Crooked Lake using sediment curtains. ▪ The new outlet structure should be commissioned in June, after the spring and fall spawning window has passed, and prior to isolating the existing outlet structure to begin construction of the fishway.	Negligible
Isolation of fishway and existing outlet structure	Stranding of fish within isolation areas	▪ Fish rescue should be conducted when isolation has the potential to strand fish. ▪ Fish salvage/rescue should be conducted in accordance with the Special Collection Permit issued by the MoE. Contact: Curtis Kuntz Ministry of Environment, Fisheries Research Officer (306) 787-0539 Curtis.Kuntz@gov.sk.ca	Negligible
	Fish injury or mortality due to entrainment or impingement during dewatering	▪ Pump intakes should be screened in compliance with the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (1995) when used to dewater isolation areas.	Negligible
	Temporary loss of fish habitat	▪ Instream construction should be undertaken according to the conditions provided in Authorizations and Approvals issued by DFO and WSA ▪ Should delays occur and construction cannot be completed within the timing window specified, DFO and WSA should be contacted. ▪ Construction should be completed outside of the spring spawning period (April 1 to May 30). ▪ All materials used in the cofferdams should be removed to the greatest extent safely possible. ▪ Water flow should be maintained through the replacement structure during isolation of the fishway.	Negligible
Installation of replacement structure and fishway	Net increase in habitat quantity of 2,931 m^2	▪ Decrease in quantity of habitat in the fishway channel offset by increase in habitat quantity in the outlet channel of the replacement structure. ▪ The proposed works will improve fish passage potential in the fishway and the outlet structure.	**Yes**
	Change in habitat suitability in fishway channel	▪ Reduced discharge and increased concentration of coarse substrate in fishway channel changing the character of the habitat. ▪ New potentially suitable spawning habitat may occur at the downstream end of the fishway channel and in the new outlet channel.	Negligible
	Increase in fish passage potential relative to existing condition	▪ A riffle will be created at the fishway channel confluence with the outlet channel to attract fish towards the fishway when discharge is occurring in both channels. ▪ An increase in fish passage potential is predicted.	**Yes**
Socio-economic Environment			
Construction activity and increased traffic	Disruption and disturbance of residents of Sunset Beach and Cowessess	▪ A dedicated construction access road should be constructed to avoid traffic directly within Sunset Beach. ▪ Traffic should be controlled and a reduced speed limit should be implemented on site. ▪ Local noise bylaws should be followed. ▪ Noise complaints should be logged by the construction contractor foreman to monitor for excessive noise generation. ▪ Artificial lighting should be turned off when not required.	Negligible
	Incidental benefits to hospitality industry	▪ Effect is positive.	Negligible
Replacement of water control structure	Continued ability to manage and maintain lake water levels for recreation	▪ Effect is positive.	**Yes**

6.3 Residual Effects Rating and Significance

A total of seven residual effects were identified, four of these were considered positive, two were considered negative, and one neutral. The rating of the seven residual effects is provided in Table 6.4. None of the residual effects were characterized as significant.

A loss of 20,200 m^2 of riparian floodplain vegetation has been identified as a predicted residual effect of the Project. Likewise, this effect is expected to constitute a loss of wildlife habitat suitable primarily for nesting and foraging for seasonally abundant bird species and as foraging habitat for northern leopard frogs. The vegetation ecosites that will be affected occur in abundance within the Qu'Appelle River floodplain and the predicted effect is not expected to impair the functional capacity of this habitat type to support the vegetation and wildlife species that occur here. These residual effects will be local in scale and are not considered to be significant.

The predicted net increase in aquatic habitat availability is expected to be of a low magnitude. The habitat created in the outlet channel is expected to be of limited suitability for most fish and wildlife species given the wide potential range in velocity that will occur throughout the year. The outlet channel will provide limited cover for rearing fish within the interstitial spaces of riprap at the margins of the channel. These positive residual effects are not considered to be significant.

The anticipated changes in suitability of fish habitat include both positive and negative aspects, such as the potential for both increased and decreased spawning habitat suitability in different areas. The net effect of the changes is considered to be neutral, and the residual effect is not considered to be significant.

Increased fish passage potential is expected to result in increased upstream distribution of fish. While fish passage potential is expected to increase relative to the existing condition, passage will continue to be impeded during periods of low natural discharge and may be only partially effective when the outlet structure gates are closed and discharge in the outlet channel exceeds discharge in the fishway. As a result, this effect is not considered to be significant.

Replacement of the water control structure will provide a continued ability to manage and maintain water levels in Crooked Lake for recreation in the future. This is a necessary upgrade to ensure continued operability of the structure. Although this positive effect is of high importance, the alternative of allowing the structure to deteriorate is considered unacceptable and would not be considered by the WSA; therefore, the residual effect was not considered to be significant.

Table 6.4 Residual Effect Rating and Significance

Project Activity	Residual Effect	Direction	Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Significance
Construction of replacement structure and fishway	Permanent loss of floodplain vegetation 20,200 m^2.	N	M	L	LT	C	LT	NS
	Permanent loss of terrestrial wildlife habitat of 20,200 m^2	N	M	L	LT	C	LT	NS
	Net increase in aquatic habitat for wildlife of 2,931 m^2	P	L	L	LT	C	LT	NS
	Net increase in aquatic habitat for fish of 2,931 m^2	P	L	L	LT	C	LT	NS
	Change in fish habitat suitability	Ne	L	L	LT	C	LT	NS
Construction of the fishway	Increase in fish passage potential relative to existing condition	P	M	R	LT	R	ST	NS
Replacement of water control structure	Continued ability to manage and maintain lake water levels for recreation	P	L	R	LT	C	ST	NS

6.4 Cumulative Effects

The Project has been predicted to result in adverse residual effects on vegetation and wildlife habitat and has the potential to interact cumulatively with other developments or activities in the region. However, no specific projects or developments have been identified which are expected to result in loss of riparian floodplain vegetation or wildlife habitat. Therefore, cumulative effects are not anticipated.

7 MONITORING

A construction monitoring program will be developed based on the standard practices employed by the WSA and the province of Saskatchewan. These practices are outlined in contract document specifications and various guideline documents, and form the basis for Contractor, Consultant, and WSA responsibilities.

7.1 Pre-Construction Surveys

Prior to the commencement of construction activities, pre-construction surveys of vegetation and wildlife will be conducted. The vegetation survey will document preconstruction conditions and note the location of sensitive, listed, or weed species if present in the designated footprint of the Project. A wildlife sweep may be conducted if works are expected to occur during the nesting or natal period or during the open water period when frogs are active, based on consultation with MoE. A sweep may be conducted to determine the presence of nests, dens, or sensitive wildlife species in the areas to be disturbed. Should active nests or dens be suspected in the construction zone, a set-back will be imposed around the active wildlife residence until such time as the activity of the wildlife has been concluded. The set-back distances will be determined based on the species of wildlife identified, guidelines provided by SKCDC and/or the Canadian Wildlife Service, and discussions with provincial wildlife biologists.

It is recommended that these surveys be conducted by qualified biologists and, where appropriate, summary reports be provided to regulatory agencies. In the event that sensitive habitats or species are identified during these surveys, it is recommended that contact be made with regulatory agencies and wildlife professionals to discuss and implement satisfactory mitigation measures.

7.2 Construction Monitoring

Construction monitoring will assess the effectiveness of mitigation measures during the proposed works and identify the need for implementation of additional controls. The monitoring program will be based on standard practices. The WSA's designated on-site representative will provide quality assurance during construction and will oversee Contractor implementation of the EPP and other environmental management measures. During construction, the WSA's on-site representative will be responsible for:

- Confirming that the works are constructed in accordance with the contract documents, regulatory commitments, and relevant specifications;
- Providing direction on environmental protection measures;
- Monitoring for the presence of northern leopard frog, loggerhead shrike, red-headed woodpecker, short-eared owl and yellow rail;
- Supervising implementation of mitigation measures and the ESC plan;
- Liaising with the Contractor regarding potential concerns and required environmental protection measure modifications; and

- Conducting fish rescue within isolated instream work areas.

The WSA will ultimately be responsible for environmental monitoring during the construction phase by ensuring that the delegated monitoring tasks are completed. The WSA will define the contract requirements that specify the responsibilities of the Contractor and will provide feedback on any environmental management issues raised. Construction monitoring could include additional monitoring and reporting if work is ongoing during the fall/winter closure.

7.3 Post Construction Monitoring

It is recommended that a post construction monitoring program be instituted to assess the success of revegetation of the exposed soils.

8 DECOMMISSIONING AND RECLAMATION

8.1 Construction

During construction, the work area will be disturbed. The vegetation will be stripped, and the topsoil will be stockpiled on site for reclamation. Areas disturbed by construction will be progressively reclaimed to limit the spread of noxious weeds.

8.2 Decommissioning

The life expectancy of the Project is 100 years. At this time, there is no decommissioning plan for the replacement structure. A plan will be developed and supported by regulatory approval if decommissioning should be required.

9 STAKEHOLDER ENGAGEMENT

9.1 Stakeholders

As part of the Project, the WSA has engaged stakeholders that could potential be affected by the replacement of the existing structure at Crooked Lake. The stakeholders identified included the Crooked Lake Flood Committee, the R.M. of Grayson, and the Lower Qu'Appelle Watershed Stewards Inc.

9.2 Record of Stakeholder Consultation

Stakeholder consultation conducted to date is summarized in Table 9.1.

Table 9.1 Record of Stakeholder Consultation

Date	Stakeholder	Activity	Description of Activity
Jul. 29, 2015	Crooked Lake Flood Committee	Presentation	Presentation to describe the replace the Crooked Lake outlet structure. Questions were answered during and after the presentation.
Aug. 27, 2015	R.M. Grayson	Presentation	Presentation to describe the replace the Crooked Lake outlet structure. Questions were answered during and after the presentation.
Aug. 27, 2015	Lower Qu'Appelle Watershed Stewards Inc.	Presentation	Presentation to describe the replace the Crooked Lake outlet structure. Questions were answered during and after the presentation.
Jun. 8, 2016	Crooked Lake Flood Committee	Presentation	Presentation by WSA and KCB describing the summary of work completed to date and the details of the pre-design. Questions were answered during and after the presentation.
Jun. 8, 2016	R.M. Grayson	Presentation	Presentation by WSA and KCB describing the summary of work completed to date and the details of the pre-design. Questions were answered during and after the presentation.
Jun. 8, 2016	Lower Qu'Appelle Watershed Stewards Inc.	Presentation request	Lower Qu'Appelle Watershed Stewards Inc. declined presentation request.

10 CONSULTATION WITH FIRST NATIONS

From the First Nation and Metis Consultation Policy Framework (CPF) August 2023: Government will make best efforts to consult with First Nations and rights-bearing Métis communities whose traditional territories coincide with the geographic area where an adverse impact may potentially occur. Traditional territory refers to the geographic area within which First Nations and Métis people historically exercised Aboriginal and Treaty rights and undertook traditional uses and continue to do so today. There may be circumstances in which more than one First Nation and/or Métis community must be consulted owing to overlapping traditional territories.

The Government of Saskatchewan recognizes the importance of building and maintaining strong relationships with First Nations, Métis communities, and industry. These relationships are crucial for the effective and meaningful fulfillment of Government's duty to consult. Building and maintaining these relationships requires ongoing contact, proactive communication, building trust, transparency, building cultural competency in Government, and valuing the relationship in and of itself.

Ministries will make best efforts to meaningfully engage First Nation and Métis communities in decision-making processes related to policies, programs and legislation that have the potential to impact communities and where they may have an interest or where First Nations have jurisdiction on-reserve.

Integrating the goals and aspirations of First Nation and Métis people in Saskatchewan is vital to strengthening communities, reconciling relationships, and improving social and economic outcomes for First Nations and Métis throughout the province.

Consultations are underway with Cowessess, Zagime Anishinabek, Khakewistahaw and Ochapowace First Nations.

10.1 Record of First Nations Consultation

First Nations engagement was initiated in summer 2015. Meetings were held with the Cowessess and Zagime Anishinabek (Sakimay) First Nations. Invitations to meet were sent to both Kahkewistahaw and Ochapowace First Nations in 2015; however, no response was received, and meetings were not conducted. Table 10.1provided below summarizes the consultation conducted through the design phase of the Project. Copies of the pre-design and preliminary design presentations from 2016 are provided in Appendix VIII.

Table 10.1 Record of First Nations Consultation

Date	Stakeholder	Activity	Description of Activity
Jun. 18, 2015	Cowessess First Nation	Presentation	Presentation to describe the replace the Crooked Lake outlet structure. Questions were answered during and after the presentation.
Aug. 4, 2015	Zagime Anishinabek First Nations	Presentation	Presentation to describe the replace the Crooked Lake outlet structure. Questions were answered during and after the presentation.
Jun. 9, 2016	Zagime Anishinabek First Nations	Presentation	Presentation by WSA and KCB describing the summary of work completed to date and the details of the pre-design. Questions were answered during and after the presentation.
Jun. 16, 2016	Cowessess First Nation	Presentation	Presentation by WSA and KCB describing the summary of work completed to date and the details of the pre-design. Questions were answered during and after the presentation.
Sept. 7, 2016	Cowessess First Nation	Presentation	Presentation by WSA and KCB describing the summary of work completed to date and the details of the Preliminary Design.
Sept. 10, 2020	Cowessess First Nation	Consultation	Consultation meeting to discuss design and land ownership/access considerations.
Sept. 21, 2020	Cowessess First Nation	Consultation	Consultation meeting to discuss design and land ownership/access considerations.
Oct. 29, 2020	Cowessess First Nation	Consultation	Consultation meeting to discuss design and land ownership/access considerations.
Dec. 1, 2020	Cowessess First Nation	Consultation	Consultation meeting to discuss design and land ownership/access considerations.
Jul. 22, 2022	Cowessess First Nation	Consultation	Consultation meeting to confirm land access arrangements for Stage 1 works.
Aug. 15, 2022	Cowessess First Nation	Consultation	Consultation meeting to confirm land access arrangements for Stage 1 works.
March 24, 2023	Cowessess First Nation	Consultation	Land control discussion at ISC office in Regina.
August 29, 2023	Cowessess First Nation	Consultation	Band Council Resolution issued noting support for transfer of land and redevelopment of the Crooked Lake Water Control Structure.
September 22, 2023	Cowessess First Nation	Consultation	Verification sent by Cowessess First Nation that seed mixture is acceptable.

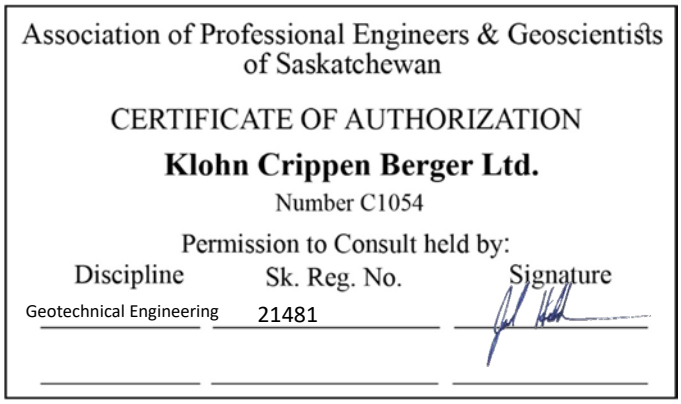
Based on the anticipated potential for direct impacts on Cowessess First Nation land, significant consultation was undertaken with the group to identify mitigation measures. A signed Band Council Resolution was issued by Cowessess First Nation on August 29, 2023, that notes support for a proposed transfer of land, along with the redevelopment of the Crooked Lake Water Control Structure (Appendix VIII).

11 CLOSING

We appreciate the opportunity to submit this report. Please contact Joel Hilderman at (306) 974-1520 if you have any questions or require further information.

KLOHN CRIPPEN BERGER LTD.

Dustin Bailey, P.Biol.
Aquatic Biologist


Association of Professional Engineers & Geoscientists of Saskatchewan

CERTIFICATE OF AUTHORIZATION

Klohn Crippen Berger Ltd.

Number C1054

Permission to Consult held by:

Discipline	Sk. Reg. No.	Signature
Geotechnical Engineering	21481	

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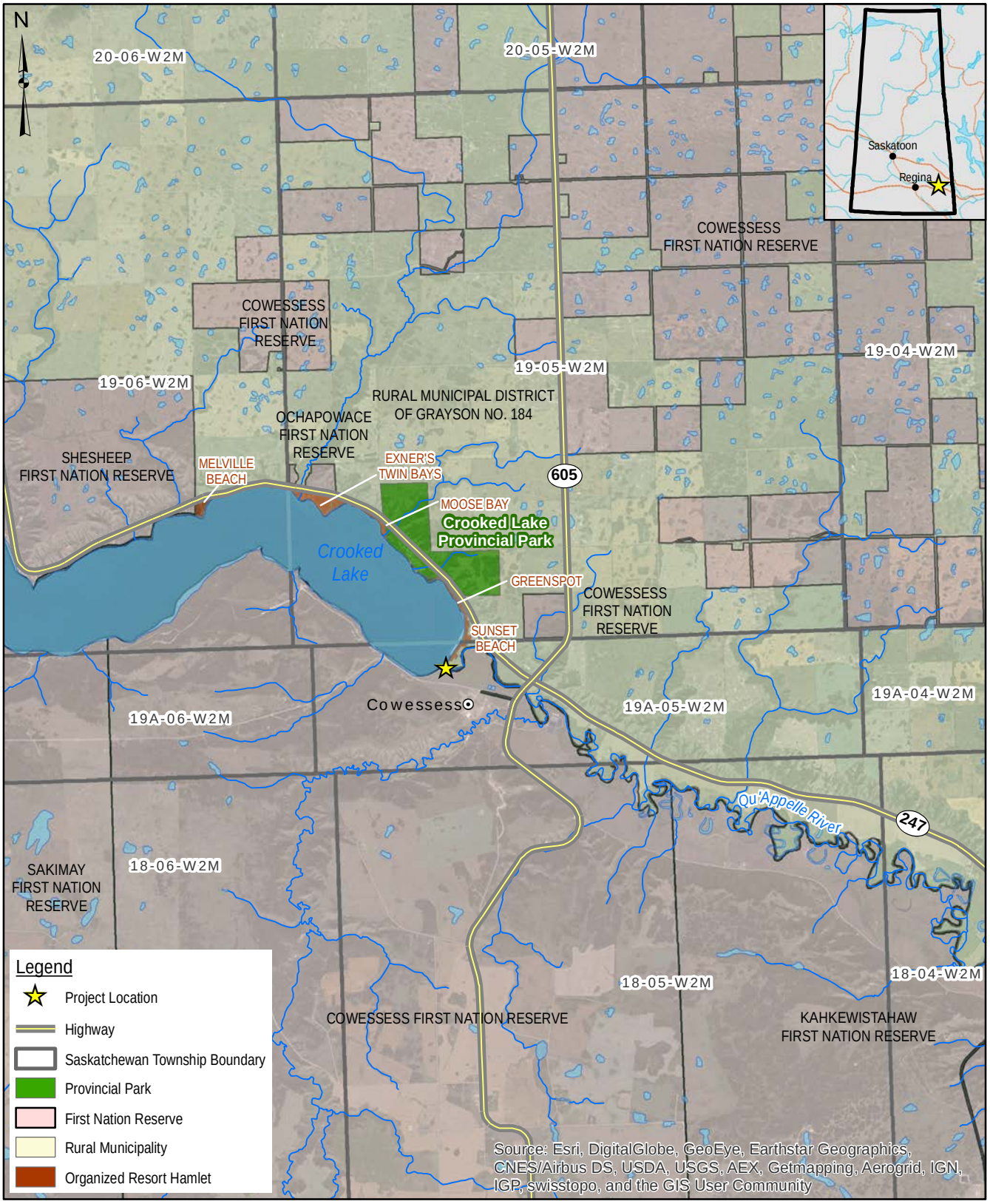
FIGURES



NOTES:
1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. DATA SOURCES:
Administrative Boundaries from Information Services Corporation
National Hydrology Network (NHN) provided by NRCan
Inset Map is Toporama provided by NRCan.
4. SCALE IS 1:100,000 on 8.5" x 11" PAPER.

CLIENT
Water Security Agency
Klohn Crippen Berger

PROJECT
CROOKED LAKE OUTLET STRUCTURE REPLACEMENT
TECHNICAL PROPOSAL

TITLE
PROJECT LOCATION

SCALE	PROJECT No.	FIG No.
1:100000	A03242C02	1

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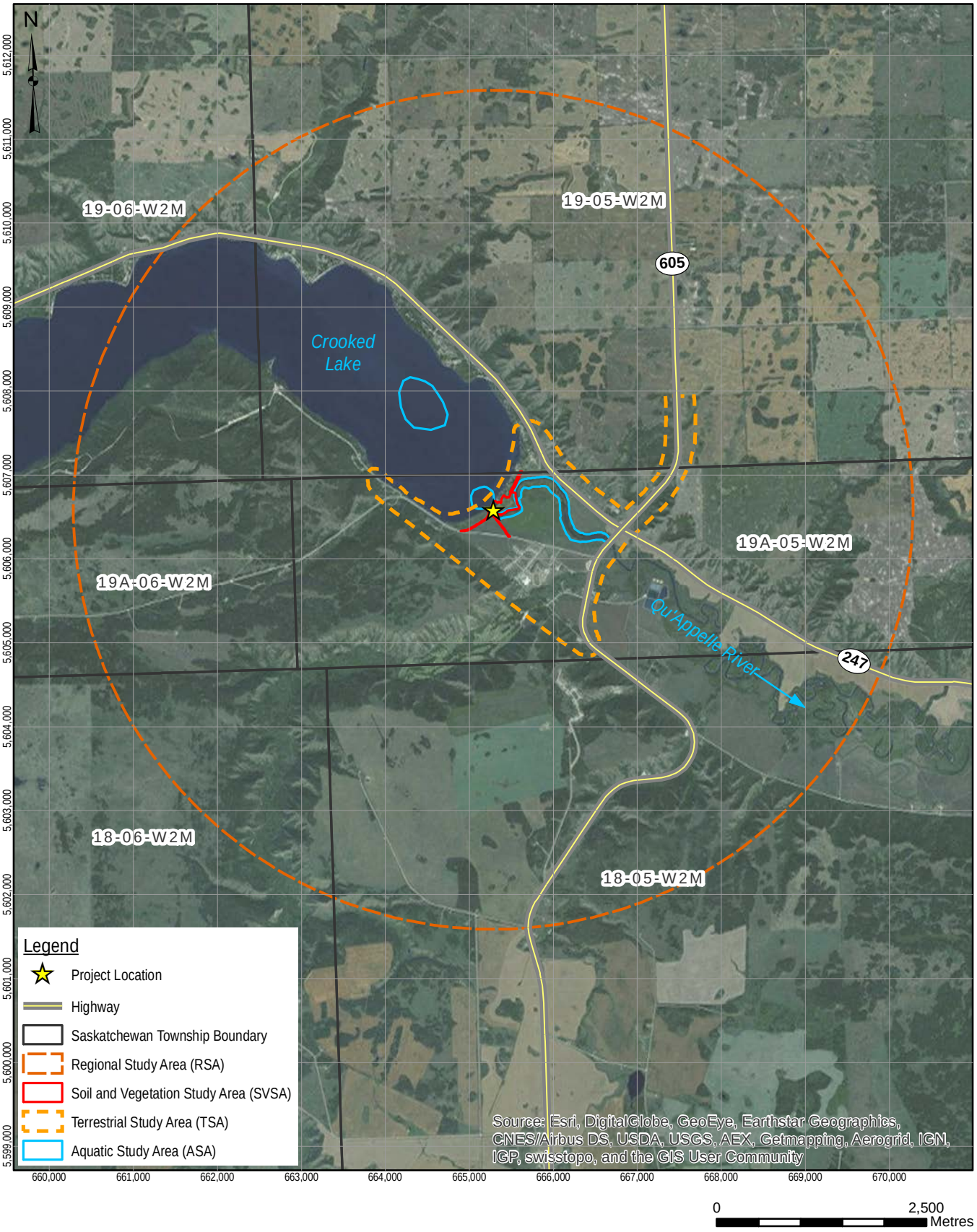


NOTES:

1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. SCALE IS 1:65,000 on 8.5" x 11" PAPER.

CLIENT

Water Security Agency

Klohn Crippen Berger

PROJECT

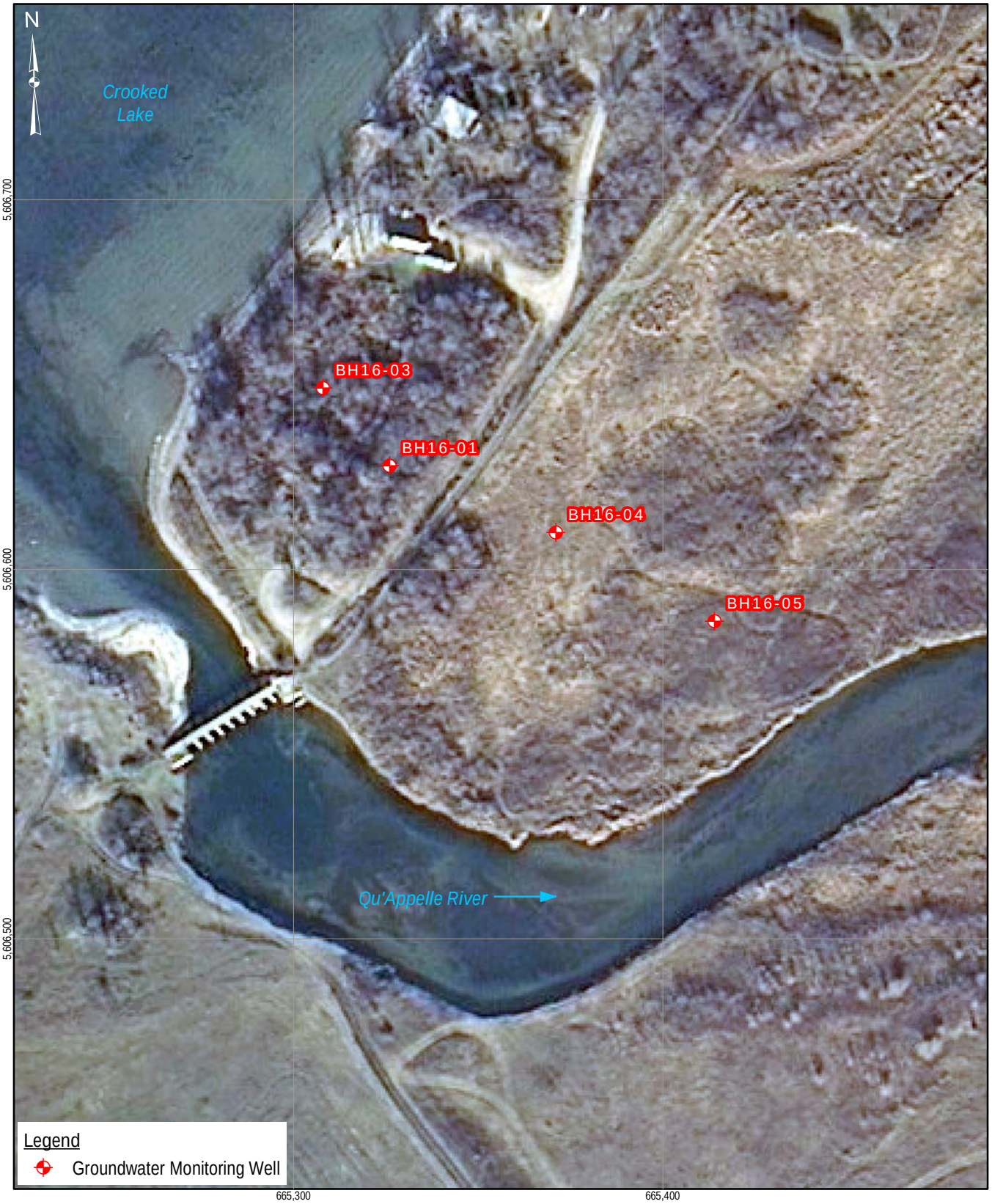
CROOKED LAKE OUTLET STRUCTURE REPLACEMENT
TECHNICAL PROPOSAL

TITLE

PROJECT STUDY AREA

SCALE	PROJECT No.	FIG No.
1:65000	A03242C02	2

File: Z:\AICGY\Alberta\A03242C01 - WSA Crooked Lake Dam WCS\400 Drawings\Environment\MXD\Technical Report Figs\160928_Fig3_StudyAreas.mxd Date: September 28, 2016 Time: 16:00:23 PM Creator: kmackenzie



NOTES:

1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. IMAGE SOURCE: WSA 2009
3. SCALE IS 1:1,500 on 8.5" x 11" PAPER.

CLIENT

Water Security Agency

Klohn Crippen Berger

PROJECT

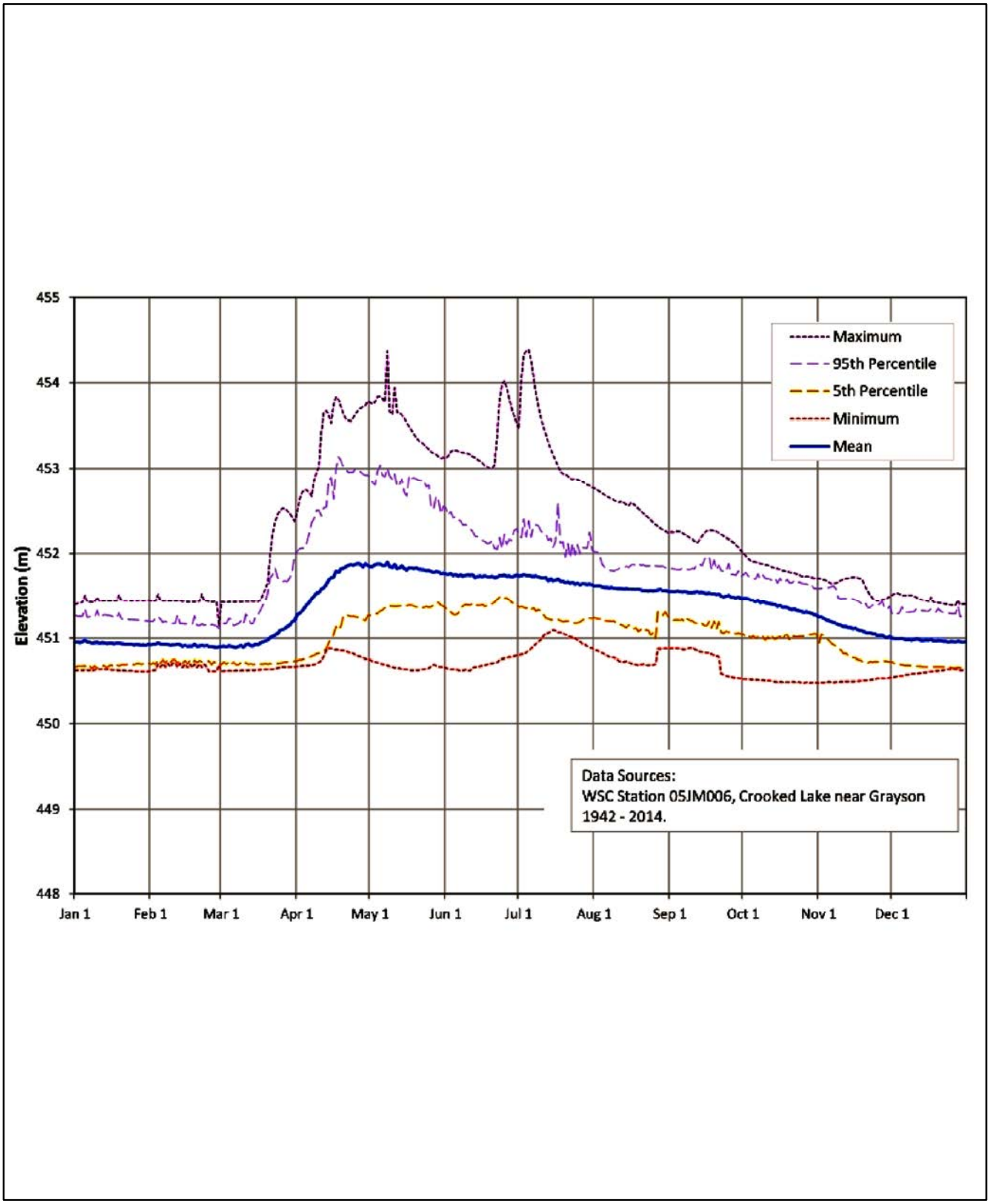
CROOKED LAKE OUTLET STRUCTURE REPLACEMENT
TECHNICAL PROPOSAL

TITLE

GROUNDWATER MONITORING WELL LOCATIONS

SCALE	PROJECT No.	FIG No.
1:1500	A03242C02	3

File: Z:\AICGY\Alberta\A03242C01 - WSA Crooked Lake Dam WCS\400 Drawings\Environment\MXD\Technical Report Figs\160921_Fig4_GW_Wells.mxd Date: September 21, 2016 Time: 15:05:08 PM Creator: kmackenzie



NOTES:

CLIENT

Water Security Agency

Klohn Crippen Berger

PROJECT

CROOKED LAKE OUTLET STRUCTURE REPLACEMENT
TECHNICAL PROPOSAL

TITLE

MEAN AND HISTORICAL WATER LEVELS
RECORDED AT 05JM006

PROJECT No. A03242C02

FIG No. 4

Legend

- Soil Inspection Location
- Soil Map Unit
- Ecosite Boundary
- Soil and Vegetation Study Area
- Woody Vegetation Removed

Soil Map Unit Labels:
Av38 - Alluvium
TSS - Topsoil Stockpile
ZDL - Disturbed Land
(25) topsoil depth in cm

Ecosite Labels:
DL - Disturbed Land
DR - Disturbed Land (Revegetated)
OV - Overflow
WMD - Wet Meadow

0 125 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. IMAGE SOURCE: WSA 2008
4. SCALE IS 1:25,000 on 11" x 17" PAPER.

CLIENT: Water Security Agency

Klohn Crippen Berger

PROJECT: CROOKED LAKE OUTLET STRUCTURE REPLACEMENT TECHNICAL PROPOSAL

TITLE: SOIL AND VEGETATION MAP 1 of 2

SCALE	PROJECT No.	FIG No.
1:1500	A03242C02	5a

File: Z:\ACGY\Alberta\A03242C01 - WSA Crooked Lake Dam WCS\400 Drawings\Environment\MXD\Technical Report Figs\160928_Fig5a_SoilVeg.mxd Date: September 28, 2016 Time: 16:45:18 PM Creator: : kmackenzie

Legend

- Soil Inspection Location
- Soil Map Unit
- Ecosite Boundary
- Soil and Vegetation Study Area
- Woody Vegetation Removed

Soil Map Unit Labels:
Av38 - Alluvium
TSS - Topsoil Stockpile
ZDL - Disturbed Land
(25) topsoil depth in cm

Ecosite Labels:
DL - Disturbed Land
DR - Disturbed Land (Revegetated)
OV - Overflow
WMD - Wet Meadow

0 125 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. IMAGE SOURCE: WSA 2008
4. SCALE IS 1:25,000 on 11" x 17" PAPER.

CLIENT: Water Security Agency; Klohn Crippen Berger

PROJECT: CROOKED LAKE OUTLET STRUCTURE REPLACEMENT TECHNICAL PROPOSAL

TITLE: SOIL AND VEGETATION MAP 2 of 2

SCALE	PROJECT No.	FIG No.
1:1500	A03242C02	5b

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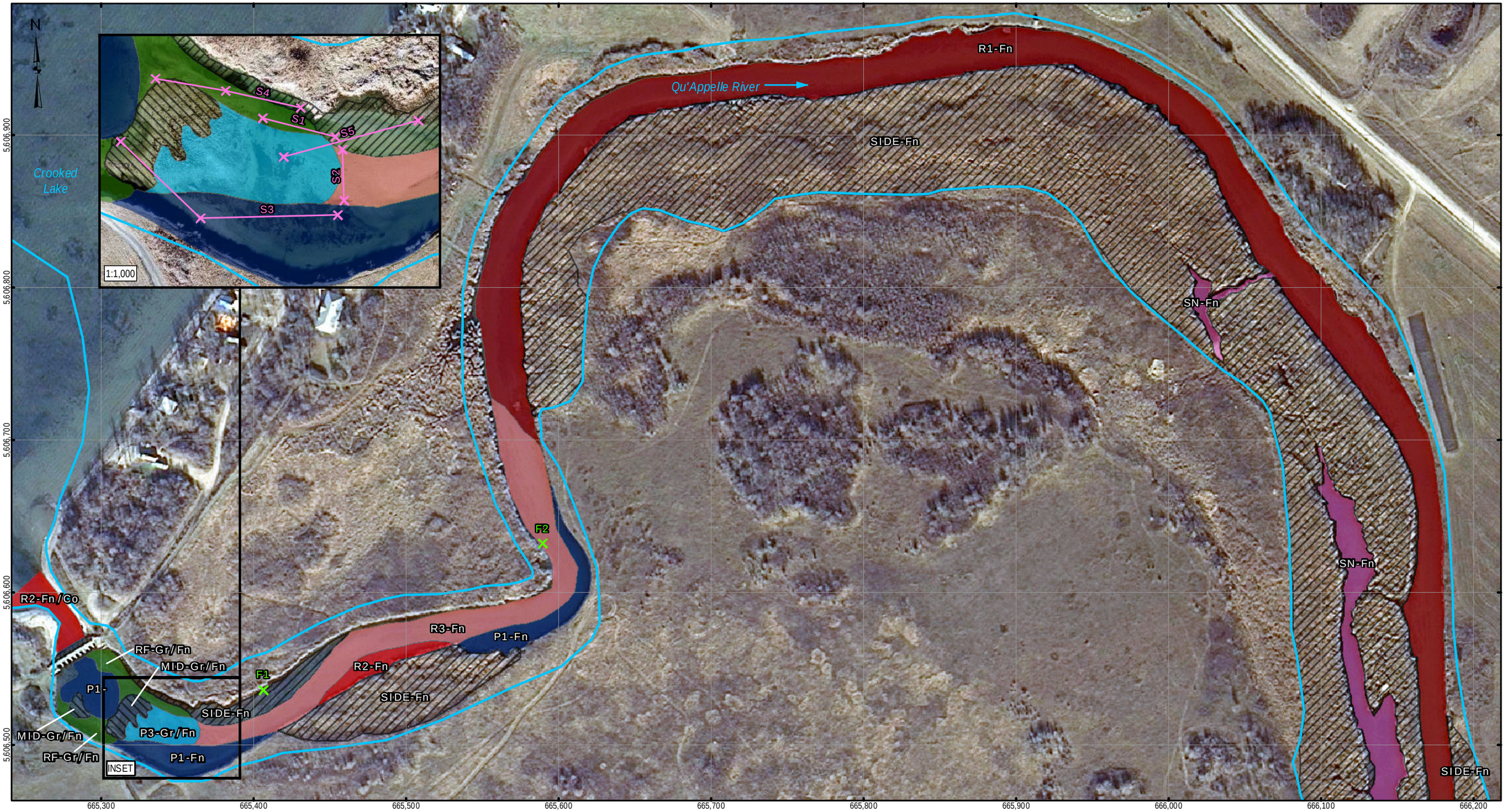

Legend

- Seine Net Location
- Fyke Location
- Aquatic Study Area

Fish Habitat

- P1 - Pool
- P3 - Pool
- R1 - Run
- R2 - Run
- R3 - Run
- SN - Snye
- RF - Riffle
- MID - Mid-channel Bar
- SIDE - Side Bar

Fish Habitat Labels:
Bo - Boulder
Co - Cobble
Fn - Fines (Silt/Clay/Sand)
Gr - Gravel
RR - Riprap
BW - Backwater
CA - Cascade
Mid - Mid Channel Bar
P - Pool
R - Run
RF - Riffle
SN - Snye

0 250 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. IMAGE SOURCE: WSA 2008 (INSET) and WSA 2009
4. SCALE IS 1:25,000 on 11" x 17" PAPER

CLIENT: Water Security Agency

Klohn Crippen Berger

PROJECT: CROOKED LAKE OUTLET STRUCTURE REPLACEMENT TECHNICAL PROPOSAL

TITLE: FISH AND FISH HABITAT MAP 1 of 2

SCALE	PROJECT No.	FIG No.
1:2500	A03242C02	6a

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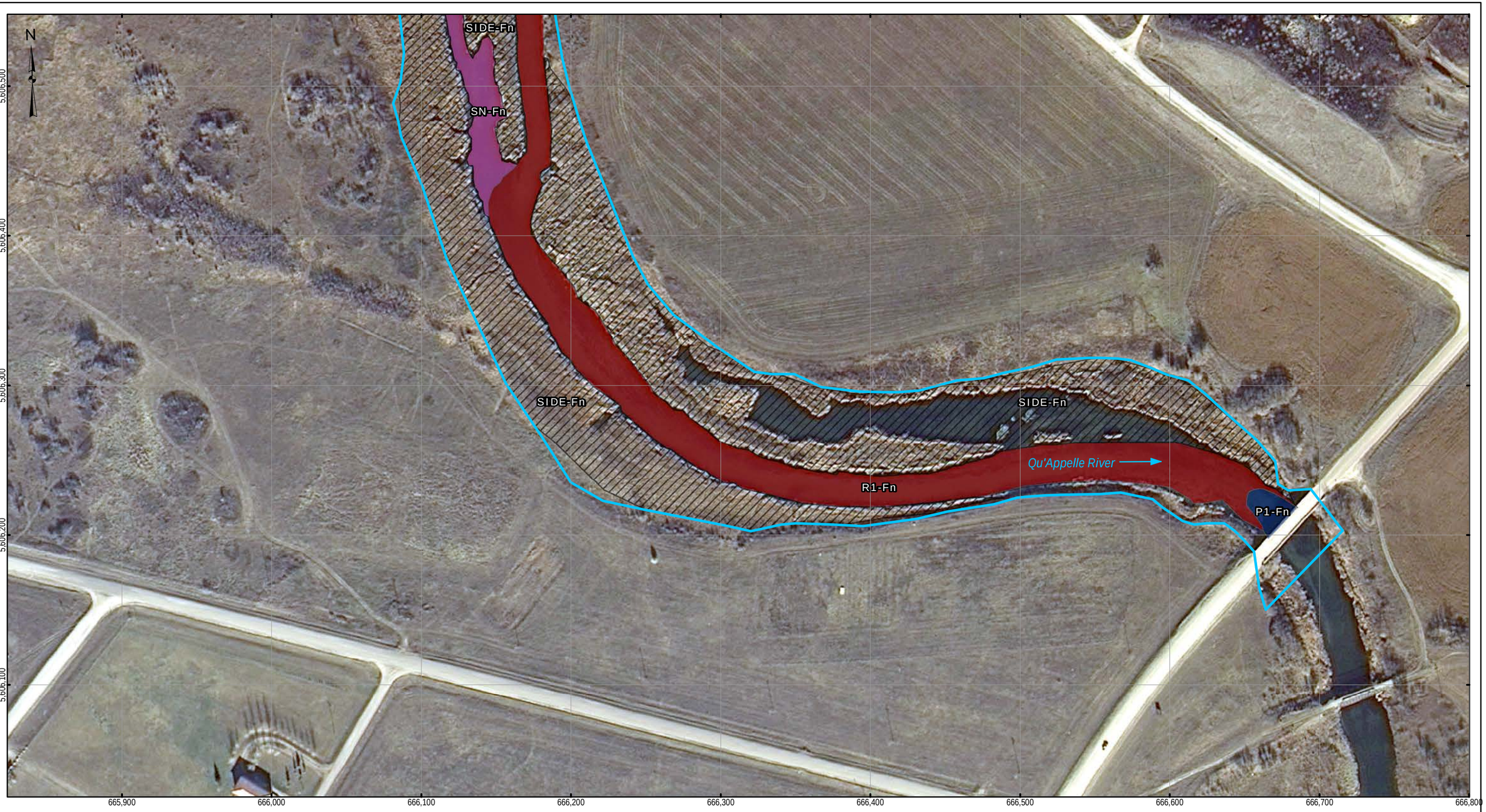

Legend

- Aquatic Study Area

Fish Habitat

- P1 - Pool
- P3 - Pool
- R1 - Run
- R2 - Run
- R3 - Run
- SN - Snye
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Fish Habitat Labels:
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Gr - Gravel
RR - Riprap
BW - Backwater
CA - Cascade
Mid - Mid Channel Bar
P - Pool
R - Run
RF - Riffle
SN - Snye

0 250 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. IMAGE SOURCE: WSA 2009
4. SCALE IS 1:25,000 on 11" x 17" PAPER.

CLIENT: Water Security Agency

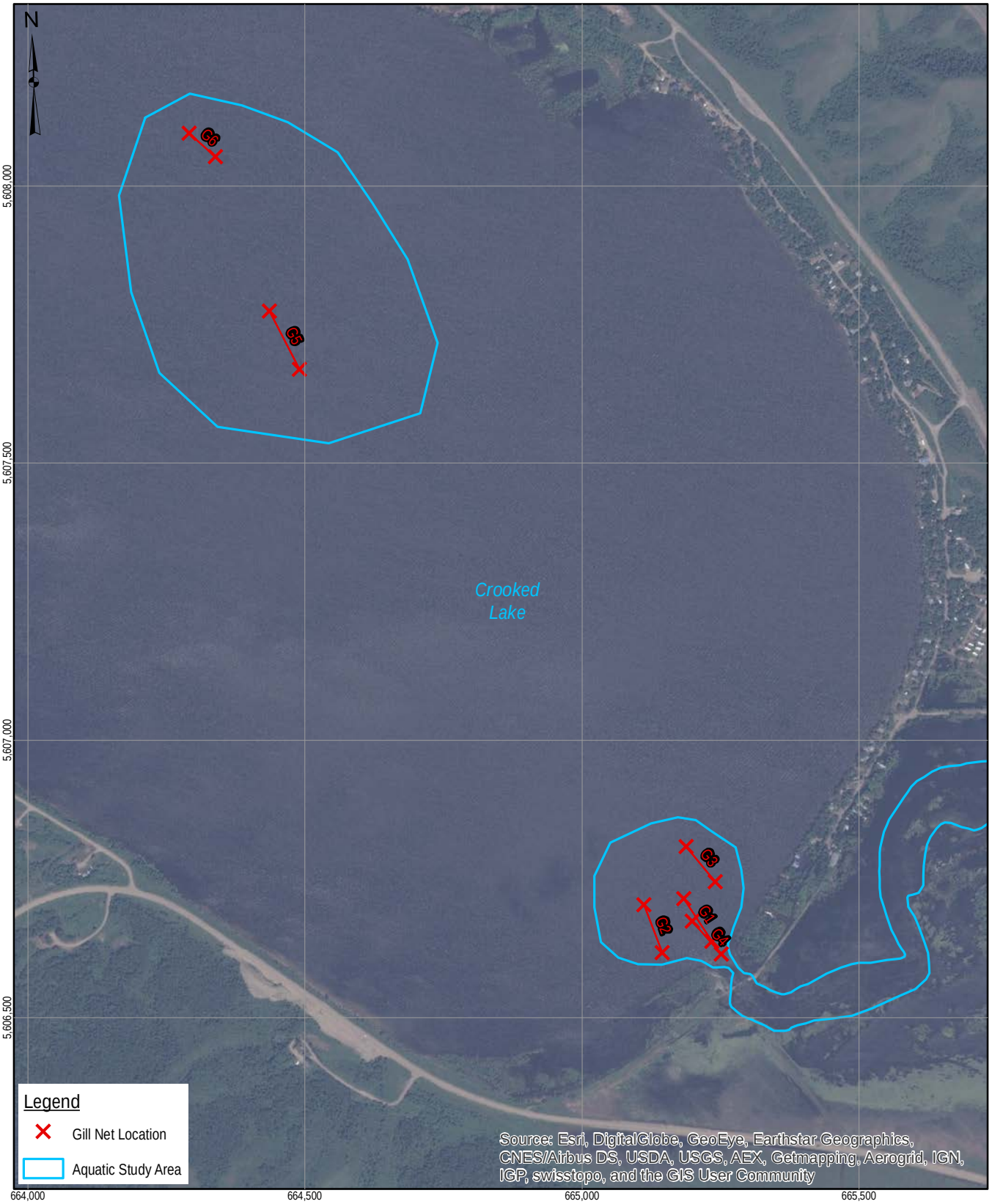
Klohn Crippen Berger

PROJECT: CROOKED LAKE OUTLET STRUCTURE REPLACEMENT TECHNICAL PROPOSAL

TITLE: FISH AND FISH HABITAT MAP 2 of 2

SCALE	PROJECT No.	FIG No.
1:2500	A03242C02	6b

File: Z:\AICGY\Alberta\A03242C01 - WSA Crooked Lake Dam WCS\400 Drawings\Environment\MXD\Technical Report Figs\160923_Fig7b_FFHA.mxd Date: September 23, 2016 Time: 13:31:54 PM Creator: : kmackenzie



NOTES:

1. HORIZONTAL DATUM: NAD83 (CSRS98)
2. GRID ZONE: UTM Zone 13
3. SCALE IS 1:10,000 on 8.5" x 11" PAPER.

CLIENT

Water Security Agency

Klohn Crippen Berger

PROJECT

CROOKED LAKE OUTLET STRUCTURE REPLACEMENT
TECHNICAL PROPOSAL

TITLE

CROOKED LAKE SAMPLING LOCATIONS

SCALE	PROJECT No.	FIG No.
1:10000	A03242C02	7

File: Z:\AICGY\Alberta\A03242C01 - WSA Crooked Lake Dam WCS\400 Drawings\Environment\MXD\Technical Report Figs\160920_Fig8_CLSamplingLocs.mxd Date: September 20, 2016 Time: 17:30:59 PM Creator: kmackenzie

APPENDIX I

Photographs

Appendix I
Photographs

Photograph I-1 Intake side of the Crooked Lake water control structure.

Photograph I-2 Facing south from the existing dyke with the Crooked Lake water control structure in the background.

Photograph I-3 **Facing northeast from soil inspection location S07 on the existing dyke. Note the saturated soil conditions of the Wet Meadow ecosite in the foreground and the absence of vegetation in the background (May 27, 2016).**

Photograph I-4 **Facing northeast from soil inspection location S07 on the existing dyke. Note the mature graminoid vegetation of Wet Meadow ecosite and the absence of bare soil or standing water. Perennial sow thistle infestation on the dyke in the foreground (July 21, 2016).**

Photograph I-5 **Facing southwest near soil inspection location S06 in the Overflow ecosite. Note the slash pile of coarse woody material and the infestation of perennial sow thistle (July 21, 2016).**

Photograph I-6 **Facing downstream from the south side of existing outlet structure showing the Overflow ecosite. Community of Cowessess is in the background (July 21, 2016).**

Photograph I-7 Facing upstream from the south side of existing outlet structure showing the disturbed sparsely vegetated area used as trail access to the outlet structure. Crooked Lake is in the background (July 21, 2016).

Photograph I-8 Revegetated topsoil stockpile south of existing outlet structure (May 27, 2016).

Photograph I-9 Northern Leopard Frog observed within the Project Footprint

Photograph I-10 American White Pelican on the Qu'Appelle River

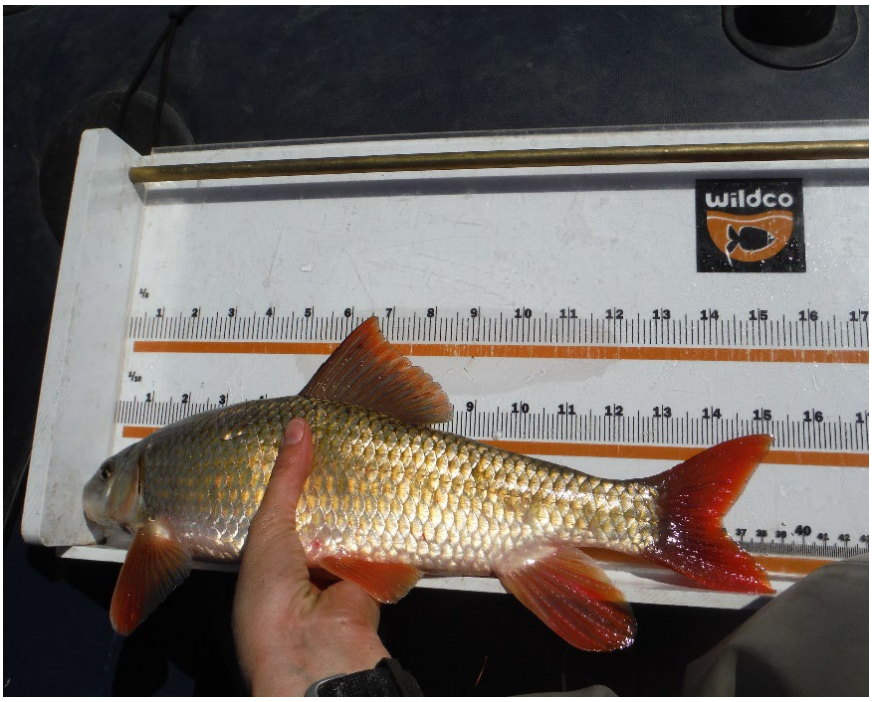
Photograph I-11 Fish congregating downstream of the existing outlet structure (May 19, 2016).

Photograph I-12 Erosion along the Qu'Appelle River (May 19, 2016).

Photograph I-13 Mid-channel gravel bar and riffle habitat downstream of the structure (May 19, 2016)

Photograph I-14 Deep run habitat found throughout the aquatic study area (May 19, 2016)

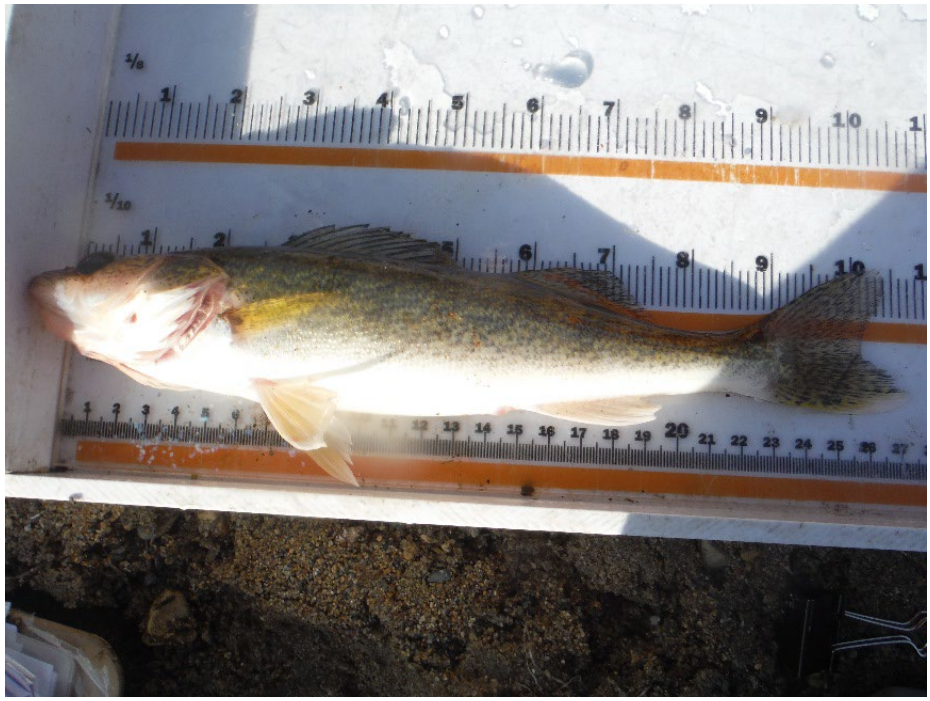
Photograph I-15 Spawning male shorthead redhorse with nuptial tubercles on anal fin (May 17, 2016)



Photograph I-16 Northern pike captured in gill net (G1) (May 17, 2016).

Photograph I-17 Yellow perch captured in gill net (G5) (May 17, 2016).

Photograph I-18 Walleye captured from gill net (G5) (May 17, 2016).



Photograph I-19 Rock bass captured in fyke net (F1) (May 17, 2016).

Photograph I-20 Fish captured from seine (S1) (July 17, 2016).

APPENDIX II

Ministry of Environment Review Response

Bailey, Dustin

Subject: RE: WSA Replacement of the Crooked Lake Water Control Structure - Environmental Screening MoE

From: England, Brianne ENV [mailto:brianne.england@gov.sk.ca]
Sent: Tuesday, August 14, 2018 1:04 PM
To: Aaron Schweitzer <Aaron.Schweitzer@wsask.ca>
Subject: RE: WSA Replacement of the Crooked Lake Water Control Structure

Hi Aaron,

Sorry for the delay in getting back to you on this. Screening for this project under *The Environmental Assessment Act* will not be required.

Thanks for passing it along for our consideration.

Cheers,

Brianne
306-787-6190

From: Aaron Schweitzer [mailto:Aaron.Schweitzer@wsask.ca]
Sent: Friday, July 27, 2018 4:24 PM
To: England, Brianne ENV
Cc: Ed Fredeen
Subject: WSA Replacement of the Crooked Lake Water Control Structure

Hi Brianne,

I hope you have been able to enjoy the summer!

This afternoon, Ed Fredeen, WSA Senior Project Engineer asked me if the WSA should consider submitting an EA Technical Proposal for the proposed replacement of the water control structure on Crooked Lake. My initial though was no, since we are not changing operations and the new structure will be an improvement for the fishery but I figured we should run it by you for an opinion. I have attached a brief summary that Ed put together for your info.

Please let me or Ed know if you have any questions. Thanks in advance for your help!

Aaron

APPENDIX III

Soils

Appendix III
Soil Tables

Table III-1 Summary of Soil Inspection Locations

Site	Northing (Zone 13 UTM)	Easting (Zone 13 UTM)	SMU Polygon	Soil Inclusion (Y/N)	Soil Subgroup Classification	Parent Material	Topsoil Depth (LFH/O/A) (cm)	Upper Subsoil Depth (B) (cm)	Colour Change	Topsoil Stripping Limitations	Topsoil Texture (A)	Dominant Subsoil Texture (B or C)	Surface Form	% Coarse Fragments	Slope Class	Drainage	Land Use	Comments
S01	5606571	665234	Av38	N	O.BLC	Fluvial	11	22+	Obvious	Stony/gravelly	cLS	grS	Level	>10	2	R	Cleared	▪ Alluvial floodplain ▪ Previously disturbed ▪ Grasses ▪ Dandelion ▪ Auger refusal at 22 cm (gravel)
S02	5606549	665245	TSS	N	TSS (topsoil stockpile)	Fluvial	107+	-	NA	Very thick TS	LS	-	Level	0	1	R	Treed	▪ Manitoba maple, elm, raspberry, rose, quack grass, brome ▪ Thistle ▪ Either flooded or topsoil pile from construction
S03	5606518	665253	Av38	N	R.HG	Fluvial	23	-	Not Obvious	Wet	SiCL	SiCL	Disturbed Land	0	1	I	Treed wetland	▪ Alluvial floodplain ▪ Willow, rose, brome grass ▪ Canada thistle, sow-thistle, broadleaf plantain
S04	5606619	665276	Av38	N	R.G	Fluvial	5	-	Not Obvious	Very thin TS, stony/gravelly	grS	grcS	Level		1	I	Wetland	▪ Floodplain ▪ Willow, grass, sweet clover ▪ Absinth, thistle, broadleaf plantain
S05	5606645	665298	Av38	N	R.HG	Fluvial	24	-	Obvious	Discontinous TS	ptLS	grcS	Level	10	1	I	Wetland	▪ Floodplain ▪ Willow, raspberry ▪ Nettle, Canada thistle, sow-thistle ▪ Borehole BH16-01, BH16-03 nearby
S06	5606666	665347	Av38	N	GLCU.R	Fluvial	13	-	Obvious	Discontinous TS	ptSiL	grLS/grSiCL	Floodplain	<10	1	I	Cleared	▪ Floodplain ▪ Willow, Manitoba maple ▪ Cleared area ▪ Scentless chamomile, Canada thistle, sow-thistle, burdock, stinkweed ▪ Disturbed for borehole ▪ North of BH16-07 stake
S07	5606665	665375	Av38	N	R.HG	Fluvial	20	-	Obvious	Wet	ptSiL	PtSiCL	Floodplain	0	1	VP	Wetland	▪ Wetland flood ▪ Rushes, marsh ragweed ▪ On berm: broadleaf plantain, wild licorice, absinth, thistle
S08	5606561	665327	Av38	N	R.HG	Fluvial	32	-	Obvious	Wet	cSiL	grS	Floodplain	0	1	P	Wetland	▪ Close to berm to wet area ▪ Depression/low ▪ Canary reed grass, willow ▪ Stinging nettle
S09	5606551	665363	Av38	N	GLCU.R	Fluvial	14 (buried)	-	Obvious	Very thick TS	SiL	S	Floodplain	0	1	P	Wetland/ Cleared	▪ Floodplain ▪ Bare area ▪ Redroot pigweed, lamb's quarters, buckwheat ▪ Buried black topsoil under sand

Site	Northing (Zone 13 UTM)	Easting (Zone 13 UTM)	SMU Polygon	Soil Inclusion (Y/N)	Soil Subgroup Classification	Parent Material	Topsoil Depth (LFH/O/A) (cm)	Upper Subsoil Depth (B) (cm)	Colour Change	Topsoil Stripping Limitations	Topsoil Texture (A)	Dominant Subsoil Texture (B or C)	Surface Form	% Coarse Fragments	Slope Class	Drainage	Land Use	Comments
S10	5606598	665408	Av38	N	R.G	Fluvial	0	-	NA	None	-	SiCL/cS	Floodplain	0	1	P	Wetland	▪ Wetland floodplain ▪ No topsoil ▪ Reeds ▪ Nettle, marsh buttercup, ragweed ▪ Northwest of BH16-05 in the canary reed grass
S11	5606623	665556	Av38	N	R.G	Fluvial	0	-	NA	None	-	Si/SiCL	Floodplain		1	P	Wetland	▪ Level floodplain ▪ No vegetation (weeds only) ▪ Unstable banks
S12	5606717	665534	Av38	N	R.G	Fluvial	0	-	NA	None	-	SiC/Si	Floodplain	0	1	P	Wetland	▪ Level floodplain ▪ No vegetation (weeds only) ▪ Purslane ▪ Soil very wet
S13	5606411	665372	Av38	N	O.R	Fluvial	10	-	Not Obvious	None	CL	CL	Level	0	1	W	Cleared	▪ Likely used for agriculture or pasture previously ▪ Beside trail ▪ Canada thistle ▪ Soil very wet
S14	5606438	665147	Av38	N	O.R	Fluvial	28	-	Obvious	Very thick TS	LS	LS	Level	<1	1	W	Cleared	▪ Likely used for agriculture or pasture previously ▪ Beside trail ▪ Canada thistle, perennial sow thistle ▪ Soil very wet

Table III-2 Analytical Characteristics of Soil Samples

GENERAL				SALINITY													INORGANICS AND NUTRIENTS				PHYSICAL					
Sample Designation	Soil Series	Sample Depth (cm bgs)	Sample Date (yyyy-mm-dd)	EC	SAR	pH ($CaCl_2$ Extraction)	pH (Saturated Paste)	pH (1:2 Water Extraction)	Saturation	Calcium (Soluble)	Potassium (Soluble)	Magnesium (Soluble)	Sodium (Soluble)	Chloride (Soluble)	Sulfur (as Sulfate) (Soluble)	Ion Balance	TGR	Organic Matter	Total Kjedahl Nitrogen (TKN)	Total Organic Carbon	C:N Ratio	Moisture	Sand	Silt	Clay	Lab Texture	Field Texture
Units				dS/m	-	-	-	-	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	-	ton/acre	%	mg/kg	%	-	%	%	%	%	-	-
SOIL ANALYTICAL RESULTS																											
S02-Oh		0 - 7	2016-05-27	0.55	0.37	7.19	7.60	7.74	52	27	25	8.8	6.3	5.3	15	6.6	<0.20	3.7	4900[b]	2.2	4.42	14	81	13	5.8	LS	-
S02-Ahk		7 - 100	2016-05-27	0.60	0.85	7.49	7.68	8.07	33	19	13	5.2	9.3	11	18	3.2	<0.20	1.9	1500[b]	1.1	7.32	7.5	89	7.2	3.7	S	LS
S02-Ahk Dup		7 - 100	2016-05-27	0.56	0.64	7.21	7.53	7.96	32	20	12	5.2	7.0	7	15	3.9	<0.20	4.4	1800b	2.6	14.1	7.1	92	3.3	4.9	S	LS
S05-Ahk		0 - 24	2016-05-27	0.60	1.5	7.28	7.86	8.10	55	27	10	9.4	26	23	58	1.9	<0.20	9.1	2900[b]	5.3	18.3	23	80	14	5.9	LS	LS
S05-Ckg		24 - 70	2016-05-27	1.6	2.6	7.72	7.85	8.31	34	50	7.6	15	48	21	210	1.2	<0.20	-	-	-	-	-	85	10	4.9	LS	GrCS
S07-Ah		0 - 20	2016-05-27	2.2	3.7	6.96	7.75	8.01[a]	130	210	36	89	290	120	1400	0.97	<0.20	13	12000[b]	7.3	6.17	70	43	43	14	L	SiL
S07-Ccag		20 - 100	2016-05-27	2.1	3.7	7.41	7.92	8.00	71	110	19	54	160	89	730	0.98	<0.20	-	-	-	-	-	38	38	24	L	SiCL
S10-Ckg		0 - 50	2016-05-27	2.4	2.2	7.39	7.86	8.00	56	130	5.5	67	92	26	690	1.1	<0.20	3.6	2200[b]	2.1	9.33	29	53	25	22	SCL	SiC
S10-Ccag		50 - 75	2016-05-27	2.2	2.7	7.51	8.01	8.28	45	85	5.8	46	83	33	480	1.1	<0.20	-	-	-	-	-	70	18	13	SL	CS

Notes:
bgs = below ground surface
dS/m = deciSiemens per metre
EC = Electrical Conductivity
SAR = Sodium Adsorption Ratio
TGR = Theoretical Gypsum Requirement
a pH was analyzed at a 10:1 Calcium Chloride to soil ratio due to the matrix of the sample.
b Detection limits raised due to dilution to bring analyte within the calibrated range.

APPENDIX IV

Vegetation

Appendix IV
Vegetation

Table IV-1 List of Plant Species found within the Soil and Vegetation Study Area

Common Name	Scientific Name	Weed [1] Designation	Documented Occurrence by Ecosite Type			
			Wet Meadow	Overflow	Disturbed Land	Disturbed Land (Re-vegetated)
Absinthe	*Artemisia absinthium*	Noxious		●	●	●
American Elm	*Ulmus americana*			●		●
American Purple Vetch	*Vicia americana*			●		
Arum-leaved Arrowhead	*Sagittaria cuneata*		●			
Barnyard Grass	*Echinochloa crus-galli*				●	●
Black Medic	*Medicago lupulina*			●		
Bog Yellow-cress	*Rorippa palustris*					●
Canada Anemone	*Anemone canadensis*			●		
Canada Thistle	*Cirsium arvense*	Noxious	●	●	●	●
Cockle Bur	*Xanthium strumarium*			●		
Common Burdock	*Arctium minus*	Noxious		●		
Common Cattail	*Typha latifolia*		●			
Common Dandelion	*Taraxacum officinale*	Nuisance	●	●	●	●
Common Plantain	*Plantago major*		●	●	●	●
Common Reed-grass	*Phragmites australis*		●			
Common Scouring-rush	*Equisetum hyemale*		●	●		
Creeping Spike-rush	*Eleocharis palustris*		●			
Curled Dock	*Rumex crispus*		●	●		

Common Name	Scientific Name	Weed Designation [1]	Documented Occurrence by Ecosite Type			
			Wet Meadow	Overflow	Disturbed Land	Disturbed Land (Re-vegetated)
Curly-cup Gumweed	*Grindelia squarrosa*			●		
Cursed Crowfoot	*Ranunculus sceleratus*		●			
Flixweed	*Descurainia sophia*					
Fowl Blue Grass	*Poa palustris*		●			
Fox-tail Barley	*Hordeum jubatum*	Nuisance		●		
Golden Corydalis	*Corydalis aurea*					●
Green Ash	*Fraxinus pennsylvanica*			●		
Hairy Hedge-nettle	*Stachys pilosa var. pilosa*		●			
Hard-stemmed Bulrush	*Schoenoplectus acutus*		●			
Horseweed	*Conyza canadensis*			●		
Lamb's-quarter's	*Chenopodium album*			●		
Leafy Spurge	*Euphorbia esula*	Noxious		●	●	●
Manitoba Maple	*Acer negundo*			●		●
Marsh Ragwort	*Tephroseris palustris*		●			
Marsh Willowherb	*Epilobium palustre*		●			
Northern Bedstraw	*Galium boreale*			●		●
Northern Black Current	*Ribes hudsonianum*			●		●
Northern Hawthorn	*Crataegus chrysocarpa*			●		
Pale Persicaria	*Persicaria lapathifolia*		●			
Peppergrass	*Lepidium ramosissimum*			●		
Perennial Sow-thistle	*Sonchus arvensis*	Noxious	●	●	●	●

Common Name	Scientific Name	Weed Designation [1]	Documented Occurrence by Ecosite Type			
			Wet Meadow	Overflow	Disturbed Land	Disturbed Land (Re-vegetated)
Philadelphia Fleabane	*Erigeron philadelphicus*		●			
Pineapple-weed	*Matricaria discoidea*				●	
Prairie Bulrush	*Bolboschoenus maritimus*		●			
Prickly Lettuce	*Lactuca serriola*		●			
Prickly Rose	*Rosa acicularis*					
Purslane	*Portulaca oleracea*		●			
Red-osier Dogwood	*Cornus sericea*			●		
Red-root Pigweed	*Amaranthus retroflexus*		●			
Rough Cinquefoil	*Potentilla norvegica*			●		
Saline Plantain	*Plantago eriopoda*			●		
Sandbar Willow	*Salix interior*		●	●		●
Saskatoon	*Amelanchier alnifolia*					●
Scentless Chamomile	*Tripleurospermum inodorum*	Noxious		●		
Seaside Buttercup	*Ranunculus cymbalaria*		●			
Silverweed	*Argentina anserina*			●	●	
Slender Wheatgrass	*Elymus trachycaulus ssp. subsecundus*			●		
Slender Wheatgrass	*Elymus trachycaulus ssp. trachycaulus*			●		●
Slough Grass	*Beckmannia syzigachne*		●			
Small Yellow Watercrowfoot	*Ranunculus gmelinii*		●			
Smooth Brome	*Bromus inermis*			●		●
Soft-stem Bulrush	*Schoenoplectus tabernaemontani*		●			

Common Name	Scientific Name	Weed Designation [1]	Documented Occurrence by Ecosite Type			
			Wet Meadow	Overflow	Disturbed Land	Disturbed Land (Re-vegetated)
Stinging Nettle	*Urtica dioica ssp. gracilis*		●	●		●
Stinkweed	*Thlaspi arvense*		●	●		
Swamp Red Currant	*Ribes triste*			●		
Tall Lungwort	*Mertensia paniculata*			●		
Tartary Buckwheat	*Fagopyrum tataricum*		●	●		
Three-square Rush	*Schoenoplectus pungens*		●			
Water-hemlock	*Cicuta maculata var. angustifolia*		●	●		
Western Snowberry	*Symphoricarpos occidentalis*					●
White Panicled American-aster	*Symphyotrichum lanceolatum*			●		
White Sweet-clover	*Melilotus albus*			●		
Wild Licorice	*Glycyrrhiza lepidota*		●	●	●	
Wild Mint	*Mentha arvensis*		●			
Wood's Rose	*Rosa woodsii*		●	●		●
Yellow Evening Primrose	*Oenothera biennis*		●			
Yellow Sweet-clover	*Melilotus officinalis*		●	●		

[1]The Weed Control Act Chapter W-11.1* of the Statutes of Saskatchewan, 2010 as amended by the Statutes of Saskatchewan, 2014, c.19; and 2020, c.13. (2020)

APPENDIX V

Wildlife

Appendix V
Wildlife

Table V-1 Bird Species Detected within the TSA

Common Name	Latin Name	Species Status			
		SKCDC[1]	Wildlife Act[2]	COSEWIC[3]	SARA[5]
Alder Flycatcher	*Empidonax alnorum*	S5B	No Status	No Status	No Status
American Avocet	*Recurvirostra americana*	S4B	No Status	No Status	No Status
American Crow	*Corvus brachyrhynchos*	S5B,S4N	No Status	No Status	No Status
American Goldfinch	*Carduelis tristis*	S5B	No Status	No Status	No Status
American Robin	*Turdus migratorius*	S5B,SUN	No Status	No Status	No Status
American White Pelican	*Pelecanus erythrorhynchos*	S5B	No Status	Not at Risk	No Status
American Wigeon	*Anas americana*	S5B	No Status	No Status	No Status
Bald Eagle	*Haliaeetus leucocephalus*	S5B, S4M,S5N	No Status	Not at Risk	No Status
Baltimore Oriole	*Icterus galbula*	S5B	No Status	No Status	No Status
Barn Swallow	***Hirundo rustica***	**S5B, S5M**	**No Status**	**Special Concern**	**Threatened**
Belted Kingfisher	*Megaceryle alcyon*	S4B	No Status	No Status	No Status
Black-billed Magpie	*Pica hudsonia*	S5	No Status	No Status	No Status
Black-capped Chickadee	*Poecile atricapillus*	S5	No Status	No Status	No Status
Blue-winged Teal	*Anas discors*	S5B	No Status	No Status	No Status
Bobolink	***Dolichonyx oryzivorus***	**S5B**	**No Status**	**Special Concern**	**Threatened**
Brewer's Blackbird	*Euphagus cyanocephalus*	S5B,SUN	No Status	No Status	No Status
Brown-headed Cowbird	*Molothrus ater*	S5B,SUN	No Status	No Status	No Status
Canada Goose	*Branta canadensis*	S5B,	No Status	No Status	No Status
Canvasback	*Aythya valisineria*	S5B,	No Status	No Status	No Status
Cedar Waxwing	*Bombycilla cedrorum*	S5B	No Status	No Status	No Status
Chipping Sparrow	*Spizella passerina*	S5B	No Status	No Status	No Status
Clay-colored Sparrow	*Spizella pallida*	S5B	No Status	No Status	No Status
Cliff Swallow	*Petrochelidon pyrrhonota*	S5B,	No Status	No Status	No Status
Common Grackle	*Quiscalus quiscula*	S5B	No Status	No Status	No Status
Common Loon	*Gavia immer*	S5B, SUN	No Status	Not at Risk	No Status
Common Merganser	*Mergus merganser*	S5B	No Status	No Status	No Status
Common Nighthawk	***Chordeiles minor***	**S4B,**	**No Status**	**Special Concern**	**Special Concern**
Common Raven	*Corvus corax*	S5	No Status	No Status	No Status
Common Yellowthroat	*Geothlypis trichas*	S5B	No Status	No Status	No Status
Cooper's Hawk	*Accipiter cooperii*	S4B, S2M, S2N	No Status	Not at Risk	No Status
Double-crested Cormorant	*Phalacrocorax auritus*	S5B	No Status	Not at Risk	No Status
Eastern Kingbird	*Tyrannus tyrannus*	S5B	No Status	No Status	No Status
Eastern Phoebe	*Sayornis phoebe*	S4B	No Status	No Status	No Status
European Starling	*Sturnus vulgaris*	SNA	No Status	No Status	No Status

Common Name	Latin Name	Species Status			
		SKCDC[1]	Wildlife Act[2]	COSEWIC[3]	SARA[5]
Gadwall	*Anas strepera*	S5B	No Status	No Status	No Status
Gray Catbird	*Dumetella carolinensis*	S5B	No Status	No Status	No Status
Great Blue Heron	*Ardea herodias*	S5B	No Status	No Status	No Status
Green-winged Teal	*Anas carolinensis*	S5B	No Status	No Status	No Status
Hairy Woodpecker	*Picoides villosus*	S5	No Status	No Status	No Status
Horned Lark	*Eremophila alpestris*	S4B, SUM, S3N	No Status	No Status	No Status
House Sparrow	*Passer domesticus*	SNA	No Status	No Status	No Status
House Wren	*Troglodytes aedon*	S5B	No Status	No Status	No Status
Killdeer	*Charadrius vociferus*	S5B	No Status	No Status[4]	No Status
Le Conte's Sparrow	*Ammodramus leconteii*	S5B	No Status	No Status	No Status
Least Flycatcher	*Empidonax minimus*	S5B	No Status	No Status[4]	No Status
Mallard	*Anas platyrhynchos*	S5	No Status	No Status	No Status
Mourning Dove	*Zenaida macroura*	S5B	No Status	No Status	No Status
Nelson's Sparrow	*Ammodramus nelsoni*	S5B	No Status	Not at Risk	No Status
Northern Shoveler	*Anas clypeata*	S5B	No Status	No Status	No Status
Orange-crowned Warbler	*Vermivora celata*	S5B	No Status	No Status	No Status
Ovenbird	*Seiurus aurocapilla*	S5B	No Status	No Status	No Status
Purple Martin	*Progne subis*	S5B	No Status	No Status	No Status
Red-eyed Vireo	*Vireo olivaceus*	S5B	No Status	No Status	No Status
Red-necked Grebe	*Podiceps grisegena*	S5B	No Status	Not at Risk	No Status
Red-tailed Hawk	*Buteo jamaicensis*	S5B, S1N	No Status	Not at Risk	No Status
Red-winged Blackbird	*Agelaius phoeniceus*	S5B, SUN	No Status	No Status	No Status
Ring-billed Gull	*Larus delawarensis*	S5B	No Status	No Status	No Status
Savannah Sparrow	*Passerculus sandwichensis*	S5B	No Status	No Status	No Status
Sharp-shinned Hawk	*Accipiter striatus*	S4B, S2N	No Status	Not at Risk	No Status
Song Sparrow	*Melospiza melodia*	S5B	No Status	No Status	No Status
Sora	*Porzana carolina*	S5B	No Status	No Status	No Status
Spotted Sandpiper	*Actitis macularius*	S5B	No Status	No Status	No Status
Spotted Towhee	*Pipilo maculatus*	S5B	No Status	No Status	No Status
Swainson's Hawk	*Buteo swainsoni*	S4B	No Status	No Status	No Status
Tree Swallow	*Tachycineta bicolor*	S5B	No Status	No Status	No Status
Turkey Vulture	***Cathartes aura***	**S3B**	**No Status**	**No Status**	**No Status**
Veery	*Catharus fuscescens*	S4B	No Status	No Status	No Status
Vesper Sparrow	*Pooecetes gramineus*	S5B	No Status	No Status	No Status
Wilson's Phalarope	*Phalaropus tricolor*	S5B	No Status	No Status	No Status
Wilson's Snipe	*Gallinago delicata*	S5B	No Status	No Status	No Status
Yellow Warbler	*Dendroica petechia*	S5B	No Status	No Status	No Status
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	S5B	No Status	No Status	No Status

Notes:
Species of conservation concern are indicated by **bold** text. Species ranked S1, S2, or S3 are of conservation concern in Saskatchewan.

[1] Saskatchewan Conservation Data Centre (SKCDC) Taxa List: Vertebrates S-Rank (September 14, 2015)
[2] Saskatchewan Wildlife Act (S.S. 1998, c W-13.12)

[3] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) searchable database (2015)
[4] Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Candidate Wildlife Species (February 8, 2016)
[5] Species at Risk Act (S.C. 2002, c. 29) designation as listed on Species at Risk Public Registry (SARPR 2016)

APPENDIX VI

Fisheries and Aquatics

Appendix VI
Fisheries and Aquatics

Table VI-1 Fish Capture Data for Crooked Lake

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
Gill Net	1	2016-05-17 11:29	2016-05-17 12:07	0.63	WHSC	453	-
					WHSC	420	-
					SHRD	405	-
					WHSC	446	-
					WHSC	430	-
					WHSC	445	-
					SHRD	400	-
					NRPK	1000	-
					WHSC	468	-
Gill Net	2	2016-05-17 11:48	2016-05-17 12:47	0.98	SHRD	399	-
					WHSC	414	-
					WHSC	448	-
					SHRD	4040	-
					SHRD	360	-
					SHRD	399	-
					SPSH	93	-
					SPSH	92	-
Gill Net	3	2016-05-17 12:40	2016-05-17 13:17	0.62	WHSC	470	-
					WHSC	459	-
					SHRD	400	-
					WHSC	421	-
					WHSC	447	-
					WHSC	419	-
					WHSC	420	-
					EMSH	96	-
					EMSH	97	-
					EMSH	68	-
Gill Net	4	2016-05-17 13:14	2016-05-17 13:42	0.47	EMSH	65	-
					EMSH	64	-
					EMSH	61	-
					EMSH	62	-
					EMSH	63	-
					EMSH	67	-
					SPSH	85	-
					EMSH	46	-
					SHRD	427	-
					WHSC	436	-
					SHRD	397	-
					WHSC	481	-

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
					SHRD	378	-
					SHRD	360	-
					SHRD	412	-
					SHRD	390	-
					WHSC	455	-
					WHSC	453	-
					SHRD	385	-
					SHRD	1	-
					NRPK	800	-
					SHRD	437	-
					WHSC	451	-
					SHRD	410	-
					SHRD	390	-
					SHRD	401	-
					SHRD	388	-
					WHSC	436	-
					WHSC	487	-
					SHRD	415	-
					WHSC	470	-
					SHRD	474	-
					CMCR	483	-
					CMCR	506	-
					CMCR	503	
Gill Net	5	2016-05-17 15:43	2016-05-17 16:40	0.95	WALL	248	143
					YLPR	171	61.2
					YLPR	209	137
					YLPR	149	37
					YLPR	200	111.5
					YLPR	73	3.3
					YLPR	87	4.7
					SPSH	79	8.3
Gill Net	6	2016-05-17 16:01	2016-05-17 17:15	1.23	SPSH	58	2.6
					YLPR	203	120.5
					YLPR	86	85.6
					WALL	226	113.6
					WALL	257	164.4

Species Acronyms:

Blackside darter = BLDR
Common carp = CMCR
Common shiner = CMSH
Emerald shiner = EMSH
Johnny darter = JHDR
Iowa darter = IWDR
Northern pike = NRPK
Pearl dace = PRDC
River shiner = RVSH
Rock bass = RCBS
Sand shiner = SNSH
Shorthead redhorse = SHRD
Spottail shiner = SPSH
Walleye = WALL
White sucker = WHSC
Yellow perch = YLPR

Table VI-2 Fish Capture Data for Qu'Appelle River

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
Fyke	1	2016-05-18 11:51	2016-05-19 10:22	22.52	NRPK	336	164
					SPSH	39	0.6
					SPSH	55	2
					SPSH	51	0.4
					SPSH	56	0.4
					SPSH	55	1.9
					SPSH	55	3.1
					SPSH	49	0.6
					SPSH	57	1.3
					SPSH	47	0.7
					SPSH	51	0.6
					SPSH	56	0.3
					SPSH	47	0.5
					SPSH	46	0.7
					SPSH	50	0.2
					SPSH	56	0.9
					SPSH	43	0.3
					SPSH	50	0.9
					SPSH	41	0.6
					SPSH	48	0.5
					SPSH	47	1.1
					SPSH	46	3.3
					SPSH	43	0.4
					SPSH	43	0.7
					SPSH	47	0.3
					SPSH	53	1.1
					SPSH	47	0.7
					SPSH	41	0.3
					SPSH	47	1.7
					SPSH	48	1.2
					SPSH	56	0.8
					SPSH	47	0.4
					SPSH	47	0.4
					SPSH	47	0.2
					SPSH	52	0.7
					SPSH	47	0.4
					SPSH	42	0.4
					RCBS	105	31.4
					SPSH	46	0.7
					SPSH	55	1.2
					SPSH	43	0.3
					SPSH	63	0.9

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
					SPSH	56	0.6
					SPSH	50	0.4
					SPSH	47	0.4
					SPSH	55	0.6
					SPSH	48	0.7
					SPSH	47	0.7
					SPSH	47	1.2
Fyke	2	2016-05-18 12:00	2016-05-19 10:22	22.37	SPSH x 20	47	0.6
					RCBS	222	303.4
EF	1	2016-05-19 17:00	2016-05-19 18:06	0.24	SPSH	84	6
					BLDR	49	0.8
					SPSH	53	1.2
					BLDR	73	4.8
					BLDR	49	0.8
					BLDR	49	0.8
Seine	1	2016-07-17 10:30	2016-07-17 10:40	0.17	WHSC	338	1100
					WHSC	396	550
					RVSH	60	31
					JHDR	24	0.4
					WHSC	43	0.6
					WHSC	46	3.3
					WALL	66	1.5
					WALL	68	6.4
					WALL	75	3.5
					WALL	61	1.7
					WALL	62	4
					WALL	-	3.5
					WALL	76	3.7
					CMCR	41	1.9
					CMCR	39	3.2
					CMCR	36	2.5
					JHDR	38	1.2
					WALL	66	6.2
					CMCR	32	1.6
					WALL	68	3.5
					CMCR	28	1.2
					WALL	68	2.8
					RVSH	48	3.4
					SPSH	38	1.7
					RVSH	53	1.8
					RVSH	51	2.5
					WHSC	42	1.4
					WALL	-	-
					WALL	-	-

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
					WALL	-	-
					SPSH x 85	38	1.7
					WHSC x 345	42	1.4
					JHDR x 73	24	0.4
					CMSH	-	-
					PRDC x 45	24	0.6
Seine	2	2016-07-17 11:30	2016-07-17 11:45	0.25	CMSH	87	11.2
					SNSH	78	7.4
					YLPR	47	1.2
					WALL	68	3.3
					YLPR	38	1.2
					YLPR	45	1.1
					CMSH	74	10.4
					CMSH	78	9.8
					SNDH	48	4.9
					CMSH	78	8.4
					SNSH	62	4.7
					CMSH	73	4.2
					SNSH	54	2.5
					SNSH	63	3.1
					SNSH	66	4.1
					SNSH	66	3.6
					SNSH	66	3.6
					SNSH	45	-
					CMSH	92	9.8
					JHDR X 31	24	0.4
					SPSH x 19	38	1.7
					SNSH x 25	66	3.6
					CMCR	41	1.9
					WHSC x 240	42	1.4
					YLPR x 14	45	1.1
Seine	3	2016-07-17 13:45	2016-07-17 14:00	0.25	WHSC	420	1100
					IWDR	42	0.4
					YLPR	44	0.6
					WALL	45	0.3
					IWDR	41	0.3
					IWDR	43	0.6
					IWDR	44	2.1
					IWDR	40	1.2
					CMCR	35	0.6
					WALL	64	2.4
					WALL	44	0.3

Method	Location	Date In	Date Out	Time Fished (hr)	Species	Length (mm)	Weight (g)
Seine	4	2016-07-17 14:15	2016-07-17 14:30	0.25	-	-	-
Seine	5	2016-07-17 14:42	2016-07-17 14:58	0.27	WHSC	425	1320
					WHSC	425	1100
					WHSC	488	1395
					WHSC	439	1015
					WHSC	445	1057
					WHSC	431	961
					WHSC	445	1057
					WHSC	446	1065
					WHSC	415	858
					WHSC	416	864
					WHSC	485	1369
					WHSC	445	1057
					WHSC	431	961
					WHSC	457	1145
					SHRD	420	889
					WHSC	410	827
					WHSC	434	981
					WHSC	495	1455
					YLPR	40	1.1
					WALL	75	3.5
					WALL	40	3.3
					SPSH x 58	38	1.7
					WHSC x 185	42	1.4
					RVSH x 10	66	3.6
					JHDR X33	24	0.4

APPENDIX VII

Historical Resources

Saskatchewan

Ministry of
Tourism, Parks,
Culture and Sport

Heritage Conservation Branch
2nd Floor 3211 Albert Street
Regina, Saskatchewan
S4S 5W6

(306) 787-5774
nathan.friesen@gov.sk.ca

December 2, 2015

Our File: 14-2906

Mr. Robert Parker
Water Security Agency
400 – 111 Fairford Street East
MOOSE JAW SK S6H 7X9

Dear Mr. Parker:

RE: Replacement of Water Control Structure at Crooked Lake Outlet: Section 8-19A-5 W2M (Your File: D205-19A-08 C); HERITAGE RESOURCE IMPACT ASSESSMENT RESULTS

Please be advised we received (November 26, 2015) a final report from Bison Historical Services Ltd. on their heritage resource impact assessment (HRIA) of this project completed under Investigation Permit #15-159.

No new heritage sites were observed in the course of pedestrian survey and testing of the development, despite the high potential of the area. Therefore, this office has no further concerns with this project proceeding as planned.

On behalf of the Heritage Conservation Branch, please accept our appreciation for having commissioned this investigation, and for your continuing assistance and support in preserving Saskatchewan's archaeological heritage.

Sincerely,

Nathan Friesen
Senior Archaeologist
Archaeological Resource Management

FINAL REPORT
HERITAGE RESOURCES IMPACT ASSESSMENT

Water Security Agency - Crooked Lake Outlet Structure Replacement (Permit 2015-159)

FINAL REPORT
HISTORICAL RESOURCES IMPACT ASSESSMENT
Water Security Agency - Crooked Lake Outlet Structure Replacement

(Permit 2015-159)

Prepared for

Joel Hilderman

Klohn Crippen Berger Ltd.
100 - 2366 Ave C North
Saskatoon, SK
S7L 5X5

on behalf of

Robert Parker

The Water Security Agency
400 - 111 Fairford Street East
Moose Jaw, SK
S6H 7X9

By

Sean Pickering, M.A.

Bison Historical Services Ltd.
1A-215 36th Avenue NE
Calgary, Alberta
T2E 2L4

November 20, 2015

EXECUTIVE SUMMARY

On behalf of Klohn Crippen Berger Ltd., acting as agent for The Water Security Agency, Bison Historical Services Ltd. has conducted a Historical Resources Impact Assessment (HRIA) of the Water Security Agency - Crooked Lake Outlet Structure Replacement project. The project will involve replacement of the existing 9-bay concrete and timber control structure at the outlet of Crooked Lake into the Qu'Appelle River.

A direction letter was issued by the Heritage Conservation Branch (HCB) of the Ministry of Parks, Culture and Sport which stated that the heritage potential for the project was considered to be moderate to high, and that an HRIA was required (File: 14-2906).

During the HRIA field investigations on November 9, 2015, no new historical resource sites were recorded as a result of visual inspection of the proposed project area, and none of the 10 subsurface tests excavated within the study area contained evidence of cultural materials.

Based on the fact that no heritage materials were observed in the project area, and that no previously recorded heritage resource sites will be impacted, **no further archaeological investigations are recommended in association with the Water Security Agency - Crooked Lake Outlet Structure Replacement project.** Therefore, **it is recommended that the Water Security Agency - Crooked Lake Outlet Structure Replacement project be given clearance to proceed with construction.** This recommendation is subject to the approval of Heritage Conservation Branch.

CREDITS

Permit Holder:	Sean Pickering, M.A.
Field Personnel:	Sean Pickering, M.A. Stephen Wagner, M.A.
Report Author:	Sean Pickering, M.A.

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INTRODUCTION

On behalf of Klohn Crippen Berger Ltd., acting as agent for The Water Security Agency, Bison Historical Services Ltd. has conducted a Heritage Resources Impact Assessment (HRIA) of the Water Security Agency - Crooked Lake Outlet Structure Replacement project (See Figure 1 and Figure 2; Appendix A). The proposed project will have a land surface impact of 7.8 ha in a mix of disturbed and undisturbed lands within the Aspen Parkland Ecoegion of Saskatchewan, in the Qu'Appelle River Valley north of Marieval, SK.

A direction letter was issued by the Heritage Conservation Branch (HCB) of the Ministry of Parks, Culture and Sport which stated that the heritage potential for the project was considered moderate to high, and that an HRIA was required (File: 14-2906).

Fieldwork was conducted under the direction of the author on November 9, 2015. Areas of native vegetation were examined by pedestrian survey, while subsurface testing was concentrated in areas thought to have a potential for buried heritage resources. Ten subsurface tests were excavated during the course of this study. No previously unrecorded heritage resource sites were identified as a result of this survey, and no previous recorded sites were revisited.

Detailed results of the Water Security Agency - Crooked Lake Outlet Structure Replacement project HRIA are presented below, but first this report will provide the necessary context for evaluating the results including: 1) a brief overview of the environmental and culture-historical contexts of the proposed project area, 2) the results of a literature review outlining all previous archaeological work in the vicinity of the proposed project, and 3) a summary of the methodology by which the field component of this HRIA was conducted.

PROJECT DESCRIPTION

The existing Crooked Lake outlet structure is located in Section 8, Township 19A, Range 5, West of the Second Meridian (Figure 3). The location is approximately

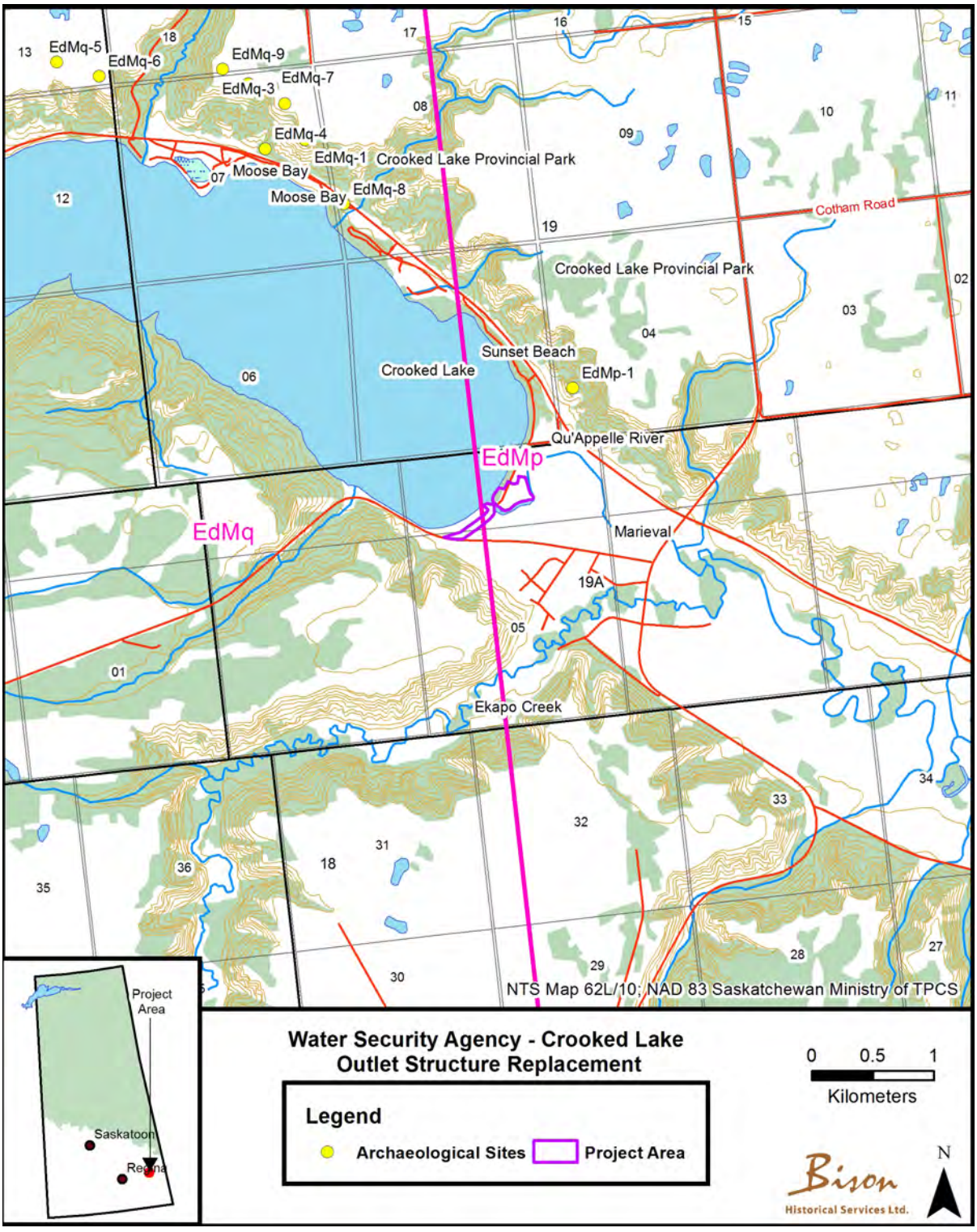

Figure 1: Map of the project area

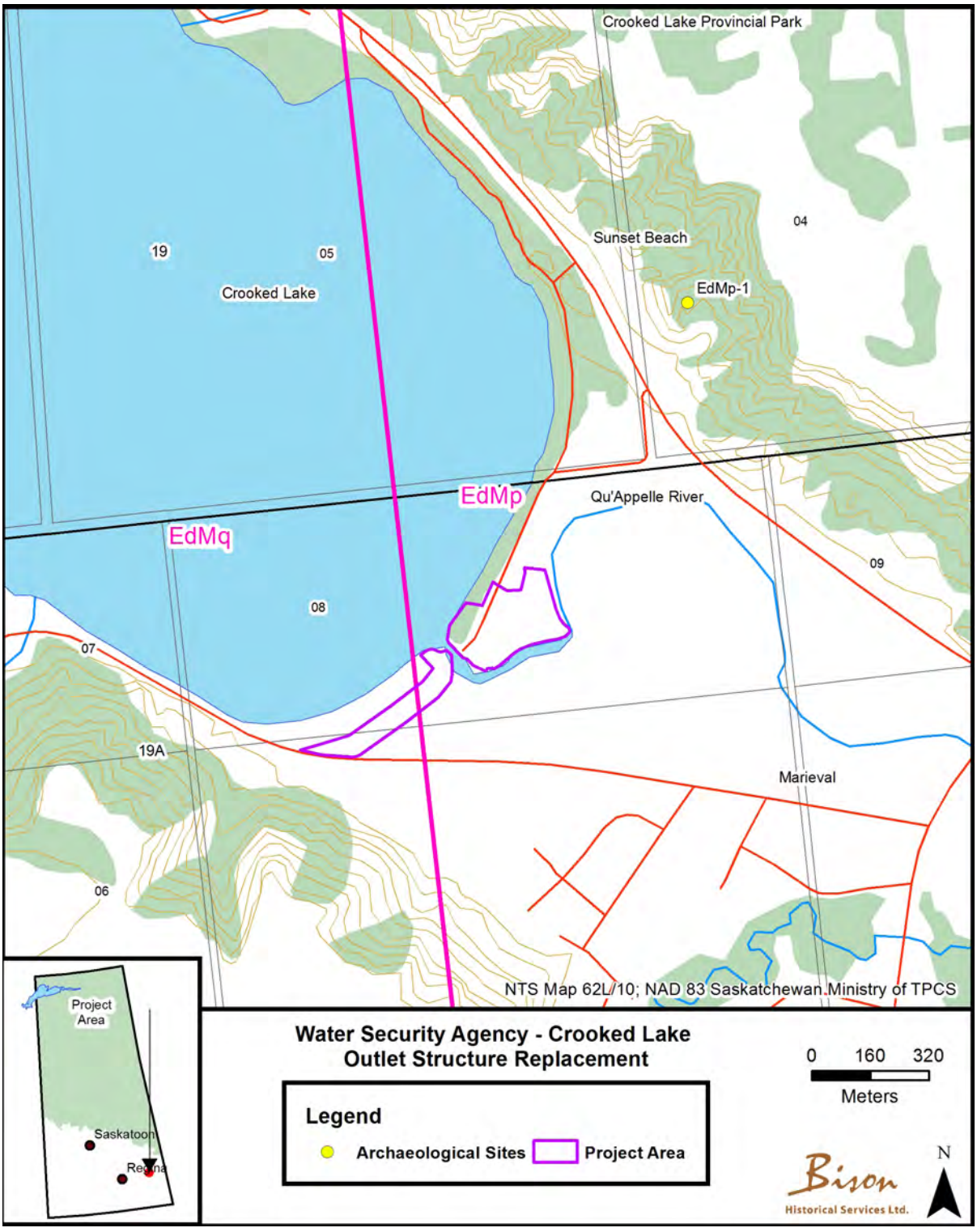

Figure 2: Close up map of the project area

Figure 3: The current Crooked Lake outlet structure, view south

16 kilometers southwest of Grayson Saskatchewan. Crooked Lake is one of a series of recreational water bodies along the Qu'Appelle River.

The existing 9-bay concrete and timber structure was constructed by PFRA (now Agriculture and Agri-Food Canada, Agri-Environment Services Branch) in the early 1940's and is currently in very poor condition. It was overtopped and isolated by flood waters in 2011 and 2014, during periods where the inflow rate was approximately 240 m3/s, and water levels rose to approximately elevation 454.5 m. It is difficult to operate; is not accessible at high water levels, and poses safety issues for both the Client's staff and the general public. A short length of earthen dyke exists on the north side of the structure. The current structure has no functional provision for the passage of fish during periods of normal water levels. The project will involve the replacement of the existing 9-bay concrete and timber control structure at the outlet of Crooked Lake into the Qu'Appelle River. A maximum area of approximately 7.8 ha will be disturbed by the development.

PREVIOUS RESEARCH

The area affected by the proposed development lies within the EdMp and EdMq Borden Block areas. The Borden system is a Canada-wide, geographically based system for recording heritage sites (Borden 1952). In this part of Canada, each block is ten minutes of latitude by ten minutes of longitude. Each block is referred to by a four-letter code uniquely describing the location of that block. Sites are sequentially numbered within each block in the order in which they are discovered and reported. A complete Borden block encompasses an area somewhat larger than two Townships.

Prior to the current HRIA, one heritage resource sites had been recorded in the EdMp Borden Block. EdMp-1 is the Crooked Lake Burial that was recorded in 1999 at the head of a side coulee of the Qu'Appelle Valley, and is located approximately 830 m from the proposed project area. This site is a First Nations burial of unknown age that was uncovered in a depression with heavy equipment. The remains were fully excavated. Additionally, there have been 12 sites recorded in the EdMq Borden Block. These sites consisted of nine artifact scatters, two artifact finds, and a burial mound.

No other heritage resource sites have previously been recorded within two kilometres of the proposed development.

HERITAGE RESOURCES

Definitions

Heritage Resources include prehistoric sites, historic-aged sites, palaeontological sites, sites of ethnic or community interest, and traditional native use sites. Prehistoric sites contain the cultural remains of past use, including artifacts, features, and refuse resulting from subsistence practices (e.g., bone, fire-cracked rock). Prehistoric materials date to the period prior to the introduction of European trade goods. In Saskatchewan, prehistoric sites are classified as including artifact finds (e.g., between 1 and 5 archaeological objects), artifact scatters (e.g., greater than five archaeological objects), single features (e.g., a cairn or stone circle), recurrent features (e.g., two or more archaeological features of the same type), multiple features (e.g., more than

one kind of archaeological feature), middens (e.g., concentrations of ash, charcoal, bone, shell, plant remains, debitage, or fire-cracked rock), combinations of the above or sites of a special nature (e.g., burials, medicine wheels, petroglyphs, effigies).

Historic-aged sites date to the introduction of European goods. Sites of this age may be of Native or European origin but typically date to the homestead or more recent periods. Historic-aged sites include standing structures, foundations, and refuse concentrations associated with agriculture, ranching, industry or community development.

Palaeontological sites constitute the fossilized remains of animals or plants and are associated with bedrock or Pleistocene aged gravels. Sites of ethnic or community interest, and traditional native use sites are localities, with or without physical remains, which are of special value to a particular community.

Potential Adverse Effects

Heritage Resources are non-renewable. Disturbance to, removal of, or destruction of these resources has a permanent effect. Archaeological structures and objects can only be studied, preserved, or appreciated in their original context. Consequently, any activity that modifies the remains or alters their context constitutes an adverse effect which, if significant, requires active measures of protection or conservation.

Significance

The primary objectives of a Heritage Resources Impact Assessment (HRIA) are the discovery of Heritage sites and the assessment of their significance. The procedures of site discovery are described in the Methodology section. The basis of assessing the significance of sites is briefly summarized here.

The methodological bias underlying the evaluation of lands to be examined and the assessment of particular sites in these contexts is based on the arguments expressed by Wildesen and Witherspoon (1984) that 1) “not all lands are equally likely to have been used in the past”, 2) “not all past uses will leave physical evidence”, and 3)

"not all lands are equally likely to retain evidence of past use." Lands which were used in the past and retain physical traces of human occupation or use, however, may not be archaeologically meaningful by virtue of previous natural or man made disturbance or context. The principal attributes of archaeological value are stratigraphy, site size, site depth, the presence of features, artifact density, variability of artifact classes, the preservation of ancillary information (e.g., faunal or plant remains), and the presence of materials diagnostic of age, site function, and cultural affiliation.

The archaeological potential of a particular locality is determined first by its physical parameters including the potential for deposition and the integrity of those deposits that may contain archaeological material. In evaluating the localities recommended for examination, primary consideration is given to the probability of such sites being present and the potential that such heritage resources are archaeologically meaningful.

ENVIRONMENTAL SETTING

The Water Security Agency - Crooked Lake Outlet Structure Replacement project is located in the Aspen Parkland Ecoregion of the Prairie Ecozone. This Aspen Parkland extends in an arc from southwestern Manitoba, across southeastern and central Saskatchewan into central Alberta. Native parkland is characterized by fescue grasslands interspersed with groves of trembling aspen. Aspen groves are more common and denser in the northern portion of this ecoregion than the south. The topography of the region is characterized by glacial till covered by rolling terrain, including steep-sided valleys, and numerous sloughs. However, much of this region has been converted to farmland.

Short, warm summers and cool winters characterize the parkland. Black chernozems are the dominate soil type, though gleysolic soils are found in poorly drained areas. Animal species include many types of water fowl, as well as ground squirrels, northern pocket gophers, snow-shoe hare, cottontail, red fox, white-tailed deer, and coyotes (Acton *et al.* 1998; Ecoregions of Saskatchewan 2015; Saskatchewan Data Conservation Centre 2015).

THE HISTORIC CONTEXT

The First Nations

The proposed project lies in the area that can be assigned to the Northern Plains archaeological province. The initial statement for the culture history of the Northern Plains was presented by Mulloy (1958) based on his work at Pictograph Cave in Montana. This sequence outlines the three major prehistoric periods that, even today, are used to organize our archaeological knowledge (Table 1).

Over the past several decades, more detailed treatments have become available for each of the three periods. For the early prehistoric period, archaeologists still rely on the stratified sequence developed for the Hell Gap Site in Wyoming (Irwin-Williams *et al.* 1973) and confirmed by excavations at the Carter/Kerr-McGee site (Frison 1984). The Middle Prehistoric Period is best represented at the poorly reported Mummy Cave Site in Wyoming (Wedel *et al.* 1968) but has become the subject of a number of treatments concerning the Altithermal and its possible consequences for life on the Northern Plains (Buchner 1980; Forbis 1993; Reeves 1973; Walker 1992). The Late Middle period was given early attention by work at the Mortlach site (Wettlaufer 1955) and the Long Creek site (Wettlaufer and Mayer-Oaks 1960) and it is now recognized that the Oxbow Complex, first identified in Saskatchewan, has chronological priority. This complex is viewed as “ubiquitous” in southern Saskatchewan (Dyck 1983:96). The Late Prehistoric Period in Saskatchewan is best exemplified by the Avonlea (Klimko 1985), Gull Lake (Kehoe 1973), Estuary (Adams 1977), and Rousell sites (Dyck 1972) which are type-sites for Avonlea and the Prairie/Plains complex. This period has been given considerable attention by Reeves (1983) and Byrne (1973). A more recent contribution has provided a somewhat different perspective (Duke 1991).

Each of the cultural complexes are defined by a specified range of tool types, unique styles of projectile points, and shared patterns of subsistence, settlement, and, presumably, social organization and religion.

In broad terms, highly nomadic spear-using populations, opportunistically exploiting large game, characterize the Early Prehistoric period. Following a lengthy

Archaeological Period	Phase/Complex	Date Range (Years BP)
Early Prehistoric	Clovis	11,200 - 10,750
	Folsom	10,750 -10,550
	Midland	10,650 - 10,350
	Agate Basin	10,450 - 9,950
	Hell Gap	9,950 - 9,450
	Alberta	9,450 - 8,950
	Cody	8,750 - 8,350
	Frederick	8,350 - 7,950
	Lusk	7,950 - 7,450
Middle Prehistoric	Mummy Cave	7,950 - 5,500
	Oxbow	5,500- 4,000
	McKean	4,500 - 3,500
	Hanna	3,500 - 3,000
	Pelican Lake	3,000 - 2,400
	Besant	2,000 - 1,100
Late Prehistoric	Avonlea	1,750 - 1,150
	Old Women's	1,200 - 700
	Tobacco Plains	270 - 120
	One Gun	270 - 120

Table 1: Cultural historical framework for the Northern Plains

period of global drought (the Altithermal) during which bison populations were reduced and human habitation checked or restrained, the grasslands of the Northern Plains were once again intensively occupied, first by the peoples attributed to the Oxbow Complex and later by peoples associated with the McKean Complex. This Late Middle Prehistoric occupation was accompanied by the appearance of stone circles, Medicine Wheels and the adoption of a sophisticated form of organized communal hunting. Common to the Middle Prehistoric people was the use of the Atlatl, a throwing board that employed a dart rather than a spear. The Late Prehistoric Period is defined by the introduction of clay pottery and the bow and arrow. During this period, organized bison hunting reached a peak based on the industry-like exploitation and processing of bison for the production of, and trade in, pemmican (Reeves 1990). The Northern Plains archaeological sequence is subdivided into five periods (Table 1).

The subsistence system employed by the inhabitants of the Saskatchewan

Northern Plains has always been dominated by bison. To our knowledge, Saskatchewan archaeologists are yet to find cultural material in association with extinct Pleistocene mammals other than bison. In a recent article, Reeves provides a review of the evolution of bison hunting cultures on the Northern Plains (1990). This and a comprehensive work by Frison (1991) serve as the primary references to Northern Plains subsistence, both in character and evolution.

Prehistoric settlement on the Northern Plains of Saskatchewan was controlled, absolutely, by the distribution of bison. Early prehistoric patterns of exploitation seem to have been of the forager type (Kelly and Todd 1988). This pattern of exploitation was characterized by "little emphasis on 'place,' high residential mobility, variability in mobility based on local abundance of resources, emphasis on search-and-encounter hunting tactics, and a lack of stored resources" (Kelly and Todd 1988:239). This pattern of exploitation evolved during the Middle Prehistoric period into one that was season/habitat oriented and culminated, in conjunction with the development of strategies for preserving and storing foodstuffs, into the pattern of exploitation that characterized the Late Prehistoric period.

Ewers (1955, 1958), describes an equestrian (Proto Historic) pattern of seasonal movements based on ethnographic knowledge. Late Middle and Late Prehistoric models of pedestrian movement and patterns of exploitation have been proposed by Gordon (1979) and Morgan (1979, 1980). In a more recent article by Vickers (1991) these models are reviewed. Both models presume a reasonable degree of, at least, seasonal mobility and assume a pattern which has been described as "herd nomadism" (Ruebelmann 1983). Roll and Deaver (1978) take a different and less popular viewpoint and suggest that the pedestrian hunters were considerably more sedentary. The acceptance of one or the other of the viewpoints is dependent on the nature of bison movements. In the first instance, large-scale bison migration is assumed based on historic observations while in the latter case it is assumed that the distribution of bison was, in all seasons, more widely distributed than commonly believed. At present, this debate is fraught by the difficulties inherent in the inevitable circularity of their arguments, that is, with some archaeologists using archaeology

to infer bison behaviour and others then using inferred bison behaviour to support models of settlement patterning.

Micro-settlement patterns were obviously dictated by locally available resources and circumstances. Fuel and water were certainly important (Vickers 1991) as was geographic context (Brumley 1983), and even available plants. Settlement was also obviously controlled by inherited patterns of travel, the economics of trade, and traditional values dictated by religious beliefs. Community structure was dependent on the population and the size of families, bands and tribes. Most sites are small, but aggregations were common in certain seasons for bison driving and jumping, trade and ceremonies.

The ethnicity of archaeological cultures is a continued focus of discussion. In the grassland plains and prairies of Canada, Reeves (1983) recognizes two major ethnic traditions that can be traced back some 4,500 years or more. The systematics of our archaeological cultures would seem to support the view that these basic ethnic divisions can be recognized in the archaeological record.

The end of prehistory is marked by the introduction of commerce in European goods, the introduction of the rifle and the introduction of the horse. The coming of European fur traders to the north would also mark the date of the first written record of First Nations distributions and behaviour. It would also mark the introduction of diseases that would greatly impact the native inhabitants. Archaeologists conventionally date the age of contact to the period between 1700 AD and 1750 AD. In a dialogue between Alberta and Saskatchewan archaeologists, the consensus was that at the time of contact, the study area was occupied by the Hidatsa (Magne 1987:224). By 1750, this distribution is still unchanged but by 1800 the Hidatsa are replaced by the Assiniboine who move south into new territory. In 1874, Treaty No. 4 was signed at Qu'Appelle with the Cree and "Saulteau (Chippewa)". In 1875, "the Chippewa, Cree and Assiniboine who had not been present at Qu'Appelle gave their adhesion to the treaty" (White 1913:476).

The Europeans

European influence far outpaced immigration into southern Saskatchewan. The first influence was the result of the westward spread of fur trading across the north. By 1700, most of the First Nations of the plains were acquainted with European goods. At that time trading posts had been established only as far west as Manitoba. Explorations into southern Saskatchewan were initiated by Henry Kelsey in 1691 (Epp 1993). As the fur trade spread across the north under the monopoly of the Hudson's Bay Company, interaction with the Aboriginal Nations increased. By the late 1700s, southern tribes were making seasonal trading trips to the posts to obtain European goods. In the late 1700s, independent fur traders mounted an offensive against the monopoly which involved the establishment of their own posts inland. These independently formed alliances contributed to the establishment of the North West Company in 1779. Competition continued for several decades and, in many cases, involved the construction of rival posts near to each other, sometimes within the same palisades. The good relationship dissolved in 1811 and the resultant conflict between the two trading companies were not resolved until 1821, when exclusive trade rights were granted for the North West Territories.

The influence of trade on the First Nations of Southern Saskatchewan was at first indirect as there was little fur available for trade. However, the expansion of the fur trade required the development of an infrastructure to support the traders. This led, for example, to the construction of "trading posts or forts on that river [North Saskatchewan] at intervals of about 200 miles, established partly for the trading of furs, but mainly for the purpose of procuring provisions from the vast herds of buffalo, on which their more valuable trading posts in the north districts depend for subsistence" (Spry 1968:2). One post, Chesterfield House, was constructed in 1822 at the junction of the Red Deer and South Saskatchewan Rivers but was abandoned soon after as being too costly and too dangerous (Spry 1968:150).

The Palliser expedition of 1857 - 1860, charged with assessing the possibilities for settlement in the west, explored much of south central Saskatchewan where arid lands were encountered. The northern extension of the American 'desert' was

described as extending “a short way into the British territory, forming a triangle, having for its base the 49th parallel from longitude 100˚ to 114˚ W, with its apex reaching to the 52nd parallel of latitude.” (Spry 1968:9). This area has come to be known as ‘Palliser’s Triangle’ and was pronounced unfit for agriculture.

Following Confederation in 1867, the Dominion Lands Act was passed (1872) in order to encourage settlement and development of the west. The North West Mounted Police were established in 1873 and were quick to mount an expedition to the west designed to bring order in view of the ongoing whisky trade. In short order, the North West Mounted Police “established patrol routes, police outposts, and spurred the development of permanent settlements” (Javorski 1983). Treaties, principally Treaty 4 with the Chippewa, Cree, and Assiniboine in 1874 and 1875, led to the establishment of Reserves. Over a period of two decades, the Dominion Land Survey was also active in mapping most of the arable lands in the Canadian Northwest, but these did not include the lands of Palliser’s Triangle, which remained unmapped until the arrival of the Canadian Pacific Railroad (C.P.R.).

In 1881, the decision was made to construct the C.P.R. directly west across the prairies rather than through the fertile belt to the north. This surprising decision was to have a profound influence on the course of settlement over the coming decades. Communities were soon established at many of the railway points and many of these grew into towns and cities. Indeed, this shift in the focus of settlement led to moving the capital of the Northwest Territories from Battleford to Regina in 1883.

Although earlier dismissed as unsuitable, it was quickly discovered that the southern district was, except for the absence of trees and surface water, exceptionally rich and more than suitable for the growing of grain. With this discovery, the settlement of southern Saskatchewan was assured.

METHODOLOGY

PRE-FIELD INVESTIGATION

Prior to the initiation of field studies, data relevant to the project were reviewed from the Saskatchewan Heritage Resources Branch, Ministry of Parks, Culture and Sport. Data were examined for heritage resources adjacent to the proposed development (in this case EdMp-1 was the only heritage site within 1 km) as well as a review of the previous research that had taken place in the immediate area. This included checking site inventory forms, the Provincial database, information drawn from previous investigations, available information on landforms and present conditions as derived from a review of NTS maps (e.g., contours and crossings of water courses).

At the request of of Klohn Crippen Berger Ltd., acting as agent for The Water Security Agency, an archaeological permit to conduct the HRIA was acquired on October 28, 2015 (HCB Permit #15-159). This HRIA was a requirement outlined in a direction letter issued by the Saskatchewan Heritage Conservation Branch on 13 June 2012 (File: 14-2906). The Saskatchewan Heritage Conservation Branch determined that an HRIA was warranted at this location based on the presence of moderate to high potential landforms in the project area.

PROCEDURE OF SITE DISCOVERY

Typically, all areas to be investigated are covered by foot traverses walking a judgmental course with a focus on small landform features deemed to be of archaeological potential (e.g., knolls, slough edges, breaks in slope, tributary terraces). The primary means of site discovery is through an examination of man made disturbances (e.g., cultivated fields, road cuts, vehicle tracks) and natural areas of exposure (e.g., animal burrows, blowouts, tree throws, creek banks, and erosional surfaces). Where exposures are not present and where there is, in the opinion of the archaeologist, a moderate to high potential for the presence of Heritage Resources, shovel tests are employed for site prospecting.

Shovel tests under conventional HRIA work include hand excavations nominally measuring 40 x 40 cm and excavated to glacial deposits. Areas of deep sedimentation were assessed by excavating 1 m x 1 m test units. These units were excavated to the depth of sterile sedimentary deposits. The spoil of all the tests is then hand sorted to determine if cultural material is present. Where present the material is then collected for later cataloguing, description and analysis. Also if present, the location is recorded and additional shovel tests are excavated for the purpose of assessing the site. The purpose of the additional testing is to determine the extent of the site, the number and depth of cultural components, the density of cultural material, the range of artifact types present, the integrity of the site and, in general, the age and cultural affiliation of the site.

PROCEDURE FOR SITE ASSESSMENT

While the fundamental goal of archaeological survey is the identification of heritage resources; once found, the primary objective is the assessment of these resources so that significant resources might be protected by avoidance, impacts minimized by redesign, or that the information contained in the resource can be conserved by means of excavating a representative sample and recording contextual data in which it occurs. The significance of a site is based on a consideration of physical parameters (e.g., integrity [disturbance or mixing], size, depth, stratigraphy, number of occupations, content, artifact density, presence of datable bone, etc.) and archaeological values (e.g., range and variability of materials, context, season of use, age, and cultural affiliation). Assessment involves the excavation of additional shovel tests outward from the find spot until boundaries can be established. If excessively large or complex, this initial assessment of a heritage resource may require recommendations for further assessment including sample excavations. While it is possible to assess many of the physical parameters of a heritage resource, it is not always possible to determine the extent of archaeological characteristics by means of shovel testing. Instead, shovel test results would, at least, permit a determination of the potential of a site to yield valuable information. If, for example, a program of shovel

testing yields a high density of bone, this would indicate a high potential for the site to yield, in the course of sample excavations, information useful for the determination of site function, patterns of butchering, MNI information (e.g., number of individuals) and seasonality. When determined to be significant by this means, recommendations would be provided for avoiding, minimizing impacts to, or conserving the heritage resource.

PROCEDURE OF ANALYSIS

All surface artifacts collected, and all artifacts recovered from shovel testing or backhoe testing are catalogued and described. Lithic artifacts are described and typed using metric and non-metric attributes as set out by Brian Reeves for work in Waterton National Park (1972). Ancillary materials such as fire-cracked rock are weighed and sized, by categories, in the field and discarded. Sediment samples in positive tests are described by colour, texture, and stratigraphic profile.

RESULTS

On November 9, 2015, the author, with the assistance of field personnel, conducted the HRIA for the proposed Water Security Agency - Crooked Lake Outlet Structure Replacement project.

The proposed development will impact 7.8 ha of a mix of disturbed and undisturbed land on the eastern end of Crooked Lake, SK. Ten subsurface tests were excavated during this HRIA within the proposed development right-of-way in search of potential new sites (Figure 4). All shovel tests were negative for cultural material. During the fieldwork investigations, no previously unidentified heritage resource sites were recorded, and no known sites were revisited.

The project area consists of two polygons: one on the west side of the Crooked Lake outlet structure and one on the east side. The polygon on the west side follows an access trail that runs from a paved road to the western edge of the outlet structure (Figure 5). This access trail will be improved to become an access road. The western polygon was observed in the field to be completely disturbed. The northern portion of this polygon consisted of a constructed berm (Figure 6), and the southern half consisted of the edge of a cultivated field (Figure 7). Five shovel tests were excavated along the southern edge of the western polygon. These tests exhibited a disturbed soil profile that included black loam to 20 cm bs, a distinct plough line, and then clay sand mixed with gravel to at least 40 cm bs (Figure 8). A section of cutbank on the eastern edge of this polygon was also examined. The profile of this cutbank showed that at least 50 cm of overburden overlies the underlying sediments that consisted of sand and gravel flood deposits (Figure 9). No palaeosols or heritage materials were observed in the underlying deposits, so no deep tests were excavated in this area.

The eastern polygon included both disturbed and undisturbed terrain. The disturbed areas consisted of a gravel access road that ran from Highway 247 in the north to the east edge of the outlet structure (Figure 10), and a cleared area (Figure 11) between the access road and the gravel beach at the edge of crooked lake (Figure 12). Buried tanks and electrical infrastructure were also observed in this clearing

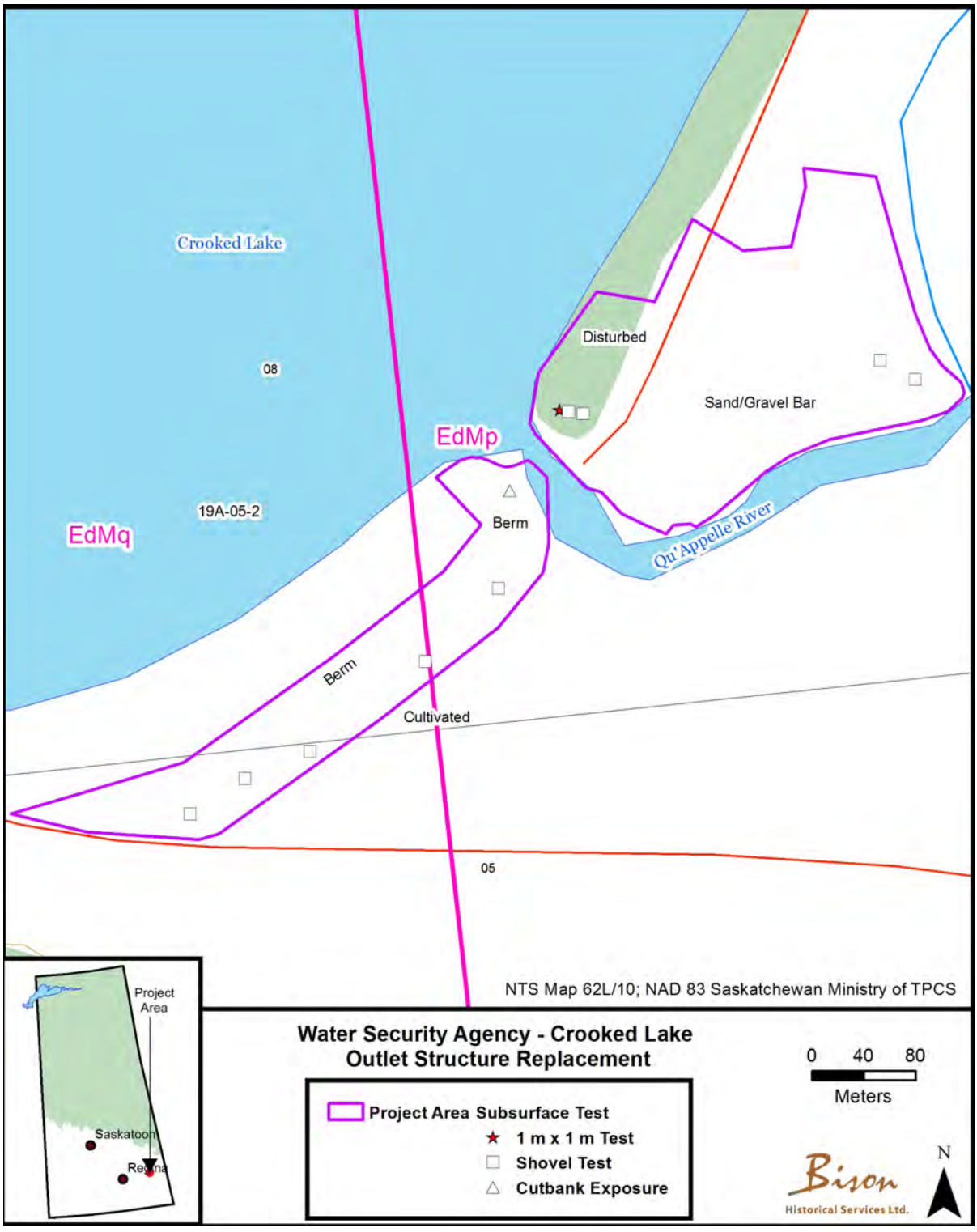

Figure 4: Map of shovel tests in project area

Figure 5: Access trail in the western polygon, view west

Figure 6: Berm in the western polygon, view north

Figure 7: Cultivated field in the western polygon, view southeast

Figure 8: Sediment profile of shovel tests excavated in the cultivated field

Figure 9: Sediment profile of the cutbank in the western polygon

Figure 10: Access road in the eastern polygon, view northeast

Figure 11: Cleared area in the western polygon, view southwest

Figure 12: Gravel beach northwest of the cleared area, view north

(Figure 13 and Figure 14). No subsurface testing was conducted in the disturbed areas in the eastern polygon.

Two areas of mostly undisturbed terrain were also observed in the eastern polygon. The largest of these is located southeast of the access road. This area consisted of a large sand/gravel bar on the inner bend of the Qu'Appelle River. This area was observed to be a seasonal marsh (Figure 15 and Figure 16). The sediment profiles of the two shovel tests excavated in this area consisted of 10 cm of sand on top of wet, black organic material to at least 50 cm bs, at which point the water table was encountered (Figure 17). This area was then assessed in the field to be of low potential for the discovery of buried heritage resources, so further testing was not conducted.

The second mostly undisturbed area was located between the access road, the edge of Crooked Lake and the outlet of the lake. This area included a low-lying seasonally wet area full of willows, which was not tested and smaller, higher landform that was suitable for testing (Figure 18 and Figure 19). Two shovel tests were excavated in this approximately 25 m x 20 m area. These tests exhibited a deep sediment profile underneath overlying construction over burden, so an additional 1 m x 1 m test was excavated to further assess the underlying deposits. The sediment profile of this deep test included construction overburden to 23 cm bs, followed by a silty black palaeosol to 25 cm bs, followed by gray sand to 33 cm bs, then a second palaeosol to 38 cm bs, then by a gravel lens to 53 cm bs, then by white, loose sand to 62 cm bs, then by another palaeosol to 67 cm bs, then by another gravel lens to 75 cm bs, then by gray sand to 94 cm bs, then by another palaeosol to 99 cm bs, then by a sand and gravel mix to 125 cm bs, then by a gravel lens to 127 cm bs, and finally by gray anaerobic clay to 130 cm bs, at which point the test was terminated (Figure 20). Three bison long bone fragments were recovered from the sand/gravel deposit at 100 - 105 cm bs. The broken edges of these fragments were heavily rounded, which suggests that they were fluvially deposited. No evidence of cultural modification were observed on any of the bones, and no cultural material was recovered from the deep test. It is very likely that these faunal elements were deposited at this location during

Figure 13: Underground tank access in the cleared area

Figure 14: Electrical infrastructure near the cleared area

Figure 15: Sand/gravel bar in the eastern polygon, view northeast

Figure 16: Another view of the sand/gravel bar, view northwest

Figure 17: Profile of shovel tests on the sand/gravel bar

Figure 18: Higher landform in the eastern polygon, view southeast

Figure 19: Another view of the higher landform, view north

Figure 20: Profile of the deep test excavated in the eastern polygon

a past flood event, and therefore do not represent an archaeological assemblage.

In summary, the majority of the project area was found in the field to be disturbed, and therefore of low potential for heritage resources. Throughout the project area nine shovel tests, one 1 m x 1 m test, and a cutbank were examined for heritage materials, but none were observed. Based on these findings, no further archaeological investigations are recommended for this project.

SUMMARY AND RECOMMENDATIONS

On behalf of Klohn Crippen Berger Ltd., acting as agent for The Water Security Agency, Bison Historical Services Ltd. has conducted a Historical Resources Impact Assessment (HRIA) of the Water Security Agency - Crooked Lake Outlet Structure Replacement project. The project will involve replacement of the existing 9-bay concrete and timber control structure at the outlet of Crooked Lake into the Qu'Appelle River.

During the HRIA field investigations on November 9, 2015, no new historical resource sites were recorded as a result of visual inspection of the proposed project area, and none of the 10 subsurface tests excavated within the study area contained evidence of cultural materials.

Based on the fact that no heritage materials were observed in the project area, and that no previously recorded heritage resource sites will be impacted, **no further archaeological investigations are recommended in association with the Water Security Agency - Crooked Lake Outlet Structure Replacement project.** Therefore, **it is recommended that the Water Security Agency - Crooked Lake Outlet Structure Replacement project be given clearance to proceed with construction.** This recommendation is subject to the approval of Heritage Conservation Branch.

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APPENDIX A: PROJECT PLANS

Water Security Agency - Crooked Lake Outlet Structure Replacement

Bison No. **1511-0100**; Permit No. **15-159**


60 m

APPENDIX B: Direction Letter

HCB File #: 14-2906

Saskatchewan

Ministry of
Tourism, Parks,
Culture and Sport

Heritage Conservation Branch
2nd Floor 3211 Albert Street
Regina, Saskatchewan
S4S 5W6

(306) 787-5774
nathan.friesen@gov.sk.ca

December 3, 2014

Our File: 14-2906

Mr. Robert Parker
Water Security Agency
400 – 111 Fairford Street East
MOOSE JAW SK S6H 7X9

Dear Mr. Parker:

RE: Replacement of Water Control Structure at Crooked Lake Outlet: Section 8-19A-5 W2M (Your File: D205-19A-08 C); HERITAGE RESOURCE REVIEW

Thank you for referring this development proposal to our office for heritage resource review.

In determining the need for, and scope of, heritage resource impact assessment (HRIA) pursuant to S. 63 of *The Heritage Property Act*, the following factors were considered: the presence of previously recorded heritage sites, the area's overall heritage resource potential, the extent of previous land disturbance, and the scope of new proposed land development.

No known archaeological sites are in direct conflict with the proposed development. One site (EdMp-1) is located in the project area. The site is represented by a human burial. The heritage potential for this project is considered moderate to high. Since there is the potential for heritage sites to be adversely affected by development in this area, an HRIA is required for the water control structure.

The HRIA study, including systematic pedestrian survey and sub-surface test exploration, is a proponent responsibility. The study will first establish the presence of heritage sites within the project area, as well as where suitable site avoidance measures (including the right-of-way relocation) may be implemented. The study will also establish the content, structure, and importance of those heritage sites located in unavoidable conflict with development. On that basis, both the need for and scope of any mitigation follow-up (including archaeological salvage excavation or other preservation action) will be determined. The HRIA must be carried out by qualified personnel under an approved investigation permit issued through this office. Normally, two days are required to process a heritage contractor's permit application.

...2

Assuming weather conditions and surface visibility are favourable, a conventional HRIA, including routine pedestrian reconnaissance and subsurface testing, is required prior to construction. However, if field conditions are limiting (e.g. by snow cover and ground frost), a conventional HRIA may not be possible. Under these conditions, a qualified consulting archaeologist should be on-site to carefully monitor snow and topsoil stripping in all sensitive areas. Where possible, snow removal should be completed with a power sweeper. This will ensure that surface features (such as tipi rings and cairns) will be exposed but not disrupted. Monitoring will ensure that if heritage resources are uncovered during construction, they can be immediately assessed, and, if deemed significant, any further destruction can perhaps be averted. The need for any follow-up investigation next spring (e.g. post-impact assessment, compensatory salvage, or other conservation action) will also be determined at this time.

If you have any questions regarding this project please do not hesitate to contact me or Wade Dargin at the above address or by calling 787-5753.

Sincerely,

Nathan Friesen
Senior Archaeologist
Archaeological Resource Management

Bison

Historical Services Ltd.

ARCHAEOLOGY & HERITAGE CONSULTANTS

ALBERTA OFFICE (MAIN)

1A, 215 - 36 Avenue NE
Calgary, AB T2E 2L4
Ph: (403) 283-8974
Fax: (403) 270-0575

SASKATCHEWAN OFFICE

P.O. Box 22063 RPO Wildwood
Saskatoon, SK S7H 5P1
Ph: (306) 249-4242
Fax: (306) 249-4004

MANITOBA OFFICE

268 Lynbrook Drive
Winnipeg, MB R3R 0S7
Ph: (204) 805-6841

www.bisonhistorical.com

BISON IS PROUDLY COMPLIANT WITH THE FOLLOWING SAFETY PROGRAMS.

COMPLYWORKS Get ready to work.

ENFORM

APPENDIX VIII

Stakeholder Engagement

SASKATCHEWAN

Water Security Agency

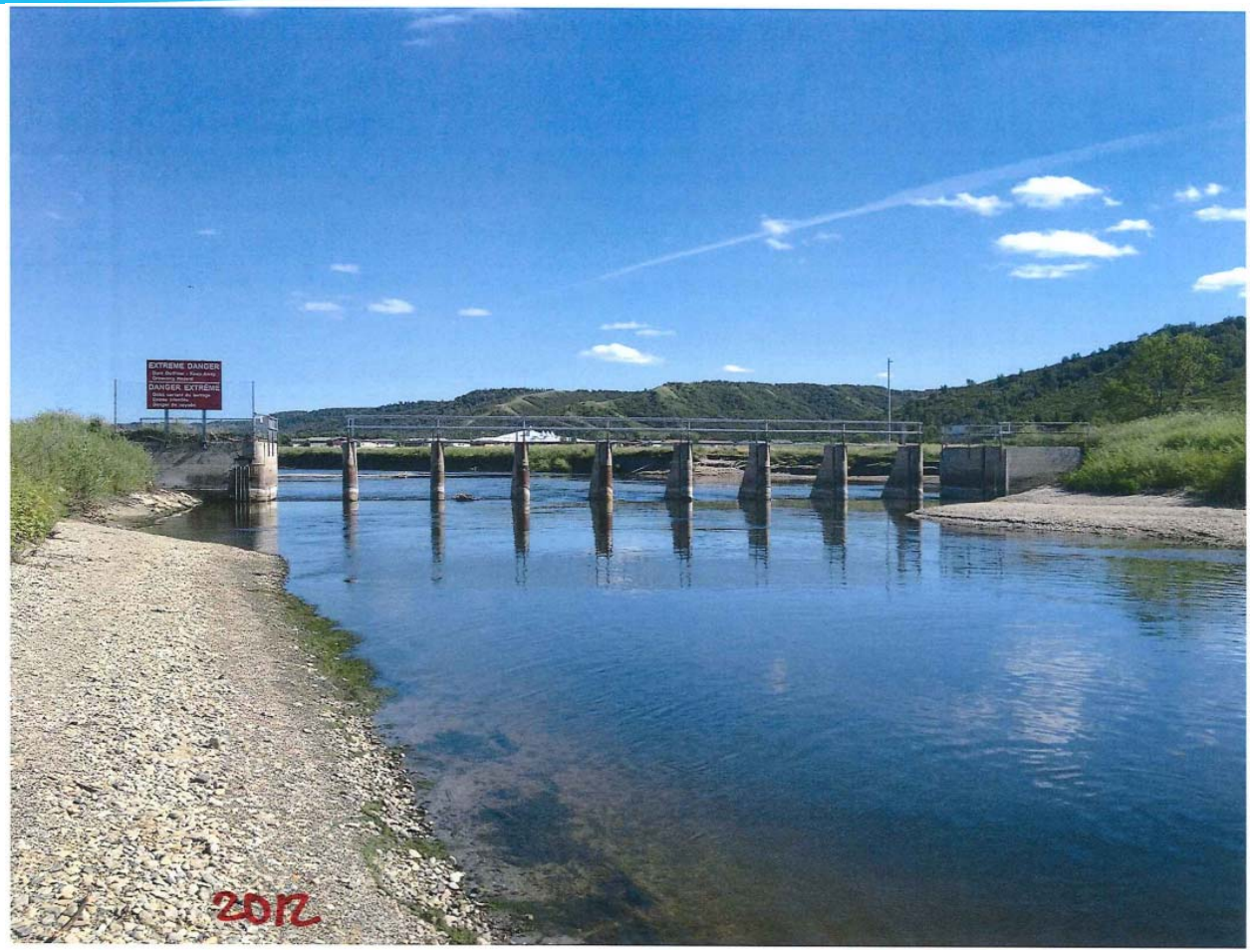
Crooked Lake Structure Replacement and Project Improvements

Second round of Presentations including a Summary of work completed to date and Details of the Pre-Design

May 2016

Existing Facilities Plan

Existing Outlet Structure

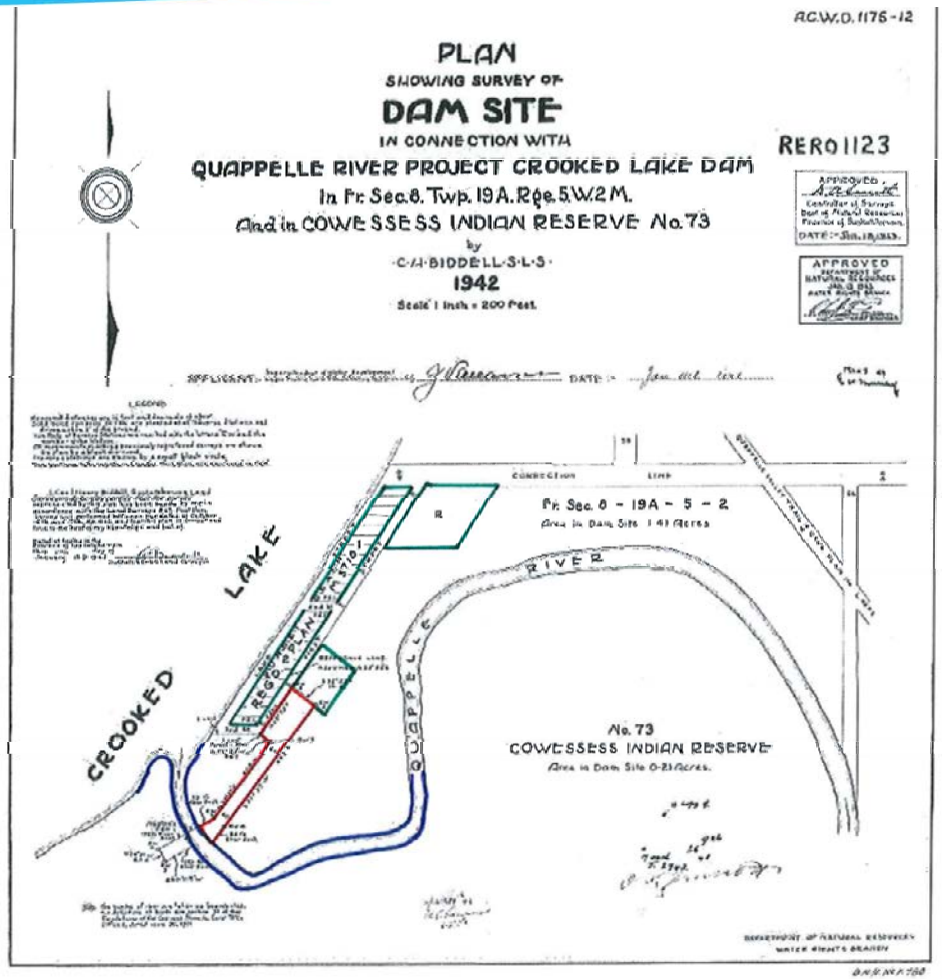


Existing Outlet Structure

2014 Flood

2014 Flood

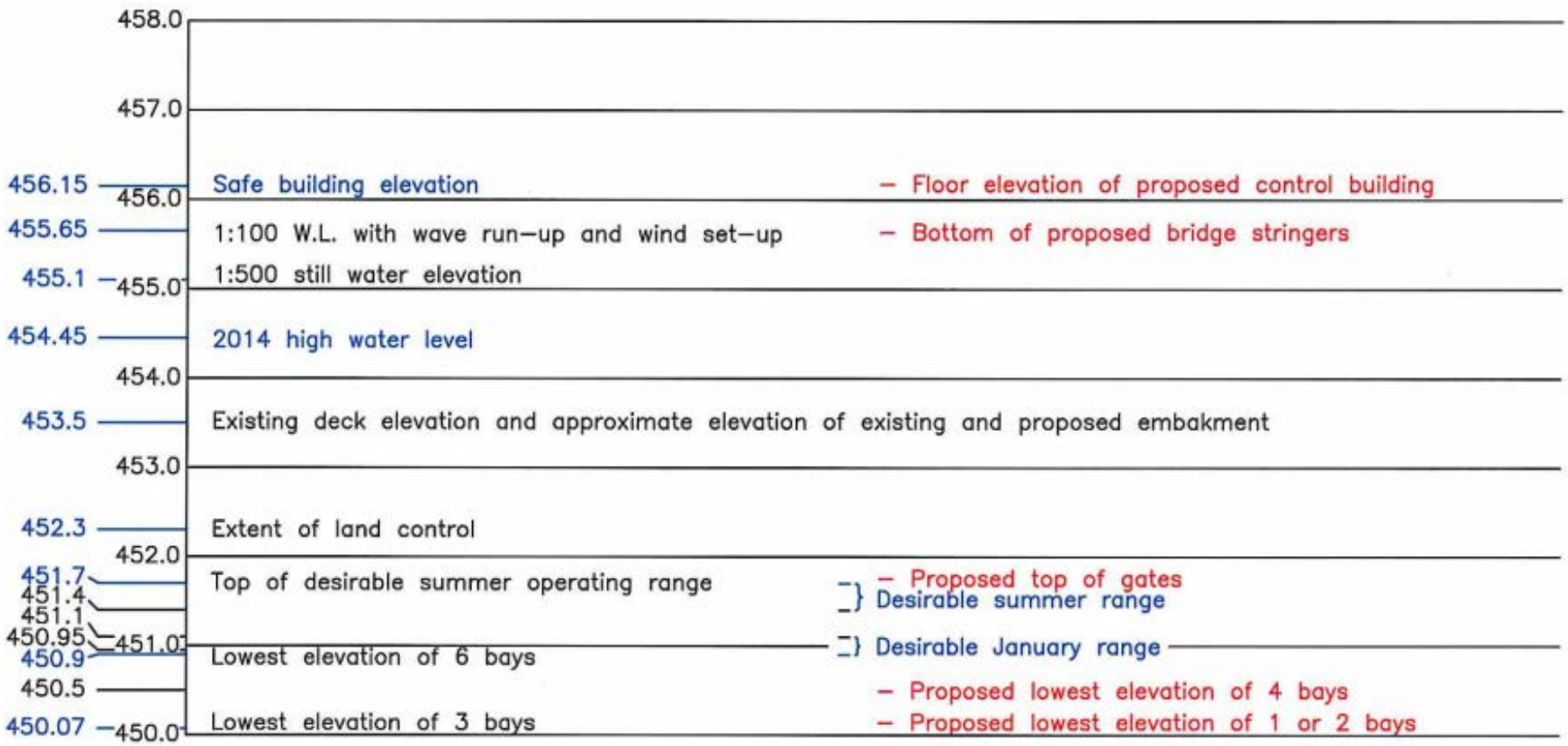
Property Ownership



Desirable Operating Ranges of Crooked Lake

Month	Minimum	Maximum
January	450.95	451.1
February	450.95	451.1
March	450.95	452.02
April	450.95	452.02
May	451.26	451.87
June	451.41	451.71
July	451.41	451.71
August	451.41	451.71
September	451.26	451.71
October	451.10	451.56
November	451.10	451.41
December	450.95	451.26

Outlet Structure Elevations

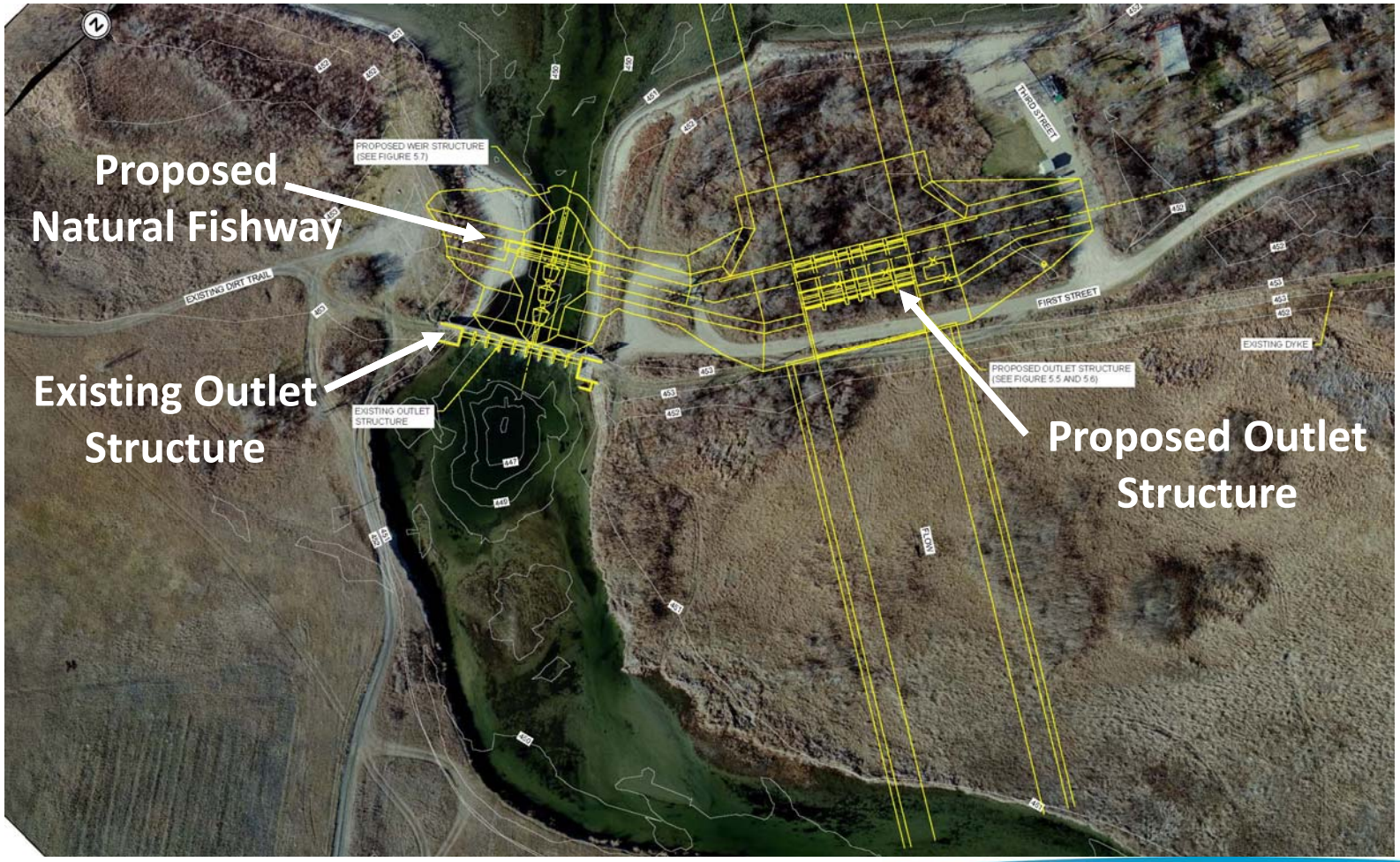


Other Design Criteria

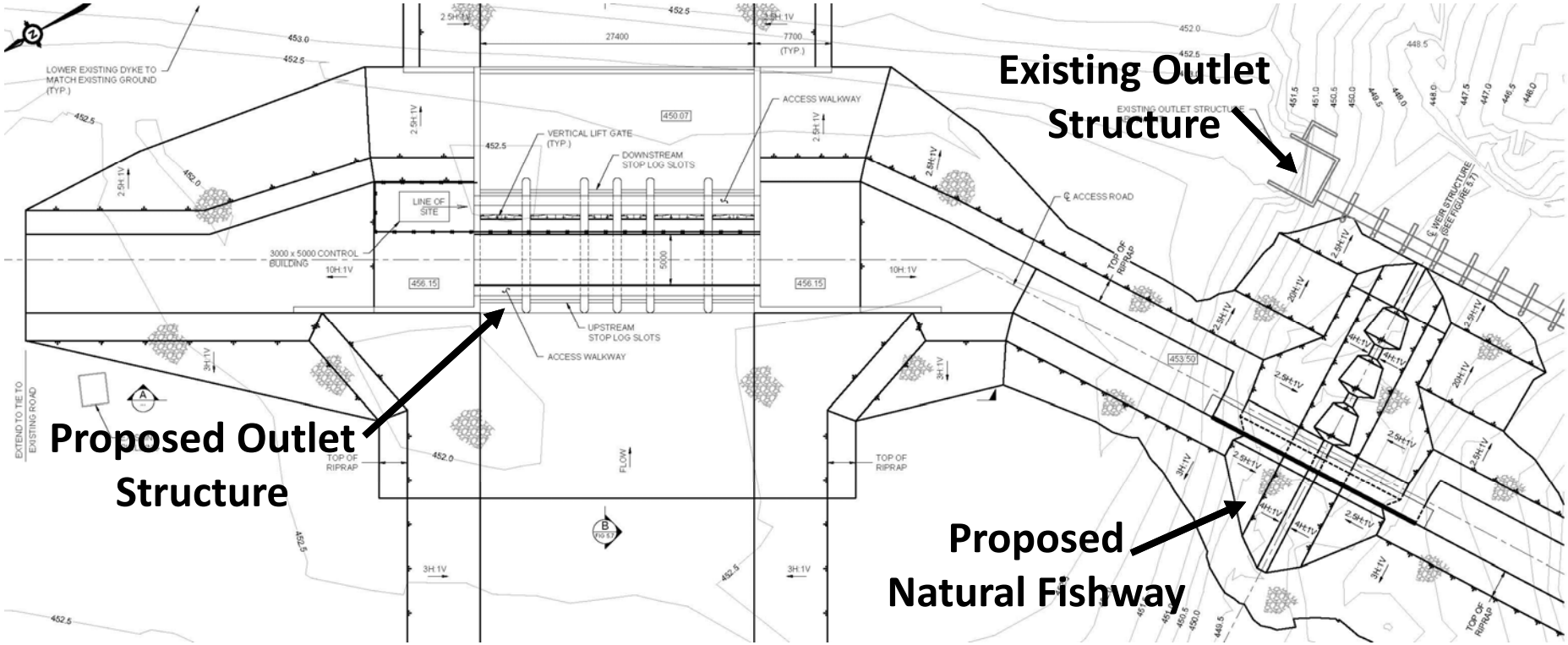
- Meet Canadian Dam Association (CDA) Dam Safety Criteria for:
  - Inflow Design Flood
  - Earthquake Design Ground Motion
- Improved functionality during flood events
  - Gates to replace stoplogs
  - Control building above safe building level (El. 456.15 m)
- Improved fish passage through nature-like fishway:
  - Designated design fish: Walleye of 300 mm fork length
  - Critical migration period of April 1 to May 15
  - Fish passage will attempt to be made possible between lake levels of 452.0 m and 451.7 m

Site Selection

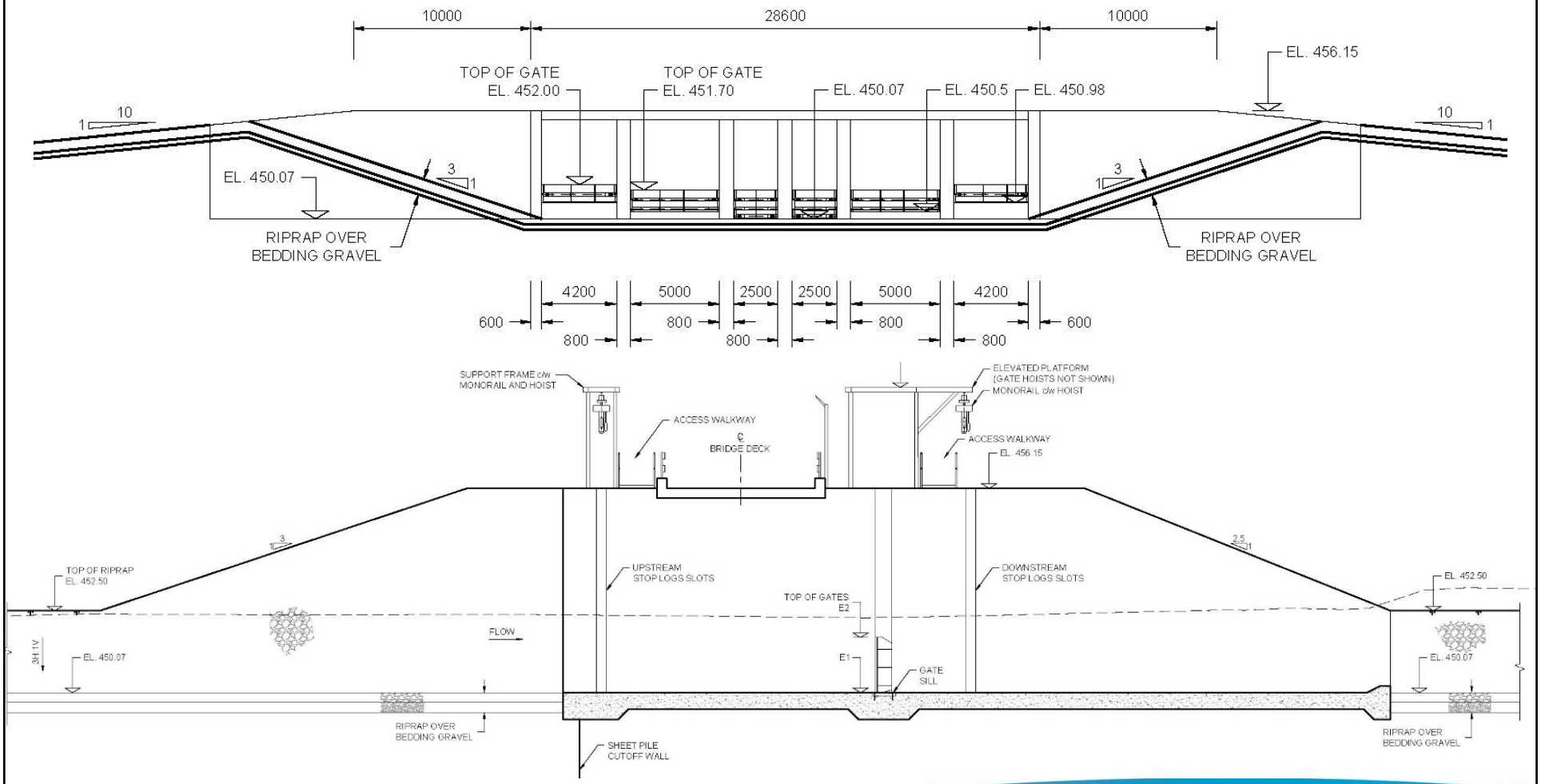
Proposed Structures Location Plan



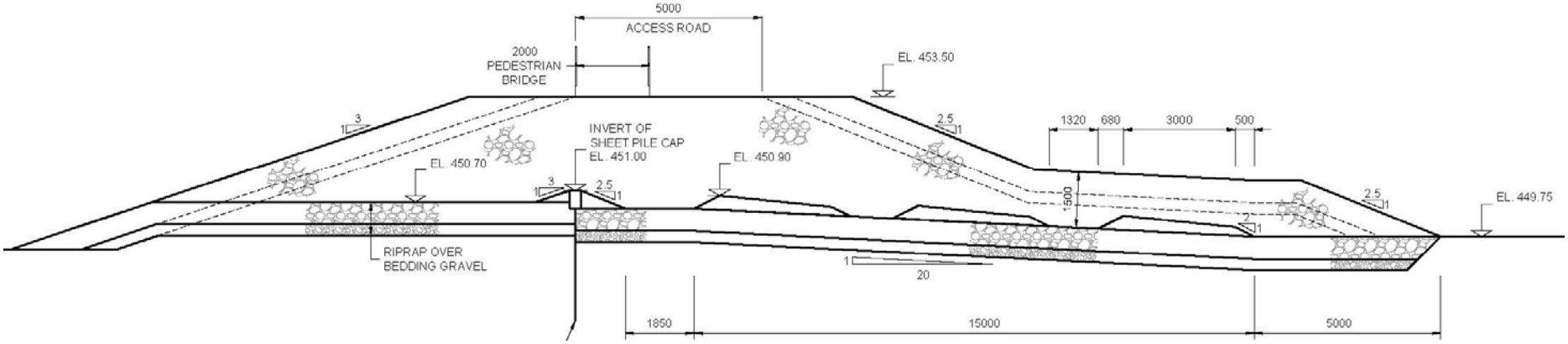
Proposed Outlet Structure Plan

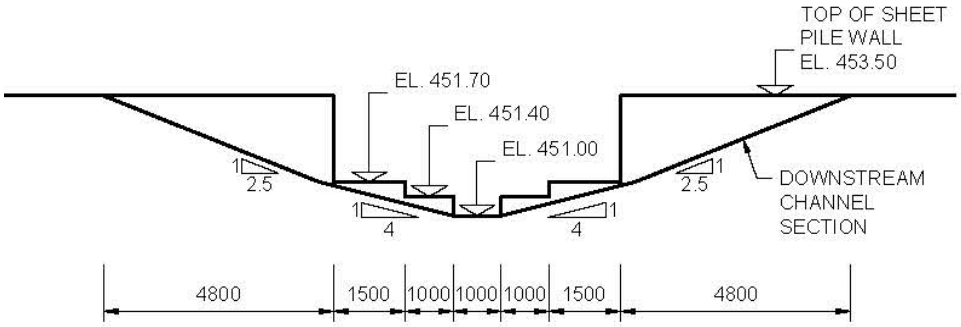


Proposed Outlet Structure Sections



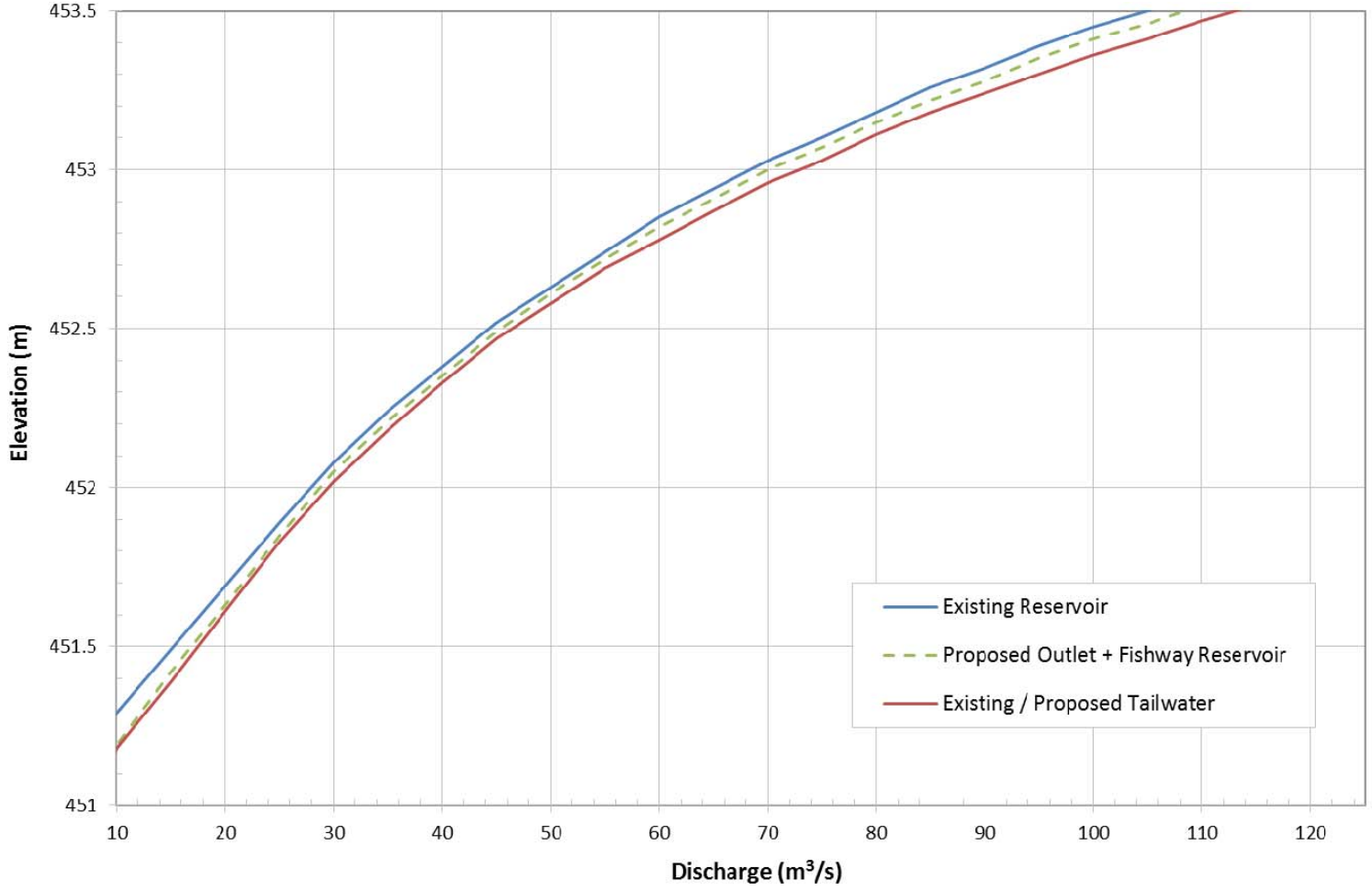
Proposed Fishway Sections





- Pool and riffle fishway
- Will include pedestrian bridge
- Sheet pile wall controls discharge into existing channel

Discharge Rating Curve Comparison



Schedule - Part 1 (Completed)

- SITE LOCATION SELECTION – Nov. 17, 2015
- TOPOGRAPHIC AND BATHYMETRIC SURVEY – November 2015
- HERITAGE RESOURCE STUDY – Clearance provided Dec. 2, 2015
- CONCEPTUAL DESIGN REPORT – April 22, 2016
- GEOTECHNICAL INVESTIGATION – Drilling Program March 3-10, 2016; Lab Testing Completed May 2016

Schedule - Part 2 (Upcoming)

- ENVIRONMENTAL ASSESSMENT – Field Work: May to July 2016
- PRELIMINARY DESIGN – Complete by July 2016
- DETAILED DESIGN – Complete by November 2016
- TENDER PACKAGE AND CONSTRUCTION DRAWINGS – Complete by February 2017
- CONSTRUCTION – 2017

Crooked Lake Outlet Structure Replacement

Questions?

SASKATCHEWAN

Water Security Agency

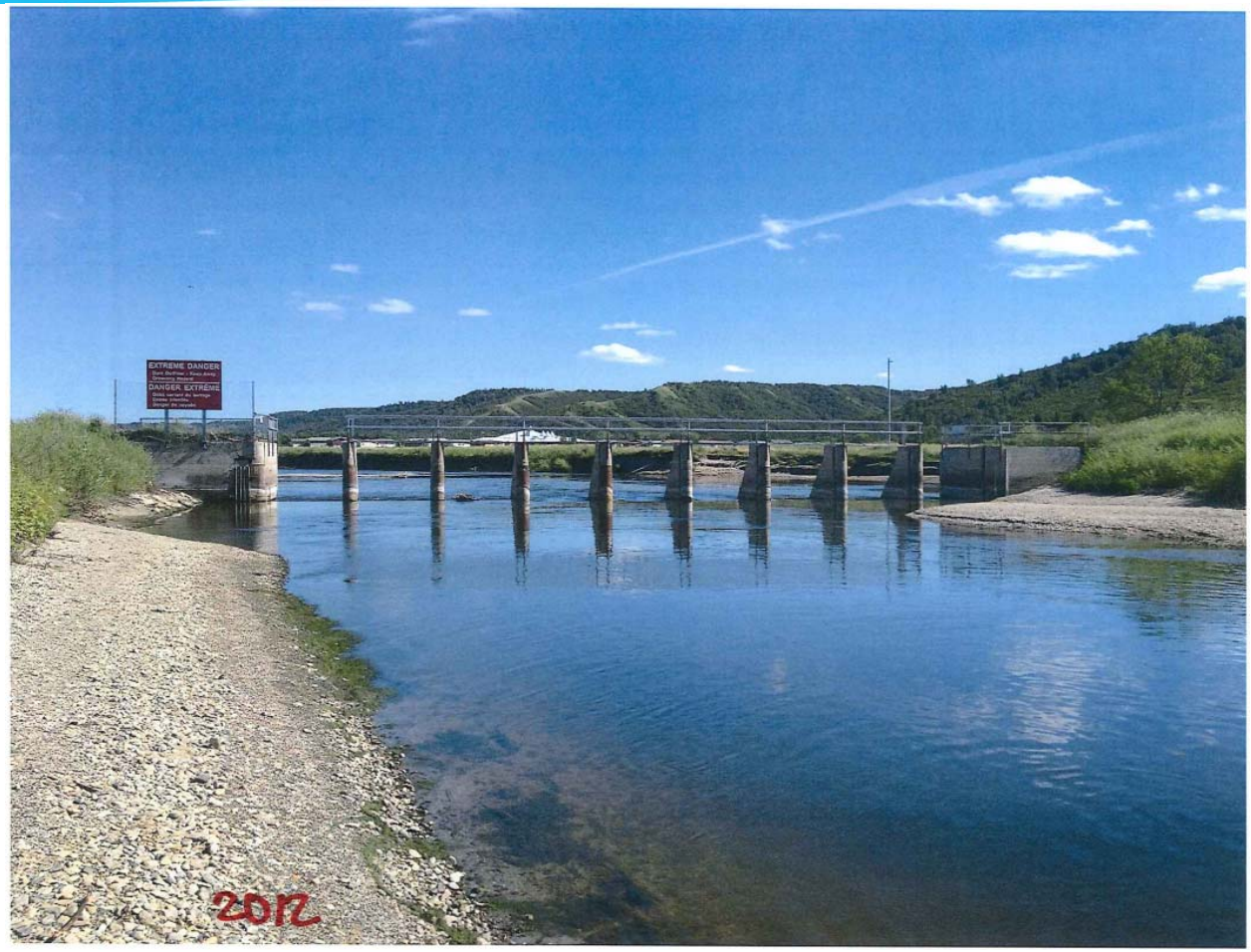
Crooked Lake Structure Replacement and Project Improvements

Third round of Presentations including a Summary of work completed to date and Details of the Preliminary Design

September 2016

Existing Facilities Plan

Existing Outlet Structure

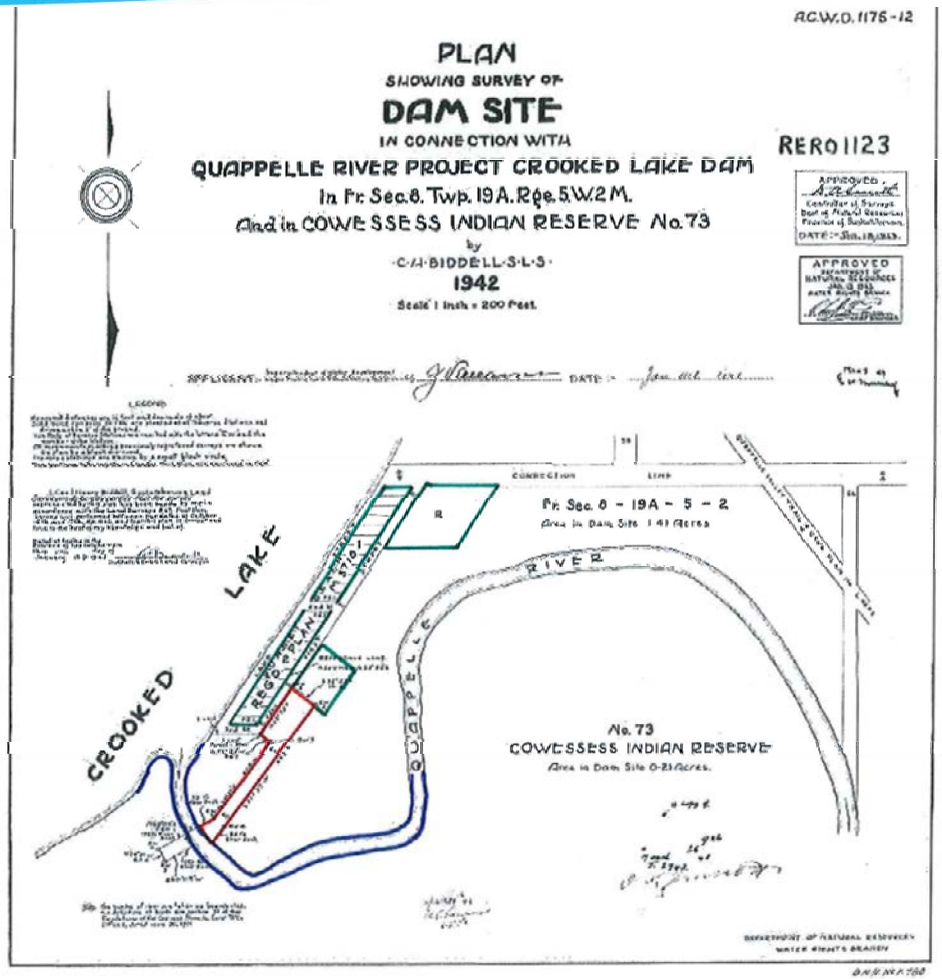


Existing Outlet Structure

2014 Flood

2014 Flood

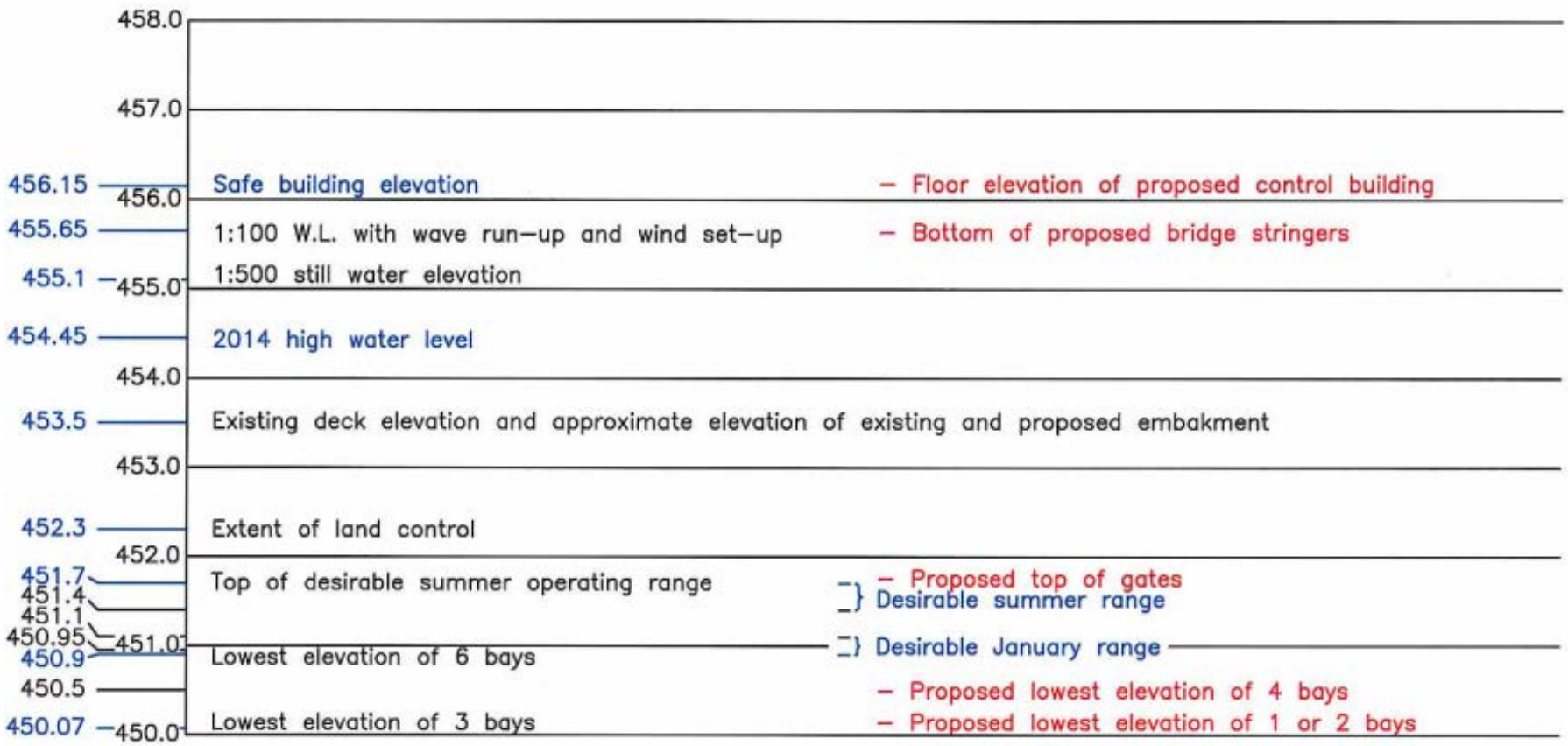
Property Ownership



Target Operating Ranges of Crooked Lake

Month	Minimum	Maximum
January	450.95	451.1
February	450.95	451.1
March	450.95	452.02
April	450.95	452.02
May	451.26	451.87
June	451.41	451.71
July	451.41	451.71
August	451.41	451.71
September	451.26	451.71
October	451.10	451.56
November	451.10	451.41
December	450.95	451.26

Outlet Structure Elevations

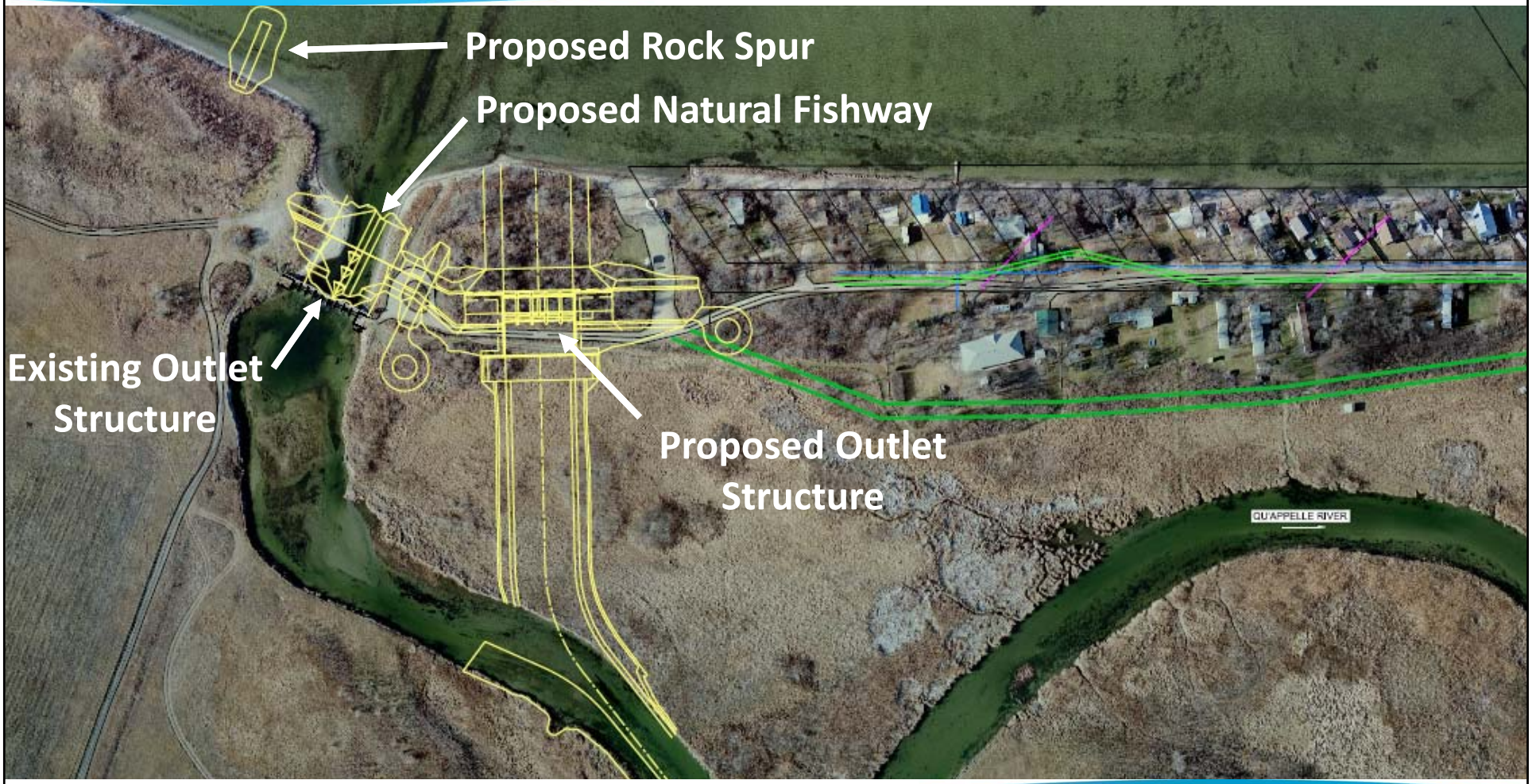


Other Design Criteria

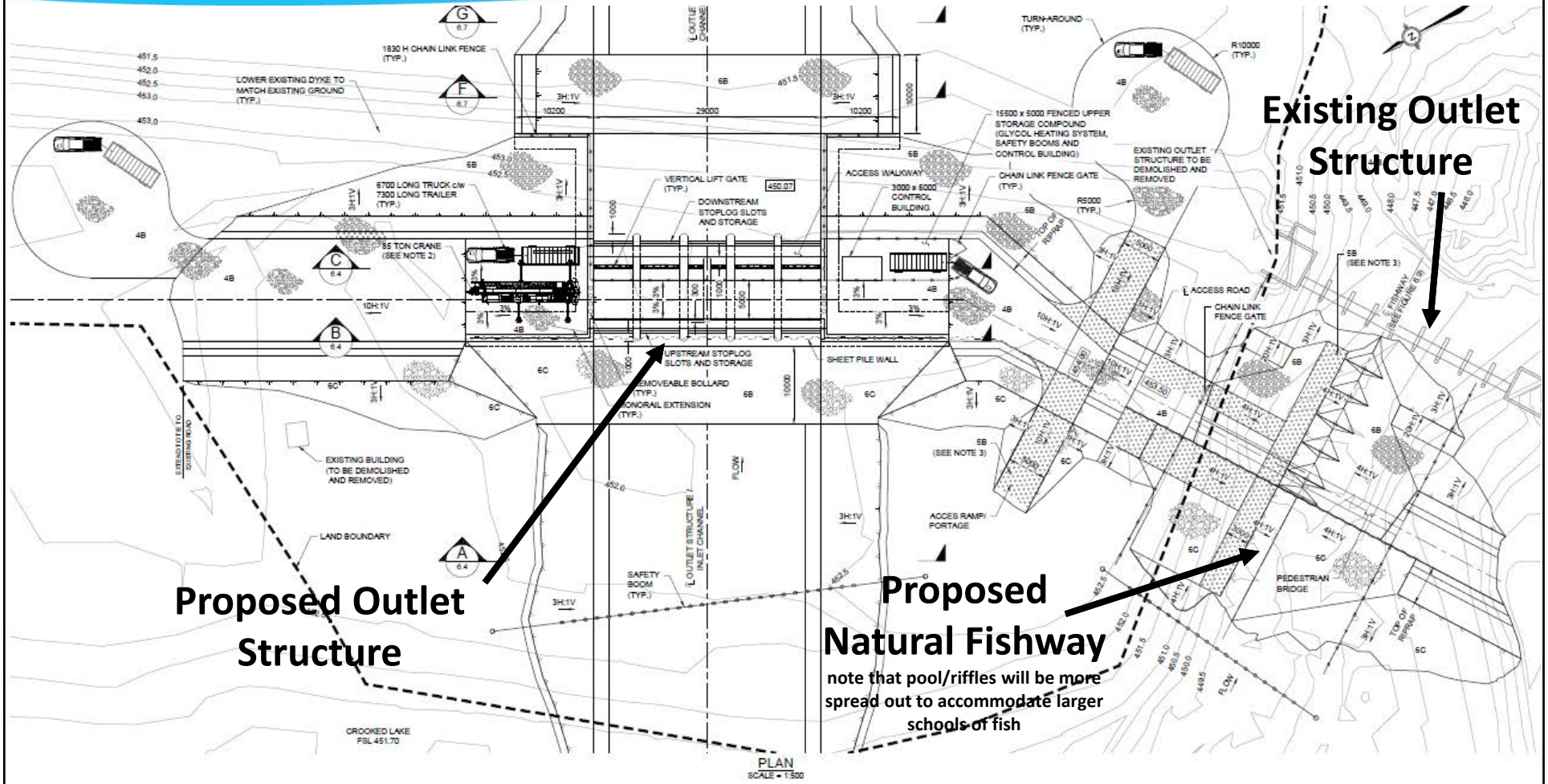
- Meet Canadian Dam Association (CDA) Dam Safety Guidelines for:
  - Earthquake Design Ground Motion
- Improved functionality during flood events
  - Gates to replace stoplogs
  - Control building above safe building level (El. 456.15 m)
  - However access to structure during flood events will still be a problem
- Improved fish passage through nature-like fishway:
  - Designated design fish: Walleye of 300 mm fork length
  - Critical migration period of April 1 to May 15
  - Fish passage will attempt to be made possible between lake levels of 452.0 m and 451.7 m

Site Selection

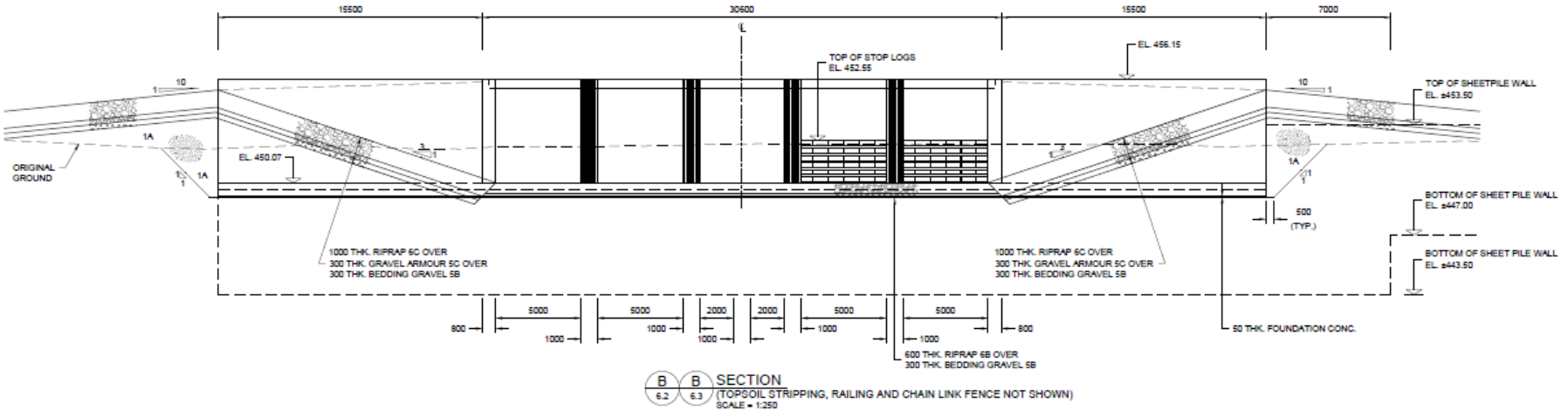
Proposed Structures Location Plan

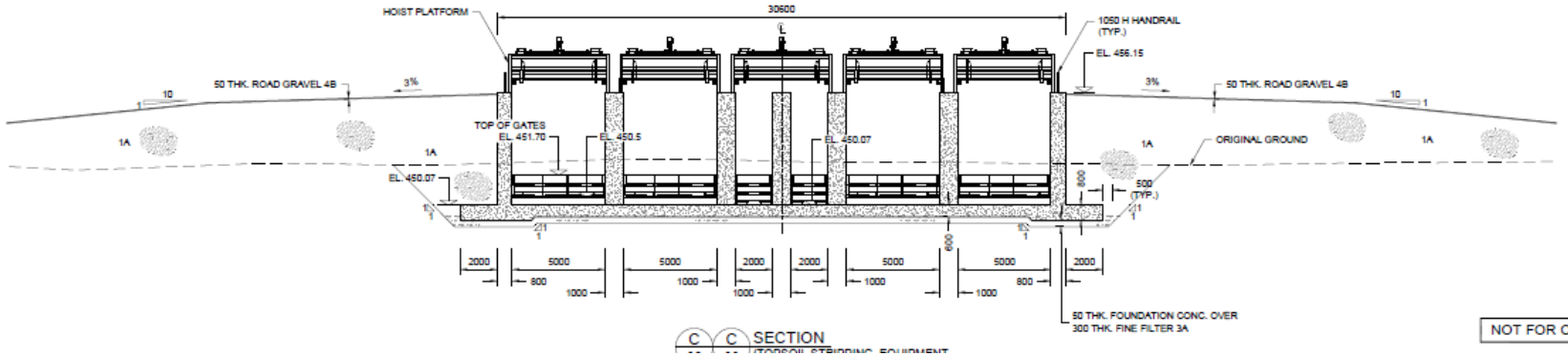


Proposed Outlet Structure Plan



Proposed Outlet Structure Sections

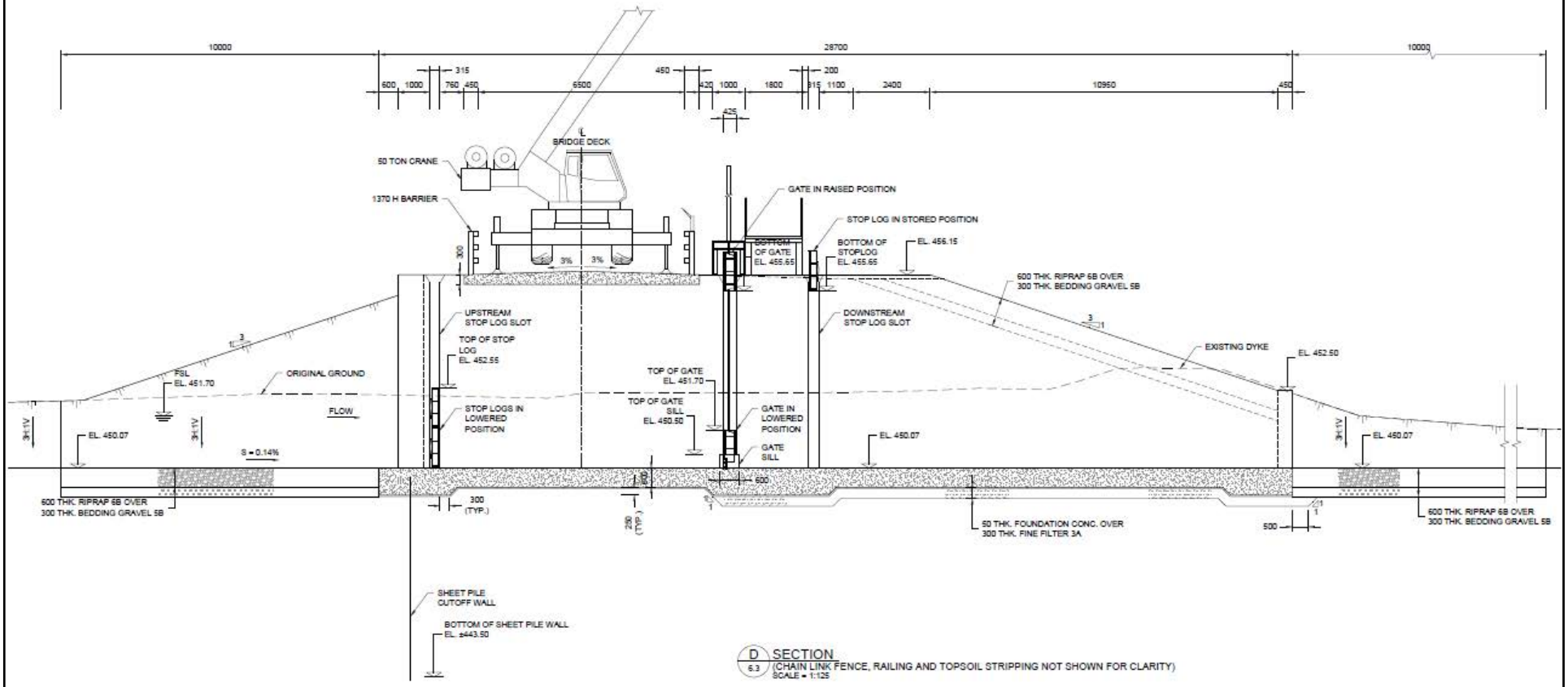




DRAFT

NOT FOR CONSTRUCTION

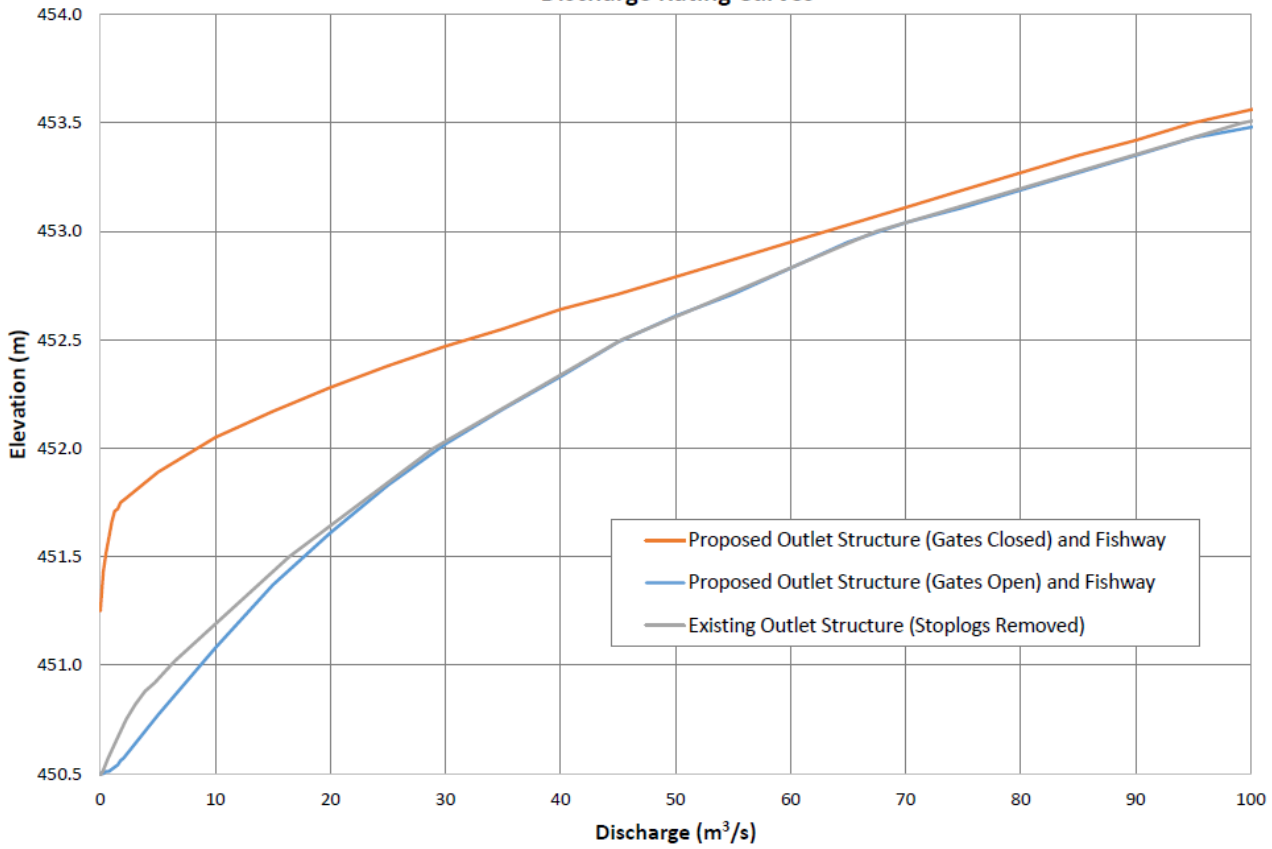
Proposed Outlet Structure Profile



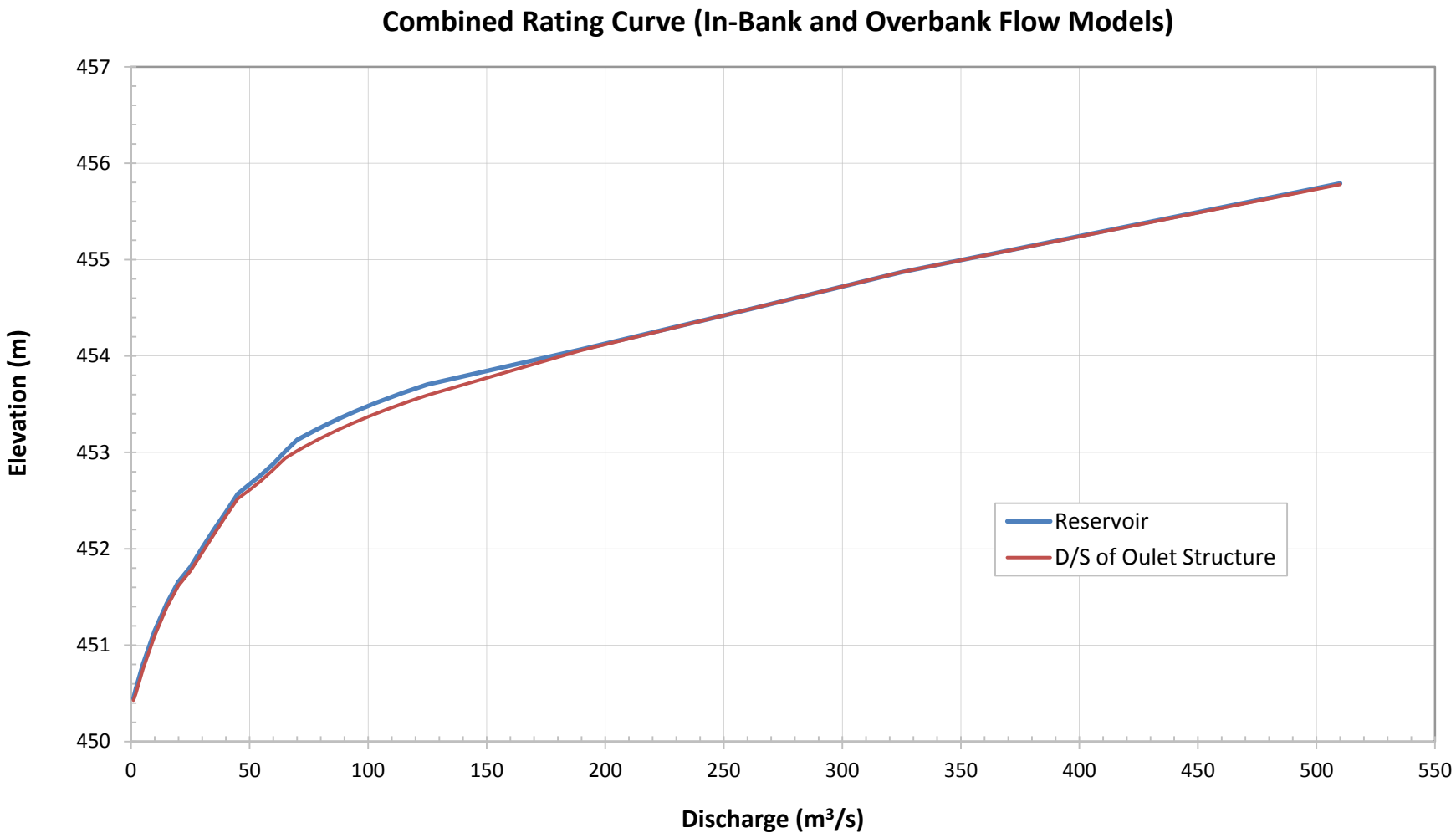
D 6.3 SECTION
(CHAIN LINK FENCE, RAILING AND TOPSOIL STRIPPING NOT SHOWN FOR CLARITY)
SCALE = 1:125

Discharge Rating Curve Comparison

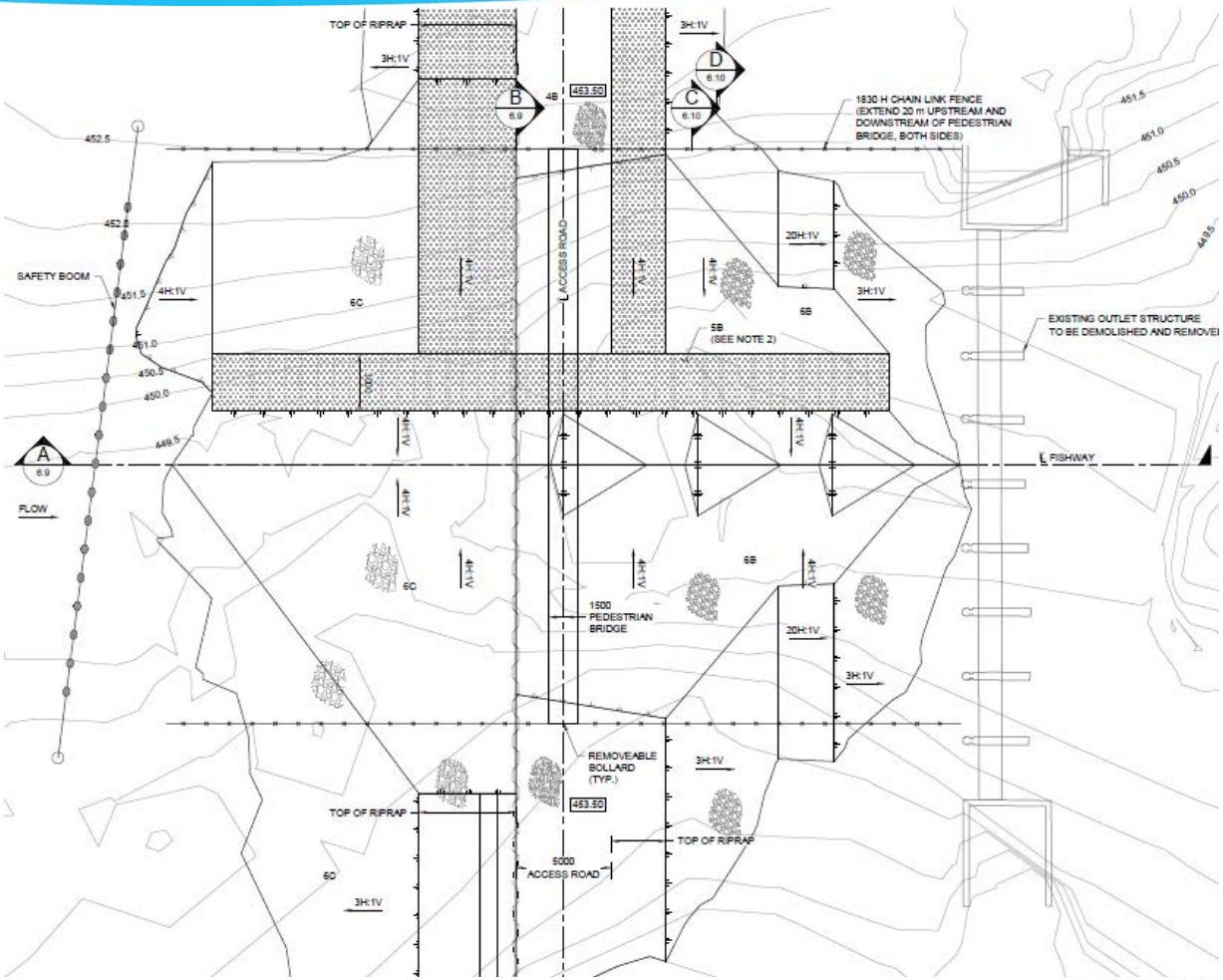
Figure 6.18
Crooked Lake Existing and Proposed Outlet Structures
Discharge Rating Curves



Crooked Lake Outlet Structure Replacement

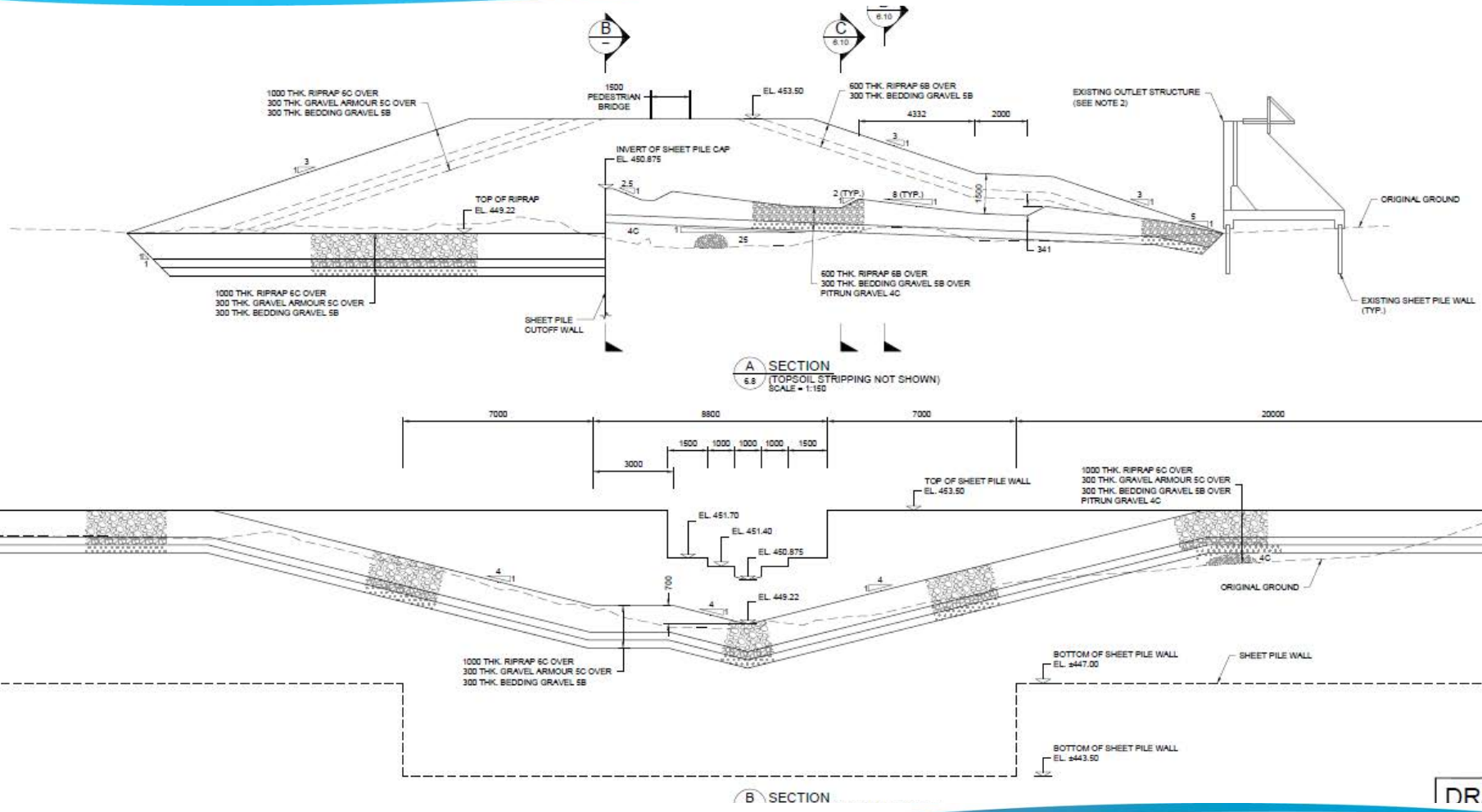


Proposed Fishway Plan



- Pool and riffle fishway
- Will include pedestrian bridge
- Sheet pile wall controls discharge into existing channel

Proposed Fishway Sections



Examples of Pool and Riffle Fishways

- La Plonge, SK

Examples of Pool and Riffle Fishways

- Makwa, SK

Examples of Pool and Riffle Fishways

- Candle Lake, SK

Schedule - Part 1 (Completed)

- SITE LOCATION SELECTION – Nov. 17, 2015
- TOPOGRAPHIC AND BATHYMETRIC SURVEY – November 2015
- HERITAGE RESOURCE STUDY – Clearance provided Dec. 2, 2015
- CONCEPTUAL DESIGN REPORT – April 22, 2016
- GEOTECHNICAL INVESTIGATION – Drilling Program March 3-10, 2016; Lab Testing Completed May 2016

Schedule - Part 2 (work in progres

- ENVIRONMENTAL ASSESSMENT:
  - Field Work Completed July 2016
  - Technical Proposal finalized by October 31, 2016 and submitted to Saskatchewan Ministry of Environment
  - Applications to DFO (Request for Review) and WSA (AHPP)
- PRELIMINARY DESIGN:
  - Draft submitted August 2, 2016
- Ongoing consultations
- DETAILED DESIGN – not yet started
- TENDER PACKAGE AND CONSTRUCTION DRAWINGS – not yet started

Construction Schedule – Outlet Structure

Activity	Approx. Duration	Approx. Scheduling
Pre-loading of structure location	6 months	Winter
Pre-construction activities (utility relocation, mobilization, laydown, construction road)	1 month	Spring / Early Summer
Outlet Structure Construction	3-4 months	Summer
Gates, Hoists, Stoplogs, Controls	2 months	Fall
Channel Excavation	1 month	Fall or Winter
Wet testing of Gates and Stoplogs	2 weeks	Fall or Winter

Construction Schedule – Fishway – note that the fishway will be constructed following completion of the outlet structure

Activity	Approx. Duration	Approx. Scheduling
Mobilization, Site Preparation	1 to 2 weeks	Summer
Install Cofferdams	2 weeks	Summer
Fishway and Rock Spur Construction	6 weeks	Summer
Demolish Existing Structure (Salvage Monorail)	1 to 2 weeks	Summer
Remove Cofferdams, Reclaim Site, Demobilize	1 month	Summer

Crooked Lake Outlet Structure Replacement

Questions?

Crooked Lake Outlet Structure Replacement

END OF PRESENTATION

Crooked Lake Outlet Structure Replacement

Table 6.3 Fishway Hydraulics (Outlet Structure Gates Closed)

Bottom Elevation of V Channel (m)	Length (m)	Channel Slope (%)	Return Period (years)	Total Discharge (m^3/s)	Discharge in Outlet Channel (m^3/s)	Discharge in Fishway (m^3/s)	Lake Level (m)	Depth of Flow (m)	Velocity (m/s)
450.875	20.7	4	-	1.00	0.00	1.00	451.59	0.281[1]	1.27
			-	1.25	0.00	1.25	451.66	0.312[1]	1.05
			-	1.50	0.06	1.44	451.71	0.375	1.11
			-	1.75	0.18	1.57	451.72	0.375	1.17
			-	2.00	0.34	1.66	451.74	0.375	1.20
			-	5.00	2.42	2.58	451.87	0.425	1.41
			-	10.0	6.00	4.00	452.04	0.495	1.60
			-	15.0	9.80	5.20	452.16	0.545	1.71
			100	325.0	157.8	167.2	454.81	3.665	1.95

1. Depth of flow accounts for flow through riprap voids

As outlined in the DBM in Appendix I, the minimum water depth and maximum burst speed of the target fish species (i.e. walleye) is 0.3 m and 1.8 m/s, respectively (Katapodis 1991). Results of the hydraulic analysis presented in Table 6.3 indicate that velocities are less than 1.8 m/s for most of the discharges except the 1:100 year return period flood event. However, at a discharge of approximately 10 m^3/s, or a lake level of 452.0 m, the outlet structure gates are expected to be opened in which case fish will be attracted to and pass through the gates.

Crooked Lake Outlet Structure Replacement

Table 6.4 Fish Passage Percent of Time

Scenario	Date	Total Discharge (m^3/s)	Crooked Lake Level (m)	Percent of Time (%)	Fish Passage	Notes
1	November 16 to March 31	Any	Any	38	Possible	Outlet structure gates open – meets fish passage criteria
2	April 1 to November 15	< 1.15	< 451.6	19	Restricted	Fishway does not satisfy fish passage depth criteria
3		1.15 – 5.0	451.6 – 451.9	19	Possible	Fishway satisfies fish passage criteria
4		5.0 – 10.0	451.9 – 452.0	7	Restricted	Fish may be preferentially attracted to outlet channel
5		> 10.0	> 452.0	17	Possible	Outlet Structure gates open – meets fish passage criteria

Cowessess First Nation #73

COUNCIL RESOLUTION

Date:	August 30, 2022
Chronological No.	2022/2023-231
File Reference	Crooked Lake Water Control Structure

DO HEREBY RESOLVE:

WHEREAS: the Water Security Agency along with officials from the Cowessess First Nation and Her Majesty the Queen in Right of Canada as represented by the Minister of Crown-Indigenous Relations and Indigenous Services Canada have been in discussions regarding the proposed replacement of the existing Crooked Lake Water Control Structure.

WHEREAS: the Water Security Agency and Her Majesty the Queen in Right of Canada as represented by the Minister of Crown-Indigenous Relations are currently negotiating a Preload Fill Storage and Road Construction Licence Agreement (the "Licence Agreement") which would allow for the undertaking of certain preconstruction work to be undertaken on lands located adjacent to the current Crooked Lake Water Control Structure.

WHEREAS: the Cowessess First Nation is in support of the Water Security Agency developing a new water control structure which would be used to replace the existing Crooked Lake Water Control Structure on the understanding that the lands upon which the new Crooked Lake Water Control Structure would include reserve lands of the Cowessess First Nation.

WHEREAS: the Cowessess First Nation wishes to provide its support in relation to the Licence Agreement to allow for the required preconstruction work to be undertaken on the lands covered by the Licence Agreement.

NOW THEREFORE BE IT RESOLVED:

1. That the Chief and Council of Cowessess First Nation in the spirit of collaboration and in good faith and with a view to supporting the development of the new water control structure hereby provides its support to the completion by the Water Security Agency and Her Majesty the Queen in Right of Canada as represented by the Minister of Crown-Indigenous Relations of the proposed Licence Agreement.

2. That upon execution, that a copy of this band council resolution be provided to officials at the Water Security Agency, Crown-Indigenous Relations and Indigenous Services Canada for their records.

Quorum: Five (5)

(Chief)

(Councillor) (Councillor) (Councillor)

(Councillor) (Councillor) (Councillor)

(Councillor) (Councillor) (Councillor)

Cowessess First Nation #73

COUNCIL RESOLUTION

Date:	August 29, 2023
Chronological No.	2023/2024-027
File Reference	Crooked Lake Water Control Structure

DO HEREBY RESOLVE:

WHEREAS: the Water Security Agency along with officials from the Cowessess First Nation and His Majesty the King in Right of Canada as represented by the Minister of Crown-Indigenous Relations and Indigenous Services Canada ("Canada") have been in discussions regarding the proposed redevelopment of the Crooked Lake Water Control Structure.

WHEREAS: the Water Security Agency has submitted to officials on behalf of the Cowessess First Nation and Canada for their consideration a proposed land transfer plan based on the attached draft survey plan which would accommodate the redevelopment of the Crooked Lake Water Control Structure.

WHEREAS: the Cowessess First Nation is in support of the proposed land transfer plan along with the redevelopment of the Crooked Lake Water Control Structure.

NOW THEREFORE BE IT RESOLVED:

1. That the Chief and Council of the Cowessess First Nation approve in principle the proposed land transfer plan along with the redevelopment of the Crooked Lake Water Control Structure.

2. That the Chief and Council of the Cowessess First Nation hereby instruct Canada and its officials to proceed forward with the completion of all required legal, environmental and regulatory processes associated with the proposed redevelopment of the Crooked Lake Water Control Structure and land transfer as outlined in the attached draft survey plan including, without restricting the generality of the foregoing, the preparation of a Tripartite Agreement between the Cowessess First Nation, Water Security Agency and Canada regarding the proposed land tenure and transfer arrangements, Easement Agreements along with any other related documents and agreements as may be required so as to accommodate completion of the proposed redevelopment of the Crooked Lake Water Control Structure.

3. That upon execution, that a copy of this band council resolution be provided to officials on behalf of Canada and the Water Security Agency for their records.

Quorum: Five (5)

(Chief)

(Councillor) (Councillor) (Councillor)

(Councillor) (Councillor) (Councillor)

(Councillor) (Councillor) (Councillor)