Touch the Water Promenade Project - Rossdale Reach Final Concept Design

Environmental Overview
Final Report

Prepared for:
City of Edmonton
Integrated Infrastructure Services
Edmonton, Alberta

Under Contract to:
Dub Architects Ltd.
Edmonton, Alberta

Project Number EP-826
August 2021

Prepared by:
Spencer Environmental Management Services Ltd.
Edmonton, Alberta

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

SPENCER ENVIRONMENTAL
MANAGEMENT SERVICES LTD.

Suite 402, 9925 – 109 Street
Edmonton, Alberta T5K 2L9
Phone (780) 429-2108 Fax (780) 429-2127

Michael Dub, Architect AAA, MRAIC, LEED® AP
Principal
Dub Architects
#901 - 10345 107 Street
Edmonton AB T5J 1K3

17 August 2021
File: EP-826

Dear Mr. Dub,

Re: Final Environmental Overview for Touch the Water Promenade Rossdale Reach Final Concept

We are pleased to submit this pdf copy of the above-mentioned final Environmental Overview. This final report reflects comments received by City of Edmonton reviewers in July 2021. This report examined the Rossdale Reach final concept adopted by the City and is intended to serve as a resource for future project design phases and environmental assessments.

Thank you for your assistance throughout this study and for the opportunity to be of service.

Sincerely,

Spencer Environmental
Management Services Ltd.

Andra Bismanis, M.Sc., P.Biol.
Vice President, Science Practice

Lynn Maslen, M.Sc., P.Biol.
President

cc: Kevin Dieterman, BLA, CSLA, ISL Engineering and Land Services Ltd.

Table of Contents

List of Tables

List of Plates

1.0 INTRODUCTION

1.1 Background

The City of Edmonton (the City) proposes to develop the Touch the Water Promenade Project (TTWP) in Edmonton's North Saskatchewan River Valley (NSRV). The project would extend along the north bank of the North Saskatchewan River (NSR) from the Rossdale area to Government House Park (Figure 1, Appendix A). The proposed project is intended to increase access and connectivity to the NSRV, meet the objectives of the City's Ribbon of Green Master Plan (1992), be consistent with Breathe: Edmonton's Green Network Strategy (2017), River Valley Alliance's (RVA's) Plan of Action (2007); RVA's Phase II Capital Program and Rive Crossing. The TTWP would be located within the boundaries of the North Saskatchewan River Valley Area Redevelopment Plan (NSRV ARP; Bylaw 7188) and would form part of the existing river valley trail system connecting Louise McKinney Park and Government House Park.

The City has divided the greater TTWP into two discrete project components based on funding priorities: 1) the Rossdale Reach (RR) extending from Walterdale Bridge downstream to 94 Avenue in Rossdale (approximately 1 km long); and 2) the North Shore Promenade (NSP) extending upstream of the Walterdale Bridge along the north riverbank to Groat Road Bridge and Government House Park (approximately 3 km long) (Figure 1, Appendix A). Both project components are currently in the conceptual design phase, which requires completion of a desktop Environmental Overview (EO) for each component. The EO will form the basis of future Bylaw 7188 environmental assessment requirements. The City has retained Dub Architects Ltd. (Dub) to prepare conceptual design for the entire TTWP and Dub has retained Spencer Environmental Management Services Ltd. (Spencer Environmental) to serve as environmental consultant to the project and to complete the EO's. The RR component is the focus of this EO report. A separate EO report for the NSP is available under separate cover.

1.1 Project Location, Disposition and Land Use Zoning

The RR project area assessed by this EO is located on the north bank of the NSR from just upstream of the new Walterdale Bridge to 94 Avenue in Rossdale (Figure 2, Appendix A). At the time of investigation, the center of the project area was zoned PU (Public Utility Zone), reflecting the power plant history. The river and upstream and downstream banks in the project area were zoned A (Metropolitan Recreational Zone) (Figure 3, Appendix A). Council is expected to soon consider a proposed zoning change in this area that includes rezoning PU lands in the center of the project area to AN (Activity Node). The entire project area falls within Bylaw 7188 lands (Figure 2, Appendix A). The majority of the project area lands have been previously disturbed with development of recreational trails, the Rossdale Power Plant and associated pumphouses (now decommissioned), EPCOR's water treatment facility and the new Walterdale Bridge.

1.2 Project Description

Concept design has been an iterative process undertaken over several years and has included a staged public and stakeholder engagement program with input sought at key milestones. For example, in autumn of 2020 the City presented to the public and other stakeholders, two early conceptual design directions for the overall TTWP project, prepared by the design consultants: Concept Option 1 (Gateways), and Concept Option 2 (Threads). The Gateways concept focused on developing discrete gateways or nodes as gathering spaces, which were connected by trails or promenades of various types. The Threads concept took a more linear approach that focussed more on through-movement and less on destination gathering spaces. Threads built on and enhanced the existing shared-use path (SUP)/multi-use trail system in the TTWP project area and provided several promenades and lookouts. By considering what was heard during public engagement, input from regional Indigenous Nations and Communities, results from several technical studies, and City policy direction, the City directed the design consultants to refine, adjusted and improve on those early concept directions. The end result was identification of a preferred, final TTWP concept design, released on the City's website in May of 2021 (Dub Architects Ltd. and Stoss Landscape Urbanism 2021), that consists of three relatively large, featured spaces connected by prominent pathways of variable design, and includes several enhanced river viewpoints/rest stops/platforms at key locations. Following is a more detailed description of the RR portion of the TTWP final concept.

1.2.1 Rossdale Reach Preferred / Final Concept

The preferred concept for the Rossdale Reach consists of two significant featured spaces (*Rossdale Power Plant* and *The Bend*) connected by improved pathways and tying in at either end to existing river valley pathways. The RR concept spans a total distance of 1.0 km of riverbank and interfaces closely with the river at several locations. This concept is best understood by examining the illustrative materials provided in Appendix B that were excerpted from the concept package provided by the design consultant. Following is a short narrative description of the key concept components, moving upstream to downstream.

The *Rossdale Power Plant* (Figures 3 to 11, Appendix B) concept includes a large wooden deck adjacent the power plant, intimate event areas, multipurpose lawns, a plaza and overlook, a cantilevered outdoor sitting terrace and pumphouse overlook, a kayak tie-up area, a terraced series of flat surfaces down to the water (Touch the Water Scramble), an accessible platform, a second river overlook, internal circulation trails, enhanced riverbank/riparian vegetation and native plantings, including discrete planting beds and a rain garden (LID BMP facility). Planting themes include lawn, boreal forest, native garden, urban orchard, and aspen parkland and will include strategic native species plantings for ecological restoration of the riverbank (Figure 7, Appendix B).

Pathways in this featured area creatively move people through the area, offering choice and catering to all modes and speeds. They include a 6.0 m wide path comprising adjacent multi-use and slow paths - located at various top of bank upper bank elevations, separate, lower, slow paths connecting to and adjoining wide terraces and overlooks. The

cantilevered features over the river are below the 25 year flood event elevation. The concept includes two features comprising tiered surfaces that lead down to the river's edge.

The *Rossdale Power Plant* is intended to provide a more intimate connection with the NSR and provide a range of river viewing experiences. Recognizing the location in Rossdale Neighbourhood and potential future use of decommissioned and retained infrastructure, the concept also provides space for food trucks and other mobile vendors, art walks, community markets, and river events and good connection to the existing developed spaces further from the river (Figures 4 and 5, Appendix B).

Further downstream, *The Bend*, takes advantage of views available at the prominent river bend just upstream of the Edmonton Fire and Rescue boat launch (Figures 14 to 18, Appendix B). The concept consists of an improved, 4.0 m wide, multi-use pathway situated at the ~100 year flood event elevation and a connected, significant (8.6 m wide x ~35m long), teardrop shaped, elevated overlook that includes a seating area and also functions as a slow path. The overlook perches over the mid-riverbank, with the deck at ~ the 25 year flood elevation. There is potential to create a pathway connection leading away from the overlook and directly into the adjacent Rossdale neighbourhood.

1.3 Environmental Overview Objectives

The primary EO objectives are to:

- identify relevant environmental sensitivities on the project lands through desktop characterization and a site reconnaissance;
- identify opportunities and constraints related to the feasibility of the final/preferred, proposed concept and associated amenities in the project area;
- at a very high level, identify potential impacts that could arise and should be considered in future design phases;
- identify potential environmental regulatory requirements associated with the proposed concept and associated amenities in the project area; and
- identify additional environmental investigations required to meet those permitting requirements.

2.0 METHODS

2.1 General Approach

Beginning in 2019, we undertook the following activities to prepare this EO:

- Desktop review of existing project area information, City of Edmonton 2017 aerial imagery, City of Edmonton pictometry (then 2018 latest available) and online open data sources to document the existing environmental context in the project area.
- Desktop review focussed on the Valued Environmental Components (VECs) identified in the City of Edmonton's "A Guide to Completing Environmental Impact Assessments" (i.e., surface water, groundwater, fisheries, geology/geomorphology and soils, vegetation, wildlife and historical resources).
- Site reconnaissance of the project area.
- GIS-based mapping of relevant environmental information.
- Qualitative assessment of the potential interaction of the proposed RR project concept with documented conditions and resources in the project area, in 2021.
- Identification of potential permitting requirements and need for additional studies.

2.2 Desktop Review

2.2.1 Online Open Data Sources

The following online open data sources were searched/reviewed:

- Alberta Conservation Information Management System (ACIMS) online data map, searched 25 November 2019 for records of rare plant species or uncommon plant communities in the project area (AEP 2019a).
- Fish and Wildlife Management Information System (FWMIS), searched 25 November 2019, using the Fish and Wildlife Internet Mapping Tool (FWIMT), for recorded instances of special status wildlife species and historical fish sampling records in the project area (AEP 2019b). The search area comprised a 1 km radius circle centered on the project area.
- A search of the eBird database on 16 January 2020 for records of special status bird species in the project area.

2.2.2 Literature Review

The following studies/documents were reviewed:

- Touch the Water Promenade Project Rossdale Reach – Conceptual Design Fisheries Resource Overview (Kingfisher 2021).
- Preliminary Geotechnical Assessment Report Touch the Water Promenade River Bank between Walterdale Bridge to Rossdale Fire Station, Edmonton, Alberta (Tetra Tech Canada Inc. 2019).
- Touch the Water Promenade and North Shore Promenade – Draft Report Hydrotechnical Assessment (Northwest Hydraulic Consultants Ltd. 2019).

- Touch the Water and North Shore Promenade Project. Edmonton, Alberta, Canada. Statement of Justification (SoJ) (Turtle Island Cultural Resource Management Inc. 2019).
- Downtown Public Places Plan (City of Edmonton 2018).
- Touch the Water Biophysical Data Summary (Stantec Consulting Ltd. 2017).
- Breathe – Edmonton's Green Network Strategy. Strategic Plan (City of Edmonton 2017).
- River Crossing Heritage Interpretive Plan (City of Edmonton 2017).
- West Rossdale Urban Design Plan (City of Edmonton 2010).
- Walterdale Bridge Replacement Environmental Assessment Edmonton, Alberta Final Report (Spencer Environmental 2012).
- Natural Connections Strategic Plan – City of Edmonton Integrated Natural Areas Conservation Plan (City of Edmonton 2007).
- River Valley Alliance Plan of Action 2007-2025 (RVA 2007).
- Ribbon of Green Master Plan (Edmonton Parks and Recreation 1992).
- Repurposing the Rossdale Generating Station and Riverfront Plaza: Views and Perspectives (City of Edmonton n.d.).

2.3 Field Reconnaissance

A site reconnaissance of the project area was conducted on 12 December 2019 to inspect existing conditions and note any areas that may need to be considered in project design. Photographs were taken during the site reconnaissance.

2.4 Fisheries Assessment

As part of this EO exercise, Kingfisher Aquatics Ltd. (Kingfisher) conducted a desktop review of existing fish and fish habitat conditions in the project area, in 2019. Their desktop review comprised a search of FWMIS and review of select historical documents. They supplemented their desktop review with field investigations conducted on 24 and 25 October 2019, which included habitat assessment of a 2.4 km study section of the NSR in the project vicinity. That assessment comprised a large river habitat inventory of the study section and near-shore (within 30 m of the bank) assessment of water depths, fish cover and substrates within the RR project area. In addition, Kingfisher characterized the river channel profile, assessed streambank conditions, collected video and photograph logs, documented the presence of anthropogenic alterations and existing infrastructure and conducted in situ measurements of temperature, dissolved oxygen, specific conductivity, pH and turbidity. Kingfisher then analysed the final concept at a high level to identify potential fisheries issues, impacts and permitting requirements of the RR concept.

3.0 EXISTING ENVIRONMENTAL CONTEXT

Existing conditions information is described below by VEC for the RR project area.

3.1 Surface Water, Groundwater

The only surface water body in the project area is the North Saskatchewan River (NSR), which is the drinking water source for the City of Edmonton. The headwaters of the river originate at the Saskatchewan Glacier in the Rocky Mountains, 500 km upstream from Edmonton. The river length within Edmonton is approximately 48 km. Several tributary streams release into the NSR in the city; however, none are located within the project area. There are nine outfalls and one water intake structure within the project area that are owned by EPCOR (Tetra Tech 2019).

Dub retained Northwest Hydraulic Consultants Ltd (NHC) (NHC 2019) to provide a hydrotechnical assessment for the proposed TTWP, including the RR project area. Their scope of work included a site reconnaissance on 14 and 15 August 2019 and a desktop aerial photograph assessment of lateral stability of the north riverbank. NHC also developed a one-dimensional hydraulic model to determine river levels under open water and ice cover conditions and a two-dimensional hydraulic model to estimate local flow velocities along the bank to assess risk of bank erosion, deposition and ice forces.

NHC (2019) found that, in general, the north bank of the NSR in the project area is not susceptible to significant bank erosion and has been relatively stable for the past 60 years. Based on NHC's (2019) velocity contour maps for the RR project area, highest velocities are generally in the center of the river channel in front of the Rossdale Power Plant and increase in a downstream direction at the bend in the river and beyond. Lowest velocities are shown in a narrow band along the north riverbank.

Ice cover typically forms on the North Saskatchewan River in November in Edmonton (NHC 2019). Ice formation generally begins with the production of frazil ice particles, which eventually consolidate into larger ice floes (frazil pans). Once a certain density of the ice floes is present, the floes will consolidate into a solid ice cover, which corresponds to a rise in water level.

In August 2011, Thurber (2011) installed a standpipe piezometer in the vicinity of the new Walterdale Bridge north abutment in alluvial sand and gravel overlying bedrock. Groundwater measurements were taken at the time of installation and again two months later with a groundwater level of 11 m below ground surface (approximate elevation of 615.3 m) (Thurber 2011 in Spencer Environmental 2012). Thurber's (2011) report stated that groundwater at this location was likely hydraulically connected to the water level in the river, therefore, groundwater levels were expected to fluctuate throughout the year accordingly.

North Saskatchewan River Floodplain

Based on available flood hazard mapping for the RR project (AEP 2015) (Figure 1, Appendix C), all of the riverbank to the top-of-bank is located in the floodway (defined by AEP as: "The portion of the flood hazard area where flows are deepest, fastest and most destructive. The floodway typically includes the main channel of a stream and a portion of the adjacent overbank area. New development is discouraged in the floodway.") Most of the Rossdale neighbourhood and a portion of the EPCOR facility is located in the flood fringe (defined by AEP as: "the portion of the flood hazard area outside of the floodway. Water in the flood fringe is generally shallower and flows more slowly than in the floodway. New development in the flood fringe may be permitted in some communities and should be flood-proofed.").

It should be noted that a new AEP floodplain study of the NSR in Edmonton is currently underway and mapped conditions could change pending the results of that study (NHC 2019).

3.2 Fisheries

The information provided below represents a summary of findings by Kingfisher. Kingfisher's full report is available in Appendix D of this report.

Historical capture data indicated that the RR study section of the NSR is inhabited by a diverse assemblage of sport, coarse and forage fish species. The frequency and extent of habitat use is dependant on the life cycle stage and specific habitat requirements of each species. At the time of investigations, the study section included slow velocity, moderate depth holding habitat that was suitable for larger-bodied fish species as well as moderate velocity, low depth areas with relatively clean substrates that could provide preferential feeding habitat for species that target benthic invertebrates (e.g., mountain whitefish and mooneye) and/or suitable spawning and rearing habitat for species requiring coarse substrates.

Overall, fish habitat within the RR study section was not considered to be unique or in short supply within the NSR. Water depth and substrate composition varied slightly within the, while fish cover was homogenous. No unique habitat features were present; however, no major limiting factors were identified, and the habitat appeared to be capable of supporting a wide variety of fish species. The fish habitat documented in the RR study section lacked attributes that would be considered important or critical for sensitive federally and/or provincially listed species. The streambanks within the study reach have been subject to previous disturbance (e.g., riprap, outfalls, buildings) and were considered to have low habitat capability.

The majority of forage fish species known to inhabit the RR study reach are considered generalists that are able to tolerate a wide variety of environmental conditions. Most of these species likely occupy the study section on a year-round basis, likely inhabiting slower moving waters along the river margins, along armouring, and in backwater areas. Sucker species likely occupy the area on a year-round basis for all life cycle phases. Based on

relatively high capture records, goldeye, mooneye, mountain whitefish, and walleye are expected to occur in higher numbers in the project area compared to other sport fish species that appear to use the area sporadically, and on a limited basis. The relative abundance of coarse substrates and boulder cover along armoured banks offer moderate to high quality habitat for burbot. Lake sturgeon have been found in the area but an overall lack of deep water (>4 m) and suitable spawning habitat in the project area suggests that they primarily use the habitat for migration. Preferential northern pike habitat, which is closely associated with dense aquatic vegetation and low flow velocities habitat that is often provided by snyes, backwaters and oxbow channels in large river settings, was rare within the study section.

3.3 Geology/Geomorphology and Soils

The City of Edmonton retained Tetra Tech (2019) to conduct a preliminary desktop geotechnical evaluation of the proposed RR project area that included a review of existing available borehole data, published geological information, historical aerial photographs, and records of existing structures relevant to geotechnical aspects of the site and a site reconnaissance.

Tetra Tech (2019) described the surficial geology of the project area as mainly river terrace deposits comprising alluvial gravel, sand and silt from the NSR. Stratigraphy indicates there is approximately 6 m of alluvium originating from river terrace and flood plain deposits comprising clay, silt and gravel underlain by bedrock. The top of bedrock is approximately 616 m elevation and comprises interbedded bentonitic shales and sandstones with numerous coals seams.

Tetra Tech (2019) found that the proposed RR project is considered geotechnically feasible provided geological concerns or constraints related to bank slope stability, existing and proposed foundations and structures, long-term erosion and presence of existing fill are appropriately addressed in future phases of the project. It is expected that once refined locations of the proposed project components are known, more detailed geotechnical assessments will be conducted.

Tetra Tech (2019) also identified the need to confirm the presence of historical coal mines within the project area.

3.3.1.1 Contaminated Soils

The City of Edmonton (2019) reviewed their files for the project area for the potential presence of contaminated soils. They identified four areas of potential concern that are reflective of the development history of the area and will require further investigations in future phases of the project:

- Landfill material that was discovered at the northeast corner of the new Walterdale Bridge during bridge construction.
- Debris (concrete, treated wood, etc.) with elevated Polycyclic Aromatic Hydrocarbon (PAH) levels in the soils along the riverbank south of the Rossdale

Power Plant and pumphouses. Disturbance of these areas has potential to cause contamination of the NSR.

- General fill is expected to occur along the riverbank and top-of-bank south of the EPCOR site.
- The Watermark Building in the southeast corner of the EPCOR property requires 3 m – 6 m excavations to mitigate known contamination.

Newly generated contaminated soils information will be fully addressed in a future Environmental Impact Assessment to be completed in the next phase of the project.

3.4 Vegetation

Vegetation within the project area is a mixture of manicured land (City Parks) and natural shrub and forested communities (Figure 2, Appendix C). The City's urban Primary Land and Vegetation Inventory (uPLVI) maps the native plant communities in the RR project area as dominated by balsam poplar (*Populus balsamifera*) (Figure 2, Appendix C). Observations during the site visit determined that balsam poplar was the dominant tree species within this portion of the river valley. However, closer to the Rossdale Power Plant, Manitoba maple (*Acer negundo*) was the dominant tree species as previously noted by Spencer Environmental (2012) and Stantec (2017) (Plate 3.1). Forest within this section of the river valley was also patchy with some areas of low shrubs present, as noted in Stantec (2017). Those shrubby communities comprised prickly rose (*Rosa acicularis*), red-osier dogwood (*Cornus sericea*) and smooth brome (*Bromus inermis*). These species were also found in the understorey of the forest community.

Plate 3.1. View west of the riverbank near Rossdale Power Plant dominated by Manitoba maple (12 December 2019).

Natural Areas

Two previously identified City of Edmonton (2010) natural areas are located within the project area. The first Natural Area (059 RV) extends from outside the western boundary of the project area to approximately 40 m east of the Walterdale Bridge. Only the small strip of river valley between the river and multi-use trail is mapped as a Natural Area. The second Natural Area (056 RV) extends from outside the northeast project area limits to approximately 80 m from 94 Avenue. Similar to 059 RV, the Natural Area comprises only a narrow strip of river valley from the river to the multi-use trail. These designations are reflective of earlier mapping of lands supporting natural areas.

Special Status Species

An ACIMS search returned no records of special status vascular plant species within the proposed RR project area. No rare plants were observed in the project area during 2015 and 2016 rare plant surveys conducted by Stantec Consulting Ltd. (2017).

3.5 Wildlife

3.5.1 Available Habitat

Wildlife habitat within the project area is limited due to the highly disturbed and developed nature of the Rossdale area near Edmonton's downtown. The narrow band of vegetation along the riverbank in the study area east of the pumphouses could provide some suitable habitat for urban-adapted species, particularly in areas that do not experience high levels of human use.

3.5.2 Wildlife Species (Common and Special Status)

While approximately 200 wildlife species have been observed within the city, most of which were observed in the NSRV (Pattie and Fisher 1999; Fisher and Acorn 1998; Russell and Bauer 2000, Westworth and Associates 1980), many fewer would be expected in the project area. Of those species the most common are tolerant to human activity. Species include migrants, breeding individuals and resident species. Species migrating through the area may not remain in the regional area, they may instead rest or forage for a short time before continuing their migration.

Amphibians and Reptiles

Limited amphibian breeding habitat is available in the project area floodplain. The riparian woods adjacent to the river may provide suitable habitat for terrestrial post-breeding stages of several amphibian species [e.g., wood frogs (*Lithobates sylvaticus*) and boreal chorus frogs (*Pseudacris maculate*)], however, there is low potential for them to occur in the project area as there is a paucity of wetland breeding habitat.

The steep slopes along the NSRV in the project area are not suitable for most reptile species, however, the upland areas along the river floodplain may provide habitat for common garter snake (*Thamnophis sirtalis*), provincially ranked *Sensitive*. Common garter snakes have broad foraging habitat preferences, including habitat with ample ground cover such as woody debris and leaf litter often found in aspen stands. All terrestrial reptiles in

Alberta, including snakes, congregate in winter dens or hibernacula. Hibernacula may be naturally occurring pits or crevices in rocky outcrops, burrows co-opted from small to medium-sized mammals or excavated by snakes themselves (Russell and Bauer 2000). No known hibernacula are located within the project area.

Avifauna

During breeding bird surveys in the project area (Stantec Consulting Ltd. 2017) and around the new Walterdale Bridge project area (Spencer Environmental 2012) common, urban-adapted bird species were observed including: American crow (*Corvus brachyrhynchos*), American goldfinch (*Spinus tristis*), American robin (*Turdus migratorius*), black-capped chickadee (*Poecile atricapillus*), black-billed magpie (*Pica hudsonia*), chipping sparrow (*Spizella passerine*), clay-coloured sparrow (*Spizella pallida*), common merganser (*Mergus merganser*), dark-eyed junco (*Junco hyemalis*), mallard (*Anas platyrhynchos*), red-eyed vireo (*Vireo olivaceus*), ring-billed gull (*Larus delawarensis*), song sparrow (*Melospiza melodia*), white-breasted nuthatch (*Sitta carolinensis*), white-throated sparrow (*Zonotrichia albicollis*) and yellow warbler (*Setophaga petechia*). No special status species were observed in either of the surveys. A search of Ebird returned no results of any special status bird species observed by the public near the project area.

Mammals

Small-, medium- and large-sized urban-adapted mammals are likely the most common mammals to occur in the project area. Small furbearers, such as hares (*Lepus sp*.) and squirrels (*Tamiasciurus hudsonicus*), are commonly observed within the NSRV. Based on habitat preference, other species, including voles, mice and bats may use the forested habitat in the project area. Coyotes (*Canis latrans*) are also known to frequent the river valley and surrounding areas.

Ungulate species use habitat in the inner-city parkland areas less frequently than more suitable habitat located on agricultural lands in outer City limit areas. Both white-tailed (*Odocoileus virginianus*) and mule deer (*Odocoileus hemionus*) have been observed in the river valley area outside the downtown core. Deer or moose (*Alces alces*) that are observed within the inner-city regions of the river valley are likely dispersing to other areas of habitat. The limited forest cover and presence of human activity throughout this area of the river valley likely prevents the establishment of resident deer and moose populations.

Cougars (*Puma concolor*) and Canada Lynx (*Lynx canadensis*) also have been observed in Edmonton's river valley and are known to exist in areas surrounding the city of Edmonton. A lynx was observed in August 2019 just upstream of the project area. The two species occur in Edmonton only rarely and likely use the river valley and associated ravines as travel corridors. Cougars and lynx are not expected to be resident species in the project area or the larger city.

Special Status Species

A FWMIS search of a 1 km radius centered on the project area returned results of two special status wildlife species: Canadian toad (*Anaxyrus hemiophrys*) and peregrine falcon

(*Falco peregrinus*). The Canadian toad is provincially listed as *May Be At Risk*. Similar to other amphibian species Canadian toads breed in wetlands; however, for much of the year they can be found in adjacent uplands. Canadian toads are often found along lakes and rivers with sandy soil, which is important for winter hibernation. As a result, Canadian toads have potential to be present within the project area, however, the chances are low due to a lack wetland habitat.

Peregrine falcons are provincially listed as *Threatened* under Alberta's *Wildlife Act* and are federally listed as *Special Concern* under Schedule 1 of the *Species at Risk Act* (SARA). Peregrine falcons are known to nest in two locations nearby the project area: on the High Level Bridge (approximately 700 m west of the project area) and at the Biological Sciences Building at the University of Alberta (approximately 1.5 km west of the project area on the south side of the river) (A. Bismanis, *pers. comm*.). Due to the close proximity of known nests to the project area, it is possible that peregrine falcons may occasionally forage in the project area, therefore, their likelihood of occurrence in the project area is rated as moderate.

Based on our understanding of species-habitat associations, the presence of old mature trees in the forested areas along the riverbank, old buildings and the proximity of the NSR results in some potential for little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*), two species of bats that are federally listed as Endangered (Government of Canada 2019), to use habitat in the project area during the growing season as a roosting site. Legal protection currently only extends to overwintering hibernacula and does not cover individual bats. The protection of individual bats and roost sites exists as a best management practice in line with emerging bat conservation efforts.

Little brown myotis utilizes tree crevices (especially old dead or dying trees in mature deciduous forests), buildings and bridges for roosting and maternity roosts during the breeding season. Northern myotis are more dependent on trees for summer roosting and maternity roosts, utilizing a wide range of tree species (deciduous trees preferred) in primarily intact forests (AESRD 2009 and Alberta Community Bat Program 2018). The importance of human made structures, such as buildings, to the northern myotis is unknown (AESRD 2009).

There are few large deciduous trees in the project area that would be suitable for roosts. However, the little brown myotis may roost in the old Rossdale Power Plant buildings in the project area or on the Walterdale Bridge. Little brown myotis and northern myotis do not hibernate in trees and are not known to overwinter in the Edmonton area. The likelihood of occurrence in the project area for the little brown myotis was rated as moderate because of the project area's proximity to the NSR, a suitable foraging area and water source, and suitable available habitat for roosting immediately adjacent to the project area. The likelihood of occurrence in the project area for the northern myotis was rated as low because this species prefers more intact forest habitats and does not roost in human made structures.

3.5.1 Wildlife Movement

The NSRV cuts through the city's developed core, providing a permeable passageway into, and out of, the city. Although it is considered a regional biological corridor, the NSRV's corridor functionality in the city centre, including the project area, is reduced. Hindrances to wildlife movement in the city centre include steep valley slopes and significant urban development in the valley bottom that in a few locations extends to the top of riverbank. The project area is in one of those constrained locations and the riverbank is relatively steep. In addition, the two existing Rossdale pump houses and the new Walterdale Bridge abutment and associated development including multi-use trails, riprap, and gabion basket retaining walls occupy the riverbank. That infrastructure has created a local but significant pinch point within this portion of the project area. Downstream, in the central and eastern portions of the project area existing development is set further back from the top-of-riverbank and there is a continuous riparian vegetated strip along the riverbank that is more conducive to wildlife movement. Across the river from the project area, better habitat connectivity and corridor functionality is found along the south bank of the NSR.

3.6 Historical Resources

The City of Edmonton retained Turtle Island Cultural Resource Management Inc. (Turtle Island 2019) to conduct a desktop archaeological and palaeontological review of the entire TTWP project area, including the RR project area. Turtle Island identified one large cultural resource site that occupies the entire proposed RR project area, typed as: campsite, scatter, burial, fur trade and historic. The site has been assigned Historical Resource Values (HRVs) of 1, 4 and 5 for archeological, 2 for historic period and 4 for cultural resources. These HRV scores are defined as:

- HRV 1: designated under the *Historical Resources Act* (HRA) as a Provincial Historic Resource
- HRV 2: designated under the HRA as a Registered Historic Resource
- HRV 4: contains a historic resource that may require avoidance
- HRV 5: high potential to contain a historic resource

3.7 Environmental Sensitivities (per City of Edmonton data)

The City of Edmonton's Environmental Sensitivity mapping (Solstice Canada 2016) shows lands ranging from moderate value to extremely high value within the RR project area (Figure 3, Appendix C). Lands around the Rossdale Power Plant and two pump houses were classified as moderate to very high value. Areas downstream of the Power Plant were classified as high to very high values with a few pockets of more densely vegetated land classified as extremely high value. The NSR is classified as very high value. The City considers high, very high and extremely high values as lands suitable for protection or conservation. Areas of moderate value represent areas that have potential to be restored.

4.0 SUMMARY OF POTENTIAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Relevant federal, provincial and municipal legislation and policy that often has potential to result in the need for environmental (or other) approvals or to influence construction practices for river valley infrastructure projects is summarized in Table 1 in Appendix E.

Ultimately, regulatory requirements for the project will be dependent on project designs, construction plans, and project schedules. Based on the information available for the preferred/final concept for the Rossdale Reach project, the anticipated federal and provincial regulatory burden is summarized in Table 4.1 below.

Table 4.1. Possible Federal and Provincial Approvals Required for the Preferred Rossdale Reach Concept

Regulation	Relevant Concept Feature
Fisheries Act	Infrastructure or activity located on low riverbank (riparian habitat) will likely require a DFO Request for Review, potentially resulting in the need for an Authorization and fish habitat offsetting
Canadian Navigable Waters Act	Approval may be required; the determination will consider overlook elevations and instream structures, such as Touch the Water Scramble, or berms to build infrastructure piers.
Water Act	Approval for low bank, instream structures such as Touch the Water Scramble and kayak tie-up area; possible approval for placement of fill or permanent infrastructure in the floodplain.
Public Lands Act	Disposition for new structures to permanently occupy the bed and shore of the NSR (e.g., Touch the Water Scramble) Temporary Field Authorization for instream work
Historical Resources Act	Application to Province required; Historical Resource Impact Assessment likely required for earthworks in the NSRV

5.0 POTENTIAL IMPACTS AND OPPORTUNITIES AND CONSTRAINTS

5.1 Potential Impacts

Table 5.1 summarizes potential environmental impact types that may be associated with development of the preferred concept. This high level, preliminary assessment qualitatively considered the impact of permanent infrastructure and assumed the use of typical construction methods. It did not consider additional measures required to account for erosion protection, ice scour, etc. This table does not account for the application of mitigation measures, such as plant community restoration. That level of analysis is beyond the scope of this report, which is intended to be an overview that serves as a precursor to a full EIA. More positive project features that would assist to mitigate these adverse impacts, are accounted for at a high level in the subsequent sections describing positive impacts and opportunities.

Table 5.1. Types of Adverse Impacts Potentially Associated with Proposed Rossdale Reach Preferred Concept, by VEC

Environmental Sensitivity	Potential Impact
Slope Stability	Construction of components such as pilings and piers on the riverbank, which is steep in areas and contains existing structures such as pumphouses and outfalls, has potential to affect slope stability.
Hydrology	Potential for shoreline armouring to cause bank erosion and bank and riverbed scour under frozen and non-frozen conditions.
Fish and aquatic resources	Increase in impervious surface area that could facilitate conveyance of untreated stormwater and contaminants into the NSR, adversely affecting water quality. Some riverbank components have potential to directly or indirectly impact fisheries resources in the NSR. Kingfisher (2021) provides a detailed analysis in Appendix D, Table 7, that should be carefully considered. Following are select, summarized key points, provided as examples of potential impacts: • Strong potential for sedimentation or deleterious substance release into river during construction of low and mid bank components. • Potential for minor, permanent instream footprint associated with Touch the Water Scramble component. • Potential negative impacts to lower riverbank riparian habitat (noting there is also potential for positive impacts). • Instream works have potential to spread aquatic invasive species. • Some potential for increased pressure on fisheries associated with the post-construction/use of the RR.

Native Vegetation	Removal of minor areas of native forest vegetation adjacent the river at *The Bend* to accommodate construction of overlook. Note: some riverbank and upland vegetation enhancement is planned for the *Rossdale Power Plant* area.
Wildlife Habitat	Some loss and temporary disturbance to riparian forested habitat.
Wildlife Passage	Introduces more infrastructure at an existing pinch point along the riverbank (at the pumphouses and Walterdale Bridge). With the maturation of the planned wooded communities further back from the river's edge the pinchpoint may be tempered for some species. Further downstream, the elevated structure at *The Bend* retains some natural riverbank movement corridor.

*Qualitative assessment only

5.2 Opportunities and Constraints

The following section highlights environmental opportunities and constraints associated with the proposed RR preferred concept. This section is intended to be used to inform decision-making during future phases of the project.

5.2.1 Opportunities

- Restoration of short sections of riverbank with native vegetation
- Ensure landscaping and vegetation restoration design maximizes opportunities to promote wildlife movement through the project area
- Contaminated soils clean-up
- Strategically locate outfalls based on environmental protection principles (e.g., discharge volumes, water quality, footprint on riverbank, etc.)
- Support regional fisheries management objectives (regarding habitat, populations, fishing opportunities, public input)
- Support species recovery efforts (in this case for Lake Sturgeon)
- Specific to fisheries, potential to improve riparian conditions through: bank stabilization, reclamation of disused infrastructure and enhancement of riparian vegetation
- Enhance the existing available recreational amenities in the project area
- Minimize environmental footprint of proposed project by utilizing existing disturbed areas

5.2.2 Constraints

- The project area has a rich pre-settlement and settlement history. As a result, there is a risk that surficial disturbance for trail and associated infrastructure construction may disturb unknown historical resources. Risk should be mitigated through design and preparation of HRIAs and collaboration with the Provincial ministry.
- Construction activities will be subject to the following restricted activity periods:

  - In-stream activities in the NSR (Class C) are subject to a Restricted Activity Period (RAP) of 16 September to 31 July.
  - All vegetation clearing should be avoided during the breeding bird season from 20 April to 20 August.
  - Clearing of large trees and snags should be avoided during breeding owl season from 15 February to 20 April.
  - Clearing of large trees and snags and building demolition should be avoided during the bat breeding season from 01 May and 15 September.
  - Wildlife trees within the proposed project footprint should be identified and removal or damage avoided.
- Much of the proposed project will be developed within the Flood Hazard Zone identified by the Government of Alberta. NSR flooding could damage infrastructure.
- Several other projects are proposed for this area including the City of Edmonton's West Rossdale River Crossing development initiative and the Prairie Sky Gondola development proposed by a private entity. How these projects interface and their cumulative effects should be considered. Conversely, these projects could provide synergistic opportunities for development and restoration in the Rossdale area.

6.0 FUTURE INVESTIGATIONS

Based on the preferred concept design, the following investigations are recommended to facilitate future design phases and eventual acquisition of environmental permits and approvals.

6.1 Surface Water, Groundwater

NHC (2019) made the following recommendations for future phases of the TTWP project, including in the RR project area:

- All features on the bank should be assessed for erosion potential and potential mitigation.
- Proposed support structures should be assessed to determine potential local scour depth and scour mitigation measures including riprap.
- Proposed bank hardening/bank access features should be assessed to determine potential scour depth and scour mitigation measures including riprap.
- All proposed features should be designed with consideration of the flood peak elevations and associated risks of flood damage from the forces associated with water, debris or ice.
- Hydrodynamic forces during peak floods, including when there is ice cover, should be assessed on all features extending into the river channel.
- Vertical support structures should be designed in accordance with CSA guidelines for ice loads on bridge piers.
- All proposed features should be designed with consideration of the typical freeze-up ice levels and associated risks (e.g., ice scarring from ice floes during break-up or freeze-up).

6.2 Fisheries

Assuming that there are no major changes to the concept design as currently proposed, the fisheries information presented in Kingfisher (2021 (Appendix D) report is considered to be sufficient for completion of a fisheries impact assessment in support of environmental permitting applications pursuant to the federal *Fisheries Act* and the provincial *Water Act*. Additional design and construction details, however, will be required before the fisheries impact assessment can be completed. It is assumed that this information will become available in future phases of the project. Of course, when preliminary design is examined, additional information gaps may be identified (Kingfisher 2020; Appendix D). Key information that will be required to complete the impact assessment includes (but is not limited to) the following:

- Design plans with sufficient detail to determine physical footprints of ***permanent*** and ***temporary*** infrastructure on the bed and banks of the NSR.
- Construction plans detailing construction methodologies and schedules.

6.3 Geology/Geomorphology and Soils

- Tetra Tech Canada Inc. (2019) recommended that detailed geotechnical investigations and evaluations take place once the locations and design of the proposed RR project promenade and associated structures are known.
- Contamination investigations will be required, at a minimum to confirm boundaries of currently identified contaminated areas.

6.4 Vegetation

The following site-specific vegetation investigations should be conducted in the directly affected areas of the proposed RR project area:

- A seasonally appropriate site-specific plant community and rare plant survey to document conditions and determine whether any rare plants or unique plant communities will be adversely impacted by the project.
- Concurrent with the rare plant survey, a weed survey should be conducted to determine if noxious and/or prohibited noxious weeds are present that will require management/removal.

6.5 Wildlife

The following site-specific wildlife investigations should be conducted in the directly affected areas of the proposed RR project area:

- Seasonally appropriate breeding bird survey to determine the presence/absence of special status species.
- Document incidental wildlife observations and evidence of habitat use including animal sightings, tracks, droppings, nests, dens, etc.
- Document and map any wildlife trees (i.e., trees with visible nests, or large trees with cavities) and other critical habitat.
- Acquire and analyse City of Edmonton camera trap data, if data are available, to document wildlife species and related movements in the project area, with a view to using the data to improving wildlife movement options through the area.

6.6 Historical Resources

Turtle Island (2019) recommended a Historical Resources Impact Assessment (HRIA) be completed for this project. An HRIA would identify areas to avoid during construction, if possible. Then a Historical Resource Application could be submitted to Alberta Culture, Multiculturalism and the Status of Women (ACMSW) for their review and assessment regarding requirements for future field investigations. ACMSW prefers to review final project disturbance footprints, including staging areas, in applications, however, they will accept submission of multiple alignment options.

6.7 Environmental Sensitivities

In future phases of the project, undertake refinement of the City's original environmental sensitivity mapping with field-collected, site-specific vegetation data mapping from the project area.

7.0 SUMMARY AND CONCLUSIONS

The City of Edmonton, consistent with the River Valley Alliance Plan of Action (2007), proposes to construct a promenade and associated structures in the Rossdale area of the NSRV from upstream of the new Walterdale Bridge to 94 Avenue. The proposed Rossdale Reach project will be located within the boundaries of the Central Area of the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188). The project is currently near the final stages of the concept design phase.

While there is a known, rich pre-settlement and settlement history in the project area *and* there is potential to disturb unknown historical resources. To date, studies have indicated that overall, river valley biophysical and development conditions in the Rossdale Reach project area are amenable to a recreational promenade experience. The proposed RR project would enhance the existing river valley trail system in the project area with a multi-use space and would create a public gathering place for events and markets. It would also enhance the continuous river valley connection from Government House Park to 94 Avenue while providing improved access to the NSRV and the NSR from Rossdale and nearby downtown Edmonton.

Based on the desktop environmental information presented in this Environmental Overview for surface water, groundwater, fisheries, geology/geomorphology and soils, vegetation, wildlife and historical resources, no major constraints were identified although the project would adversely affect some resources. With respect to wildlife passage, the *Rossdale Power Plant* development would add hard surface along the riverbank in a location that may already constrain wildlife movement.

Recognizing lack of site-specific environmental information during this phase of the project, and, depending on the final construction footprint, we recommend undertaking additional site assessments related to hydrotechnical assessments, fish habitat (to be determined pending final design and construction methods), geotechnical concerns, vegetation, wildlife and historical resources to better understand potential for impacts and opportunity to mitigate those impacts. That information would also support future environmental permitting application requirements. In addition, the footprint of the final design and proposed construction practices will be of interest to environmental regulators. In turn, regulators may have comments that may influence future design efforts.

8.0 REFERENCES

8.1 Literature Cited

Alberta Community Bat Program. 2018. Building Bat-Friendly Communities – Alberta Program Guide. Available at: https://www.albertabats.ca/wpcontent/uploads/AlbertaBFC.pdf

Alberta Environment and Parks (AEP). 2015. Flood Hazard Mapping. Available at: https://maps.alberta.ca/FloodHazard/

Alberta Environment and Parks. 2019a. Alberta Conservation Information Management System (ACIMS). https://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-acims/search-acims-data/. Accessed: 25 November 2019.

Alberta Environment and Parks (AEP). 2019b. Fish and Wildlife Internet Mapping Tool (FWIMT). http://aep.alberta.ca/fish-wildlife/fwmis/access-fwmis-data.aspx. Accessed: 25 November 2019.

Alberta Sustainable Resource Development and Alberta Conservation Association. 2009. Status of the Northern Myotis (*Myotis septentrionalis*) in Alberta: Update 2009. Alberta Sustainable Resource Development. Wildlife Status Report No. 3 (Update 2009). Edmonton, Alberta.

Dub Architects Ltd. and Stoss Landscape Urbanism. 2019. Touch the Water & North Shore Promenades. Concept Options: Threads and Nodes. December 2019 Meeting Materials Prepared for City of Edmonton, Edmonton, Alberta.

City of Edmonton. 2010. West Rossdale Urban Design Plan. Edmonton, Alberta

City of Edmonton. 2017. River Crossing Heritage Interpretive Plan. Edmonton, Alberta

City of Edmonton. 2018. Ribbon of Green Draft Plan. Edmonton, Alberta.

City of Edmonton. 2018. Downtown Public Places Plan. Edmonton, Alberta.

City of Edmonton. 2019. Touch the Water Promenade Project Contaminants Review. Edmonton, Alberta.

City of Edmonton. n.d. Repurposing the Rossdale Generating Station and Riverfront Plaza: Views and Perspectives. Edmonton, Alberta

Edmonton Parks and Recreation. 1992. Ribbon of Green - North Saskatchewan River Valley and Ravine System Master Plan. Prepared for the City of Edmonton. Edmonton, Alberta.

Government of Canada. 2019. Species At Risk Public Registry – Little Brown Myotis (*Myotis lucifugus*). Available at: https://species-registry.canada.ca/index-en.html#/species/1173-848

Kingfisher Aquatics Ltd. 2021. Touch the Water Promenade Project Rossdale Reach – Conceptual Design Fisheries Resource Overview. Prepared for Spencer Environmental Management Services Ltd., Edmonton, Alberta.

Northwest Hydraulic Consultants Ltd. 2019. Touch the Water Promenade and North Shore Promenade – Draft Report Hydrotechnical Assessment. Prepared for Dub Architects Ltd., Edmonton, Alberta.

O2 Planning and Design Inc. 2016. Breath: Edmonton's Green Network Strategy. Prepared for: The City of Edmonton. Edmonton, Alberta.

River Valley Alliance. 2007. A Plan of Action for the Capital Region River Valley Park – Summary Report. Edmonton, Alberta.

Solstice Canada. 2016. Environmental Sensitivity project, Draft Final Report. Prepared for: The City of Edmonton. Prepared by: solstice Canada. Edmonton, Alberta.

Spencer Environmental Management Services Ltd. 2012. Walterdale Bridge Replacement Environmental Assessment. Prepared for the City of Edmonton. Edmonton, Alberta.

Stantec Consulting Ltd. 2017. Touch the Water Biophysical Data Summary. Prepared for the City of Edmonton. Edmonton, Alberta.

Tetra Tech Canada Inc. 2019. Preliminary Geotechnical Assessment Report – Touch the Water Promenade River Bank between Walterdale Bridge to Rossdale Fire Station, Edmonton, Alberta. Prepared for the City of Edmonton. Edmonton, Alberta.

Turtle Island Cultural Resource Management Inc. 2019. Touch the Water and North Shore Promenade Project Edmonton, Alberta, Canada Statement of Justification (SoJ). Prepared for the City of Edmonton. Edmonton, Alberta.

8.2 Personal Communications

A. Bismanis, P. Biol., Senior Environmental Scientist, Spencer Environmental Management Services Ltd.

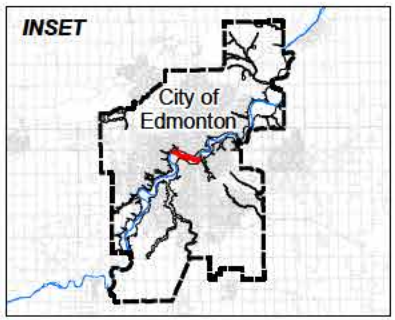
Appendix A: Project Overview Figures

Figure 1.
Project Overview
Rossdale Reach
TTWP

Legend

Project Areas

- Rossdale Reach
- North Shore Promenade
- Bylaw 7188 Boundary (COE, 2010)
- Watercourse (FWMIS, 2018)

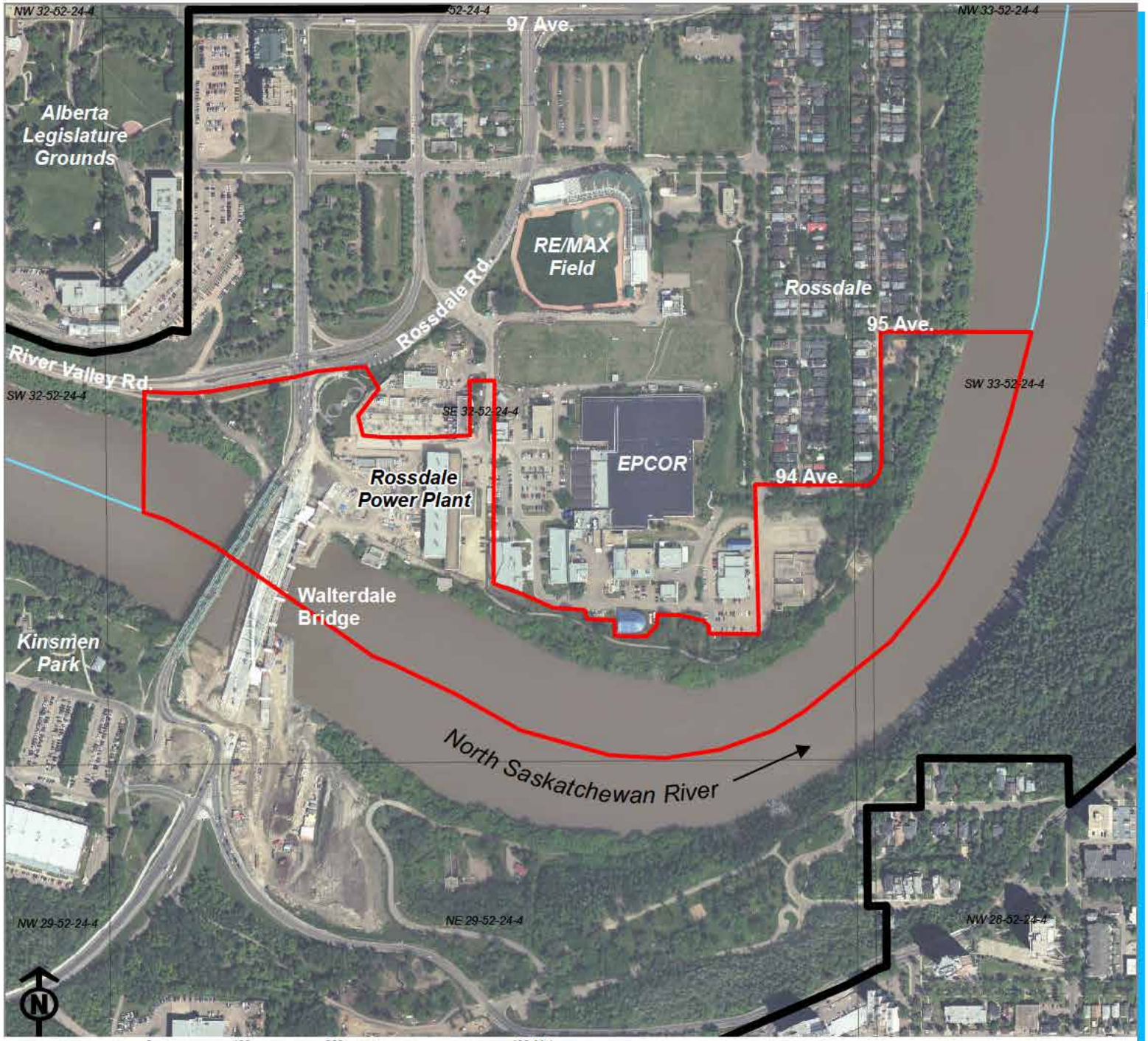


Map Date: 08 July 2021
Imagery Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

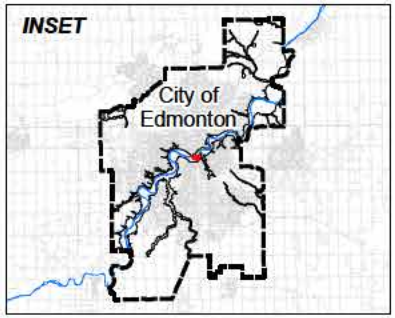
*Note: The watercourse in Groat Ravine is no longer present. Other FMWIS watercourse data may not accurately indicate current conditions.

Figure 2.
Project Area
Rossdale Reach
TTWP



Legend

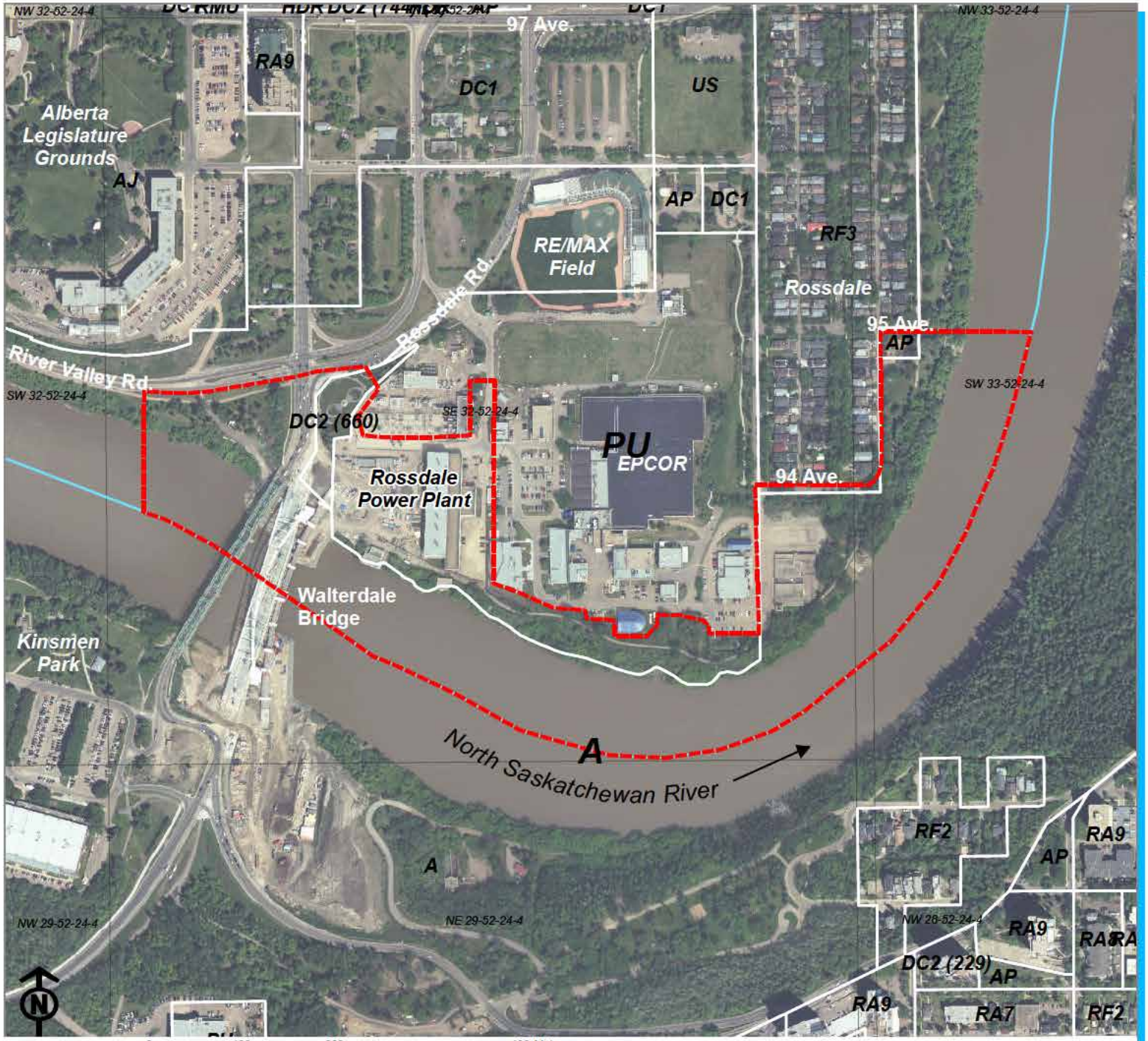
- Project Area
- Bylaw 7188 Boundary (COE, 2010)
- Watercourse (FWMIS, 2018)



Map Date: 18 June 2021
Imagery Date: May 2017

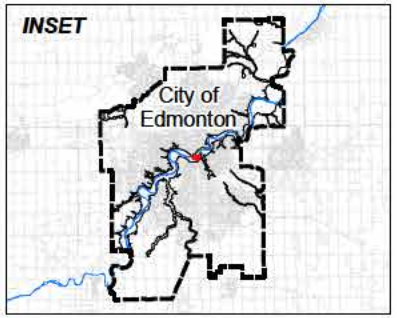
SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

Figure 3.
City of Edmonton
Land Use Zoning
Rossdale Reach
TTWP



Legend

- Project Area
- Watercourse (FWMIS, 2018)
- A — Zoning (COE, 2020)



Map Date: 18 June 2021
Imagery Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

Appendix B: Final Concept Design for Rossdale Reach (Dub Architects Ltd. and Stoss Landscape Urbanism 2021)

Figure 1. Project Overview - Existing Conditions

dub STOSS

Figure 2. Project Overview - Preferred Concept

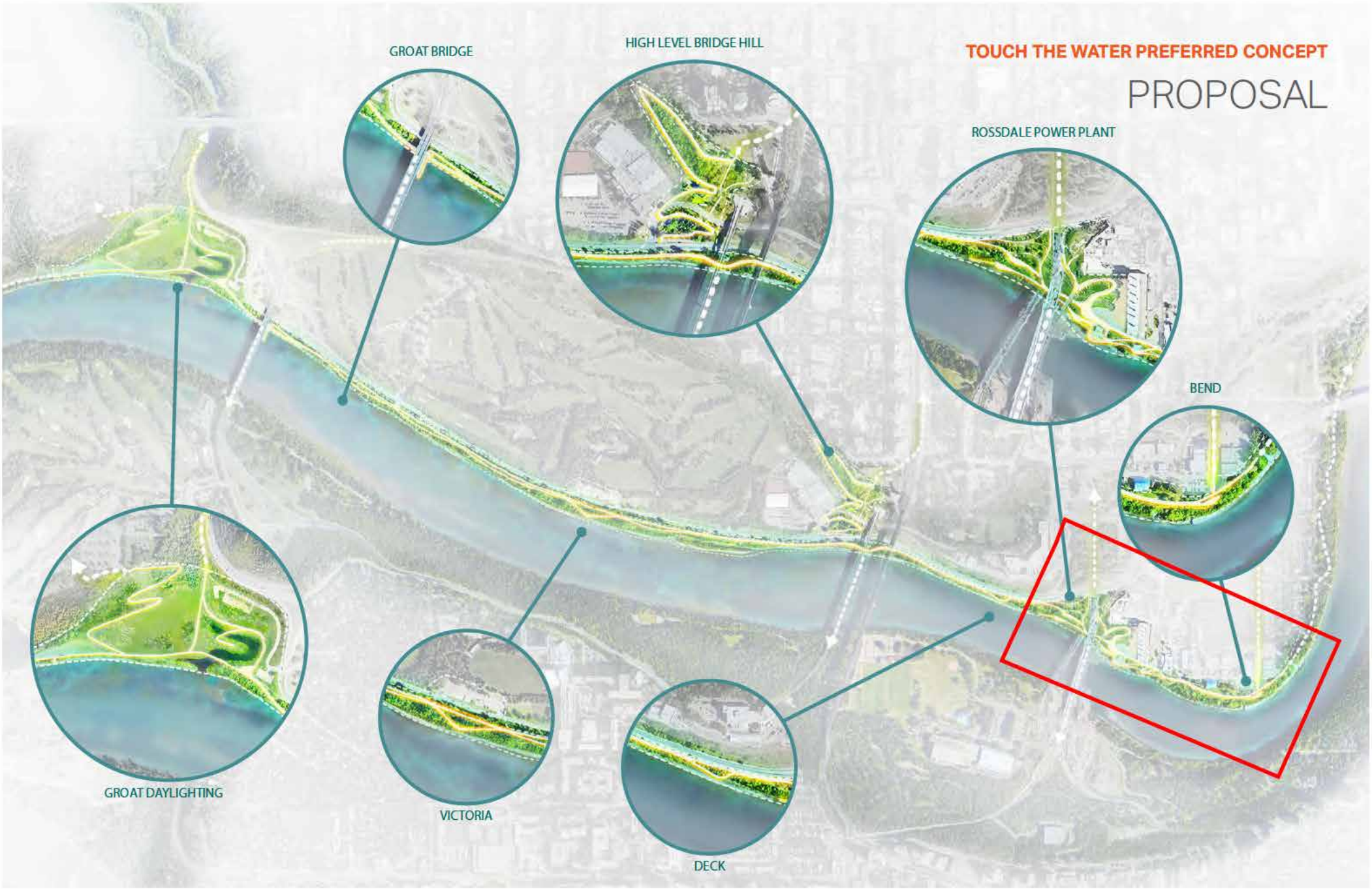


Figure 3. Rossdale Power Plant - Existing Conditions

Figure 4. Rossdale Power Plant - Preferred Concept

ROSSDALE POWER PLANT

PROPOSAL

Figure 5. Rossdale Power Plant - Preferred Concept Elements

ROSSDALE POWER PLANT

PROPOSAL

Figure 6. Rossdale Power Plant - Preferred Concept Elevation

ROSSDALE POWER PLANT

PROPOSED CONDITION ELEVATION

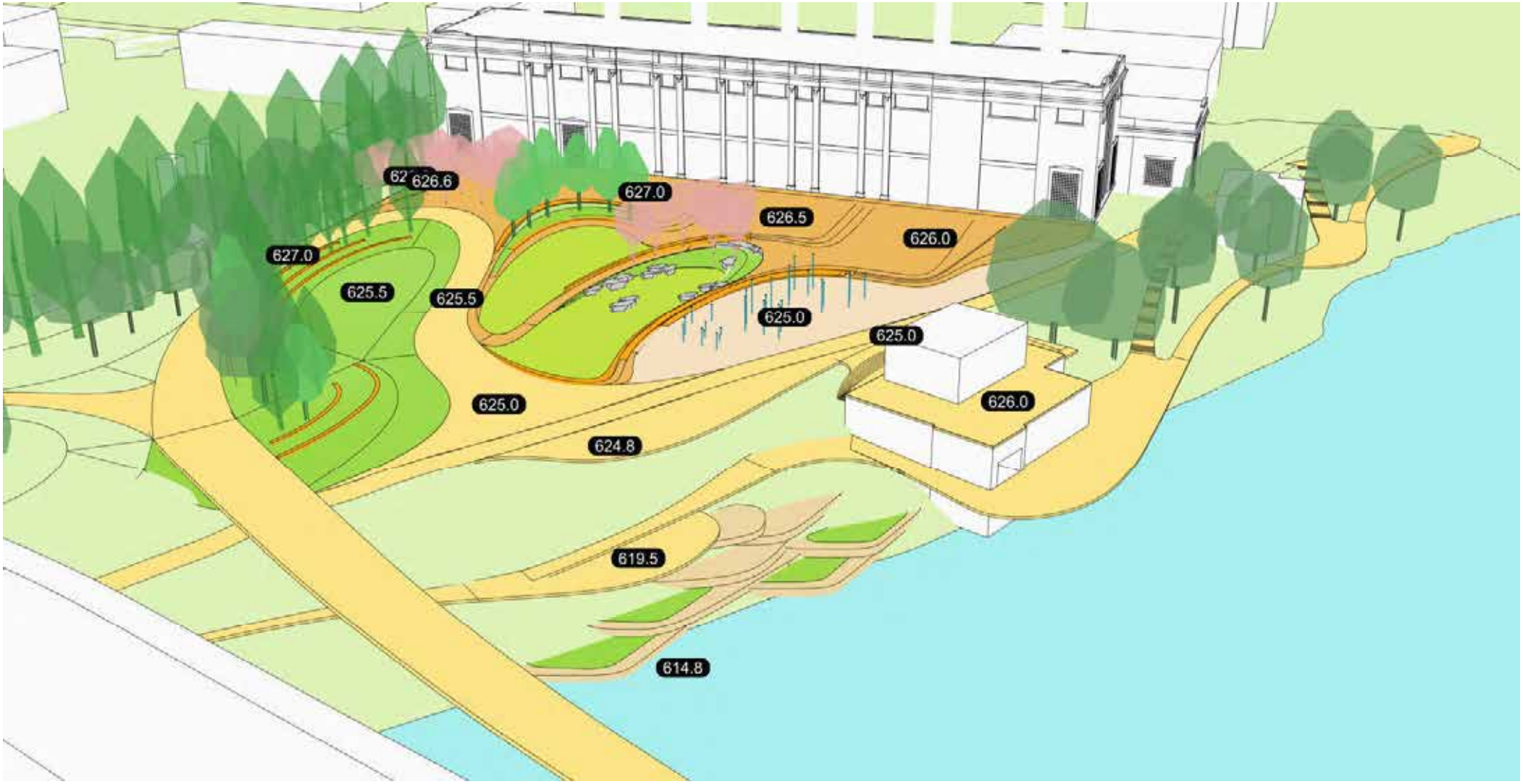


Figure 7. Rossdale Power Plant - Proposed Vegetation

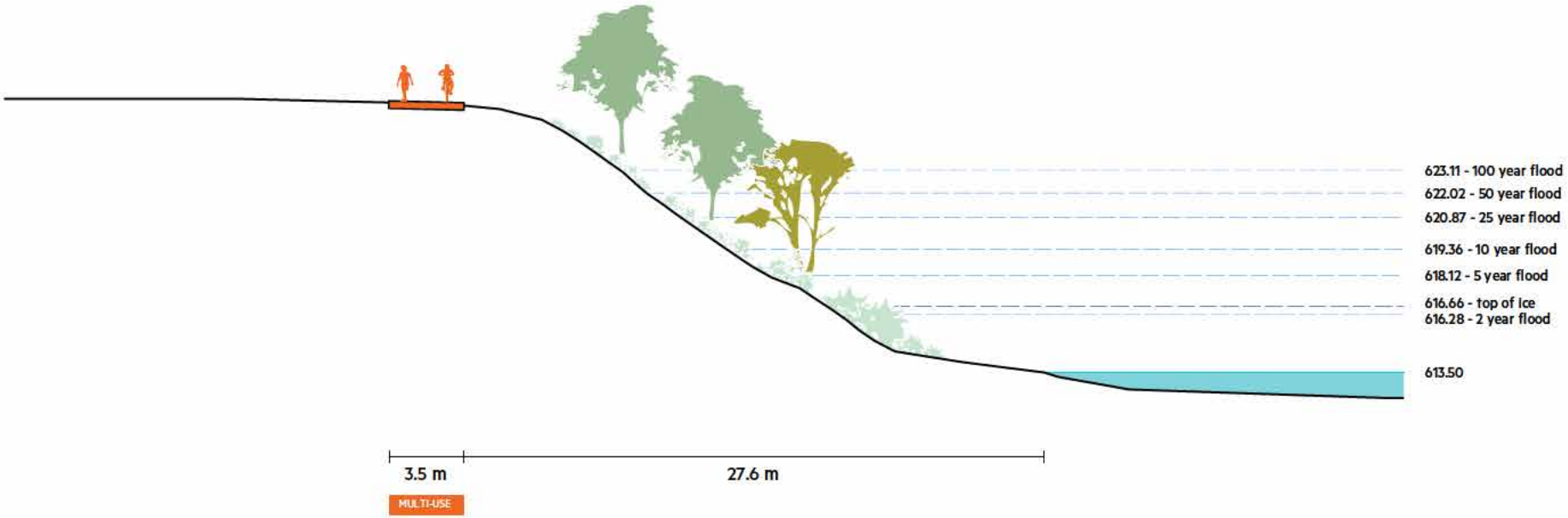
ROSSDALE POWER PLANT

PROPOSED CONDITION: PLANTING

Figure 8. Rossdale Landing - Existing Pathway

ROSSDALE LANDING

EXISTING PATHWAYS CONDITION

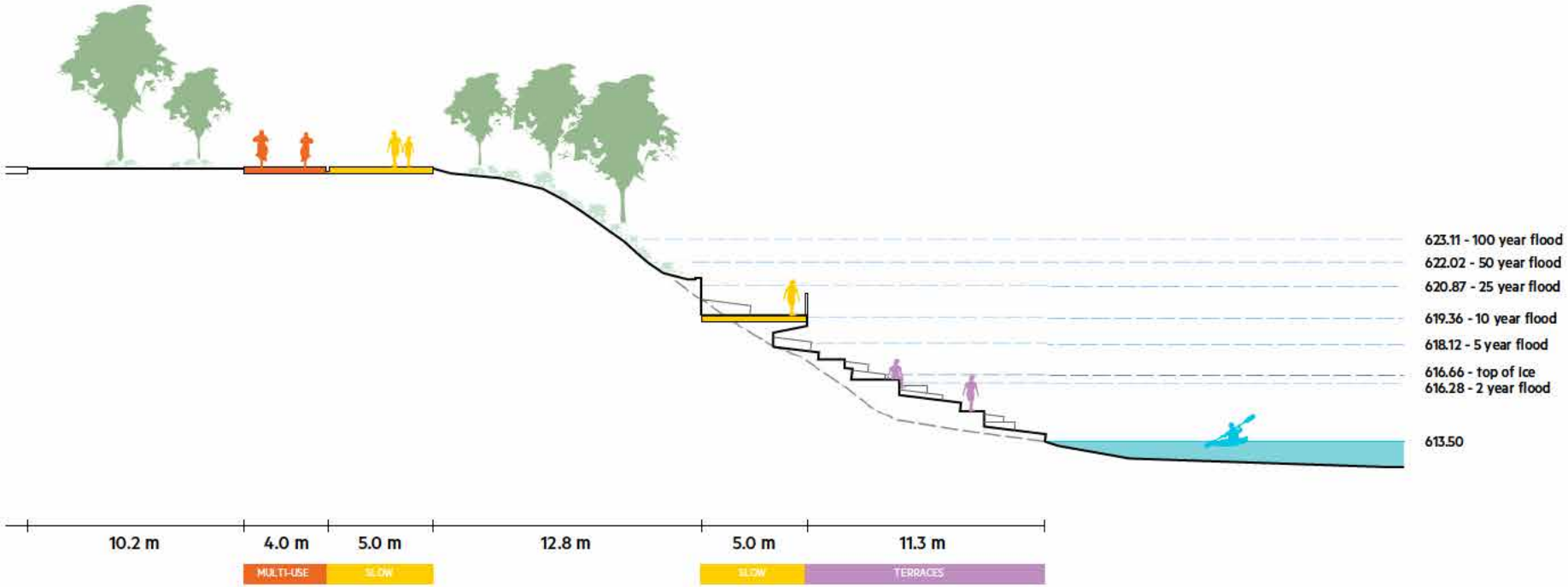


EXISTING

Figure 9. Rossdale Landing - Proposed Pathway

ROSSDALE LANDING

PROPOSED PATHWAYS



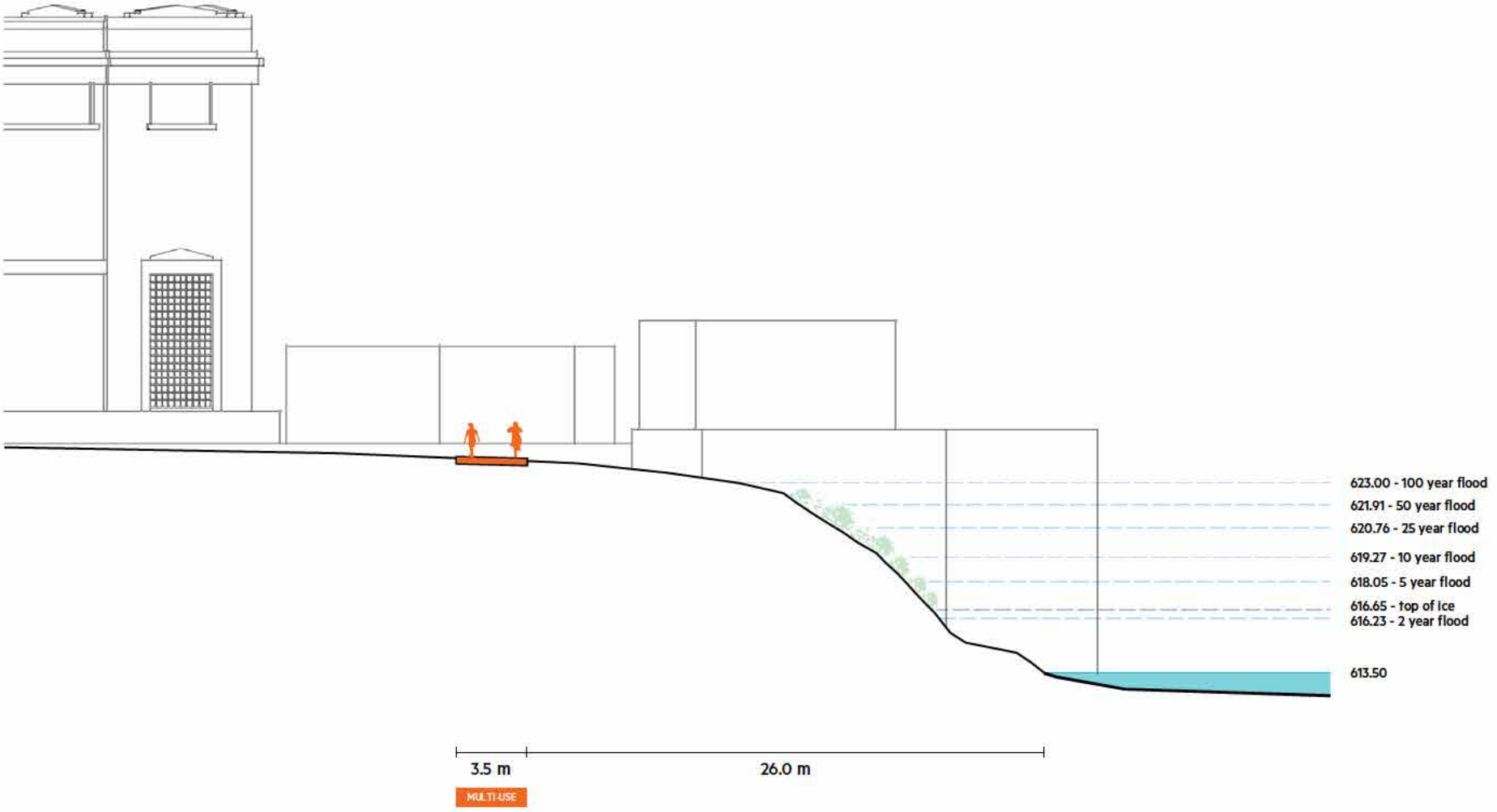
PROPOSED

10 m

Figure 10. Rossdale Power Plant - Existing Pathway

ROSSDALE POWER PLANT

EXISTING PATHWAYS CONDITION



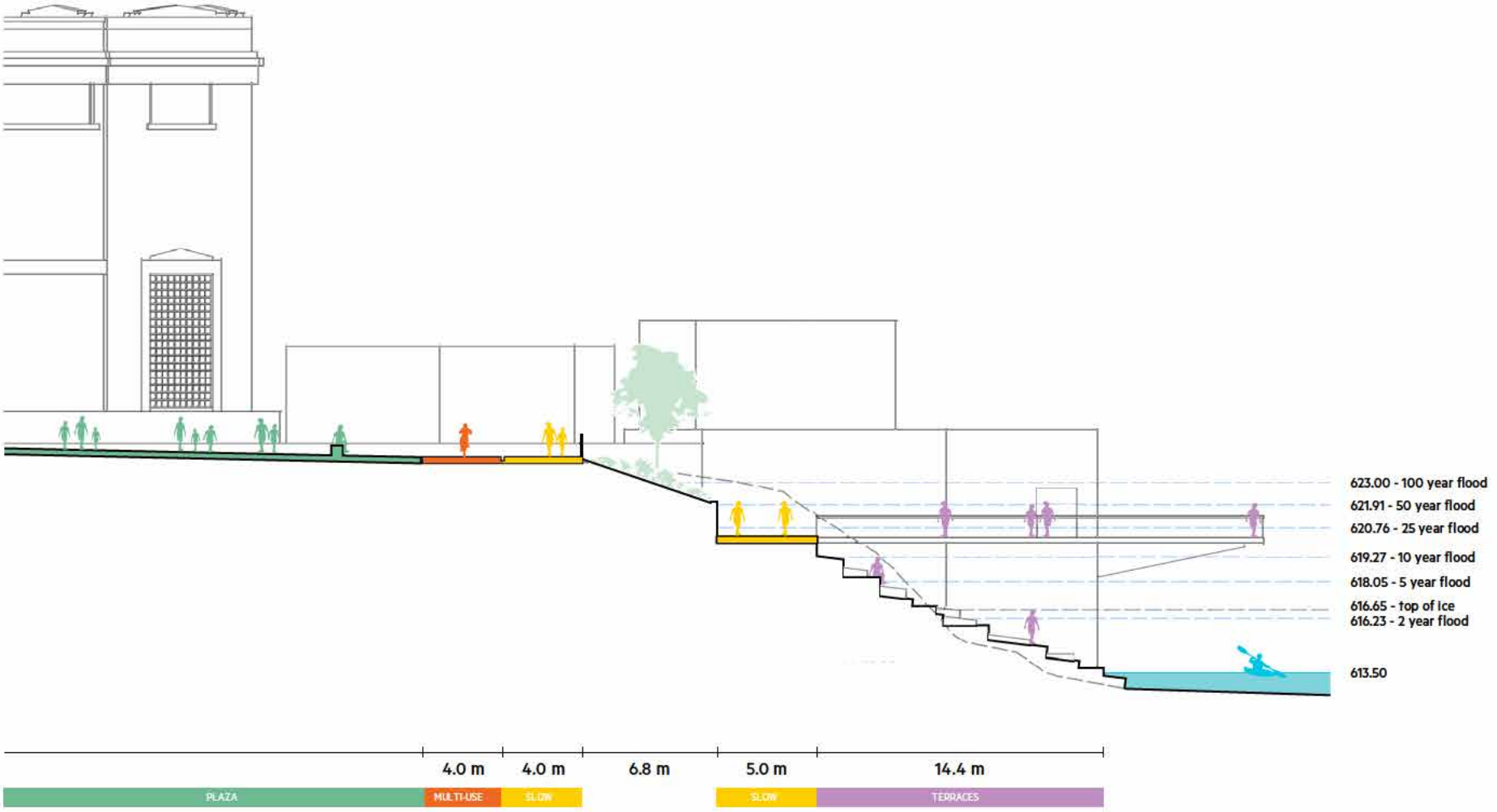
EXISTING

10 m

Figure 11. Rossdale Power Plant - Proposed Pathway

ROSSDALE POWER PLANT

EXISTING PATHWAYS CONDITION



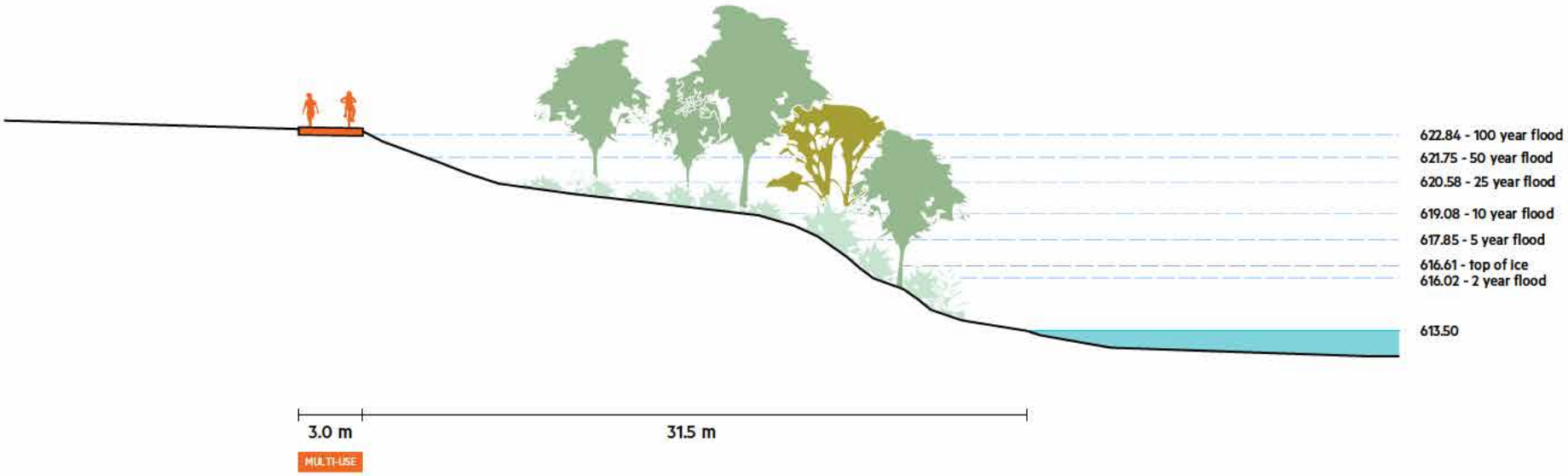
PROPOSED

10 m

Figure 12. EPCOR Treatment Plant - Existing Pathway

EPCOR TREATMENT PLANT

EXISTING PATHWAYS CONDITION



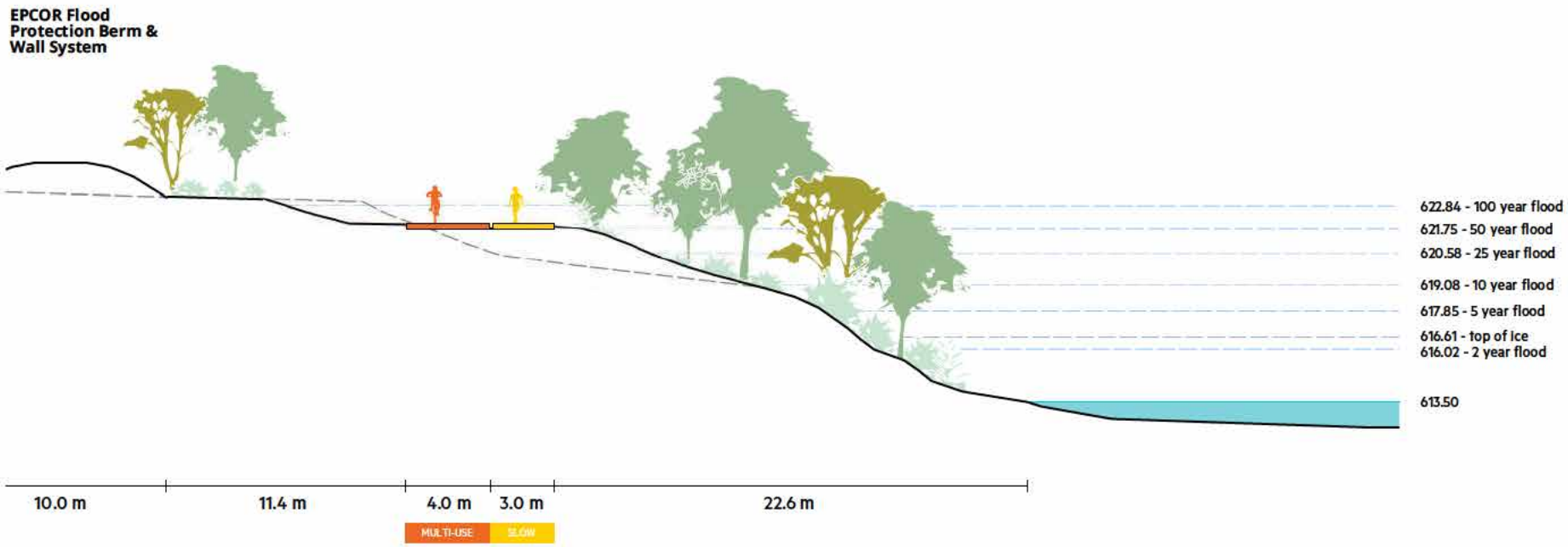
EXISTING

10 m

Figure 13. EPCOR Treatment Plant - Proposed Pathway

EPCOR TREATMENT PLANT

PROPOSED PATHWAYS



PROPOSED

10 m

Figure 14. The Bend - Existing Conditions

Figure 15. The Bend - Preferred Concept

THE BEND

PROPOSAL

Figure 16. The Bend - Preferred Concept Elements

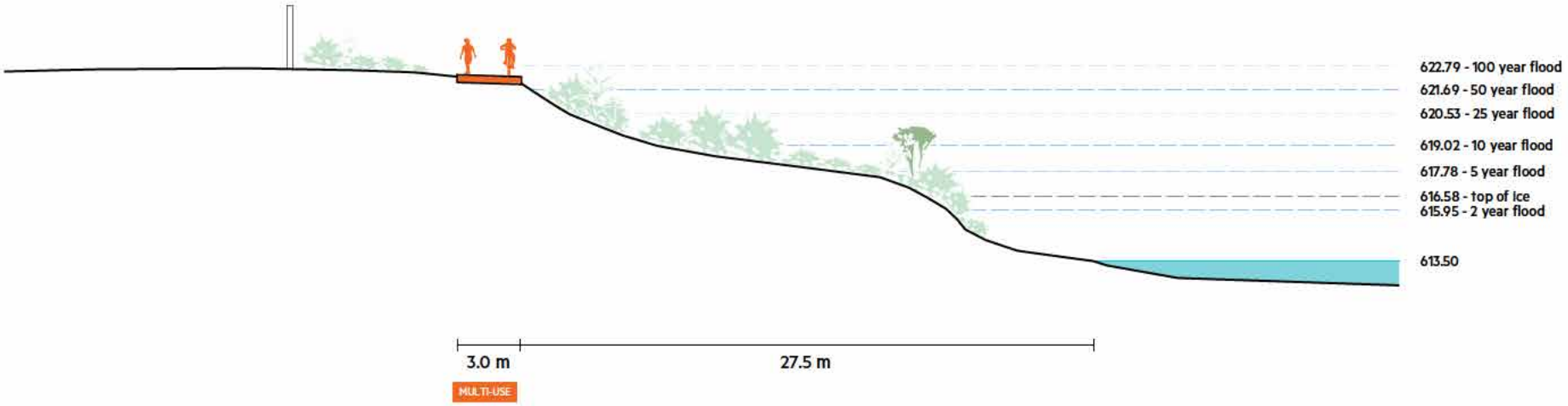
THE BEND

PROPOSAL

Figure 17. The Bend - Existing Pathway

THE BEND

EXISTING PATHWAYS CONDITION



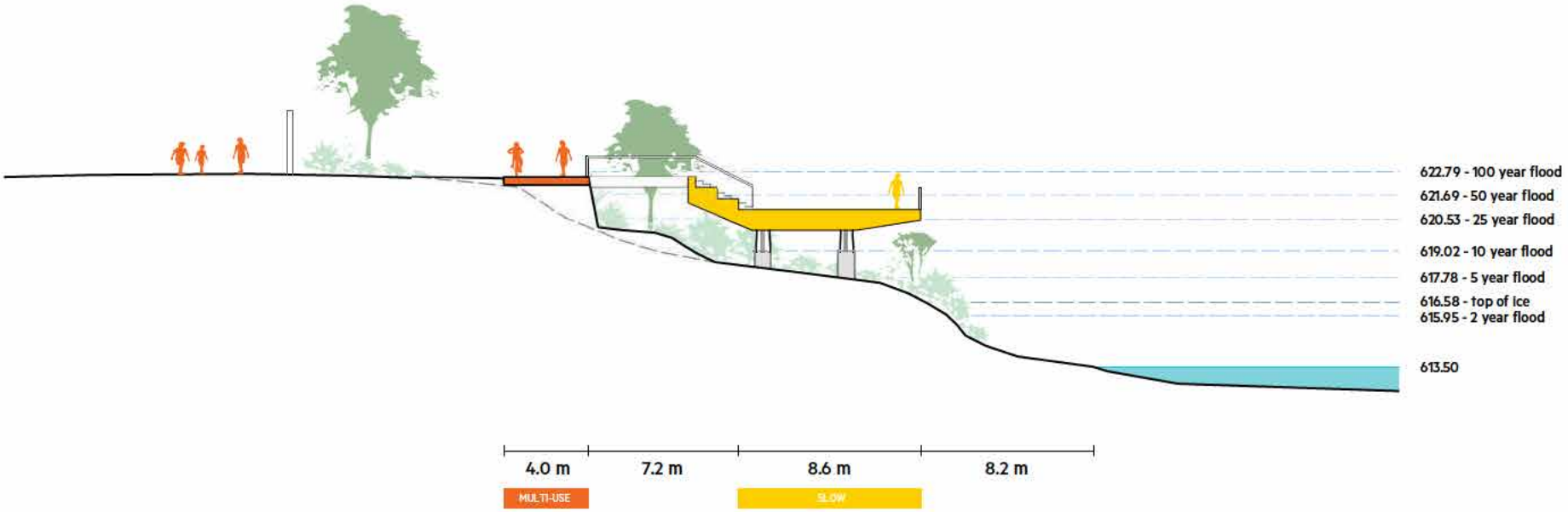
EXISTING

10 m

Figure 18. The Bend - Proposed Pathway

THE BEND

PROPOSED PATHWAYS



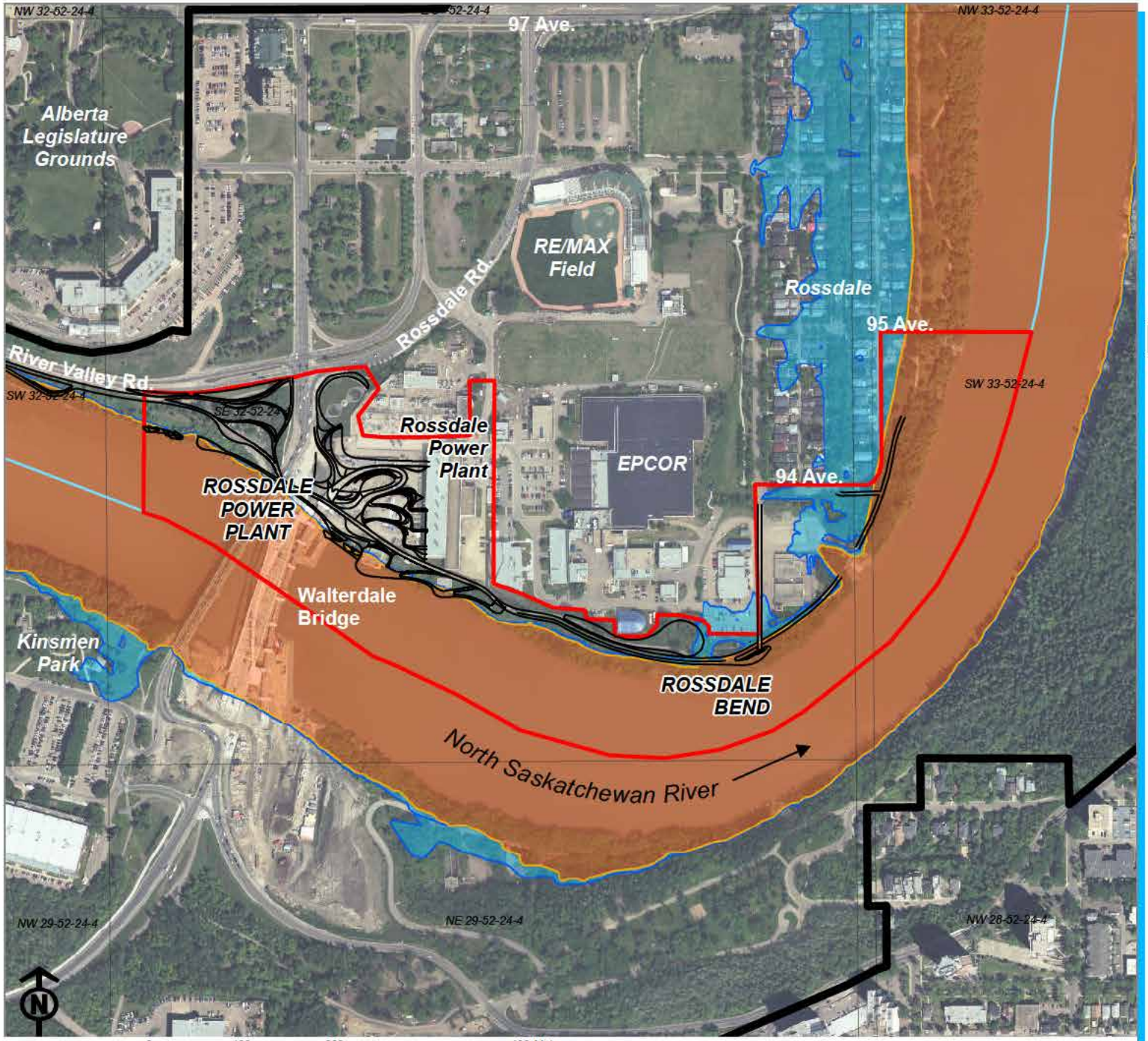
PROPOSED

10 m

Appendix C: Existing Environmental Conditions

Figure 1. Flood Hazard Mapping
Figure 2. Urban Primary Land and Vegetation Inventory (uPLVI)
Figure 3. City of Edmonton Environmental Sensitivities

Figure 1.
Flood Hazard Mapping
Rossdale Reach
TTWP

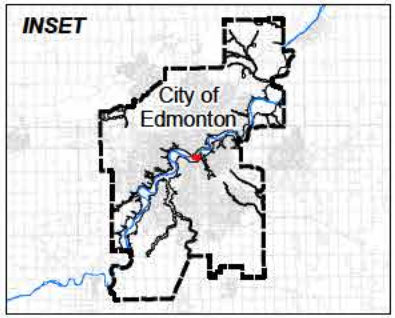


Legend

- Concept Design*
- Project Area
- Bylaw 7188 Boundary (COE, 2010)
- Watercourse (FWMIS, 2018)

Flood Hazard Area**

- Floodway
- Flood Fringe



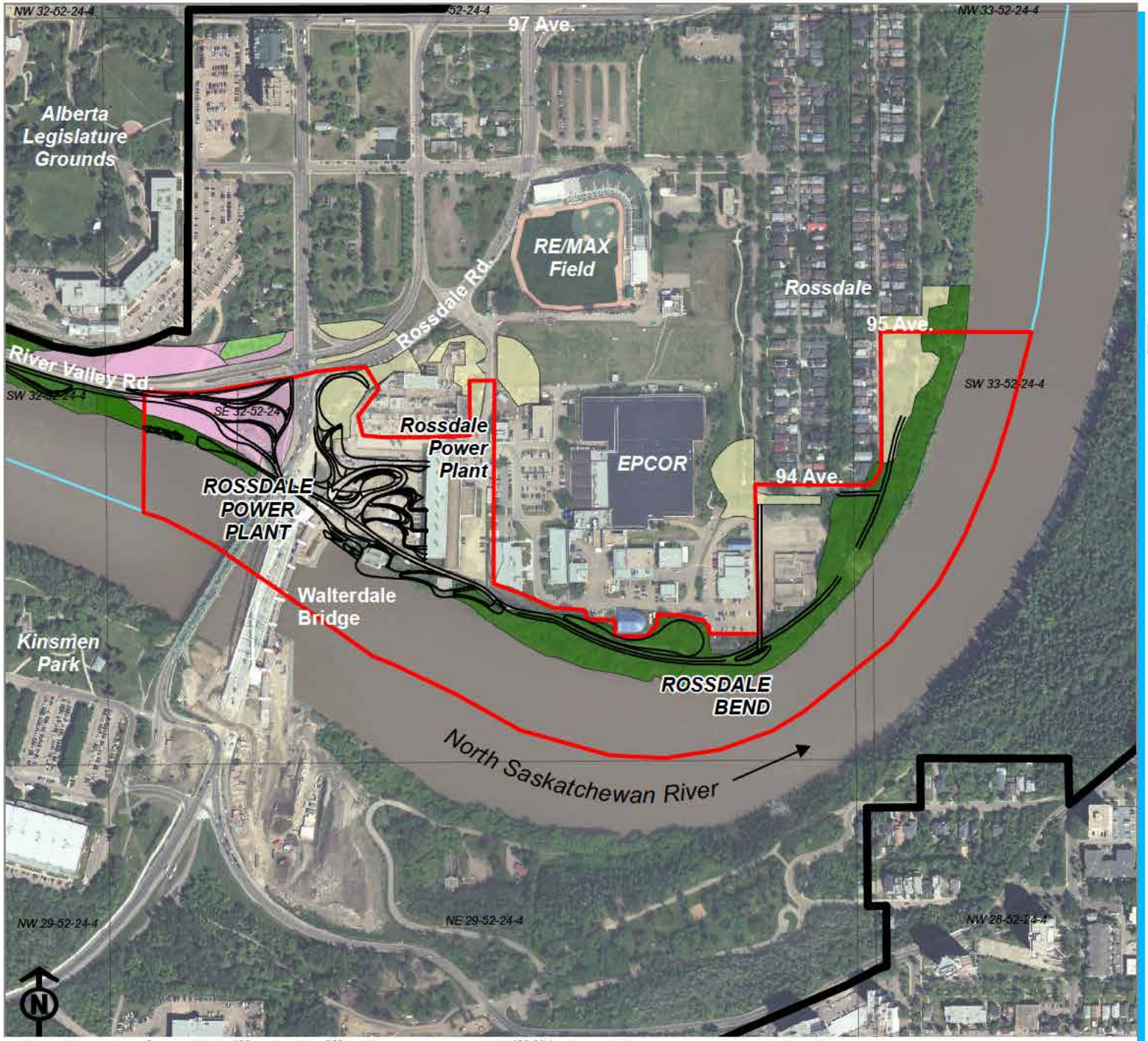
Map Date: 18 June 2021
Imagery Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Conceptual design provided by Dub Architects (2021).
**Flood Hazard Mapping (AEP, 2015); Government of Alberta is currently updating the City of Edmonton s flood hazard mapping data so the information presented here could change.

Figure 2. Urban Primary Land and Vegetation Inventory (uPLVI)

Rossdale Reach
TTWP

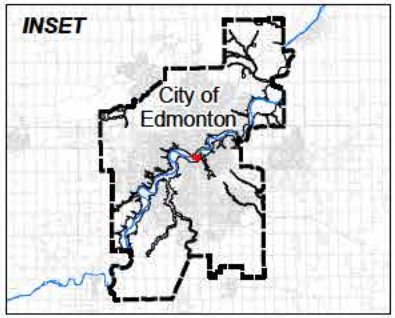


Legend

- Concept Design*
- Project Area
- Bylaw 7188 Boundary (COE, 2010)
- Watercourse (FWMIS, 2018)

Urban Primary Land and Vegetation Inventory (uPLVI)**

- Forested
- Transplant Trees
- Maintained Grass
- Non maintained Grass/Shrubs

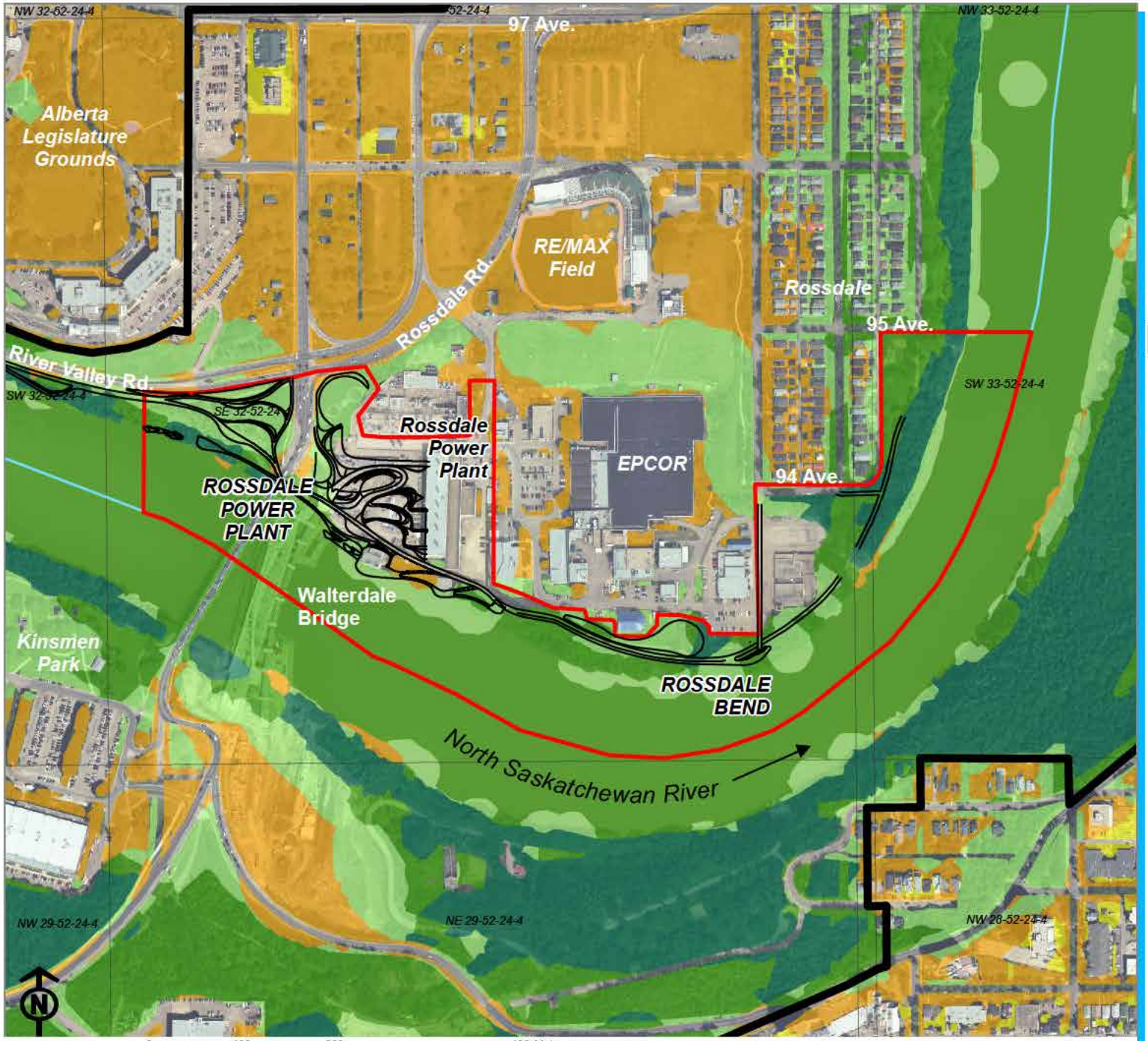


Map Date: 18 June 2021
Imagery Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Conceptual design provided by Dub Architects (2021).
**City of Edmonton Urban Primary Land and Vegetation Inventory (uPLVI) (Greenlink Forestry, 2014).

Figure 3.
City of Edmonton Environmental Sensitivities
Rossdale Reach
TTWP

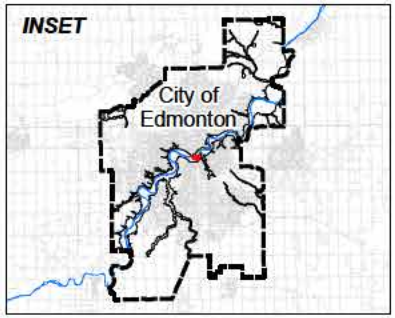


Legend

- Concept Design*
- Project Area
- Bylaw 7188 Boundary (COE, 2010)
- Watercourse (FWMIS, 2018)

Environmental Sensitivity**

- Extremely High Value
- Very High Value
- High Value
- Moderate Value
- Low Value



Map Date: 18 June 2021
Imagery Date: May 2017

SPENCER ENVIRONMENTAL MANAGEMENT SERVICES LTD.

*Conceptual design provided by Dub Architects (2021).
**City of Edmonton Environmental Sensitivity Project (Solstice Canada, 2015).

Appendix D: Fisheries Environmental Overview (Kingfisher Aquatics Ltd. 2021)

Kingfisher Aquatics

Touch the Water Promenade Project – Rossdale Reach

Conceptual Design Fisheries Resources Overview

PREPARED FOR:

Spencer Environmental Management Services Ltd.

#402 9925-109 Street
Edmonton, AB
T5K 2J8

PREPARED BY:

Kingfisher Aquatics Ltd.

23 Otterbury Avenue
Red Deer, AB
T4N 4Z8

July 2021

Table of Contents

List of Tables

List of Figures

Appendices

List of Acronyms

AEP	Alberta Environment and Parks
ASRD	Alberta Sustainable Resource Development
AESRD	Alberta Environment and Sustainable Resource Development
AT	Alberta Transportation
CoP	Code of Practice
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
DFO	Fisheries and Oceans Canada
FSI	Fish Sustainability Index
FWMIS	Fish and Wildlife Management Information System
GoA	Government of Alberta
HADD	Harmful Alteration, Disruption, and Destruction
LRT	Light Rail Transit
LUB	Left Upstream Bank
NAD83	North American Datum 1983
NSR	North Saskatchewan River
QAES	Qualified Aquatic Environment Specialist
RAP	Restricted Activity Period
RUB	Right Upstream Bank
SARA	Species at Risk Act
TWPP	Touch the Water Promenade Project
UTM	Universal Transverse Mercator

1.0 INTRODUCTION

The City of Edmonton (the City) and the River Valley Alliance have proposed the Touch the Water Promenade Project. The TWPP aims to improve public experience and access to and within the North Saskatchewan River valley through the development of a public promenade and accompanying infrastructure along the north bank of the NSR between Government House Park and 94th Avenue NW.

The TWPP is being delivered in accordance with the City's Policy C591 – Capital Project Governance and will be developed in three stages (conceptual design; preliminary design; and detailed design/build implementation). The TWPP is currently in the conceptual design stage which is being led by Dub Architects Ltd. (Dub Architects). Kingfisher Aquatics Ltd (Kingfisher) was retained to provide fisheries expertise for the TWPP.

The TWPP consists of two distinct areas referred to as the North Shore Promenade and the Rossdale Reach. The North Shore Promenade is situated between the Government House Park and the Walterdale Bridge and the Rossdale Reach extends downstream from the Walterdale Bridge to 94th Avenue NW. This document provides a description of existing fisheries conditions, an overview of potential fisheries issues, and an analysis of the preferred concept design for the Rossdale Reach area (the Project).

2.0 PROJECT DESCRIPTION

The Project will involve infrastructure upgrades to existing park facilities and construction of new developments along the north bank (the RUB) of the NSR to improve connectivity to the adjacent park trail systems and to interface with the existing Rossdale Generating Station infrastructure. Dub Architects has proposed a preferred concept design (Dub and Stoss 2021) through which design objectives will be achieved. Key elements of the preferred concept design that will interface with the NSR are described below. A detailed description of all aspects of the proposed Project is provided in the Environmental Overview (Spencer Environmental 2021).

The preferred concept design includes development of infrastructure at two main areas (as described below) and improvements to the existing trail system in the area.

Rossdale Power Plant

- Located along the shoreline near the Rossdale Generating Station (Figure 1).
- Involves development of a plaza, gardens, and decks on the top of the streambank, construction of an outlook (that would encircle the existing pumphouse) approximately mid-way up the bank, and installation of tiered platforms (referred to as the Touch the Water Scramble) and a boat tie-up area on the lower bank of the NSR.

The Bend

- Located at the apex of the meander between the Edmonton Fire and Rescue boat launch and the Rossdale Generating Station (Figure 1).
- Involves development of a widened portion of the promenade on the top of the bank and a lookout platform that would extend out over the lower bank of the NSR.


0
2.0
4.0
Kilometers
1:65,000
N
FIGURE 1.
Study Area Overview
LEGEND
Project Area
Study Area
Major Roadways
Flow Direction
Class A Habitat
Preferred Concept
Kingfisher Aquatics
107 AVE NW
TONY PIZIN AVE NW
GROAT RD NW
102 AVE NW
JASPER AVE NW
VICTORIA RD NW
Mackinnon Ravine Park
100 AVE NW
ROSSDALE HILL NW
87 AVE NW
ROWLAND RD NW
RIVER VALLEY RD NW
NORTH SASKATCHEWAN RIVER
Royal Mayfair Golf Club
Rossdale Power Plant
ROSSDALE
The Bend
SASKATCHEWAN DR NW
William Hawrelak Park
Kinsmen Park
Mill Creek Ravine
WALTERDALE HILL NW
ELIZABETH PARK RD NW
SASKATCHEWAN DR NW
87 AVE NW
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 333383.57 M E 5934173.84 M N. 26/11/2019.

3.0 EXISTING CONDITIONS

3.1 SETTING

The Project is situated on the north bank of the NSR in the Rossdale neighborhood near the centre of the Edmonton metropolitan area. It is located in one of the oldest areas in the City, which has been subject to extensive urbanization (i.e. transportation infrastructure, residential and industrial developments). Existing developments that are located within the active channel of the NSR in the vicinity of the Project include:

- the Walterdale Bridge located near the western boundary of the Project,
- the Rossdale Generation Station and pump houses located near the middle of the Project area;
- numerous stormwater outfall structures that are generally concentrated to the east (downstream) of the Rossdale Generation Station; and
- the Edmonton Fire and Rescue boat launch located near the eastern boundary of the Project.

The NSR originates at the Saskatchewan Glacier in the Columbia Icefields and flows over 1000 km from its headwaters to the Alberta – Saskatchewan border. There are two dams on the river that regulate flow; the Bighorn Dam is located on the NSR west of Nordegg and the Brazeau Dam is located on the Brazeau River which is a major tributary to the NSR (ASRD 2008). The NSR channel meanders through the City in an irregular pattern forming point and side bars throughout (Allan 1984). The valley surrounding the Project is generally entrenched with steep valley walls. Urban development in the valley can be extensive in areas where the valley walls have gentler slopes and are stable while steep or unstable portions of the valley appear to be largely undisturbed by anthropogenic activities.

AEP hydrologic unit code designations for the NSR in the vicinity of the Project are as follows:

HUC 2 – #11 – “North Saskatchewan River”

HUC 4 – #1102 – “Middle North Saskatchewan River”

HUC 6 – #110202 – “Whitemud/Blackmud Creeks”

HUC 8 – #11020201 – “North Saskatchewan Below Strawberry”.

3.2 STUDY AREA

The preferred concept design indicates that Project activities will be located within an approximately 850 metre long section of the NSR, between the Walterdale Bridge and the 94th Avenue (the Project Area).

A 2400 metre study area was established to assess existing fisheries conditions within the NSR in the vicinity of the Project. The study area encompassed the entire length of the Project Area, extending from approximately 750 metres upstream to approximately 1000 metres downstream of the Project Area. And included a portion of the study area for the TWPP North Shore Promenade Conceptual Design Fisheries Overview (Kingfisher 2021). Figure 1 provides a visual overview of both the Project Area and study area.

3.3 EXISTING INFORMATION REVIEW

The FWMIS was queried to produce a Fish and Wildlife Report for the NSR in the vicinity in of the Project. This report was used to confirm the fish species that are known to occupy the NSR in the vicinity of the Project.

Provincial fisheries management has indicated that contemporary fisheries management objectives for the NSR in vicinity of the Project have not been formalized at this time (Pers. Comm. O. Watkins). Other pertinent literature that was reviewed to assess general condition and management objectives of the NSR included:

- Fisheries Management Objectives of the North Saskatchewan River (ASRD 2008)
- Alberta Lake Sturgeon Recovery Plan, 2011-2016 (Alberta Lake Sturgeon Recovery Team 2011).
- Sustaining the Recovery of Lake Sturgeon (*Acipenser fulvescens*) in the North Saskatchewan River of Alberta (Watkins 2016)
- Lake Sturgeon Fish Sustainability Index. (AEP 2019a)
- Goldeye Fish Sustainability Index. (AEP 2019b)
- Mooneye Fish Sustainability Index. (AEP 2019c)

3.4 FIELD ASSESSMENT METHODS

Field investigations on the NSR were conducted on October 24 and 25, 2019. The investigations included:

- habitat assessment of a 2400 metre section of the NSR in the vicinity of the Project which consisted of:
    - large river habitat inventory of the study section; and
    - near-shore (within 30 m of the bank) assessment of water depths, fish cover and substrates within the Project Area;
- characterization of the river channel profile using a depth sounder along 12 transects that were established perpendicular to the river flow every 200 metre within the study area;
- assessment of streambank conditions of the RUB at each of the 12 transects;
- collection of video and photograph logs of RUB riparian conditions within the study area;
- documentations of anthropogenic alterations and existing infrastructure on the RUB within the study area; and
- in situ measurement of temperature, dissolved oxygen, specific conductivity, pH, and turbidity at one location within the NSR.

Field investigations were conducted following Kingfisher's standard procedures (Appendix A). The procedures were developed to be consistent with the methods described in the Alberta Fish Habitat Manual (AT 2009), which were designed to meet the requirements of the Code of Practice for Watercourse Crossings (AEP 2019d) as well as the information requirements of Fisheries and Oceans Canada.

3.5 RESULTS

3.5.1 Fish Populations

Since 2000, FWMIS (AEP 2019e) has record of 16 fish species being captured from within the 2400 metres of the NSR that was encompassed by the study area (Table 1, Appendix B). Overall, sport fish have been captured in greater numbers than non-sport species and mountain whitefish, goldeye, mooneye, and walleye have been captured more frequently than other sport species.

The FWMIS has records of 24 fish species occupying the NSR within 25 kilometres of the Project (Table 2). Most of the fish species encountered in this section of the NSR are not listed by COSEWIC or the SARA and are considered to be *Secure* under the provincial *Wildlife Act* (Table 2). However, Saskatchewan River populations of lake sturgeon are listed as *Endangered* by COSEWIC (COSEWIC 2006) and are ranked as *Threatened* under the *Wildlife Act* (AEP 2019f). At present, Saskatchewan River lake sturgeon populations are not listed under SARA (SARA Public Registry 2019). Primary limiting factors to lake sturgeon recovery include habitat fragmentation due to dams, poor water quality, overharvesting, and life history characteristics (slow growth and delayed maturity) that reduce population resiliency (ASRD 2002). Sauger and spoonhead sculpin are listed under the *Wildlife Act* as *Sensitive* and *May Be At Risk* respectively; the listings are due to limited information regarding sauger and spoonhead sculpin populations in Alberta (AEP 2019g and AEP 2019h).

Table 1. Historic fish captures from the 2.4 km study section on the NSR.

Species[1]	Total						
	2009	2010	2013	2016	2017	2018	Total
Burbot	-	1	-		2		3
Emerald Shiner	2	-	-	1	1		4
Goldeye	7	-	-	5	13	6	31
Longnose Dace	-	-	-			3	3
Longnose Sucker	9	-	-	7	5	3	15
Mountain Whitefish	18	10	-		3	13	44
Mooneye	-	-	-	4	13		17
Northern P ke	-	1	-	1	1		3
Quillback	-	-	-			1	1
River Shiner	-	-	-	3			3
Shorthead Redhorse	6	-	-	5	1	3	15
Spottail Shiner	-	-	-	2			2
Trout-perch	-	5	-	1			6
Walleye	1	2	-	14	11	8	36
White Sucker	4	2	-	10	9	6	31
Yellow Perch			7				7

1 From FWMIS; does not include species with fewer than 5 individuals captured or records older than 20 years

Table 2. Status and management ranking for fish species found in the NSR within 25 km of the Project.

Fish Species[1]			Status			Provincial Management Priority Ranking[4]
Common Name	Scientific Name	Code	Federal[2]		Provincial[3]	
			COSEWIC	SARA	Wildlife Act	
Brook Stickleback	*Culaea inconstans*	BRST	No Listing	No Status	Secure	5
Burbot	*Lota lota*	BURB	No Listing	No Status	Secure	3
Emerald Shiner	*Notropis atherinoides*	EMSH	No Listing	No Status	Secure	5
Fathead Minnow	*Pimephales promelas*	FTMN	No Listing	No Status	Secure	5
Goldeye	*Hiodon alosoides*	GOLD	No Listing	No Status	Secure	3
Lake Chub	*Couesius plumbeus*	LKCH	No Listing	No Status	Secure	5
Lake Sturgeon	*Acipenser fulvescens*	LKST	Endangered	No Status	Threatened	1
Longnose Dace	*Rhinichthys cataractae*	LNDC	No Listing	No Status	Secure	5
Longnose Sucker	*Catostomus*	LNSC	No Listing	No Status	Secure	4
Mountain Whitefish	*Prosopium williamsoni*	MNWH	No Listing	No Status	Secure	5
Mooneye	*Hiodon tergisus*	MOON	No Listing	No Status	Secure	3
Northern Pike	*Esox lucius*	NRPK	No Listing	No Status	Secure	2
Pearl Dace	*Margariscus margarita*	PRDC	No Listing	No Status	Secure	5
Quil back	*Carpoides cyprinus*	QUIL	No Listing	No Status	Undetermined	4
River Shiner	*Notropis blennius*	RVSH	No Listing	No Status	Secure	5
Sauger	*Stizostedion canadense*	SAUG	No Listing	No Status	Sensitive	3
Shorthead Redhorse	*Moxostoma macrolepidotum*	SHRD	No Listing	No Status	Secure	4
Silver Redhorse	*Moxostoma anisurum*	SLRD	No Listing	No Status	Undetermined	4
Spoonhead Sculpin	*Cottus ricei*	SPSC	Not At Risk	No Status	May Be At Risk	5
Spottail Shiner	*Notropis hudsonius*	SPSH	No Listing	No Status	Secure	5
Trout-perch	*Percopsis omiscomaycus*	TRPR	No Listing	No Status	Secure	5
Walleye	*Sander vitreus*	WALL	No Listing	No Status	Secure	2
White Sucker	*Catostomus commersoni*	WHSC	No Listing	No Status	Secure	4
Yellow Perch	*Perca flavescens*	YLPR	No Listing	No Status	Secure	not listed

1 From FWMIS; does not include species with fewer than 5 individuals captured or records older than 20 years
2 SARA Public Registry 2019
3 AESRD 2015
4 ASRD 2008

Alberta fisheries management (ASRD 2008) has designated several native sportfish species found within the study area as higher management priority (priority ranking 1 to 3, Table 2). These species include:

Burbot

Burbot typically lead a nocturnal, solitary life in the colder parts of large rivers, sheltering under rocks, weed beds, debris, and cut-banks during the day, and foraging at night (McPhail 1997). They are predominantly piscivorous, but they also eat insects, macro-invertebrates, and prey heavily on whitefish eggs in some systems (Nelson and Paetz 1992). The spawning season occurs from mid winter to early spring, often under ice (Nelson and Paetz 1992). In rivers, burbot spawn in low velocity areas in main channels, or in side channels behind depositional bars where water depths are less than 2 m (McPhail 1997). The preferred substrate in rivers appears to be fine gravel, sand, or even fine silt; eggs are broadcast into the water column above the streambed but eventually settle into interstices in the substrate (McPhail 1997).

Goldeye

Goldeye diet is relative to the size of individual fish and availability of food types. Food sources consist primarily of aquatic and aerial insects although goldeye will also feed on other fish, zooplankton, and occasionally aquatic tetrapods such as shrews (Nelson and Paetz 1992). They typically spawn in May and/or June often grouping in large schools and migrating to spawning areas from deeper overwintering areas. Spawning generally occurs in pools and backwater areas of higher turbidity (Kennedy and Sprules 1967).

Lake Sturgeon

Adult lake sturgeon are generally found in deeper water (between 5 m and 10 m) over substrates of mud, clay, sand or gravel. Habitat utilization is low where velocities exceed 0.7 m/s (COSEWIC 2006). Food sources consist of benthic organisms such as clams, snails, insect larvae, some fish, and plant material (Nelson and Paetz 1992). Spawning occurs in the late spring with maturity reached when an individual is about 15 years old and about 90 cm in fork length (Watters 1993). Spawning habitats are fast-flowing rocky areas, usually below rapids, or dams. Adults often return to the same spawning sites year after year and undertake long migrations to reach spawning habitat (ASRD 2002).

Mooneye

Mooneye are found in large clear rivers, often in deeper holes with swift currents and firm substrates; they appear to be relatively intolerant of silt and turbid waters (Joynt and Sullivan 2003). Mooneye have similar diets to goldeye, feeding mostly on aquatic invertebrates (Nelson and Paetz 1992). Spawning occurs in the spring from April to June.

Northern Pike

Northern pike prefer relatively shallow, vegetated, clear waters. They typically avoid high velocity habitat and seek outside channels, sloughs, and backwater areas in river systems. Northern pike are largely sedentary and territorial, only moving in and out of deeper water as needed during seasonal changes (Harvey 2009). Using an ambush style of hunting that relies on camouflage in aquatic vegetation, northern pike are predominantly piscivores, but will also eat invertebrates, crustaceans, and tetrapods such as muskrats and ducklings (Harvey 2009). They spawn in the early spring in shallow, marshy areas or flooded vegetation in shallow bays.

Sauger

Sauger can be found in larger, deeper, and more turbid portions of rivers. They feed mostly on bottom-dwelling fishes and aquatic insects, as well as leaches, crayfish and other macroinvertebrates (Nelson and Paetz 1992). Emerald shiners are an important part of the sauger diet during most of the year (Scott and Crossman 1973). Spawning occurs in the spring in varying water depths (0.5 m to 3.5 m) where eggs are broadcast over shoals of gravel or rubble (Nelson and Paetz 1992).

Walleye

Walleye are tolerant of a wide range of conditions. In rivers they are found most often in habitats with stable banks and cobble/fines or boulder/gravel substrates where the shoreline is uniform and water velocities are low and where instream cover is limited to roughness and overhead cover is provided by turbidity (Hartman 2009). Walleye feed mostly on fish and aquatic invertebrates (Nelson and Paetz 1992). Spawning occurs in early spring along cobble or gravel reefs with depths typically between one half metre and one and a half metres. Water velocities at spawning sites can vary but are usually relatively swift. Walleye are broadcast spawners that release eggs into the water column where they fall to the bottom, adhere to the gravel, and sink into interstitial spaces (Scott and Crossman 1973).

3.5.2 Fish Habitat

3.5.2.1 Large River Habitat Inventory

Within the study area, the NSR flows through a single, unobstructed channel where point and side bar formations were common, but islands and channel braiding were absent. The Project is located on the inside of a large meander. Upstream of the Project, the NSR channel was relatively straight and broad and water depths were generally shallow. Immediately adjacent to the Project, the NSR was narrower and water depths were greater. Downstream of 94th Avenue NW, water depths decreased but the channel remained relatively narrow compared to upstream of the Project. The mean wetted width and mean depth across the 12 transects was 164 m and 1.44 m respectively. The thalweg was on the LUB side of the river in the upper end of the study area, it transitioned to the middle of the channel at the Walterdale Bridge and was closer to the RUB adjacent to the Rossdale generating station before transitioning back to the LUB as the river meandered to the north. Channel depth profiles are provided in Appendix C.

A map delineating fish habitat within the study area is provided on Figure 2, and a summary of results for the large river habitat inventory is presented in Table 3. The upstream portion of the RUB, including a substantial part of the Project Area, was composed of natural and artificial armoured habitats with A1 habitat predominant. A1 habitat is characterized as having sparse cover (afforded by substrate and turbidity), low to moderate flow velocities, and banks that are stable with slopes at repose. Moving downstream, the RUB habitat transitioned to being almost exclusively composed of depositional (D1) habitat, which is characterized by a lack of cover, shallow depths, lows velocities, a predominance of fine substrates, and low banks. The LUB was relatively steep throughout the study section, increasing in height and instability with downstream direction. Habitat along the LUB was composed primarily of erosional habitat (E4 and E5) that was interspersed with relatively small sections of armoured banks (e.g. Walterdale bridge south abutment and Mill Creek outfall armouring). Water depth and velocities were moderate to high and fish cover along the LUB was sparse, generally consisting of boulders and turbidity.

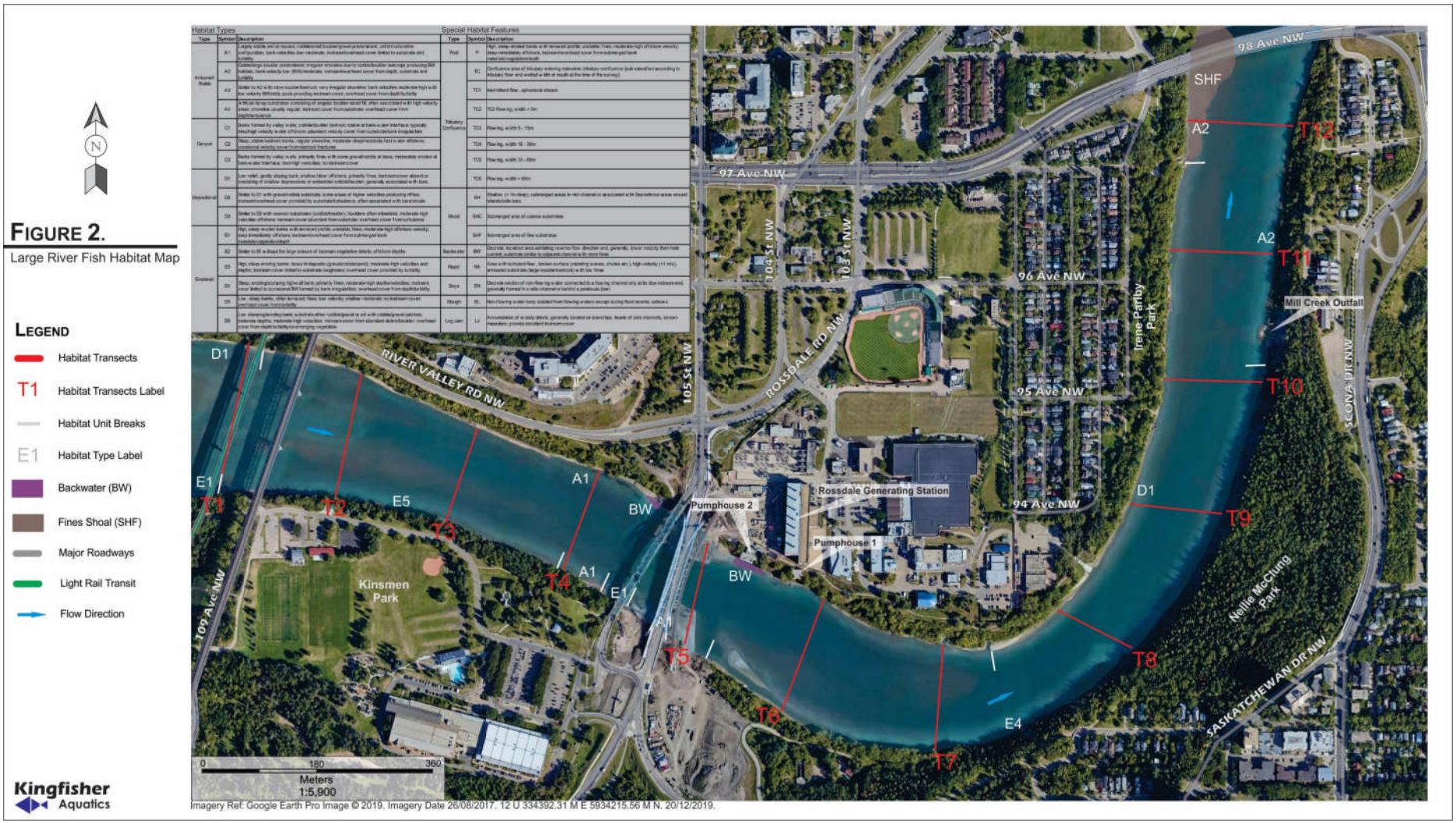

Habitat Types
Special Habitat Features
N
FIGURE 2.
Large River Fish Habitat Map
LEGEND
Habitat Transects
Habitat Transects Label
Habitat Unit Breaks
Habitat Type Label
Backwater (BW)
Fines Shoal (SHF)
Major Roadways
Light Rail Transit
Flow Direction
Kingfisher Aquatics
98 Ave NW
97 Ave NW
96 Ave NW
95 Ave NW
94 Ave NW
104 St NW
103 St NW
105 St NW
109 Ave NW
RIVER VALLEY RD NW
ROSSDALE RD NW
SASKATCHEWAN DR NW
SCONA TR NW
Irene Parlby Park
Nellie McClung Park
Kinsmen Park
Rossdale Generating Station
Pumphouse 2
Pumphouse 1
Mill Creek Outfall
SHF
A2
T12
T11
T10
T9
T8
T7
T6
T5
T4
T3
T2
T1
D1
E1
E5
E4
A1
BW
0
180
360
Meters
1:5,900
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 334392.31 M E 5934215.56 M N. 20/12/2019.

Table 3. Summary of results for large river habitat inventory.

Habitat Unit[1] or Feature[2]	Number of Units		Total Combined Length (m)[3]		Percentage of Bank Length (%)	
	LUB	RUB	LUB	RUB	LUB	RUB
A1	0	2		938	0.0	42.1
A2	1	1	488	143	19.0	6.4
A4	2	1	253	241	9.9	10.8
D1	0	2	0	907	0.0	40.7
E1	2		42	0	1.6	0.0
E4	1		1234	0	48.1	0.0
E5	1		550	0	21.4	0.0
BW		2	Not Calculated[2]			
SHF		1				

1 Habitat features are defined in Appendix A
2 Habitat features dimensions were not calculated due to lack of distinct habitat feature boundaries.
3 Lengths derived from habitat map

3.5.2.2 Streambank and Near-Shore Habitat

A summary of RUB streambank and channel characteristics that were measured at 12 transects within the study area is presented in Appendix D. Bank heights ranged from one metre and ten metres but were generally between three metres and five metres. Overall, bank angles were steepest upstream and downstream of the Project area and were more moderately sloped within the Project Area. Bank substrates were composed almost exclusively of fine material except for the riprap armouring adjacent to the Walterdale Bridge and various outfall structures. Near-shore substrates within the Project Area were composed mainly of fine materials while a mixture of coarse substrates was more prevalent upstream in the rest of the study area.

Near-shore water depths within the study section generally ranged from zero to one metre. However, the depth transitions were variable and were the most abrupt within the Project Area between the Walterdale Bridge and the Edmonton Fire and Rescue boat launch. In this section of the river, water depths typically exceeded one metre within a few metres of the shore. Detailed maps of the near-shore conditions are presented in a series of figures in Appendix E

Banks were largely stable in the upstream half of the study area but were relatively unstable downstream of the Edmonton Fire and Rescue boat launch, near the downstream end of the Project Area (Appendix E Figure E8). Riparian vegetation composition and density varied widely throughout the study area. A largely contiguous, narrow band of mature trees and shrub undergrowth existed between the Dudley B. Menzies LRT bridge and the Walterdale Bridge. The 100 metre section under the Walterdale Bridge abutment had been armoured with riprap and was nearly devoid of vegetation. Downstream of this bridge, within the Project Area, the band of vegetation between the existing pathway and water's edge was narrow and was interrupted by numerous outfalls and infrastructure associated with the generating station. Mature trees were sparse and shrub species were predominant with several grass covered and exposed areas present. Mature trees with moderate to sparse shrub undergrowth dominated the lower portion of the study area.

Anthropogenic alterations to the riverbank were present throughout the study area but were the most prevalent within the Project Area. The Walterdale Bridge riprap apron, the two pumphouses, and the Edmonton Fire and Rescue boat launch were the most significant disturbances identified in addition to 34 outfall structures that were located throughout the study section. Anthropogenic alterations are mapped on figures provided in Appendix E and photographs showing bank conditions at each transect are provided in Appendix F.

3.5.3 Water Quality

In situ water quality was measured at one location within the NSR (Table 4).

Table 4. In *situ* water quality from the NSR (October 24, 2019).

Dissolved Oxygen (mg/L)	pH	Turbidity (NTU)	Temperature (^{O}C)	Specific Conductivity (µS/cm)	Discharge [1] (m^3/s)
11.3	8.3	3.33	4.5 @ 16:30	432	154.1

[1]Retrieved from the Alberta River Basins application (GoA 2019)

3.6 SUMMARY

3.6.1 Existing Conditions

Overall, the habitat within the study section is not considered to be unique or in short supply in the NSR. Instream habitat capability within the study area was rated moderate based on the diversity and rarity of specific habitat characteristics and the potential for the habitat to support sensitive or listed species (Figure 3). Water depth and substrate composition varied slightly throughout the study area while the amount and type of available fish cover was homogenous. No major limiting factors were identified, and the habitat appeared capable of supporting a wide variety of fish species. However, no unique habitat features were present, and the area lacked attributes that would be considered important or critical for sensitive or federally and/or provincially listed species.

Streambank habitat capability was assessed based on streambank conditions and the level of disturbance (i.e. changes to natural form and function of the streambank). The streambanks upstream and downstream of the Project area were largely unimpaired and were considered to have moderate habitat capability while the streambanks within the Project Area had been subject to substantial disturbance (i.e. riprap, outfalls, buildings) and were considered to have low habitat capability (Figure 3).

Historical capture data indicated that the reach of the NSR in the vicinity of the Project is inhabited by a diverse assemblage of sport, coarse and forage fish species. The frequency and extent of the habitat use is dependant on the life cycle stage and specific habitat requirements of each species. The study area included slow velocity, moderate depth holding habitat that was suitable for larger-bodied fish species as well as moderate velocity, low depth areas with relatively clean substrates that could provide preferential feeding habitat for species that target benthic invertebrates (e.g. mountain whitefish and mooneye) and/or suitable spawning and rearing habitat for species requiring coarse substrates.

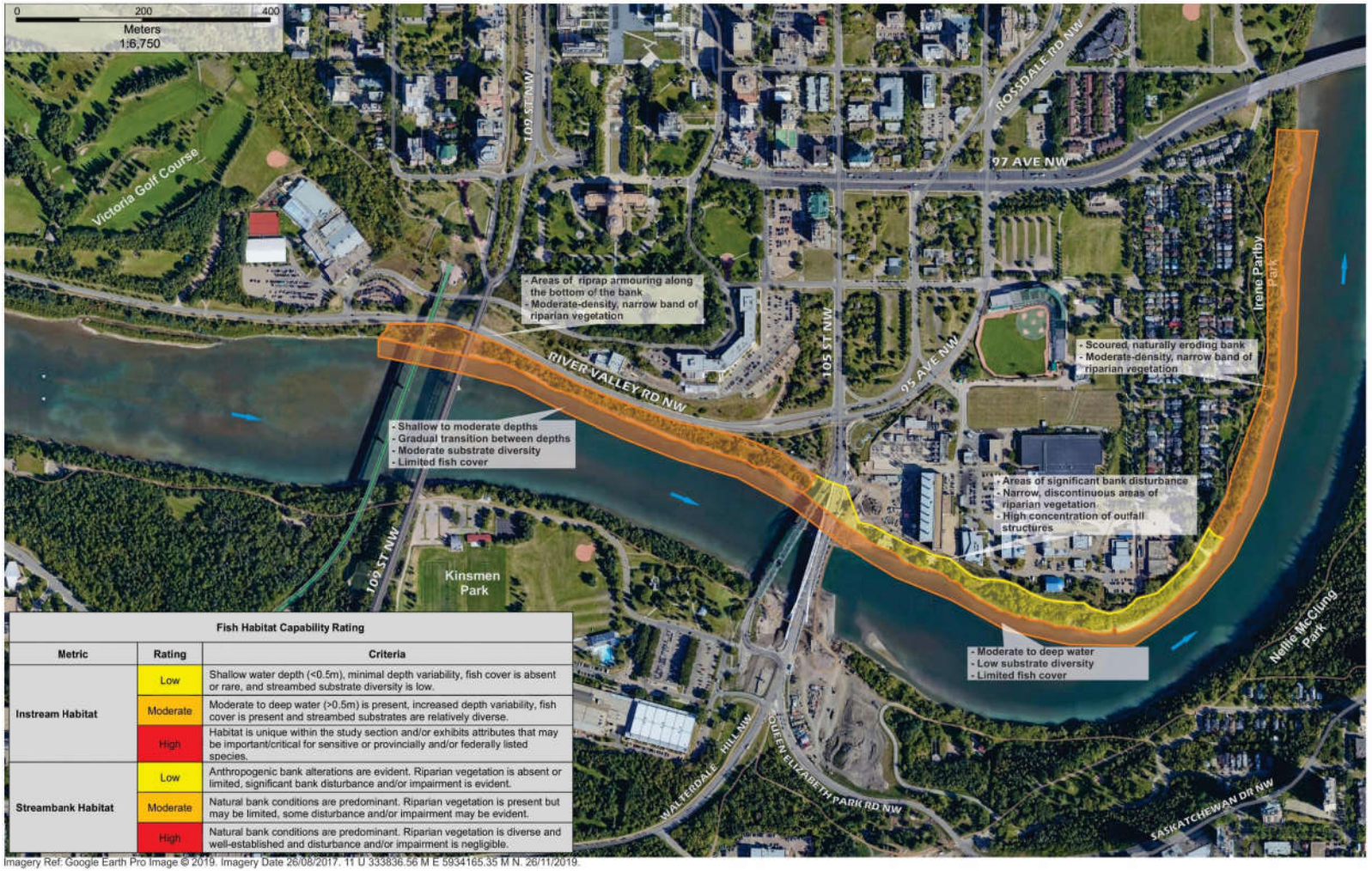


FIGURE 3.
Fish Habitat Capability Rating

LEGEND

- Major Roadways
- Trails
- Light Rail Transit
- Flow Direction

Fish Habitat Capability Rating

Metric	Rating	Criteria
Instream Habitat	Low	Shallow water depth (<0.5m), minimal depth variability, fish cover is absent or rare, and streambed substrate diversity is low.
	Moderate	Moderate to deep water (>0.5m) is present, increased depth variability, fish cover is present and streambed substrates are relatively diverse.
	High	Habitat is unique within the study section and/or exhibits attributes that may be important/critical for sensitive or provincially and/or federally listed species.
Streambank Habitat	Low	Anthropogenic bank alterations are evident. Riparian vegetation is absent or limited, significant bank disturbance and/or impairment is evident.
	Moderate	Natural bank conditions are predominant. Riparian vegetation is present but may be limited, some disturbance and/or impairment may be evident.
	High	Natural bank conditions are predominant. Riparian vegetation is diverse and well-established and disturbance and/or impairment is negligible.

Kingfisher Aquatics

Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 333836.56 M E 5934165.35 M N. 26/11/2019.

The majority of forage fish species known to inhabit the study area can be considered generalists that are able to tolerate a wide variety of environmental conditions. Most of these species probably occupy the study section on a year-round basis, likely inhabiting slower moving waters along the river margins, along armouring, and in backwater areas. Sucker species have been captured relatively frequently and likely occupy the area on a year-round basis for all life cycle phases. Goldeye, mooneye, mountain whitefish, and walleye have been captured from the study area more frequently and in greater numbers compared to other sport fish species that appear to use the area sporadically, and on a limited basis. While burbot capture numbers have been low, the relative abundance of coarse substrates and boulder cover along armoured banks offered moderate to high quality habitat for this species. Lake sturgeon have been found in the area but an overall lack of deep water (>4 m) and suitable spawning habitat suggests that they primarily use the habitat for migration. Preferential northern pike habitat, which is closely associated with dense aquatic vegetation and low flow velocity habitat that is often provided by snyes, backwaters and oxbow channels in large river settings, was rare within the study section.

Most forage and coarse fish species previously captured in the study area likely utilize the area for overwintering, feeding, migration, and rearing. Similarly, the most frequently encountered sportfish species may also be capable of fulfilling most of their life history requirements within or in close proximity to the study area. Spawning opportunities varied depending on species requirements but generally favoured species requiring coarse substrates.

3.6.2 Fisheries Management Considerations

Fish Sustainability Index assessments have been completed for three of the species found within NSR in Edmonton. The FSI assessment detail provincial priorities and objectives to recover populations. There are also other species residing within the vicinity of the Project that have been identified as priority FSI species; however, provincial assessments of these species have not been completed. These include river populations of northern pike and walleye, burbot, mountain whitefish, and sauger.

Lake Sturgeon *(from AEP 2019a)*

The historic adult density of lake sturgeon in this section of the NSR was high, and although populations are slowly increasing from critically low populations, current adult density is listed as very low. The main threats to the recovery of lake sturgeon are overfishing and poor river water quality in the past century, particularly in the NSR. Improved sewage treatment and catch-and-release fishing have been key to initiating species recovery efforts. However, dams on the Saskatchewan River system and long-term population declines have effectively isolated two populations of lake sturgeon, adding to the difficulty of recovery and species conservation efforts. In addition, lake sturgeon are very long-lived (100+ years in some cases and slow to mature) which means impacts to the population from overfishing and harvest pressure can be very severe. AEP has listed the need for habitat protection in this section of the NSR as moderate, and the need for protection from overharvest as very high.

Goldeye *(from AEP 2019b)*

The current FSI adult density of goldeye is listed as moderate, while historic adult density in the region was very high. Goldeye have been generally declining in Alberta due to three main threats. Poor water quality, and low dissolved oxygen resulting from nutrient run-off from intensive agricultural land use, resulted in major population declines in the Battle River. Changes to natural river flows due to major dams may have caused declines in the Peace-Athabasca populations and overfishing may have adversely affected local populations near the cities of Edmonton and Red Deer. Improved monitoring efforts, and a better understanding of the effects that dams, water use, and land use along large rivers have on these fish will be necessary for species recovery. The need for habitat protection in this section of the NSR is moderate, while the need for overharvest protection in the NSR drainage is considered very high.

Mooneye *(from AEP 2019c)*

Historically, mooneye adult density in the NSR has been low. Mooneye are a relatively recent arrival in Alberta rivers; the first report in Alberta was in the 1970's (Roberts 1974). Dams located near the headwaters of mainstem rivers like the NSR may have resulted in habitat changes that supported mooneye such as reduced glacial silt and decreased summer flows that allowed Mooneye to expand their range into most of the rivers in the Saskatchewan River system. Recently, there is some indication that mooneye numbers have been increasing; however, they are commonly misidentified for goldeye and monitoring for both species has been inconsistent, so conclusions are relatively uncertain. The largest threats to the sustainability of mooneye are poor water quality, particularly reduced dissolved oxygen from nutrient run-off, and dams that block migrations. To recover populations of mooneye, increased monitoring efforts, a better understanding of how land and river uses affects the fish, and an evaluation of current fishing regulations will be necessary. Habitat protection need in the area is moderate, and overfishing protection need is very high.

4.0 OVERVIEW OF POTENTIAL FISHERIES CONCERNS

4.1 FISH AND FISH HABITAT SENSITIVITIES

Fish sensitivity to perturbation/disturbance can be broadly defined as fish tolerance or adaptability to changes in environmental conditions (i.e. sediment concentrations, water temperature, dissolved oxygen, nutrient levels, etc.). Species have varying tolerance to environmental stressors but can be broadly categorized into three designations identified by Barbour *et al.* (1999) and described below.

Intolerant – Species that are sensitive to environmental or anthropogenic stresses.

Intermediate – Species that are neither particularly sensitive nor insensitive to environmental or anthropogenic stresses.

Tolerant – Species that are fairly insensitive or adaptive to environmental or anthropogenic stresses.

Tolerance designations for individual species can vary depending on local conditions and professional judgements. Table 5 provides a summary of tolerance designations for the fish species known to inhabit the NSR near the City of Edmonton.

Table 5. Tolerance designations for fish known to inhabit the NSR near the City of Edmonton.

Designation	Species	Basis/Source
Intolerant	Goldeye	➢ Barbour *et al.* 1999
	Lake Sturgeon	➢ Professional judgement based on provincial and federal status
	Mountain Whitefish	➢ Barbour *et al.* 1999
	Mooneye	➢ Barbour *et al.* 1999
	Sauger	➢ Professional judgement based on provincial status
Intermediate	Brook Stickleback	➢ Barbour *et al.* 1999
	Burbot	➢ Barbour *et al.* 1999
	Emerald Shiner	➢ Barbour *et al.* 1999
	Lake Chub	➢ Barbour *et al.* 1999
	Longnose Dace	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Professional judgement
	Longnose Sucker	➢ Barbour *et al.* 1999
	Northern Pike	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
	Pearl Dace	➢ Barbour *et al.* 1999
	Quillback	➢ Barbour *et al.* 1999
	River Shiner	➢ Barbour *et al.* 1999
	Shorthead Redhorse	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
	Silver Redhorse	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
	Spoonhead Sculpin	➢ Barbour *et al.* 1999
	Spottail Shiner	➢ Barbour *et al.* 1999
	Trout-perch	➢ Barbour *et al.* 1999
	Walleye	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
	Yellow Perch	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
Tolerant	Fathead Minnow	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999
	White Sucker	➢ Halliwell *et al.* 1999 (as cited in Grabarkiewicz and Davis 2008) ➢ Barbour *et al.* 1999

As described in Section 3.6.1, the instream habitat within the study section was considered to have moderate habitat capability. While a wide range of fish species are known to occupy the Project Area throughout the year, the local habitat was not considered critical or important to the viability of these species. The majority of the NSR in the vicinity of the Project is designated as a Class C waterbody (AESRD 2012). Class C habitat is defined as moderate sensitivity habitat that is broadly distributed and is sensitive enough to be potentially damaged by unconfined or unrestricted activities within a waterbody (Alberta Environment 2000). Class A habitat, which is considered to have high sensitivity (Alberta Environment 2000), is also present at several locations along the NSR within the City of Edmonton. This designation was established to protect localized deep-water habitat (generally >4 m depth) that has been identified as preferential habitat for lake sturgeon (AESRD 2012). The nearest Class A habitat to the Project is located approximately 2700 metres downstream of the Project Area.

4.2 POTENTIAL ISSUES

The construction of infrastructure within or near waterbodies has potential to affect aquatic resources through multiple impact pathways. Based on conceptual plans, potential impacts associated with the Project can be grouped into the five key categories described in Table 6.

Table 6. Description of potential aquatic impact pathways associated with the preferred concept.

Impact Category		Potential Effect
Water Quality	Erosion and Sediment	➢ Reduction in habitat quality ➢ Decreased food production (i.e. impacts to lower trophic resources) ➢ Reduced fish health and/or increased fish mortality ➢ Mortality of fish eggs
	Chemical Contaminants	➢ Reduced fish health and/or increased fish mortality
Direct Fish Mortality	Instream Construction	➢ Fish entrapment, impingement, entrainment which can result in fish mortality
	Increased Angling Pressure	➢ Increased exploitation of the resource
Direct Habitat Impacts	Instream Construction Riparian Disturbance	➢ Reduction in habitat availability ➢ Reduction in habitat quality
Fish Disturbance	Instream Construction	➢ Interference with fish movements due to temporary or permanent infrastructure that alters flow patterns and/or water velocities
	Boating Activity	➢ Reduction in habitat quality ➢ Reduced fish health and/or increased fish mortality.
Invasive Species	Instream Construction	➢ Reduction in habitat quality ➢ Increase in fish mortality

Kingfisher reviewed the preferred concept design to assess potential Project interactions with fish and fish habitat (Table 7).

Table 7. Summary of potential impacts associated with the preferred concept.

Impact Category		Impact Description
Water Quality	Erosion and Sediment Chemical Contaminants	➢ Project activities conducted instream or adjacent to the NSR have potential to result in sediment and/or chemical contaminants (i.e. hydrocarbons from equipment) being mobilized into the NSR. • Potential lower and mid bank riparian disturbances (centralized around the Touch the Water Scramble) represent approximately 35% of the length of the Project Area. • Relatively significant upper bank disturbances throughout the Project Area.
Direct Fish Mortality	Instream Construction	➢ Potential for fish entrapment, impingement, and/or entrainment in isolation area(s) that may be required to construct near-shore Project components.
	Increased Angling Pressure	➢ Potential that improved access to the NSR will result in increased angling pressure.
Direct Habitat Impacts	Instream Construction	➢ Potential for minor instream footprint associated with the Touch the Water Scramble component of the Project. ➢ Potential instream works will affect Moderate Capability habitat (Figure 3).
	Riparian Disturbance	➢ Potential lower bank riparian disturbances represent approximately 25% of the Project Area length. ➢ Potential riparian disturbances within Project Area will affect primarily Low Capability streambank habitat (Figure 3). Potential for post-Project riparian conditions to be improved compared to existing conditions.
Fish Disturbance	Channel Constriction	➢ Limited potential for fish movements to be affected since permanent instream infrastructure and instream isolation works are not expected to be extensive enough to significantly affect flow patterns and/or water velocities of the NSR.
	Boating Activity	➢ Potential that improved pedestrian access to the NSR due the Project may result in an increase in non-motorized boating activity in the area.
Invasive Species	Instream Construction Boating Activity	➢ Instream works and/or recreational activities have potential to spread aquatic invasive species.

4.3 REGULATORY CONSIDERATIONS

4.3.1 Permitting and Approvals

Regulatory requirements for the Project will be dependent on project designs, construction plans, and project schedules. Overall, it is expected that requisite permits and approvals will encompass a broad range of environmental disciplines including fisheries resources. The primary regulatory body overseeing the protection of fish and fish habitat in Canada is DFO, through the enforcement of the *Fisheries Act* and the *Species At Risk Act (*where it applies to aquatic species under the *Fisheries Act)*. In Alberta, AEP also regulates activities occurring on waterbodies through the *Water Act*. Based on current conceptual design options, it is expected that the Project will require:

- a DFO Request for Review and potentially an Authorization under the *Fisheries Act*; and
- a *Water Act* approval and/or notice(s) under the *Water Act*.

As discussed in Section 3.5.1, the fish species inhabiting the NSR adjacent to the Project area not listed under the *Species At Risk Act* at this time and therefore permitting under the *Species at Risk Act* is not expected to be required. Requirements for other permits and approvals are discussed in the Environmental Overview (Spencer Environmental 2021).

4.3.1.1 Fisheries and Oceans Canada

In Canada, projects that will likely result in the death of fish and/or the harmful alteration, disruption, or destruction of fish habitat must obtain an authorization from the Minister of Fisheries, Oceans and the Canadian Coast Guard as per the Canadian *Fisheries Act Regulations*. DFO provides list of steps to guide proponents in determining if they should submit a request for project review to DFO. For most projects in Alberta these steps include:

- Determining if there are aquatic species at risk or critical habitat that could be affected by the project. Approval from DFO will be required if the project will affect an aquatic species at risk in a way that is prohibited by the *Species at Risk Act.*
- Determining if the DFO Measures to Protect Fish and Fish Habitat (DFO 2019) can be implemented in their entirety including:
    - preventing the death of fish;
    - maintaining riparian vegetation;
    - carrying out works, undertakings and activities on land;
    - maintaining fish passage;
    - ensuring proper sediment control; and
    - preventing entry of deleterious substances in water

- Determining if the project will occur on a waterbody that does not require DFO review, which includes:
    - Artificial waterbodies that are not connected to a waterbody that contains fish hat any time during any given year, such as
        - private ponds
        - roadside drainage ditches
        - quarries and aggregate pits
        - irrigation ponds or channels
        - stormwater management ponds
        - agricultural drains and drainage ditches
        - commercial ponds
    - any other waterbody that:
        - does not contain fish at any time during any given year
        - is not connected to a waterbody that contains fish at any time during any given year
- Determining if the project falls within the standards and codes of practice requiring submission of a notification form.

If it is determined that a DFO review is required, then a Request for Review application will need to be submitted to DFO along with detailed project plans and fisheries information. If DFO determines that the project is likely to cause death of fish and/or HADD of fish habitat then the proponent will need to apply for a Section 34.4(2)(b) or 35 (2)(b) Authorization under the *Fisheries Act*. The Authorization will detail terms and conditions that the proponent must adhere to avoid, mitigate, offset and monitor impacts to fish habitat resulting from the project.

Fish habitat offsetting is required where impacts to fish habitat are unavoidable. Habitat offsetting typically takes the form of enhancement, remediation or creation of fish habitat. Habitat offsetting plans to counterbalance anticipated impacts are to be prepared by the proponent and submitted to DFO along with an application for Authorization. DFO has indicated that further guidance for habitat offsetting will be released in the future.

4.3.1.2 Alberta Water Act

Waterbodies in Alberta are regulated under the *Water Act* which is provincial legislation that supports and promotes the conversation and management of water in Alberta. *Water Act* approvals are required when an activity will impact a waterbody or when surface or groundwater will need to be diverted. Certain activities such as the construction, maintenance, replacement or removal of a watercourse crossing or outfall structure are exempted under the *Water (Ministerial)* Regulations and are managed under Codes of Practice.

4.3.2 Information Requirements and Schedules

In general, DFO applications and *Water Act* approval applications must provide sufficient information to allow for regulators to assess potential impacts resulting from the project. Typical information requirements include:

- Proponent contact information.
- Detailed project information including:
    - project description;
    - project location;
    - design plans; and
    - information regarding the construction methodology and schedule.
- Description of existing fish and fish habitat conditions.
- Assessment of potential effects of the proposed project and description of mitigation measures and residual effects.

AEP and DFO may request additional information over the course of their review if deemed necessary to complete their assessment of a project. In addition, submissions to regulators must include accurate information that represents final design plans and realistic construction methods and schedules since approvals/permits will often be issued with conditions that reference the information provided to the regulators. For some permits, regulators have defined time limits to complete their review while other permits do not have defined deadlines for decisions to be rendered (Table 8). In general, application completeness, project complexity, project risk, and review staff availability will all factor into permitting timelines.

Table 8. Summary of schedule/timelines for regulators to issue permits.

Regulator	Request/Permit	Schedule/Timeline
DFO	Request for Review	➢ No specific time review limits, anticipate minimum of three months.
	Authorization	➢ From the date of receipt of an application, the Minister has 60 calendar days to determine if the application is complete, incomplete or inadequate, and to notify the applicant of this determination. If the application is not complete or inadequate, the notification will identify the information or documentation that must still be provided by the applicant. [Subsection 4(3)]; and ➢ From the date of the notification that the application is complete, the Minister has 90 calendar days to either issue the authorization or notify the applicant in writing that the authorization is refused. [Subsection 4(5)] ➢ Either time limit (60- or 90-day) may cease to apply should one or more of the following occur: • the applicant proposes amendments to their application; • the applicant requests in writing that the processing of the application be suspended; • circumstances require that information or documents other than those referred to in subsection 2(1) be obtained or that amendments to the information or documents submitted by the applicant be made before an authorization can be issued or a notification of refusal can be given; • consultation is required before an authorization can be issued or a notification of refusal can be given; or • an Act of Parliament, a regulation made under an Act of Parliament or a land claims agreement provides that a decision be made or that conditions be met before an authorization can be issued or a notification of refusal can be given."
AEP	Water Act Approval	➢ No specific time review limits, anticipate minimum of one year
	Code of Practice (watercourse crossing, outfall structure)	➢ Provide notice at least 14 days prior to starting the project. ➢ To comply with CoPs, a project may also require the specifications and recommendations of a Qualified Aquatic Environment Specialist.

4.4 INFORMATION GAPS

Assuming that there are no major changes to the preferred concept design, the fisheries information presented in this document is considered to be sufficient to support a fisheries impact assessment that would meet the standard information requirements for environmental permitting under the *Fisheries Act* and the *Water Act*. However, as described in Section 4.3, additional design and construction details will be required before the fisheries impact assessment can be completed. It is assumed that this information will become available as the Project progresses at which time information gaps may become apparent. Key information that will be required to complete the impact assessment includes (but is not necessarily limited to) the following:

- Design plans with sufficient detail to determine physical footprints of permanent and temporary infrastructure on the bed and banks of the NSR.
- Construction plans detailing construction methodologies and schedules.

4.5 OPPORTUNITIES AND CONSTRAINTS

Given the broad scope of the Project and considering the phased delivery approach, there is opportunity for the Project to incorporate objectives that are subsidiary to the stated overall goals of the Project. In a fisheries context, these opportunities primarily relate to potential design modifications that will either reduce environmental disturbance or improve/enhance existing riparian and/or instream habitat. Similarly, analysis of design at the concept stage allows for the Project to be developed in a manner that minimizes potential constraints by identifying key issues in the early stages of the Project. A summary of potential opportunities and constraints based on the proposed concept options is provided in Table 9.

Table 9. Summary of fisheries opportunities and constraints associated with the preferred concept.

Opportunities	Constraints
Impact Avoidance ➢ Minimize instream footprint and disturbance to riparian areas. ➢ Incorporate streambank improvements and/or habitat enhancements into the design plan. ➢ Incorporate bioengineering techniques where bank stabilization is required. **Support regional fisheries management objectives** ➢ The primary fisheries management objectives for the NSR are to protect biologically diverse and productive ecosystems that maintain healthy fish populations and to support social and economic benefits for A bertans (ASRD 2008). The management of fish resources involves four primary components (ASRD 2008): • sustaining, or achieving, a net gain in the quality and quantity of fish habitat, • ensuring that native and desired introduced fish populations are maintained at satisfactory levels of abundance and distribution, • provide and maintain a high diversity quality and number of fishing opportunities, and • obtain information on public views and expectations for the condition and availability of fish resources in the province. **Support species recovery efforts** ➢ The Saskatchewan River populations of LKST are considered endangered by COSEWIC but no species recovery plan has been created under the SARA (SARA Public Registry 2019). However, A berta has developed a five-year recovery plan that outlines the following objectives (Alberta Lake Sturgeon Recovery Team 2011). • Quantify and increase current population levels of LKST in the North Saskatchewan and South Saskatchewan rivers. • Identity and protect critical habitat of LKST. • Identify potential threats to LKST from human activities and ecological processes and develop plans to avoid, eliminate, or mitigate these threats.	**Isolation of Instream Work Sites** ➢ It is likely that all instream work will need to be isolated from the rest of the NSR to facilitate construction. The installation and removal of isolation works can represent HADD. Some key considerations: • Regulators are unlikely to accept earthen berms as an isolation method. • Adverse impacts increase the longer that isolation works are in place. • Isolation measures must be more robust the longer they are in place, particularly if they are expected to remain in place during the winter and spring. • Isolation measures must be designed to accommodate a range in flows to ensure that the isolated area does not become inundated. Flows in the NSR are affected by upstream dam operations which should be taken into consideration in the design of the isolation works. **Timing of Instream Work** ➢ The Project area is located in a section of the NSR that is subject to a restricted activity period that extends from September 16 to July 31 (AESRD 2012). During this period, no instream work is allowed without approval from the provincial government contingent on the advice and recommendations of a QAES. Depending on the extent and duration of instream works within the RAP, additional measures may need to be implemented which include but are not necessarily limited to: • Completion of additional fisheries investigations. • Development of detailed mitigation plan that may require more extensive protection measures and/or more rigorous environmental monitoring. ➢ Conducting instream work during the winter can pose additional complications that increase risk to fish populations including: • Effective fish salvage (i.e. the successful capture and removal of fish from isolated construction areas) is unlikely if area is ice covered. • Increased risk to fish health if fish salvage is conducted when air temperatures are cold. • Increased complexity and safety concerns associated with turbidity monitoring during the winter.

4.6 SUMMARY

The preferred concept design includes components that could directly and indirectly affect the fisheries resources of the NSR. In most instances, potential impacts associated with construction activities that are completed above the one in two-year high-water mark can be mitigated through implementation of BMP's while instream works, or activities conducted below the one in two-year high-water mark typically require more site-specific mitigation planning and have a greater potential to require an Authorization under the *Fisheries Act*. Ultimately, the extent that fisheries resources are impacted and the need for habitat offsetting will depend on Project design and construction details that are yet to be determined. However, no major fisheries-related constraints to the feasibility of the preferred concept design were identified (Table 10).

Table 10. Summary of considerations for key factors associated with the preferred concept.

Key Factor	Considerations
Potential Impacts	➢ Primary impact pathway of concern is the potential for the Project to adversely affect water quality due to relatively large-scale earthworks and riparian disturbances that will be completed in relatively close proximity to the NSR. ➢ Relatively small instream footprint overall; however, support structures for infrastructure that extends over the NSR may constitute an instream footprint (depending on design specifics).
Regulatory	➢ Instream works will need to be isolated from the NSR. ➢ Environmental construction monitoring will be required for the duration of the Project. ➢ Project components/activities that disturb the bed and bank of the NSR are expected to require fisheries related permitting under the *Water Act* and the *Fisheries Act*. ➢ Instream construction activities completed during the RAP may trigger the need for additional assessment, implementation of additional mitigation, and/or additional permitting ➢ Anthropogenic features that are constructed below the 1:2-year high-water level are typically considered to be a footprint on fish habitat.
Information Gaps	➢ Potential information gaps will be determined as the Project advances through delivery phases and design, construction, and schedule details become available.
Opportunities	➢ Potential to align Project design with fisheries management objectives through outfall upgrading/decommissioning that could result in improved water quality. ➢ Strategic design to situate Project developments within previously disturbed areas. ➢ Potential to improved riparian conditions through: • bank stabilization; • reclamation of disused infrastructure; and • enhancement of riparian vegetation.
Constraints	➢ Size and duration of instream works will influence level of mitigation required to facilitate works (i.e. instream isolations). ➢ Instream activities should be scheduled to occur within the open window of the RAP (Aug 01 to Sept 15).

5.0 CLOSURE

We trust that the information presented in this report meets your requirements. If you have any questions or comments, please contact the undersigned.

Kingfisher Aquatics Ltd.

Scott Holroyd, P.Biol
Project Biologist

Erik Stemo, P.Biol
Project Director

6.0 REFERENCES

Alberta Environment 2000. Guide to the Code of Practice for Watercourse Crossings including Guidelines for Complying with the Code of Practice. Revise April 2001. Edmonton, AB. 29 pp.

Alberta Environment and Parks. 2019a. Lake Sturgeon FSI. Obtained from http://aep.alberta.ca/fish-wildlife/fisheries-management/fish-sustainability-index/fsi-species-maps/lake-sturgeon-fsi.aspx. Accessed on January 7, 2020.

Alberta Environment and Parks. 2019b. Goldeye FSI. Obtained from http://aep.alberta.ca/fish-wildlife/fisheries-management/fish-sustainability-index/fsi-species-maps/goldeye-fsi.aspx. Accessed on January 7, 2020.

Alberta Environment and Parks. 2019c. Mooneye FSI. Obtained from http://aep.alberta.ca/fish-wildlife/fisheries-management/fish-sustainability-index/fsi-species-maps/mooneye-fsi.aspx. Accessed on January 7, 2020.

Alberta Environment and Parks. 2019d. Code of Practice for Watercourse Crossings (Made under the Water Act and the Water (Ministerial) Regulation. Consolidated to include amendments in force as of March 8, 2019. Queen's Printer For Alberta. Edmonton, Alberta.

Alberta Environment and Parks. 2019e. Fish and Wildlife Management Information System. Accessed through the Fish and Wildlife Internet Mapping Tool. Website: https://maps.srd.alberta.ca/FWIMT_Pub/ Viewer/?TermsOfUseRequired=true&Viewer=FWIMT_Pub. Accessed on Dec 23, 2019.

Alberta Environment and Parks. 2019f. Lake Sturgeon FSI. Obtained from http://aep.alberta.ca/fish-wildlife/fisheries-management/fish-sustainability-index/fsi-species-maps/lake-sturgeon-fsi.aspx. Accessed on January 7, 2020.

Alberta Environment and Parks. 2019g. Alberta Wild Species Status Search – Common Name "Sauger". Obtained from http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx. Accessed on January 6, 2020.

Alberta Environment and Parks. 2019h. Alberta Wild Species Status Search – Common Name "Spoonhead Sculpin". Obtained from http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx. Accessed on January 7, 2020.

Alberta Environment Sustainable Resource Development. 2012. Code of Practice for Watercourse Crossings – St. Paul Management Area Map. Prepared by Resource Information Management Branch, Corporate Services Division. November 2012. Queen's Printer For Alberta. Edmonton, Alberta.

Alberta Environment Sustainable Resource Development. 2015. Alberta Wild Species General Status Listing – 2015. 25pp.

Alberta Lake Sturgeon Recovery Team. 2011. Alberta Lake Sturgeon Recovery Plan, 2011-2016. Alberta Environment and Sustainable Resource Development, Alberta Species at Risk Recovery Plan No. 22. Edmonton, AB. 98 pp.

Alberta Sustainable Resource Development. 2002. Status of the Lake Sturgeon (Acipenser fulvescens) in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, and Alberta Conservation Association, Wildlife Status Report No. 46, Edmonton, AB. 30 pp.

Alberta Sustainable Resource Development. 2008. Fisheries Management Objectives of the North Saskatchewan River. 52pp.

Alberta Transportation. 2009. Fish Habitat Manual – Guidelines & Procedures for Watercourse Crossings in Alberta. Alberta Transportation, Edmonton, Alberta.

Allan, J.H. 1984. The Fish and Fisheries of the North Saskatchewan River Basin; Their Status and Environmental Requirements. Report of Pisces Environmental Consulting Services Ltd. prepared for Alberta Environment. Edmonton, Alberta. 190 pp.

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling. 1999. Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish. 2nd edition. U.S. Environmental Protection Agency, Office of Water, Washington, D.C., USA.

COSEWIC. 2006. COSEWIC assessment and update status report on the lake sturgeon *Acipenser fulvescens* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa, Ontario. xi + 107pp.

Dub Architects Ltd. and Stoss Landscape Urbanism. 2021. Touch the Water Promenade Final Concept Design 5.6.2021. Prepared for City of Edmonton, Edmonton, Alberta, Canada.

Government of Alberta. 2019. Alberta River Basins. Extracted the Alberta River Basins web application https:// https://rivers.alberta.ca/ on January 8, 2020.

Grabarkiewicz, J.D. and W.S. Davis. 2008. An Introduction of Freshwater Fishes as Biological Indicators. U.S. Environmental Protection Agency. Office of Environmental Information, Office of Information Analysis and Access, Washington, D.C., USA.

Hartman, G.F. 2009. A Biological Synopsis of Walleye (*Sander vitreus*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2888. 48pp.

Harvey, B. 2009. A Biological Synopsis of Northern Pike (*Esox lucius*). Canadian Manuscript Report of Fisheries and Aquatic Sciences 2885. 31pp.

Joynt, A. and M.G. Sullivan. 2003. Fish of Alberta. Edmonton, Alberta. Lone Pine Publishing. 176 pp.

Kennedy, W.A. and W.M. Sprules. 1967. Goldeye in Canada. Fisheries Research Board of Canada Bulletin 161. Queen's Printer, Ottawa, Ontario. 60pp.

Kingfisher Aquatics Ltd. 2021. Touch the Water Promenade – North Shore Promenade Conceptual Design Fisheries Overview. Prepared for Spencer Environmental Management Services Ltd. Edmonton, AB.

McPhail, J.D. 1997. A Review of Burbot (*Lota lota*) Life History and Habitat Use in Relation to Compensation and Improvement Opportunities. Canadian Manuscript Report of Fisheries and Aquatic Sciences 2397. 37pp.

Nelson, J.S. and M.J. Paetz. 1992. The fishes of Alberta. 2nd Edition. Edmonton, Alberta: The University of Alberta Press.

Roberts, W.E. 1974. First Record of the Mooneye (*Hiodon tergisus*) in Alberta. Journal of Fisheries Research Board of Canada. 31(2): 220-221.

SARA Public Registry. 2018. Species at Risk Public Registry – Species Index. Last Modified 2019-11-29. Website: http://www.registrelep.gc.ca/sar/index/default_e.cfm. Accessed January 10, 2020.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Bulletin 184, Fisheries Research Board of Canada, Ottawa, Ontario. 966pp.

Spencer Environmental Management Services Ltd. 2021. Touch the Water Promenade – Rossdale Reach Conceptual Design Environmental Overview. Draft Report. Prepared for Dub Architects Ltd. Edmonton, Alberta.

Watters, D.V. 1993. Lake sturgeon, *Acipenser fulvescens* Rafinesque, in the North Saskatchewan River, Alberta: a summary of activities during 1993, MS Rep. Alberta Environmental Protection, Fish and Wildlife Services, Edmonton, AB. 37pp.

Watkins, O.B. 2016. Sustaining the Recovery of Lake Sturgeon (*Acipenser fulvescens*) in the North Saskatchewan River of Alberta. A thesis submitted to the Department of Renewable Resources, University of Alberta. 70pp +App.

7.0 PERSONAL COMMUNICATION

Watkins, Owen, MSc. Nov 2019. Fisheries Biologist. Alberta Environment Parks Red Deer – North Saskatchewan River.

Appendix A

Assessment Methods

Kingfisher Aquatics Ltd. (Kingfisher) Standard Procedures have been developed to meet the information requirements of provincial and federal regulators for most instream activities associated with watercourse crossing construction or other similar sized projects that require instream works. These procedures may be utilized in combination with other assessment methods that do not strictly align with this document. In these instances, any modifications to the methodology described in this document will be described and rationalized in the main body of the report.

The Guide to the Code of Practice for Watercourse Crossings Including Guidelines for Complying with the Code of Practice (the Guide to the Code of Practice), Section B: Aquatic and Biological Site Assessments (Alberta Environment 2001) served as the primary reference and outline for these standard procedures.

A) ASSESSMENT PREPARATION

In order to determine assessment requirements; all available project information will be reviewed prior to initiation of the field assessment activities to aid in the determination of:

1) potential streambed, streambank and riparian disturbance;
2) anticipated potential effects on the aquatic environment; and
3) the estimated zone of impact resulting from potential effects.

Background topography and drainage information will be collected through the review of available maps, satellite imagery and air imagery. Historical fisheries information will be collected through:

1) Querying the provincial database known as the Fish and Wildlife Management Information System that is accessed through the Fish and Wildlife Internet Mapping Tool maintained by Alberta Environment and Parks; and
2) Reviewing available literature including articles from peer-reviewed journals, governments, private firms, non-government organizations, and aboriginal organization sources.

B) FIELD ASSESSMENT

A field assessment will be conducted when existing fish and/or fish habitat information is deemed to be insufficient to support an assessment of the potential effects of the project on the aquatic environment.

1) Study Area

Field assessments conducted for watercourse crossings require at a minimum:

- one 100 m or longer study section established upstream of the watercourse crossing or proposed watercourse crossing right of way; and
- one 300 m or larger study section located downstream of the watercourse crossing or proposed watercourse crossing right of way. The downstream study section must encompass the entire zone of impact. Additional study sections may be required to determine potential fish species that could be affected by the project.

2) Determining the Zone of Impact

The Guide to the Code of Practice (Alberta Environment 2001) defines the zone of impact as:

- the area of streambed and streambanks of the water body that will be altered or disrupted as a result of the works; and
- the area where 90% of the sediment discharged as a result of the works would be deposited.

FISH COLLECTION

When there is insufficient fisheries information available to evaluate potential project effects on the aquatic environment Kingfisher will conduct fish sampling to the extent required to meet the specific information requirements of the project.

1) Permitting

All fish sampling conducted by Kingfisher will be done so under licence from the Province of Alberta and, when applicable, the Government of Canada. The follow permits may be required to conduct fish sampling depending on the method used, the location of the waterbody being sampled, and the potential fish species present:

- Alberta Environment and Parks issued Research Licence
- Department of Fisheries and Oceans Canada issued Species at Risk Act Permit
- Parks Canada issued Research and Collection Permit

2) Fish Collection Data

In accordance with the Guide to the Code of Practice (Alberta Environment 2001) data collected from fish capture will include at a minimum:

- the length of the study section;
- the type of equipment used, and the electrofishing effort made (seconds) and catch per unit effort (other active and passive fish capture methods may be used to augment electrofishing where required);
- all fish species captured, the number of each species and the location or habitat types where fish were captured;
- the fork length and weight of all sportfish species captured;
- the gender and maturity of sportfish species if externally determinable;
- the spawning potential; and
- during restricted activity periods, any evidence of spawning activity (redds, fish on redds, etc.) and determine where possible the presence of fish and fry at the crossing site.

Alberta Fisheries Management Branch (AFMB) Standard for Sampling of Small Streams in Alberta (2013[a]) provides additional guidelines for minimum information requirements for both general fish sampling and specific sampling methods. Information requirements for specific fish sampling methods are provided in Section 3. Kingfisher will collect all information to meet the AFMB Standards for general fish sampling information as outlined below:

Sample Site Descriptors:

- Waterbody Name
- Waterbody ID
- Activity Date
- Crew Initials
- Starting Universal Transverse Mercator (UTM) coordinates
- Site Location Notes
- Project Site Number
- Water Temperature
- Conductivity
- Stream Stage (Dry, Low, Moderate, High, Flood)
- Wetted Width
- Maximum Depth

Fisheries Descriptors:

- Capture Method
- Sample Number
- Species
- Fork Length (mm)
- Total Body Weight (g)
- Injury Comments
- General Fisheries Comments

3) Fish Collection Methods

Selection of fish sampling gears is initially based of the following key points (Portt et al. 2006):

- the study question(s) that the investigators wish to answer;
- the habitats that are being investigated;
- the fish species that are being investigated; and
- the time of year when investigations will take place.

In addition to the key points listed above, Kingfisher also considers the catchability, efficiency, and lethality of fish sampling gear. In general, Kingfisher selects fish sampling gear that maximizes catchability and efficiency of sampling efforts while minimizing the potential for fish mortality.

Standard Kingfisher fish collection methods, application information, and guidance documents are provided in Table C.1.

Table C.1. Standard Fish Collection Methods, Application Information, and Guidance Documents.

Fish Collection Method	Habitat Type	Water Depths	Fish species	Guidance Documents
Angling (A)	Lotic or lentic habitats	>0.1 m	Medium to large-bodied sport fish and some coarse fish	Vancouver Island University. 2010. Electrofishing: Theory, Safety and Uses Version 6.0; AFMB. 2004. Electrofishing Policy Respecting Injuries to Fish.; BCMELP. 1997. Fish Collection Methods and Standards Version 4.0; AFMB. 2013[a].Standards for sampling of small streams in A berta; AFMB. 2013[a].Standards for sampling of small-bodied fish in Alberta; AFMB. 2013[c].Standards for the ethical use of fishes in Alberta; AESRD. 2015. Fish Research Licence Application – Fish Rescue Best Practices. BCMFLNRO. Freshwater Fishing Regulation. A berta Government. Sportfishing Regulations. Portt et al. 2006. A review of fish sampling methods commonly used in Canadian freshwater habitats. A berta Transportation. 2009. Fish Habitat Manual.
Backpack Electrofishing (A)	Primarily lotic	Between 0.1 m and 0.5 m	Most species and sizes	
Boat Electrofishing (A)	Primarily lotic	Between 0.5 m and 2.0 m	Most species and sizes	
Gillnetting (P)	Lentic	>0.5 m	Medium to large bodied sport and course fish	
Minnow Trapping (P)	Primarily lentic	>0.3 m	Small bodied forage fish species and some sport fish	
Seine netting (A)	Primarily lentic	<1.0 m	Most species and sizes	

(A)=Active Technique
(P)=Passive Technique

Angling

Angling equipment and rigging are usually geared toward specific fish species or groups of fish species. This allows angling efforts to be very effective at targeting specific fish species with minimal bi-catch. In most presence/absence sampling scenarios it is ideal to utilize gear that maximizes catchability, such as electrofishing or seine netting that is capable of catching a wide variety of fish species. As such, angling is typically used for assessments that require sampling for a specific fish species that may not effectively be captured by other methods (i.e. Lake Sturgeon).

Angling is conducted in crews of two or more to maximize sampling effort. When multiple anglers are sampling a waterbody for multiple species anglers will use alternate rigging methods in an effort to expand the number of fish species and/or life stages of fish angling efforts could capture. Angling methods will largely rely on the experience of the crew members; however, all angling methods will comply with provincial sport fishing regulations.

Kingfisher will record all information to meet the AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) required angling specific information:

- Number of Anglers,
- Hours Fished per Angler

Backpack Electrofishing

Electrofishing is the technique of passing electric current through the water to attract and immobilize fish for capture. It is most efficiently used in contained areas of small rivers and streams that are difficult to sample using nets or traps (BCMELP 1997).

Backpack electrofishing is conducted by a two-person crew. One of the two crew members will be a certified electrofishing crew leader who will operate the backpack electrofisher. The second crew member will capture immobilized fish with a fine mesh nylon or rubber net. Electrofishing is conducted by sweeping the anode pole of the electrofisher across the channel and downstream towards the cathode tail and netter. The crew progresses upstream through the study area moving back and forth across the stream in a zigzagging pattern. Sampling effort is evenly distributed throughout the sample section. Captured fish are collected and temporarily held in a water-filled pail (carried by the second crew member) or in a live-well. Electrofishing can only effectively be completed when crew members are able to readily spot immobilized fish. Therefore, electrofishing surveys are not conducted when turbidity levels are elevated or when the sample area is frozen.

Boat Electrofishing

Boat electrofishing is conducted following the same principles as backpack electrofishing but is used on larger streams and shallow lakes where water depths prevent wading. Two types of boats are used, drift boats (passive) or jet boats (active), the former is typically used on small rivers that may not accommodate a power boat and the latter is used on larger rivers where the operation of a large power boat is more feasible. The basic components of the shocking system include a power supply, voltage and current regulator, cathode, anode, and safety circuits. Boats used for electrofishing are large enough to hold all the equipment and provide a safe and adequate work space for the crew. The power is supplied to the boat electrofisher via a gas-powered generator. The cathodes are suspended from the sides of the boats and the anodes are normally one or two booms protruding from the front of the boat (BCMELP 1997).

Boat electrofishing is conducted with a crew of 3 to 4 members when the boat electrofishing set up utilizes a movable anode. When the boat electrofishing set-up utilized a fixed anode, a crew of 2 to 3 members can operate the system effectively. The use of fixed or moveable anodes depends on the fish sampling objectives of the assessment. Movable anodes typically allow for greater control of the habitat sampled, and as such are considered optimal for presence/absence sampling.

Kingfisher will record all information to meet the AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) which stipulates collection of the following information:

- Electrofishing on-time
- Distance electrofished – 300 m or 40x the mean wetted width will be considered the minimum electrofishing survey distance
- Electrofisher Pulse Width
- Electrofisher Frequency
- Electrofisher Voltage

Gillnetting

Gillnets are suspended in the water column at different depths depending on the fish species type (pelagic, benthic, etc.) being targeted. Fish are captured when they swim into the mesh of the net and the maxillary or operculum area, teeth, spines, girth, or scales are caught on the mesh of the net as they attempt to pass through or free themselves from the mesh.

Net set times are dependent on whether the project requires non-lethal or lethal sampling. Gill nets are typically used when the sacrifice of fish is either necessary and/or where the risk (of gillnetting) to local fish populations is considered low. The length of the net set is a large factor in the amount of fish mortality observed. If deployed in lotic waterbodies they should be checked and cleared frequently (every two hours or less, particularly where non-lethal sampling is an objective). If deployed in lentic waterbodies they should be set overnight for no greater than 24 hours (AFMB 2013[b])

Gillnetting is conducted as per the B.C. standard procedure for gillnetting that has been developed for the use of gill nets in lakes for reconnaissance level inventories. The net consists of six nets or panels, 15.2 m long and of different mesh sizes, that are strung together in a "gang" to form a net 91.2 m long and 2.4 m deep. The mesh size is measured from knot to knot of a single, diagonally stretched mesh. Each mesh size is selective for a certain size fish (Table C.2), therefore, the individual panels used in the net have been chosen so the net is capable of catching a wide range of fish. The following is the standard order of the panels based on mesh size, the corresponding filament size used in the construction of the net and the mean fork length of the fish caught by each of the mesh sizes (BCMELP 1997; based on Hamley 1972):

Table C.2. Order, Mesh Size and Filament Size Standards relative to Fish Mean Fork Length (BCMELP 1997).

Order	Mesh Size (mm)	Filament Size (mm)	Fish Fork Length (mm)
1	25	0.20	114
2	76	0.25	345
3	51	0.20	228
4	89	0.30	380
5	38	0.20	178
6	64	0.25	280

Most gillnetting sampling requires the use of watercraft. As such, a minimum crew size of two is used during gillnetting. Crew size and number of watercraft employed for gillnet fish sampling is dependent on project objectives, the size and number of nets set, and the project time frame.

Kingfisher will record all information to meet the AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) which stipulates collection of the following information:

- Date and time of net(s) set
- Date and time of net(s) lifted
- Mesh Size (mm)
- Length of net(s) set (m)
- Depth of net(s) set (m)

Minnow Trapping (Gee Trapping)

Minnow traps or Gee-minnow traps are used to target small-bodied fish in moderate to deep (>0.5 m) habitat where electrofishing becomes less effective, particularly on small-bodied fish. Due to the small size and ease of deployment of minnow traps, minnow trapping can be conduct by a single crew member (Portt et al. 2006); however, fish processing requirements typically dictate a minimum crew size of two.

Minnow traps usually consist of two wire baskets held together by a clip and attached to a marker float. The baskets are interlocked, and the clip is inserted to hold the two halves together. The float line is attached and the trap is positioned on the bottom or suspended at a particular depth. The position of the trap is marked by the float attached to the line. Traps can be set with or without bait. Fish swim inside the traps through funnel shaped openings that guide them from a large opening near the outside of the trap to the narrow opening close to the centre of the trap. Once inside it is difficult for the fish to locate the opening and escape (BCMELP 1997).

Kingfisher will complete minnow trapping in accordance with AFMB Standards for Sampling Small-bodied Fish in Alberta (2013[b]). When bait is used, the type and amount will be recorded. Traps will be set for a minimum of 18 (trapping) hours (trapping hours = # traps x hours of set time) and all traps will be checked at least once every 2 hours and cleared of fish.

Kingfisher will record all information to meet the AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) required trap netting specific information:

- Date and time of trap(s) set
- Date and time of trap(s) lifted
- Trap type
- Number of traps

Seine Netting

Seine netting can be conducted by boat or by wading and can be an effective passive capture method. However, the effectiveness of seine netting can be limited by coarse substrates and/or fish cover (aquatic vegetation, woody debris, and overhanging bank) that can foul the net, interrupt net pulls, and allow fish to escape.

In lentic habitat, seine netting is conducted parallel to shore. The off-shore seiner walks in advance of the on-shore seiner. After the seine pull is completed the off-shore seiner brings their end of the seine net to shore and the seine is pulled in while making sure that the leadline remains in contact with the bottom and the floatline is in contact with the surface (AFMB 2013[b]). In lotic habitat, seine pulls vary depending on the local conditions.

The configuration of seine nets can vary depending on the application of the net and the target species. Most nets have a braided leadline or rolled lead weights to weigh the bottom of the net while the top of the net is typically supported by a floating corkline (BCMELP 1997). Kingfisher typically utilizes seines ranging from 3.3 m to 30 m long and 1.2 m to 1.8 m deep with mesh sizes 0.125 mm to 2.5 mm.

Kingfisher will record all information to meet the AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) required seine haul specific information:

- *Net and mesh dimensions (m and mm)
- Area Sampled
- *Number of net pulls per area

*derived requirements based on AFMB Standard for Sampling of Small Streams in Alberta (2013[a]) and Standards for Sampling Small-bodied Fish in Alberta (2013[b])

C) FISH HABITAT ASSESSMENT

1) Habitat Inventory/Habitat Mapping

Fish habitat data collection is conducted by Kingfisher crews traversing study area(s), typically from downstream to upstream either by boat (Large River Fish Habitat Assessments) or by wading (Small Stream Fish Habitat Assessments). Information is collected in a sequentially ordered and spatially referenced manner that allows for the data to be presented as a habitat map or in a habitat inventory catalogue, depending on project requirements.

Small Stream Fish Habitat

Kingfisher standard methods for small stream fish habitat assessment are adapted from R.L.& L. (1994) and Hawkins et al. (1993) that are outlined in the Alberta Transportation Fish Habitat Manual (2009). Habitat is classified into discrete units based on water depth, velocity, and substrate. The dimensions of each unit are measured and fish cover type(s), substrate composition, riparian vegetation types, and bank stability are quantified and recorded. Definitions of habitat units are provided in Table D.1 and classifications based on water depth are provided in Table D.2. Fish cover types, streambed substrates, and riparian vegetation types are presented in Table D.3 while other in-channels are described in Table D.4.

Table D.1. Small Stream Fish Habitat Units, Symbols and Descriptions.

Habitat Unit	Symbol	Description
Cascade	CA	Extremely high gradient and velocity; extremely turbulent with entire water surface broken; may have short vertical sections, but overall is passable to fish; armoured substrate, may be associated with chutes and rapids
Chute	CH	Area of channel constriction, usually due to bedrock intrusions; associated with channel deepening and increase velocity
Rapids	RA	Extremely high velocity; deeper then riffle; substrate extremely coarse (large cobble/boulder); instream cover in pocket eddies and associated with substrate
Riffle	RF	High velocity/gradient relative to run habitat; surface broken due to submerged or exposed bed material, shallow relative to other channel units; coarse substrate; usually limited instream or overhead cover for juvenile or adult fish (generally ≤ 0.5 m deep).
Run (glide)	R1, R2, R3	Moderate to high velocity; surface largely unbroken; usually deeper than RF; substrate size dependent on hydraulics
Flat	F1, F2, F3	Area characterized by low velocity and near-uniform flow; differentiated from pool habitat by high channel uniformity; more depositional than R3 habitat
Pool	P1, P2, P3	Discrete portion of channel featuring increased depth and reduced velocity relative to riffle/run habitats; formed by channel scour.
*Backwater, snye, and impoundment habitat types have been removed because the functionality and form of these habitat types can be recorded through a combination of the listed habitat types and habitat in-channel features		

Table D.2. Small Stream Depth Classifications, Definitions, and Applicable Habitat.

Class	Definition	Applicable Habitat
1	Class 1 water depths range from 1 m to 1.5 m	Run (glide), Flat, Pool
2	Class 2 water depths range from 0.5 m to 1.0 m	
3	Class 3 water depths range from 0.1 m to 0.5 m	

Table D.3. Substrate, Fish Cover and Riparian Vegetation Classifications, Symbols and Descriptions.

Classification	Symbol	Description
Fish Cover		
Woody Debris	WD	Submerged branches, logs, or tree roots
Overhanging Bank	OB	Undercut bank
Overhanging Vegetation	OV	Terrestrial vegetation hanging over or into the waterbody
Aquatic Vegetation	AV	Vegetation rooted below the waters surface
Boulder	BL	Coarse substrate either capable of providing slack water or with interstitial spaces large enough to provide cover for the fish species present
Substrate		
Fines*	FN	<2 mm
Gravel (small & large gravels)*	GR	2 – 64 mm
Cobble*	CB	65 – 256 mm
Boulder*	BL	>256 mm
Bedrock	BR	Single large unit of substrate or single large aggregated unit of substrate
Riparian Vegetation		
Grass/bryophytes	Gr	Herbaceous, or bryophytic, low, non-woody plants
Shrubs	Sh	Multiple woody stemmed low to medium height plants including sapling trees
Tress	Tr	Single large woody stemmed plants
Exposed Bank	Ex	Unvegetated bank substrate composed of soil or aggregate material
Armoured Bank	Ar	Unvegetated bank substrate composed of bedrock or boulder armouring (i.e. riprap)

*defined by Overton et al 1997.

Table D.4. Small Stream In-Channel Features, Symbols, and Descriptions

Type	Symbol	Description
Substrate Ledge	SL	Area of bedrock, clay, or aggregated smaller streambed substrates intruding into the channel; often associated with chute or plunge pool habitat, may have a vertical drop affecting fish passage
Log Ledge	LL	An area where large woody debris has fallen perpendicular to stream flow and has backed up streamflow and loose substrate on the upstream side, commonly associated with a plunge pool habitat on the downstream side
Debris Pile	DP	Debris pile (e.g., log jam) which influences instream habitat; including effects on fish cover
Beaver Dam	BD	Partial or complete beaver constructed impoundments
Anthropogenic Feature	AF	Human-made structure that protrudes into a waterbody, effecting either fish habitat or stream geomorphology
Falls	FA	Highest water velocity; involves water falling over a vertical drop; impassable to fish
Discontinuous Channel	DC	Portions of the study section where channel definition is lost, or channel is lost underground. Assumes the unit width of the last defined unit downstream of the discontinuous channel.

Large River Fish Habitat

Kingfisher standard methods for large river fish habitat assessment are adapted from R.L. & L. (1994) and are outlined in the Alberta Transportation Fish Habitat Manual (2009). Large river habitat classification methodology is intended for use on large watercourses that do not consistently exhibit specific habitat units such as pools, runs, and riffles. With this methodology, habitat is characterized based on general channel form, shoreline features, as well as the presence of specific microhabitat features. A description of large river habitat classifications is presented in Table D.5 and D.6.

Table D.5. Large River Fish Habitat Components, Symbols and Descriptions

Type	Symbol	Description
Major Habitat Types		
Unobstructed Channel	U	Single main channel, no permanent island, side bars occasionally present, limited development of exposed mid-channel bars at low flow
Singular Island	S	Two channels around single, permanent island, side and mid-channel bars often present at low flow
Multiple Island	M	More than two channels and permanent islands, generally extensive side and midchannel bars at low flow
Bank Habitat Types		
Armoured/Stable	A1	Largely stable and at repose; cobble/small boulder/gravel predominant; uniform shoreline configuration; bank velocities low-moderate; instream/overhead cover limited to substrate and turbidity
	A2	Cobble/large boulder predominant; irregular shoreline due to cobble/boulder outcrops producing BW habitats; bank velocity low (BW)/moderate; instream/overhead cover from depth, substrate and turbidity
	A3	Similar to A2 with more boulder/bedrock; very irregular shoreline; bank velocities moderate-high with low velocity BW/eddy pools providing instream cover; overhead cover from depth/turbidity
	A4	Artificial riprap substrates consisting of angular boulder-sized fill; often associated with high velocity areas; shoreline usually regular; instream cover from substrate; overhead cover from depth/turbulence
Canyon	C1	Banks formed by valley walls; cobble/boulder bedrock; stable at bank-water interface; typically deep/high velocity water offshore; abundant velocity cover from substrate/bank irregularities
	C2	Steep, stable bedrock banks; regular shoreline; moderate-deep/moderate-fast water offshore; occasional velocity cover from bedrock fractures
	C3	Banks formed by valley walls, primarily fines with some gravel/cobble at base; moderately eroded at bank-water interface; moderate-high velocities; no instream cover
Depositional	D1	Low relief, gently sloping bank; shallow/slow offshore; primarily fines; instream cover absent or consisting of shallow depressions or embedded cobble/boulder; generally associated with bars
	D2	Similar to D1 with gravel/cobble substrate; some areas of higher velocities producing riffles; instream/overhead cover provided by substrate/turbulence; often associated with bars/shoals
	D3	Similar to D2 with coarser substrates (cobble/boulder); boulders often imbedded; moderate-high velocities offshore; instream cover abundant from substrate; overhead cover from turbulence
Erosional	E1	High, steep eroded banks with terraced profile; unstable; fines; moderate-high offshore velocity; deep immediately offshore; instream/overhead cover from submerged bank materials/vegetation/depth
	E2	Similar to E1 without the large amount of instream vegetative debris; offshore depths shallower
	E3	High, steep eroding banks; loose till deposits (gravel/cobble/sand); moderate-high velocities and depths; instream cover limited to substrate roughness; overhead cover provided by turbidity
	E4	Steep, eroding/slumping highwall bank; primarily fines; moderate-high depths/velocities; instream cover limited to occasional BW formed by bank irregularities; overhead cover from depth/turbidity
	E5	Low, steep banks, often terraced; fines; low velocity; shallow-moderate; no instream cover; overhead cover from turbidity
	E6	Low slumping/eroding bank; substrate either cobble/gravel or silt with cobble/gravel patches; moderate depths; moderate-high velocities; instream cover from abundant debris/boulder; overhead cover from depth/turbidity/overhanging vegetation

Table D.6. Special Habitat Features, Symbols, and Descriptions.

Type	Symbol	Description
Pool	P	High, steep eroded banks with terraced profile; unstable; fines; moderate-high offshore velocity; deep immediately offshore; instream/overhead cover from submerged bank materials/vegetation/depth
Tr butary Confluence	TC	Confluence area of tributary entering mainstem; tributary confluence [sub-classified according to tributary flow and wetted width at mouth at the time of the survey]
	TC1	Intermittent flow, ephemeral stream
	TC2	Flowing, width < 5m
	TC3	Flowing, width 5 - 15m
	TC4	Flowing, width 16 - 30m
	TC5	Flowing, width 31 - 60m
	TC6	Flowing, width > 60m
Shoal	SH	Shallow (< 1m deep), submerged areas in mid-channel or associated with Depositional areas around islands/side bars
	SHC	Submerged area of coarse substrates
	SHF	Submerged area of fine substrates
Backwater	BW	Discrete, localized area exhibiting reverse flow direction and, generally, lower velocity than main current; substrate similar to adjacent channel with more fines
Rapid	RA	Area with turbulent flow, broken surface (standing waves, chutes etc.), high velocity (>1 m/s), armoured substrate (large boulder/bedrock) with low fines
Snye	SN	Discrete section of non-flowing water connected to a flowing channel only at its downstream end, generally formed in a side channel or behind a peninsula (bar)
Slough	SL	Non-flowing water body isolated from flowing waters except during flood events; oxbows
Log Jam	LJ	Accumulation of woody debris; generally located on island tips, heads of side channels, stream meanders; provide excellent instream cover

2) Streambank Assessment

Kingfisher standard procedures for streambank assessment are derived from the guidelines for complying with the Code of Practice for Watercourse Crossings Section B Physical Assessment Components (Alberta Environment 2001). At a minimum, five transects will be established within the study area perpendicular to stream flow. Table D.7 provides a description of the parameters that will be assessed along each transect.

Table D.7. Streambank Transect Parameters, Units and Descriptions.

Parameter Components	Parameter Units	Description
Channel Properties		
Wetted Width (m)	Metres	The distance across the wetted surface of the waterbody perpendicular to stream flows
Bankfull Width (m)	Metres	The distance between the LUB and the RUB at level of the 1:2 year highwater mark perpendicular to stream flows
Depth (m)	Metres	The distance from the water surface to a point vertically inline on the streambed
Velocity (m/s or s/m)	Metres per Second, Seconds per Metre	The distance travelled by flowing water per unit of time
Streambed Substrate (FN,GR,CB,BL,BR)	Fines, Gravel, Cobble, Boulder, Bedrock	The material composing the bottom of a stream below the usual water surface
Instream Cover (WD, OV, AV, BL)	Woody Debris, Overhanging Vegetation, Aquatic Vegetation, Boulder	Submerged stream features that are capable of providing shelter for the fish species present within the waterbody
Bank Properties		
Bank Height (m)	Metres	The distance from the water surface to the top of the level of the 1:2 year highwater mark
Bank Angle (°)	Degrees	The angle of the slope of the bank from the waters surface to the 1:2 year highwater
Bank Cover (WD, OB, OV)	Woody Debris, Overhanging Bank, Overhanging Vegetation	Bank features that are capable of providing shelter for the fish species present within the waterbody
Bank Substrate (FN, GR,CB,BL,BR)	Fines, Gravel, Cobble, Boulder, Bedrock	The material composing the streambanks adjacent to the usual water surface
Riparian Vegetation (Gr, Sh, Tr, Ex, Ar)	Grass/Bryophyte, Shrub, Tree, Exposed Bank, Armoured Bank	Vegetation (or the absence of the vegetation) rooted within the riparian area immediately adjacent to the bank
Bank Stability (S or U)	Stable or Unstable	Bank areas displaying slumping, fracturing, or other signs of erosion that would cause bank material to enter the waterbody
Bank Undercut (m)	Metres	Length of bank overhanging into the channel

3) Water Quality

In situ water quality as described in Table D.8 will be measured at one location within the study area.

Table D.8. *In Situ* Water Quality Variables and Units of Measure.

Variable	Parameter Units of Measure
Temperature	Degrees Celsius
pH	Potential of Hydrogen
Dissolved Oxygen	Milligrams per Litre
Conductivity	Micro-Siemens per Centimeter
Turbidity	Nephelometric Turbidity Unit

4) Photographic Documentation

Photographs will be taken to document general site and habitat conditions as well as channel and bank features with the study area. Typical photographic documentation may include the following:

- representative fish habitat and channel form within the study area;
- unique and/or important habitat or channel features;
- the waterbody looking upstream and downstream from the upstream end of the study area;
- the waterbody looking upstream and downstream from the downstream end of the study area;
- the waterbody looking upstream at the proposed right of way; and
- the waterbody looking downstream at the proposed right of way

D) LITERATURE CITED

Alberta Environment. 2001. Guide to the Code of Practice for Watercourse Crossings Including Guidelines for Complying with the Code of Practice (made under the Water Act and the Water (Ministerial) Regulation). Queen's Printer for Alberta. 29 p.

Alberta Environment and Sustainable Resource Development. 2015. Fish Research Licence Application – Fish Rescue Best Practices. 6 pp + Appendices.

Alberta Fisheries Management Branch. 2004. Electrofishing Policy Respecting Injuries to Fish – Fish Research Licences

Alberta Fisheries Management Branch 2013[a]. Standard for Sampling of Small Streams in Alberta (Public Version).

Alberta Fisheries Management Branch 2013[b]. Standard for Sampling of Small-bodied Fish in Alberta (Public Version).

Alberta Transportation. 2009. Fish Habitat Manual Guidelines and Procedures for Watercourse Crossings in Alberta. Edmonton, Alberta

B.C. Ministry of Environment, Lands and Parks, Fish Inventory Unit for the Aquatic Ecosystems Task Force, Resources Inventory Committee. 1997. Fish Collection Methods and Standards Version 4.0. The Province of British Columbia Resources Inventory Committee. 58 p.

Hamley, J.M. 1972. Use of the DeLury method to estimate gillnet selectivity. J. Fish. Res.Board Can. 29:1636-1638 p.

Hawkins, P. C., J. L. Kershner, P. A. Bisson, M. D. Bryant, L. M. Decker, S. V. Gregory, D. A. McCullough, C. K. Overton, G. H. Reeves, R. J. Steedman, and M. K, Young. 1993. A hierarchical approach to classifying stream habitat features. Fisheries Vol. 18, No. 6 (June): 12 p.

Overton, C.K., S.P. Wollrab, B.C. Roberts and M.A. Radko. 1997. R1/R4 (Northern/ Intermountain Regions) Fish and Fish Habitat Standard Inventory Procedures Handbook, General Technical Report INT-6TR-346, United States Department of Agriculture, Forest Service, Intermountain Research Station, Ogden, Utah, 73 p.

Portt, C.B., G.A. Coker, D.L. Ming, and R.G. Randall. 2006. A review of fish sampling methods commonly used in Canadian freshwater habitats. Can. Tech. Rep. Fish. Aquat. Sci. 2604 p.

R.L. & L. Environmental Services Ltd. 1994. A general fish and riverine habitat inventory, Athabasca River, April to May 1992. NRBS Project Report No. 32, Edmonton, Alberta. 74 p + appendices.

Vancouver Island University Natural Resources Extension Program. 2010. Electrofishing: Theory, Safety and Uses - Alberta Fish & Wildlife Electrofishing Standards Version 6.0. Vancouver Island University 76 p.

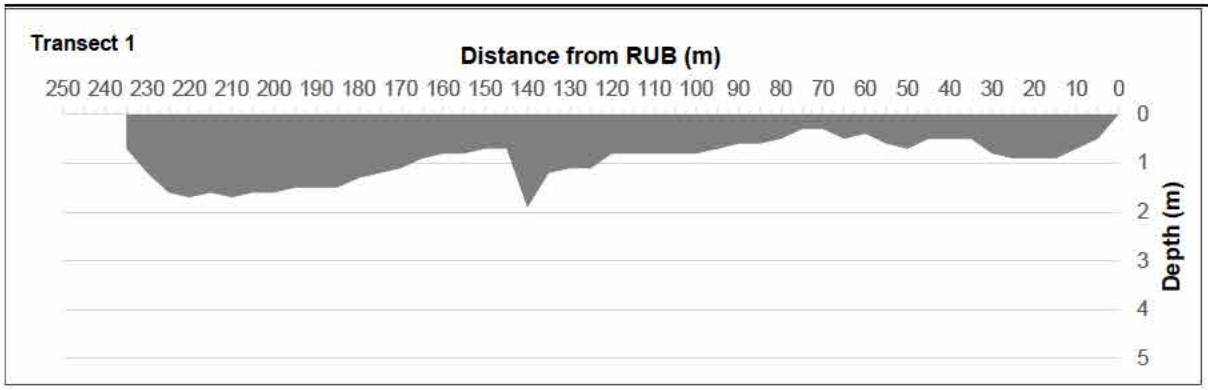
Appendix B

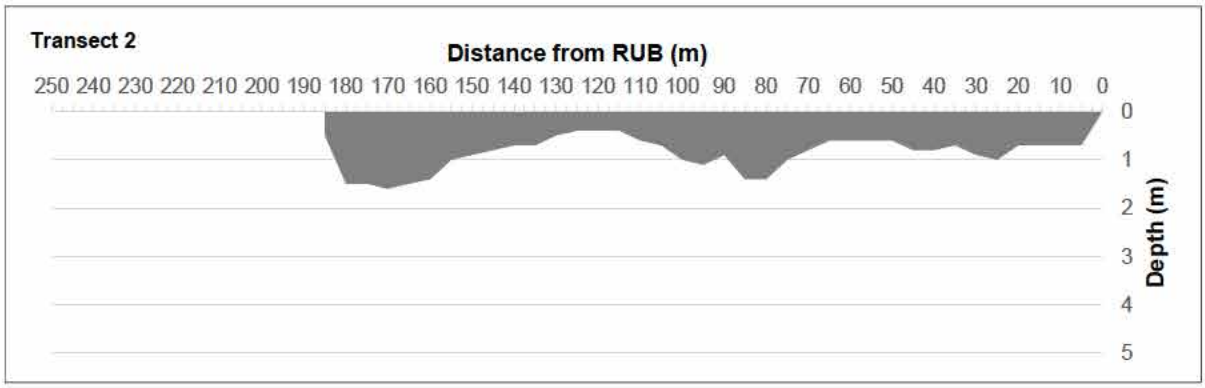
Existing Fish Capture Data

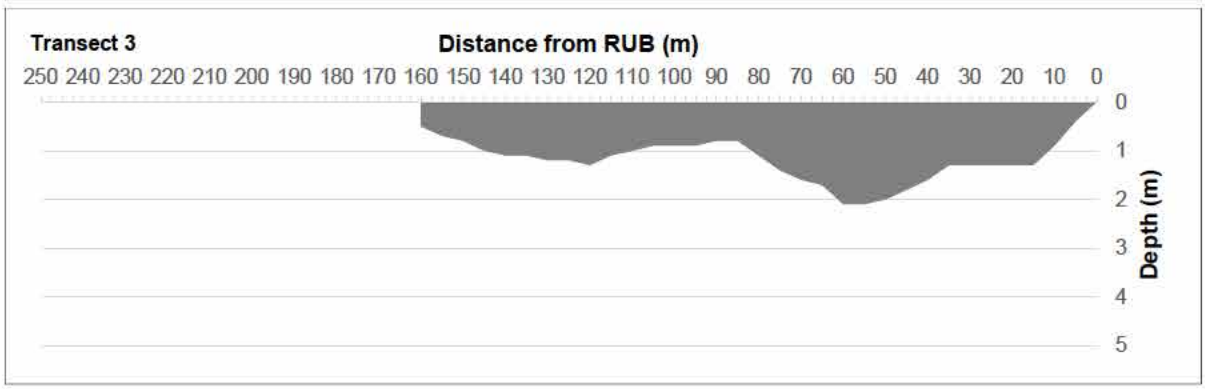
Year	Species	Count	Sampling Type	Sampling Effort
2009	EMSH	2	Electrofishing	1502 seconds
	GOLD	7		
	LNSC	9		
	MNWH	18		
	SHRD	6		
	WALL	1		
	WHSC	3		
2010	BURB	1	Electrofishing	615 seconds
	MNWH	10		
	NRPK	1	Seine	15 m
	TRPR	5		
	WALL	2		
	WHSC	2		
2013	YLPR	7	Trap Net	N/L
2016	EMSH	1	Electrofishing	2145 seconds
	FAMCYPR	2		
	GOLD	5		
	LNSC	7		
	MOON	4		
	NRPK	1		
	RVSH	3		
	SHRD	5		
	SPSH	2		
	TRPR	1		
	WALL	14		
	WHSC	10		
2017	BURB	2	Electrofishing	2451 seconds
	EMSH	1		
	FAMCATO	3		
	FAMCYPR	3		
	GOLD	13		
	LNSC	4		
	MNWH	2		
	NRPK	1		
	MOON	13		
	SLRD	1		
	WALL	11		
	WHSC	9		
2018	GOLD	6	Electrofishing	2804 seconds
	LNDC	3		
	LNSC	3		
	MOON	13		
	QUIL	1		
	SHRD	3		
	WALL	8		
	WHSC	6		

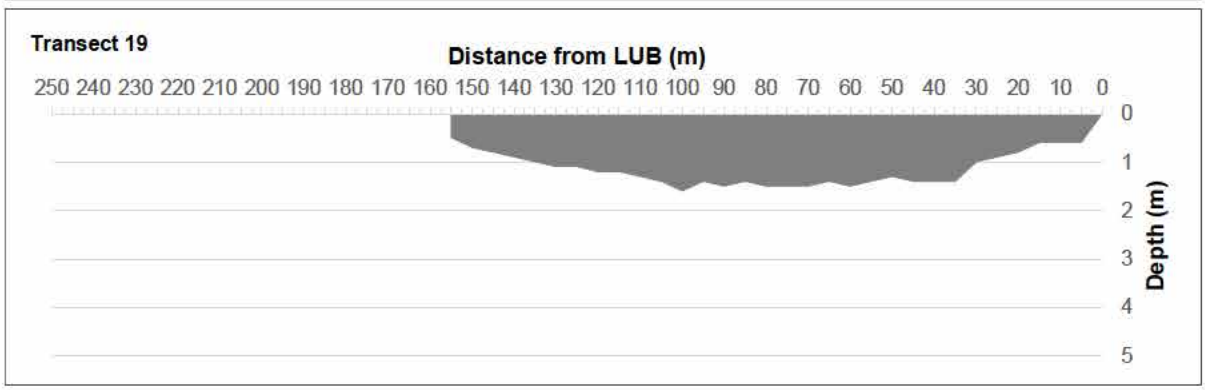
Appendix C

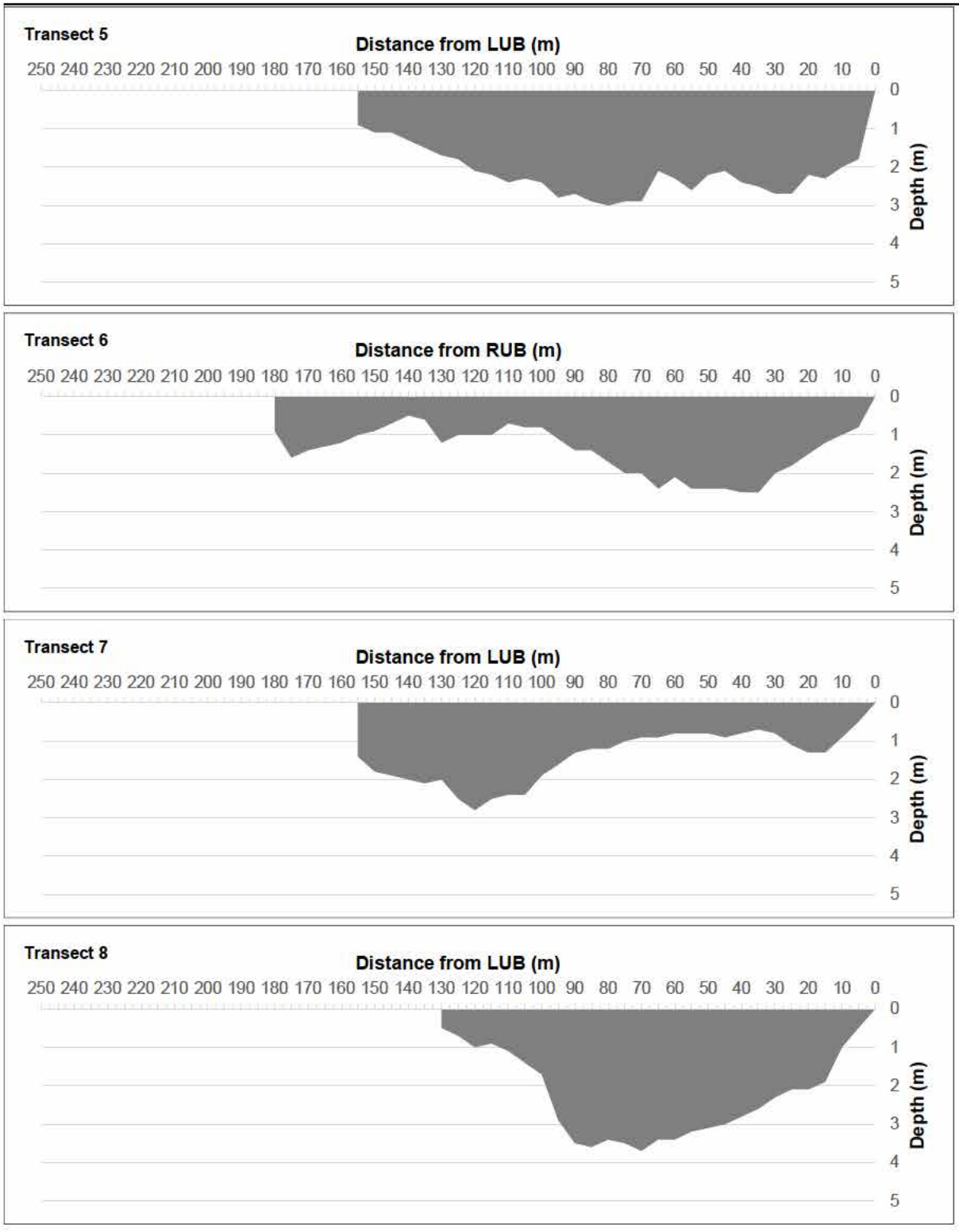
Transect Depth Profiles

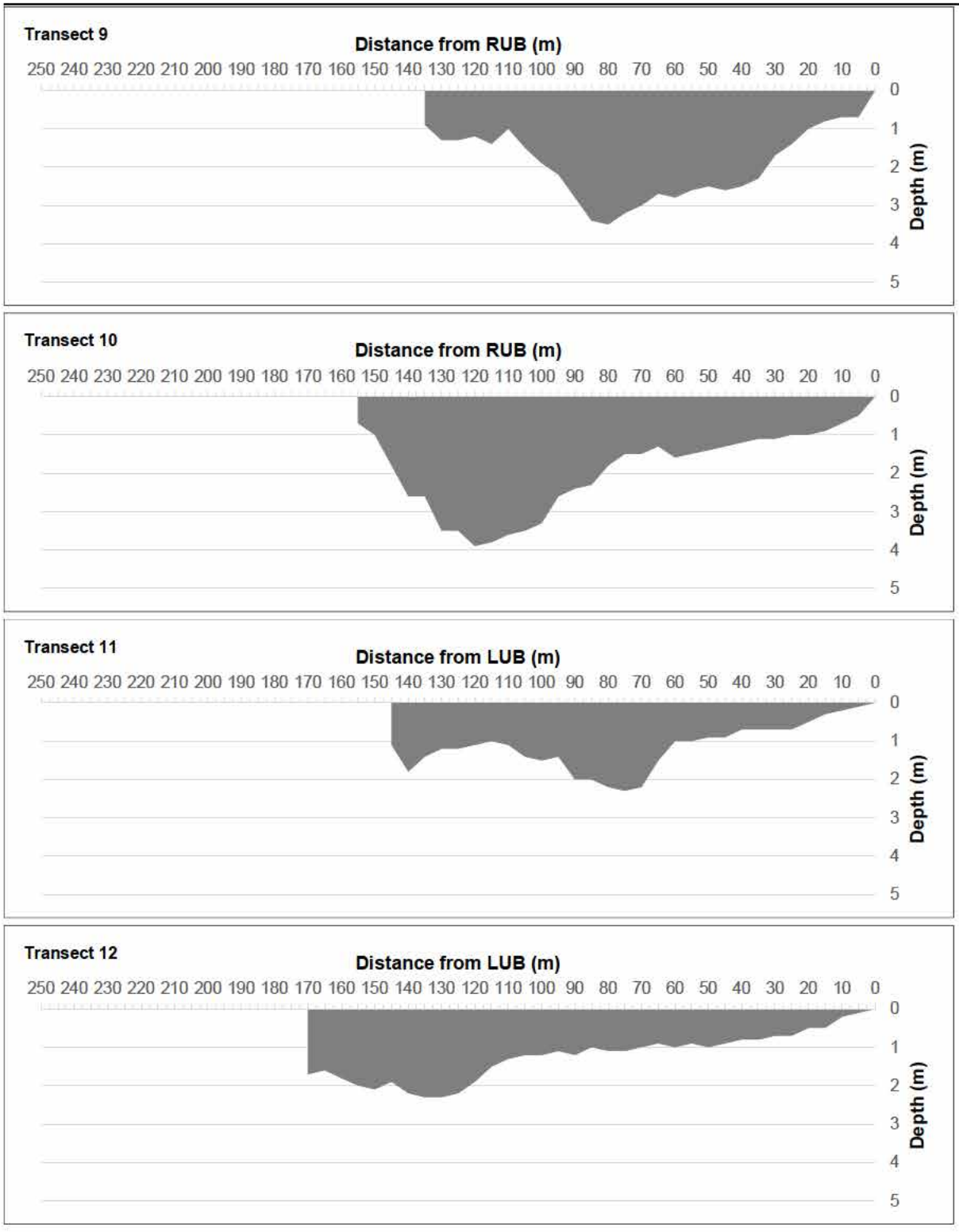

Transect 1
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0
1
2
3
4
5
Depth (m)


Transect 2
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0
1
2
3
4
5
Depth (m)


Transect 3
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0
1
2
3
4
5
Depth (m)


Transect 19
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0
1
2
3
4
5
Depth (m)


Transect 5
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 6
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 7
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 8
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)


Transect 9
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 10
Distance from RUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 11
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)
Transect 12
Distance from LUB (m)
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
0 1 2 3 4 5
Depth (m)

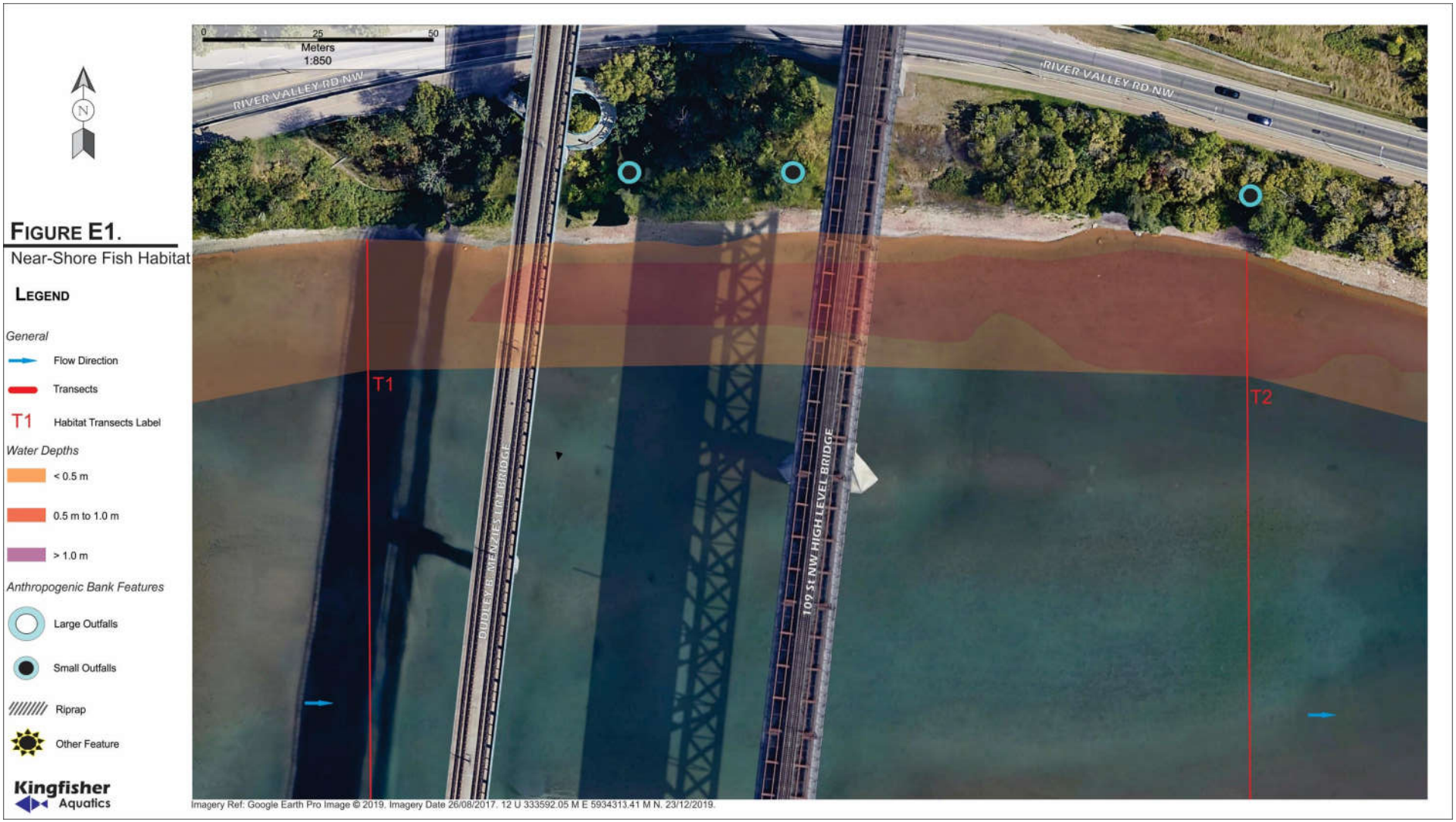
Appendix D

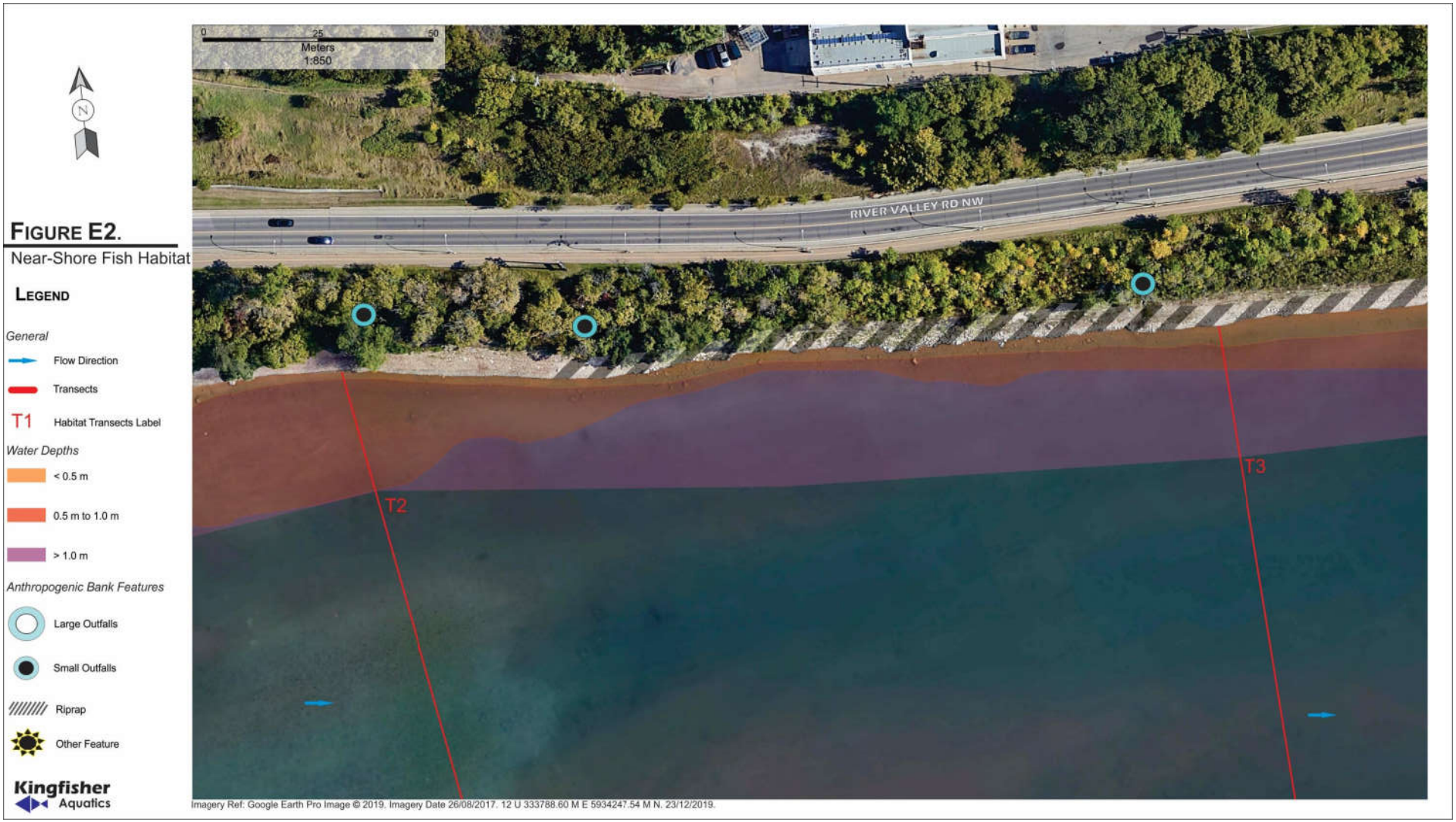
Transect Data

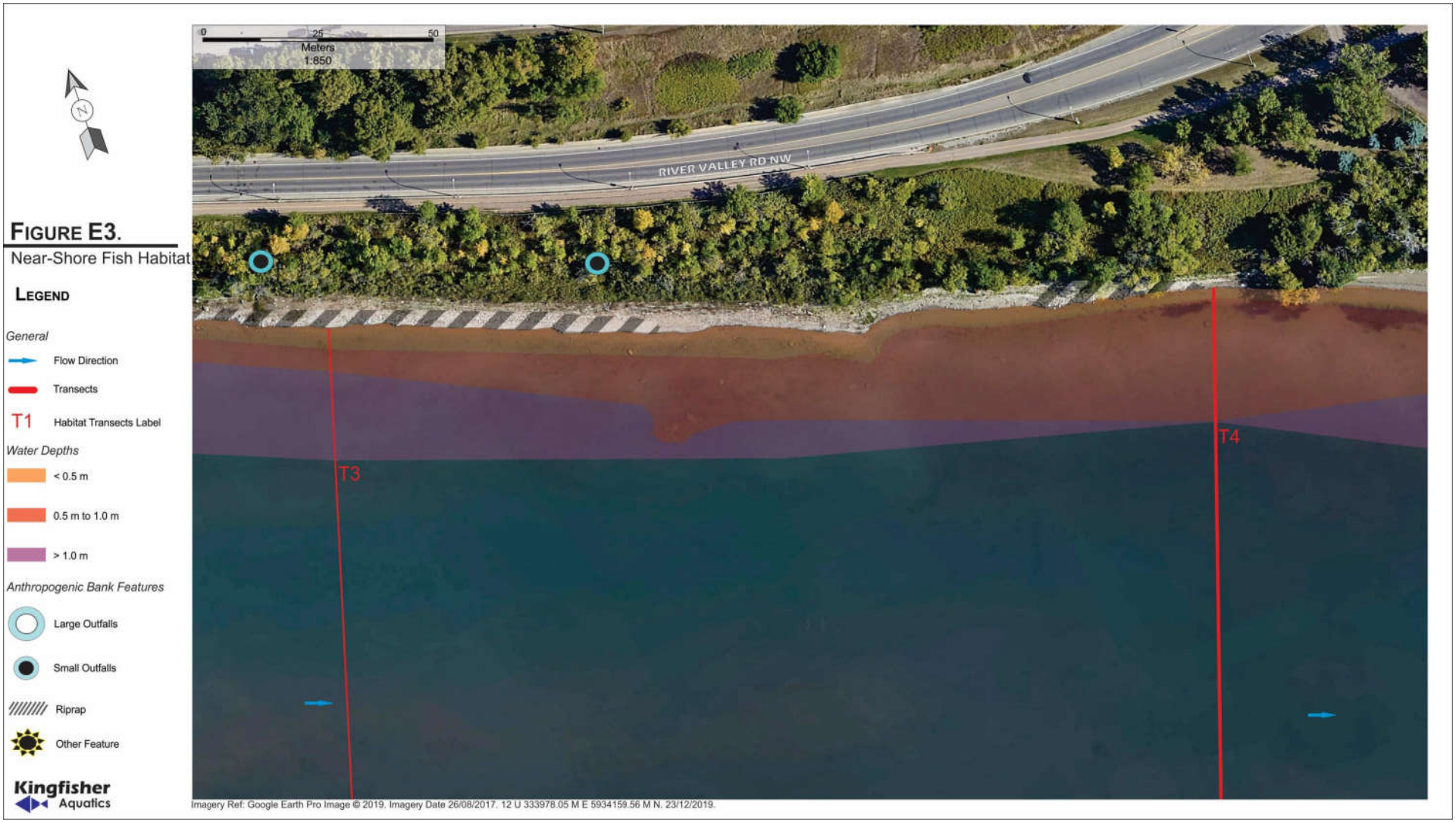
Location	Transect number		1	2	3	4	5	6	7	8	9	10	11	12
	Distance from Upstream Limit of Project Area (m)		+ 750	+ 550	+ 350	+ 150	- 50	-250	-450	- 650	- 850	- 1050	- 1250	- 1550
	UTM NAD 83 Easting		333514	333707	333883	334072	334235	334412	334593	334774	334890	334950	334968	335000
	UTM NAD 83 Northing		5934349	5934296	5934205	5933413	5934018	5933844	5933844	5933892	5934052	5934241	5934442	5934642
RUB	Large River Habitat Type		D1	A1	A1	A1	A4	A1	A1	D1	D1	D1	D1	A2
	Bank Height (m)		3	5	5	1	5	10	3	5	4	5	4	3
	Bank Angle (°)		40	65	45	40	30	40	40	50	80	60	50	65
	Riparian Veg (GR, SH, TR, EX, AR)		SH/GR	TR/GR	SH/TR	SH/GR	AR	GR/TR	GR/SH	TR/SH	TR/SH	TR/SH	TR/Sh	TR/SH
	Bank Stability (S or U)		S	Minor U	S	S	S	S	Minor U	Minor U	Minor U	Minor U	S	S
	Undercut Measurement (m)		-	-	-	-	-	-	-	-	-	-	-	-
	Bank Substrate (Fn, Gr, Cb, Bl, Br)		Fn	Fn/Gr	Fn/Bl	Fn	Bl	Fn	Fn	Fn	Fn	Fn	Fn	Fn
Channel	Streambed Substrate	Dominant	Gr	Gr	Cb	Fn	Fn	Fn	Fn	Fn	Fn	Fn	Gr	Fn
	(Fn Gr Cb Bl Br)	Sub-Dominant	Fn	Cb	Gr	Gr	Bl		Bl				Cb	Cb
	Wetted Width (m)		234	189	162	159	158	182	155	131	136	156	147	171
Specific comments for each transect														

Appendix E

Near-Shore Fish Habitat Maps


0
25
50
Meters
1:850
RIVER VALLEY RD NW
RIVER VALLEY RD NW
T1
T2
DUDLEY B. MENZIES (NB) BRIDGE
109 St NW HIGH LEVEL BRIDGE
FIGURE E1.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 333592.05 M E 5934313.41 M N. 23/12/2019.


0
25
50
Meters
1:850
RIVER VALLEY RD NW
T2
T3
FIGURE E2.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 333788.60 M E 5934247.54 M N. 23/12/2019.


0
25
50
Meters
1:850
RIVER VALLEY RD NW
T3
T4
FIGURE E3.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 333978.05 M E 5934159.56 M N. 23/12/2019.

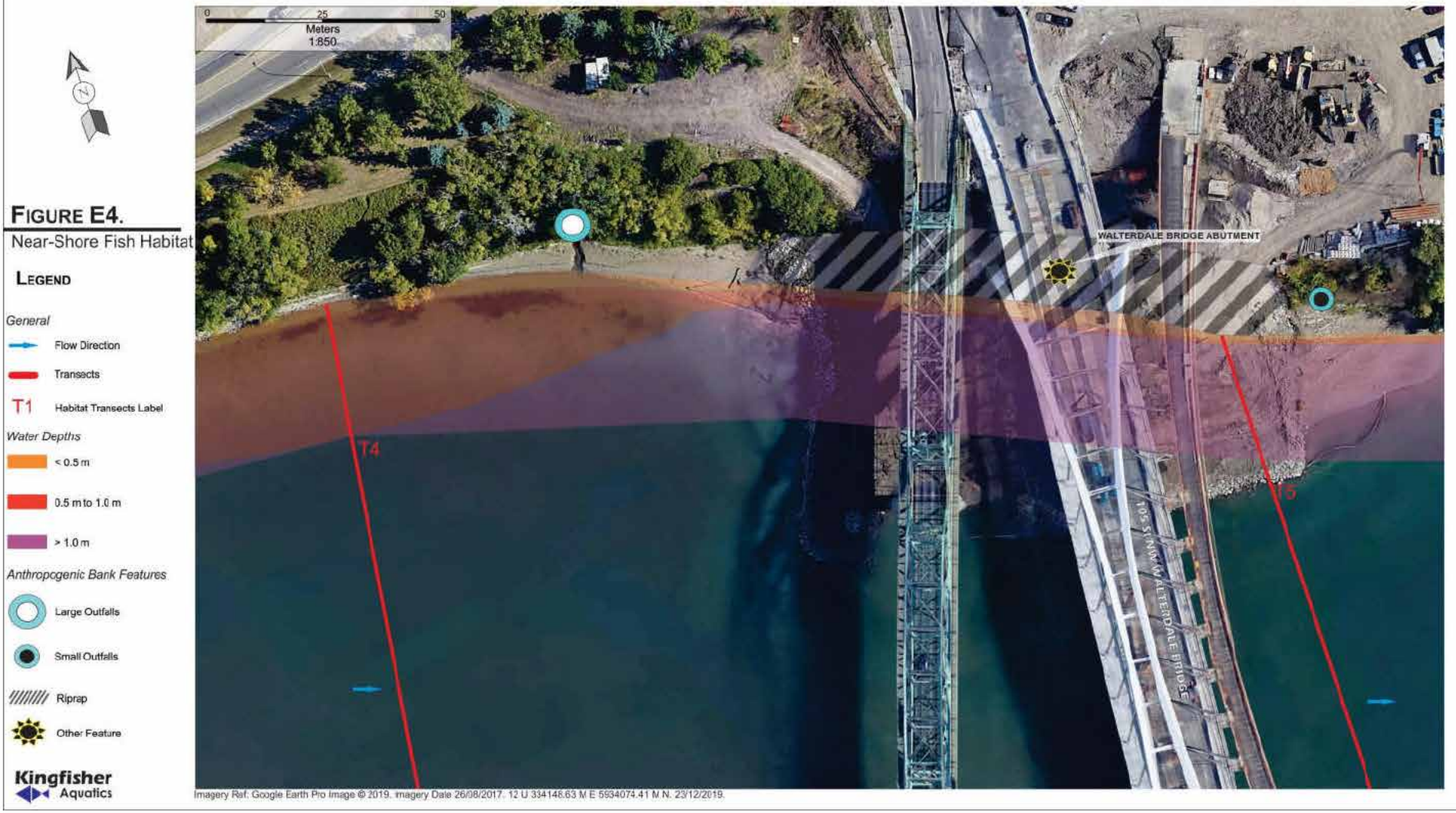


FIGURE E4.

Near-Shore Fish Habitat

LEGEND

General

- Flow Direction
- Transects
- T1 Habitat Transects Label

Water Depths

- < 0.5 m
- 0.5 m to 1.0 m
- > 1.0 m

Anthropogenic Bank Features

- Large Outfalls
- Small Outfalls
- Riprap
- Other Feature

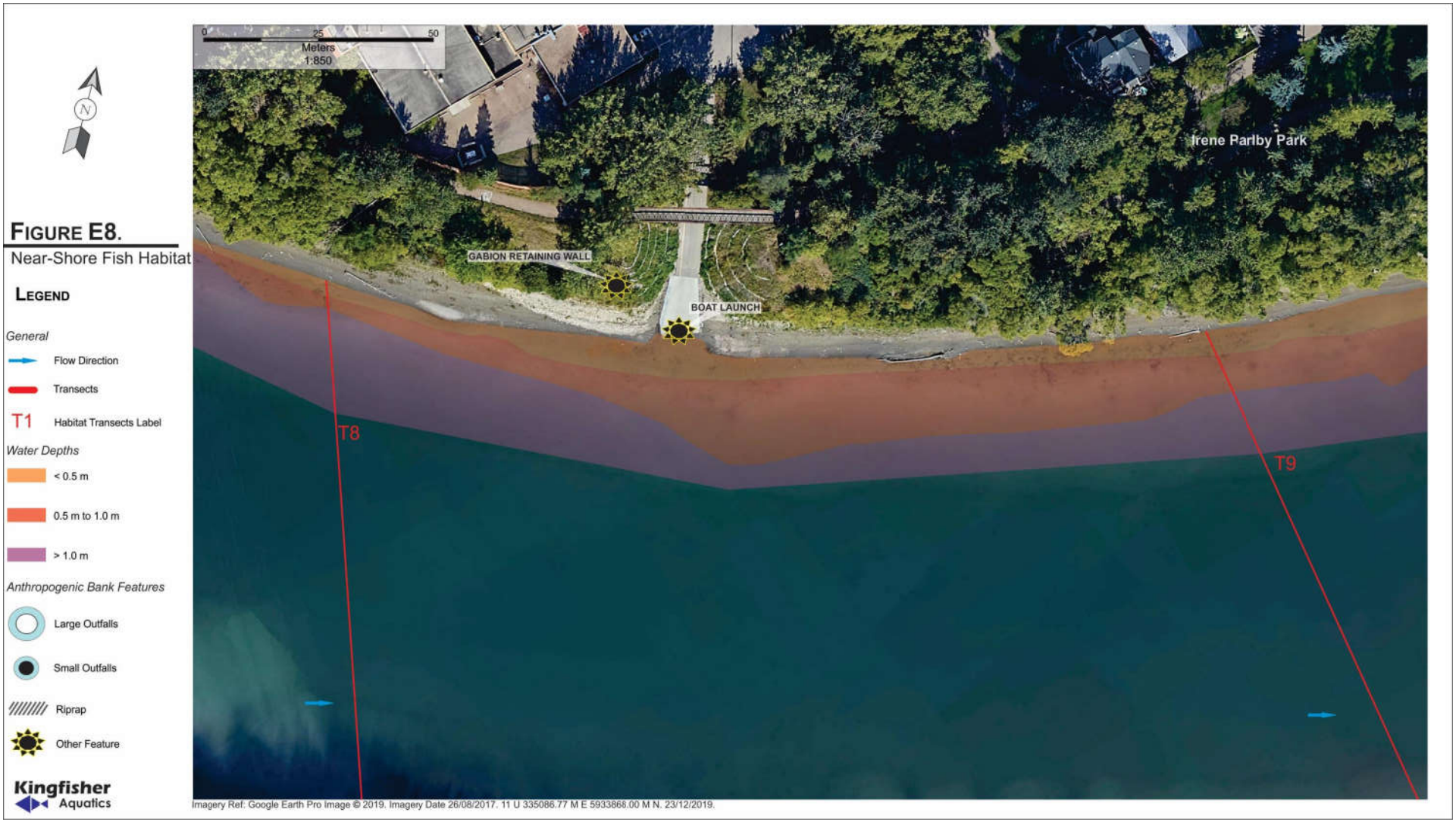
Kingfisher Aquatics

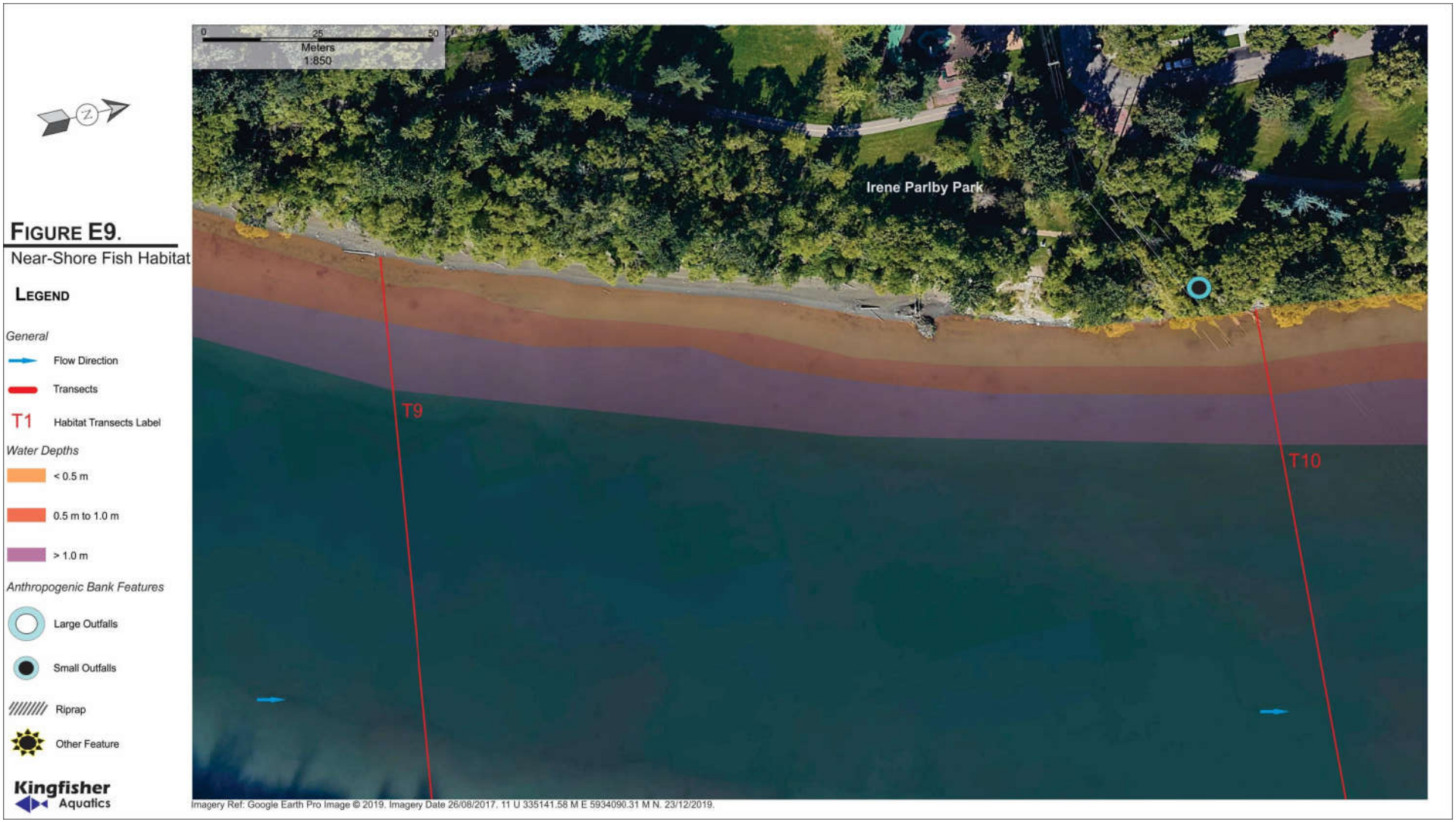
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 334148.63 M E 5934074.41 M N. 23/12/2019.

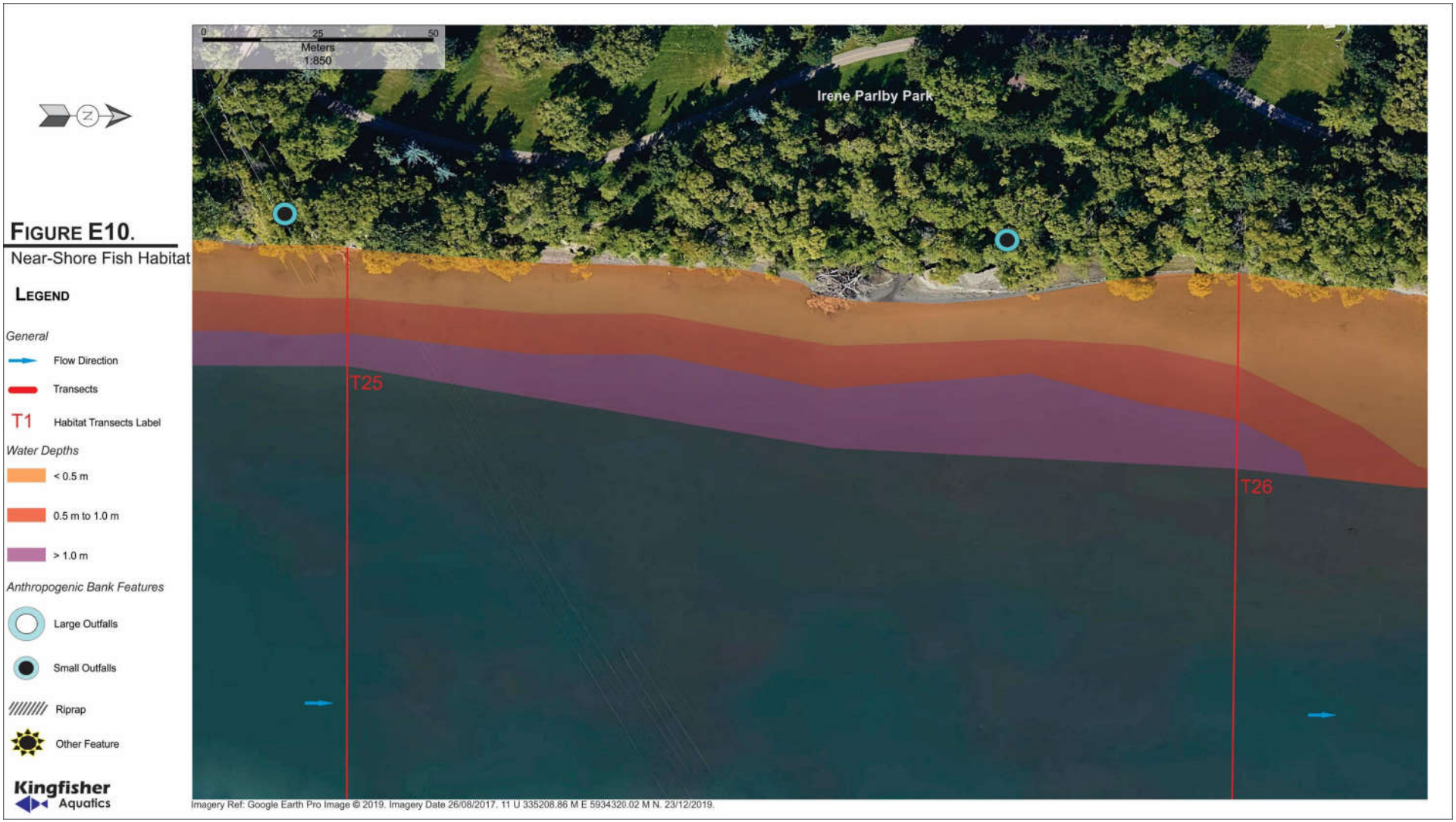

0
25
50
Meters
1:850
WALTERDALE BRIDGE ABUTMENT
PUMPHOUSE 2
PUMPHOUSE 1
CONCRETE RUBBLE PILE
T5
T6
105 ST NW WALTERDALE BRIDGE
FIGURE E5.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 334322.67 M E 5933961.88 M N. 23/12/2019.

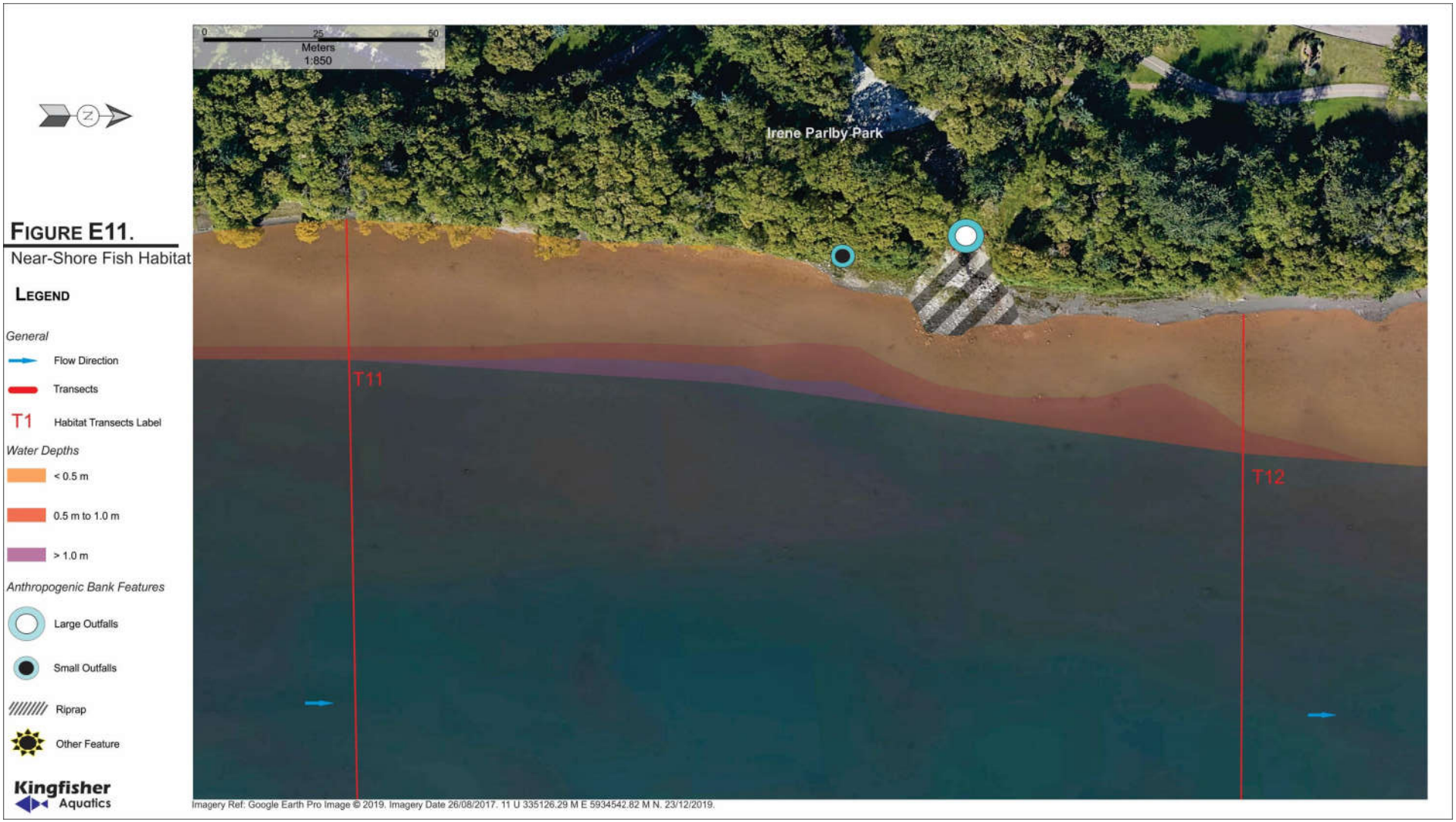

0
25
50
Meters
1:850
N
FIGURE E6.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
T6
T7
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 12 U 334491.53 M E 5933873.11 M N. 23/12/2019.


0
25
50
Meters
1:850
N
FIGURE E7.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
T7
T8
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 334897.06 M E 5933691.38 M N. 23/12/2019.


0
25
50
Meters
1:850
N
Irene Parlby Park
GABION RETAINING WALL
BOAT LAUNCH
T8
T9
FIGURE E8.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 335086.77 M E 5933868.00 M N. 23/12/2019.


0
25
50
Meters
1:850
Irene Parlby Park
T9
T10
FIGURE E9.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 335141.58 M E 5934090.31 M N. 23/12/2019.


0
25
50
Meters
1:850
Irene Parlby Park
T25
T26
FIGURE E10.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 335208.86 M E 5934320.02 M N. 23/12/2019.


0
25
50
Meters
1:850
Irene Parlby Park
T11
T12
FIGURE E11.
Near-Shore Fish Habitat
LEGEND
General
Flow Direction
Transects
T1
Habitat Transects Label
Water Depths
< 0.5 m
0.5 m to 1.0 m
> 1.0 m
Anthropogenic Bank Features
Large Outfalls
Small Outfalls
Riprap
Other Feature
Kingfisher Aquatics
Imagery Ref: Google Earth Pro Image © 2019. Imagery Date 26/08/2017. 11 U 335126.29 M E 5934542.82 M N. 23/12/2019.

Appendix F

Photographs

Plate 1: Looking at the RUB at Transect 1.

Plate 2: Looking at the RUB at Transect 2.

Plate 3: Looking at the RUB at Transect 3.

Plate 4: Looking at the RUB at Transect 4.

Plate 5: Looking at the RUB at Transect 5.

Plate 6: Looking at the RUB at Transect 6.

Plate 7: Looking at the RUB at Transect 7.

Plate 8: Looking at the RUB at Transect 8.

Plate 9: Looking at the RUB at Transect 9.

Plate 10: Looking at the RUB at Transect 10.

Plate 11: Looking at the RUB at Transect 11.

Plate 12: Looking at the RUB at Transect 12.

Plate 13: Looking at the LRT bridge abutment on the RUB between Transect 1 and Transect 2.

Plate 14: Looking at a small outfall structure and concrete riprap on the RUB between Transect 17 and Transect 18.

Plate 15: Looking at a concrete slab retaining wall on the upstream side of Pumphouse 2.

Plate 16: Looking at the downstream side of Pumphouse 2

Plate 17: Looking at an outfall structure and poor riparian vegetation between Pumphouse 1 and Pumphouse 2.

Plate 18: Looking downstream at the upstream side of Pumphouse 1 and a concrete rubble pile in the water.

Plate 19: Looking at a functioning outfall eroding a channel in a sediment deposit between Transect 7 and 8.

Plate 20: Looking at the Edmonton Fire and Rescue boat launch on the RUB between Transect 8 and 9.

Appendix E: Environmental Regulatory Requirements

Table 1. Summary of Potential Environmental Approvals for City of Edmonton Projects in North Saskatchewan River Valley

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
Federal					
Fisheries Act	Fisheries and Oceans Canada (DFO)	The *Fisheries Act* requires that projects occurring in or near water avoid causing the death of fish and the harmful alteration, disruption or destruction (HADD) of fish habitat. If there are aquatic species at risk in the area, proponents must also avoid harming, harassing, capturing or taking those species pursuant to the *Species At Risk Act (*SARA*)*. DFO has developed a series of standards and codes of practice for common works, undertakings and activities. These provide guidance on how to avoid and mitigate impacts to fish and fish habitat and comply with the *Fisheries Act* and *Species at Risk Act.* In cases where impacts to fish and fish habitat cannot be avoided, and the project does not fall within waterbodies where DFO review is not required, or the scope of the project is not covered under standards and codes of practice, proponents should submit a Request for Review to their region's Fish and Fish Habitat Protection Program office. If death of fish, the harmful alteration, disruption or destruction (HADD) of fish habitat will likely result from a project, the proponent is required to obtain an authorization from the Minister of Fisheries, Oceans and the Canadian Coast Guard as per Paragraph 34.4(2)(b) or 35(2)(b) of the	Review and/or Authorization	It is anticipated that: • A QAES will be required to confirm potential for HADD. If no serious harm to fish is anticipated, then only best management practices required as directed by QAES, or • QAES to consult with DFO regarding if an Authorization is required.	Schedule potentially impacted if Authorization is required. Request for Review has no specific time limits, anticipate a minimum of three months. Authorization can take up to 150 days (60 days to determine if application is complete and 90 days to issue authorization). Amendments to the application will restart the review schedule.

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
		Fisheries Act Regulations. DFO recommends that an application for authorization only be pursued after a project review has been completed. If harm, harassment, capture or take of an aquatic species at risk will likely result from your project, but not death of fish, nor the harmful alteration, disruption or destruction of fish habitat, then proponents are required to apply for a SARA permit. Failure to abide by the terms and conditions of the permit is a contravention of the Act and may result in fines.			
Canadian Navigable Waters Act (CNWA)	Transport Canada	The *CNWA,* brought into force late August 2019, authorizes and regulates interferences with the public right of navigation. The Act identifies scheduled and non-scheduled navigable waters. Scheduled (listed) waters are those navigable waters for which regulatory approval is required for works that risk a substantial interference with navigation. The North Saskatchewan River is a Scheduled waterway. The Act creates a category for "major" works, those likely to substantially interfere with navigation. These works will <u>always</u> require approval from Transport Canada whether the affected navigable waters are on the schedule or not. Major works include fixed span bridges with one or more piers below the ordinary high-water mark. Temporary works that are installed for a period of at least 30 consecutive days for the construction,	Approval	Consultation with Transport Canada to determine if Approval is required.	Schedule may be impacted if Approval is required

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
		placement, alteration, rebuilding, removal, decommissioning, repair or maintenance of a bridge, are designated as major works, unless they are installed during a period when navigation is not possible.			
Migratory Birds Convention Act (MBCA)	Environment and Climate Change Canada	This Act prohibits the disturbance of nests and individuals of most migratory bird species and prohibits release of deleterious substances into waters or areas frequented by migratory birds. Project may require clearing of migratory bird nesting habitat.	The Act provides guidelines for enforcement only; it is not linked to formal approvals required for construction. Violation of the MBCA may, however, result in penalties.	Avoid vegetation clearing during the period 20 April to 20 August. Contingent approach is to have a qualified biologist undertake a nest sweep of project area and to then avoid disturbance of any noted nesting birds. (See related notes for *Wildlife Act*)	Nest sweeps undertaken between 20 April and 20 August have potential to result in findings that delay clearing.
Species At Risk Act (SARA)	Environment and Climate Change Canada	This Act prohibits disturbance to listed species and, in some instances, listed species' habitat on federal lands. On non-federal lands, the Act applies to disturbance of listed aquatic species and listed migratory birds.	Although no approvals or permits are required, violation of the SARA may result in penalties.	If any federally listed species are identified as present within or adjacent to the construction area, best practice is to consider the impact of the project on that species in consultation with Environment and Climate Change Canada.	Schedule impacted only if SARA species are found in the area.
Provincial					
Historical Resources Act	Alberta Culture, Multiculturalism and Status of Women (ACMSW)	All projects with potential to disturb historical, archaeological and paleontological resources are regulated under this Act and require Approval or Clearance from ACMSW.	*Historical Resources Act* Approval or Clearance.	CoE to submit *Historical Resources Act* application to ACMSW. ACMSW will determine if an Historical Resources Impact Assessment (HRIA) is required.	~3 months for ACMSW review of application
Public Lands Act	Alberta Environment and Parks (Land Management Branch)	Use of Crown lands, including the bed and shore of all bodies of water, are regulated under this Act. Act requires proponents wishing to alter or occupy Crown land to obtain a disposition or amend existing dispositions.	Department License of Occupation (DLO) approval(s) and/or Temporary Field Authorization (TFA) required if watercourses are claimed by Crown and	City to submit DLO and TFA (if required) applications to AEP.	+/- 1 year for DLO approval - a few weeks to several months for a TFA approval

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
			project components and/or construction impacts bed and shore of watercourses		
Water Act	Alberta Environment and Parks (Water Approvals Branch)	This Act is the primary piece of legislation governing the use and management of Alberta's water resources, including water held in permanent and temporary wetlands. Approval is required for many activities affecting water and, in some cases, for placement of infrastructure on watercourse banks. The *Water Act* also contains provisions to prevent deposition of deleterious substances (including sediment and other contaminants) into watercourses. Some activities affecting watercourses are regulated through Code of Practice Notifications.	*Water Act* Approval and/or Code of Practice Notification	CoE to submit *Water Act* approval application or CoP Notification. Specifications and recommendations of a Qualified Aquatic Environment Specialist (QAES) may be required.	~3-6 months for *Water Act* Approval - CoP Notification submission at least 14 days prior to construction commencement.
Wildlife Act	Alberta Environment and Parks	This Act applies to most species of wildlife. The willful molestation, disruption, or destruction of a wildlife nest or den is prohibited by this Act. Special provisions provide for the protection of raptors and their nests/habitats. Project requires clearing of vegetation that may support nesting/denning wildlife.	Although permitting for clearing is not required under the Act, violations of Act, e.g., disturbances of breeding wildlife, such as flying squirrels, may result in fines.	Avoid vegetation clearing during the period 20 April to 20 August. Contingent approach is to have a qualified biologist undertake a nest sweep of project area to avoid disturbance of active nests and dens. Abide by findings to ensure compliance. In addition, if clearing vegetation between 16 February and 20 April, undertake a sweep for active owl nests.	Not applicable if vegetation clearing is completed outside of the period 16 February to 20 August. Nest sweeps undertaken between 16 February and 20 August have potential to result in findings that delay clearing.

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
Municipal					
North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188)	City Planning	Bylaw regulates all activities on City lands in the North Saskatchewan River Valley. The proposed project falls within the Bylaw 7188 area. Construction of the Rossdale Reach project in the river valley is considered a "major facility" pursuant to Bylaw 7188 and requires completion of an Environmental Impact Assessment (EIA) and a Site Location Study (SLS).	EIA and SLS will require City Council approval and for City Council to deem the project's location in the river valley as essential.	City Planning has confirmed the need for an Environmental Impact Assessment (EIA) and Site Location Study (SLS) for City Council approval.	Completion of an EIA and SLS and acquisition of City Council approval generally takes approximately 6-8 months.
Corporate Tree Management Policy C456	City Forestry	Policy provides protection for City tree/shrub inventory and a mechanism for monetary compensation for lost canopy. Prior to removal, trees are assessed by City's Urban Forestry Department.	None, but compensation for lost canopy must be arranged with CoE.	The proponent will meet with City of Edmonton's Urban Forester to assess shrubs and trees to be removed, if required, and an appropriate project-specific compensation program will be developed accordingly.	Compensation to be realized as part of the project as a whole. Contract tender will ensure compliance regarding protection of retained trees.
City of Edmonton Parkland Bylaw 2201	City of Edmonton	Bylaw to protect and preserve natural ecosystems for the benefit of all citizens of the City.	Approval required to stage construction equipment or other use in park open space.	Application for a permit to stage for construction.	Applies to construction phase. City or contractor responsibility.
City of Edmonton Bylaw 18100 Epcor Drainage Services Bylaw	EPCOR	Bylaw regulates use of the sewer system and contractor must consult with EPCOR regarding use of sewer to dewater site. Application for a permit and payment of fees.	No prohibited, restricted or hazardous waste may be released into the sewerage system without written consent from EPCOR.	Application for a permit to discharge to sewer system may be required.	Applies to construction phase. City or contractor responsibility.
Drainage Bylaw 18093	City of Edmonton	The purpose of this bylaw is to regulate surface drainage on public and private land and to foster the well-being of the environment by prohibiting the release of dangerous or hazardous matters into	No permits/approvals required; compliance only.	None	Applies to construction phase. Contractor responsibility.

Legislation or Policy	Regulatory Agency	Relevance to Project	Potential Authorization/Approval/ Permit	CoE Steps in the Regulatory Process	Approval Timeline or Potential Schedule Impact
		the sewerage system. Part III of this Bylaw prohibits the release of hazardous materials and materials that produce a colour value greater than or equal to 50 true colour units. The release of any material other than that permitted in this Bylaw may result in penalties. Compliance will be achieved through spill prevention measures, erosion and sedimentation control measures, and adherence to the City of Edmonton's "Contractor's Environmental Responsibilities Package".			
City of Edmonton Community Standards Bylaw 14600	City of Edmonton	No approval or application	No permits/approvals required; compliance only	None	Proponent responsibility.
ENVISO, City Policy C505, City Policy C512	City of Edmonton	Based on the ISO 14001 Standard, ENVISO provides a framework for a strong environmental management system aimed at legal/regulatory compliance, pollution prevention and continual improvement.	• Proponent must be compliant with all aspects of ENVISO. Enviso Design Environmental Permit Approval checklist must be completed for all City projects prior to tender. • Review of the Enviso Proponent's Environmental Responsibility Package and City Policy C512. • Signing Proponent's Environmental Acknowledgement Form	• Proponent to implement process as project is underway. • Checklist to be completed by City prior to tender.	Proponent responsibility.