Fisheries and Oceans Canada   Pêches et Océans Canada

Application for a Species at Risk Permit
Fisheries & Oceans Canada

1. Applicant Information

Applicant's Name:	Dave Tyson, MSc, RPBio, PBiol
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Date of application:	2 July 2015

2. Qualifications of the applicant

Mr. Dave Tyson is the Lead, Fish and Fish Habitat for Tetra Tech WEI's Environmental Assessment, Permitting, and Natural Resources group in Canada. Mr. Tyson is a recognized expert in fish and fish habitat, providing testimony in court and expert advice to semi-judicial review boards. Mr. Tyson has extensive technical experience in designing, conducting, and reporting aquatic studies as well as conducting habitat inventories and assessments in lakes and streams and developing and implementing offsetting plans under the *Fisheries Act*. Earlier in his career, Mr. Tyson served as an Area Habitat Management Biologist for Fisheries and Oceans Canada. In this role, Mr. Tyson led the review of hundreds of projects in or near water. Mr. Tyson worked with proponents to minimize effects to aquatic habitat and where this was unavoidable, worked with proponents to develop offsetting measures to address temporary and permanent losses of habitat. Drawing on his experience in designing and leading the first whole-lake fish-outs, Mr. Tyson led the development and publishing of a fish-out protocol for lakes and impoundments that includes field and data management protocols. Mr. Tyson has extensive experience with the only known host for Mapleleaf Mussel glochidia, Channel Catfish (*Ictalurus punctatus*); Mr. Tyson's M.Sc. thesis project led a research project that investigated the effects of anthropogenic stressors on seasonal habitat use by Channel Catfish. Mr. Tyson's project experience extends across power generation and distribution, mining, mineral exploration, orphan mine site reclamation, transportation, community infrastructure, oil and gas exploration, and pipelines.

☑ See attached curriculum vitae

3. Preferred Language of Correspondence: ☑ English   ☐ French

4. Has the applicant received a SARA permit before?

☐ Yes   ☑ No

If yes, please provide the permit number(s):

5. Activity name: **Replacement of the PTH 1A Bridge over the Assiniboine River at Brandon, Manitoba**

6. Listed Species affected
List species at risk that may be affected by the proposed activities (common and scientific names).

- Mapleleaf Mussel (*Quadrula quadrula*)

7. Purpose of the proposed activity(ies):
Select the option that most closely describes the purpose of your activity:

☐ Scientific research relating to the conservation of the species

☐ Activity beneficial to the species or required to enhance its chance of survival in the wild

☑ Affecting the species is incidental to the carrying out of the activity

Indicate and explain if different purposes apply to different species at risk

☑ See attached document(s), page(s): Section 7

8. Description of proposed activity(ies)
Provide a description of the activity(ies), and if applicable, a description of the project of which the activity is a part. Include an explanation of why each activity fits the category identified in the previous question.

☑ See attached document(s), page(s): Section 8

9a. Location of the proposed activity(ies):

Provide a detailed description of the location of the activity(ies).

Indicate if the activity occurs in a land claim settlement area, on an Indian Reserve, or any other lands that are set apart for an Indian band.

If the activity will take place at sea, please indicate Fishery Management areas, and vessel , platform or aircraft information including photos, name and CFV/Registration number, country of registration, and Foreign Vessel Clearance (if applicable).

The project is located within the City of Brandon, Manitoba in the Rural Municipality of Cornwallis. The project coordinates are:

Latitude: 49.85078 North
Longitude: 99.93910 West

There is no known proposed or identified critical habitat for Mapleleaf Mussel at the project site. There is no publically accessible Recovery Strategy or Action Plan for the species.

The project does not occur in a land claim settlement area, on an Indian Reserve, or any other lands that are set apart for an Indian band.

☑ See attached map in attached document

10. Date of proposed activity(ies):

From (day, month, year) 1 October 2015 To (day, month, year) 15 October 2017

If applicable, describe the anticipated phases and their timelines:

See Gantt chart in attached document.

☑ See attached document(s), page(s): Section 10

11. Effects of the proposed activity(ies) on the species

a) Describe any changes that the activity may cause to the individuals of the species, and the effect of those changes. Include the nature of the effect, and the estimated number of individuals that may be affected. Describe the potential significance of those effects on the population as a whole. If multiple activities are part of the project, please provide this information for each activity.

Activity	Change	Effect	Significance

☑ See attached document(s), page(s): Section 11

b) If applicable, describe any changes that the proposed activity(ies) may cause to any residences of the individuals of the species, and the effect of those changes. Include the nature of the effect, and the estimated number of residences that may be affected. Describe the potential significance of those effects on the population as a whole. If multiple activities are part of the project, please provide this information for each activity.

Activity	Change	Effect	Significance

☐ See attached document(s), page(s):

c) Describe any anticipated changes to the habitat of the species at risk. Include the amount and type of habitat to be impacted, and the life processes of the species supported by that habitat. Please indicate any habitat that is identified as critical habitat in a recovery strategy or action plan for the species. Describe the potential significance of those impacts on individuals of the species at risk or the population as a whole. If multiple activities are part of the project, please provide this information for each activity.

Activity	Change	Effect	Significance

☑ See attached document(s), page(s): Section 11

12. Alternatives Considered

Describe, in detail, all the alternatives to the proposed activity(ies) that were considered to avoid or reduce the impact on the species, including:

- other locations that have been considered that are outside of the species' range or outside of critical habitat, and why these locations were rejected in favour of the current location. If no other locations were considered, please provide your rationale.
- all alternative activities, technical or research designs, equipment or processes that were considered in order to achieve the outcomes of the proposed activity, and why these were rejected in favour of the proposed activity, design, equipment, or process (e.g., directional drilling instead of a stream crossing using trenching)
- other timelines that were considered that would avoid periods when the species are present or sensitive to disturbance and, why these were rejected in favour of the proposed timelines

Explain why the current proposal is the best solution. If multiple activities are part of the project, please describe alternatives that were considered for each activity.

☑ See attached document(s), page(s): Section 12

13. Measures to Minimize Impacts

Describe all the measures that will be implemented to minimize the impact of the activity on the species , its habitat, or the residences of its individuals, including:

- a description of specific mitigation measures used to minimize impacts to the species (e.g., fish/mussel salvage, sediment and erosion control etc.) and the extent to which the measures have been demonstrated to be effective
- specific contingency measures in the event that the mitigation measures fail
- use of appropriate personnel to conduct the activities (e.g., the applicant has qualifications from a recognized institution, has demonstrated experience with the species, and/or has demonstrated experience with the proposed methodology)

If multiple activities are part of the project, please describe measures that will be implemented to minimize the impact of the activity on the species for each activity.

☑ See attached document(s), page(s): Section 13

14. Monitoring: Describe how you will monitor the effects of your activity on the species. This includes monitoring the effectiveness of measures to minimize impacts to the species to determine whether the implementation of the measures achieved the intended outcomes. ☑ See attached monitoring plan (Section 14)
15. Describe, to your best understanding, why the proposed activity(ies) will not jeopardize the survival or recovery of the species. ☑ See attached document(s), page(s): Section 15
16. Offsetting measures Will you be proposing offsetting measures to counterbalance residual adverse impacts that remain after implementing all reasonable alternatives to avoid impacts and all feasible measures to minimize impacts to the species? ☑ Yes ☐ No Does your offsetting plan comply with the requirements of the DFO's Fisheries Productivity Investment Policy and additional requirements outlined in section 16 of this Application Guide? ☐ Yes ☑ No Have you discussed your offsetting plan with DFO? ☐ Yes ☑ No If yes to any of the above, please attach your offsetting plan to the application. ☑ See attached offsetting plan (Section 16)

Applicant's signature   2 JULY 2015
Date

Information about the above-noted proposed activity is collected by Fisheries and Oceans Canada under the authority of the *Species at Risk Act* (SARA) for the purpose of administering the permitting provisions of SARA. Personal information will be protected under the provisions of the *Privacy Act* and will be stored in the Personal Information Bank DFO-PPU-770. Under the *Privacy Act*, individuals have a right to, and on request shall be given access to, any personal information about them contained in a personal information bank. Instructions for obtaining personal information are contained in the Government of Canada's Info Source publications available at www.infosource.gc.ca or in Government of Canada offices. Information other than "personal" information may be accessible or protected as required by the provision of the Access to Information Act.

Please send your completed application to the Regional Manager, Species at Risk Program at the relevant DFO Regional office:

Pacific Region (British Columbia, Yukon Territory, excluding the North Slope which is within Central and Arctic Region) Fisheries and Oceans Canada 200-401 Burrard Street Vancouver, BC V6C 3S4 Tel: (604) 666-0395 E-mail: sara@pac.dfo-mpo.gc.ca	**Central & Arctic Region** (Northwest Territories, Nunavut, Alberta, Saskatchewan, Manitoba, Ontario, Yukon North Slope): Fisheries and Oceans Canada Freshwater Institute 501 University Cr Winnipeg, MB R3T 2N6 Tel: (204) 983-4438 E-mail: FWISAR@dfo-mpo.gc.ca
Quebec Region (Quebec, St. Lawrence River, Northern Gulf of St. Lawrence): Fisheries and Oceans Canada 850 Route de la Mer C.P. 1000 Mont-Joli, Québec G5H 3Z4 Tel: (418) 775-0763 E-mail: lep-sara-qc@dfo-mpo.gc.ca	**Gulf Region** (Maritime Provinces adjacent to the Gulf of St. Lawrence): Fisheries and Oceans Canada P.O. Box 5030 343 Ave. Université Moncton, N.B., E1C 9B6 Tel: (506) 851-6253 Email: GLF-SARA-LEP@dfo-mpo.gc.ca
Maritimes Region (from the northern tip of Cape Breton to the New Brunswick-Maine border): Bedford Institute of Oceanography P.O. Box 1006 1 Challenger Drive Dartmouth, NS B2Y 4A2 Tel: (902) 426-8503 E-mail: XMARSARA@mar.dfo-mpo.gc.ca	**Newfoundland/Labrador Region** (Newfoundland, Labrador): Northwest Atlantic Fisheries Centre East White Hills Rd P.O. Box 5667 St. John's, NFLD A1C 5X1 Tel: (709) 772-4088 E-mail: SARANL-LEPTNL@dfo-mpo.gc.ca

Report to:

MANITOBA INFRASTRUCTURE AND TRANSPORTATION

TETRA TECH

PTH 1A - Bridge Replacement: *Species at Risk Act* Application

Document No. 1300160400-REP-V0001-00

Report to:

TETRA TECH

MANITOBA INFRASTRUCTURE AND TRANSPORTATION

PTH 1A - BRIDGE REPLACEMENT: *SPECIES AT RISK ACT* APPLICATION

JUNE 2015

Prepared by	Dave Tyson	~~Date~~	June 30, 2015
Reviewed by	Dave Tyson	~~Date~~	June 30, 2015
Authorized by	Vaibhav Banthia	Date	June 30, 2015

DT/ gs

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TETRA TECH

REVISION HISTORY

REV. NO	ISSUE DATE	PREPARED BY AND DATE	REVIEWED BY AND DATE	APPROVED BY AND DATE	DESCRIPTION OF REVISION

TETRA TECH

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1.0 INTRODUCTION

1.1 PROJECT BACKGROUND

The existing Assiniboine River/CPR Bridge on PTH 1A in Brandon, Manitoba (bridge, site no. 2582-00) consists of four lanes (two northbound and two southbound) supported on three large in-channel piers (Figure 9.1). A preliminary design study concluded that the bridge will require immediate, substantive, disruptive and, costly repairs in order to achieve only a modest extension to the service life. The same study also concluded that a replacement of the crossing would have a longer service life, allow the crossing to be upgraded to current design standards, have reduced construction risks, and have lower maintenance costs and risks. A new crossing would also reduce the in-channel profile and flow restrictions.

The proposed project is located within the historic range of the Mapleleaf Mussel (*Quadrula quadrula;* COSEWIC 2006) Saskatchewan – Nelson population. Although Mapleleaf Mussel were never abundant in the Assiniboine River upstream of Portage la Prairie, recent and extensive surveys have resulted in only a single documented individual upstream of the Portage Diversion (COSEWIC 2006). This decline in distribution coincides with the construction and commissioning of the Portage Diversion which presents an impassable barrier for host fish species in the lower Assiniboine River (Stewart and Watkinson 2004). As a result, Mapleleaf Mussel are no longer established in the upper Assiniboine River. COSEWIC (2006) concluded that the presence of the Portage Diversion barrier precludes any natural establishment of Mapleleaf Mussel upstream of the structure in the Assiniboine River.

1.2 PURPOSE OF THE DOCUMENT

The purpose of this document is to provide additional and/or expanded information to support the Application for a Species at Risk Permit. This application is a precautionary measure as the project occurs within the historic range of Mapleleaf Mussel. Although Mapleleaf Mussel are unlikely to be encountered at the project site, this document describes the mitigation measures to ensure no individuals are harmed on how the work site will be restored. Site restoration will ensure that, should the host barrier at Portage la Prairie be addressed at some point in the future, there will be no negative changes to the availability of habitat at the project site.

The need for the crossing replacement has rapidly developed and therefore it was not possible to conduct a mussel survey in the previous open-water season. As such, the site survey will be conducted concurrent to the relocation program. If no Mapleleaf Mussel are encountered in the proposed work area, then the mussel relocation program will be concluded and the results reported to DFO. No surveys will be conducted the following summer and the monitoring program will not be conducted.

1.3 DOCUMENT ORGANIZATION

Section numbering for this document corresponds with the applicable section in the application to allow for ease of reference.

7.0 PURPOSE OF THE ACTIVITY

The existing Assiniboine River/CPR Bridge on PTH 1A in Brandon Bridge, site no. 2582-00, consists of four lanes (two northbound and two southbound) supported on three large in-channel piers. The bridge was constructed in 1972 and is in need of major rehabilitation and strengthening. Regular inspections have documented the deterioration of the steel and concrete components. In 2013, Manitoba Infrastructure and Transportation (MIT) commissioned a preliminary design study to investigate the rehabilitation works and options for the crossing. The study concluded that the bridge will require immediate, substantive, disruptive and, costly repairs in order to achieve only a modest extension to the service life. The study also concluded that a replacement of the crossing would have a longer service life, allow the crossing to be upgraded to current design standards, have reduced construction risks, and have lower maintenance costs and risks. A new crossing would also reduce the in-channel footprint and profile of the crossing.

8.0 DESCRIPTION OF PROPOSED ACTIVITY

The proposed work includes replacement of the existing bridge with two new bridges which separate traffic into dedicated northbound and southbound structures. Refer to attached preliminary design drawings. Major project components therefore include:

1. Construction of a new two-lane northbound (east) bridge;
2. Construction of a new two-lane southbound (west) bridge; and
3. Demolition of existing four-lane bridge.

The new structures would occupy the same location as the current structure. The new structures have been designed so that each would require only two piers within the Assiniboine River channel at normal summer water levels and one pier each at normal winter water levels (Figure 13.1). This results in a reduction from three piers to two in the permanently wetted channel. In addition to the in-channel works, the bridges will extend south over a CPR rail line. The existing four-lane bridge will be demolished in stages so that traffic can be maintain at the crossing during the construction of the new bridges.

The project works will be sequenced to so that at least one lane in either direction (north and south) remains open at all times. In order to accomplish this, the existing northbound (east-side) lanes will be demolished and the new northbound (east) bridge constructed. Traffic will be diverted to the lanes on the west side while the east side lanes and superstructure are demolished. This will provide access work site access and provide the necessary clearances for the equipment in order to install the river and upland piers for the new northbound bridge. The existing pier that once supported the northbound lanes may be partial demolished. Once the piers have been completed, the bridge superstructure will be shipped and the deck completed. Traffic will then be transferred to the new bridge while the remaining two lanes (west-side) of the existing bridge are demolished. Piers, superstructure, and decking for the southbound bridge will constructed as per the northbound bridge. Demolition of the existing piers and riverbed restoration will then be completed.

8.1 TEMPORARY ACCESS ROADS AND CRANE PADS

Temporary access roads and crane pads will be required to provide access to the Assiniboine River channel for in-water works, provide platforms for new pier construction and old pier demolition above the ordinary high water level, and as a foundation for the cranes erecting and removing structural steel. The access roads will be constructed into the Assiniboine River channel from the north and south banks while the crane pads will be placed adjacent to the area of the bridges under construction/demolition. Only clean, non-acid generating rock will be used in the access roads and crane pads.

The sections of access roads and crane pads below the ordinary high water mark will be constructed each fall and removed each spring. The access road approaches and crane pads will be constructed by placing a layer of 350 mm rock directly on the native soil and exposed sediments followed by a layer of 150 mm rock to provide a smooth working surface. Once the winter works have been completed, the crane pads will be removed. Crane pad recovery will be completed by 31 March of each year.

8.2 Temporary Work Bridges

Temporary rock work bridges will be required to provide platforms for new pier construction, old pier demolition, and as a foundation for the cranes erecting and/or removing structural steel (Figure 13.1). The work bridges will be constructed into the Assiniboine River channel from the temporary access roads and crane pad locations. A central channel will be left open between the work bridges with sufficient capacity to maintain Assiniboine River flows while preventing mobilization of sediments. Only clean, non-acid generating rock will be used in the work bridges.

The temporary work bridges will be constructed by placing a 0.65 m layer of 150 mm base rock directly on the river bottom using a hoe to minimize the risk of sediment re-suspension. Once a band of base rock has been placed, a layer of 350 mm rock fill will be placed on top of the base rock. A layer of 150 mm rock will then be placed on the rock fill to provide a smooth working surface. This process will be repeated until the work bridge is completed. The working surface of the work bridges will be one metre above the normal winter water level. Once the seasonal works have been completed, the temporary work bridges will be removed. Work bridge recovery will be completed by 31 March of each year.

8.3 Superstructure Demolition

A catchment deck will be installed and maintained below the east lanes of the bridge to trap and contain any materials and debris. Captured materials and debris will be removed from site. Demolition works will be conducted using the existing bridge deck as a work platform. The bridge deck will be saw cut along the girders and then the bridge deck from the slab edge will be lifted off and removed from the site. Following the removal of the east deck, the exposed girders will be lifted off the piers and removed from site. Once traffic has been transferred to the new west bridge, the process will be repeated for the west-side lanes to complete the demolition of the existing bridge superstructure. All works will be conducted during the winter with the east-side demolished in 2015 and the west-side in 2016.

These works will be conducted in-channel but above the ordinary high water mark. Mitigation measures such as catchment decks will prevent debris from entering the Assiniboine River. There are no anticipated interactions with Mapleleaf Mussel.

8.4 Abutments and Land Piers

The new bridge abutments will be located in the same general location of the existing bridge abutments and make use of the existing earthworks. The new abutments will require new foundations which will consist of a reinforced concrete bearing seat that is supported on cast-in-place concrete pile cap. Under the pile cap, the foundations will be comprised of driven steel H-piles. The approach, sides, and toe of the abutments will graded into the existing slopes. The land pier SU4 will be solid concrete shafts and SU2 will be pole/caisson bent with concrete pier cap. With the exception of SU3, the foundations will generally be comprised of steel H-piles driven to refusal in the underlying bedrock.

The abutments and land piers are upland activities that will not require in-water works. Sediment and erosion control measures will be installed around the works to prevent sediment from entering the Assiniboine River. These measures will be regularly inspected and maintained until a vegetation cover has been established. There are no anticipated interactions with Mapleleaf Mussel.

8.5 River Pier Construction

In-water pier work areas will be isolated using sheet pile coffer dams installed through the temporary work bridges. It is anticipated that only SU3 on each of the new bridges will require isolation as the neighboring piers (SU2 and SU4) are likely to be above the waterline during the winter months. A fish salvage will not be required as any fish in the work area will have been progressively displaced during the construction of the temporary work bridges. The work area will then be dewatered and excavated to ensure the pile caps will be below the grade of the river bottom. Excavated material will be stockpiled on-shore for use in restoration activities or if unsuitable, removed from site. H-piles will be placed through the excavated area and a cast-in-place concrete pile cap will be formed. The pier shafts will then be formed and cast on the pile caps. The stockpiled excavated riverbed materials will be returned to the work area and graded to the existing riverbed profile. If necessary, clean, native materials will be used to augment or replace the restoration materials. The work area will then be allowed to flood and the sheet pile coffer dam removed. Clean, cobble-sized quarry material will then be placed around the piers to prevent erosion.

All works from installing the coffer dams to site restoration will be conducted supported using work barges on the Assiniboine River and secured in place adjacent to the coffer dams. The barges will be lifted into the river using a crane stationed onshore.

Although it is not anticipated that coffer dams will be required for SU3 and SU4 on the new bridges, the work areas will be restored as per the in-channel piers. All works will be conducted during the winter with the northbound bridge constructed in 2015 and the southbound bridge in 2016.

8.6 Superstructure Installation

Once the river pier has been installed, the structural steel for the new northbound bridge will be lifted onto the piers using cranes stationed on crane pads on land and on the temporary work bridges to the east and adjacent to the work area. Deck construction and finishing will be conducted on top of the structural steel. This sequence will be repeated for the new southbound bridge but with cranes stationed on crane pads on land and on the temporary work bridges to the west and adjacent to the work area.

These works will be conducted in-channel but above the ordinary high water mark. Mitigation measures such as catchment decks will prevent debris from entering the Assiniboine River. There are no anticipated interactions with Mapleleaf Mussel.

8.7 Pier Demolition

As with the new pier construction, pier demolition areas for in-water piers will be isolated using sheet pile coffer dams installed through the temporary work bridges. Coffer dams will not be required for pier demolition above the water line. A fish salvage will not be required as any fish in the work area will have been progressively displaced during the construction of the temporary work bridges. The work area will then be dewatered and excavated to allow access to the pier foundations. Excavated native riverbed materials will be stored on-shore for use in restoration activities, if appropriate. The concrete pier shafts will be demolished in-situ to a minimum of 1 m below the existing riverbed grade and the resulting rubble will be removed from site. The excavation will be backfilled to the riverbed grade using clean rock free from fine materials and covered with native materials, if appropriate. The demolish works will be conducted during the winter months of 2016.

8.8 Erosion Protection

Rock erosion protection will be installed along the north and south river banks in two stages, following access developed during the installation of the temporary work bridges in 2016 and 2017. Winter water levels are typically at annual lows and present the opportunity for the minimum extent of in-water works. All works will be complete before spring freshet. The material used for final erosion protection will be Class 450 quarried limestone. The rock will be clean and free from fine materials. The rock will be placed in a band 15 m wide by 130 m long along the bank and extending from below the normal winter water level to above the normal summer water level. The 10 m width of rock placed above the ice surface will be notched into the river bank, resulting in no change to the bank profile. The 5 m width of rock below the ice surface will be placed directly on the riverbed. Bank material excavated during notching will be removed from site.

8.9 Equipment Decontamination

Equipment used within the river channel, including work barges, will undergo decontamination for both chemical and biological contaminants. Equipment will be cleaned prior to mobilization to site. Loose or visible soil will be scraped or brushed off the equipment and contained. Equipment will be inspected for fluid leaks which will be repaired prior to deployment. Any water will be drained from the equipment and collected for subsequent disposal. The equipment will then be pressured washed using high pressure (>2500 psi) and extremely hot water: 50oC for at least two minutes; or 60oC for at least 10 seconds. The wash water will be contained and collected for subsequent disposal. Equipment will then be allowed to dry at least 18 days (spring/fall), or freeze for three days. These procedures follow the recommended invasive aquatic species decontamination process from Manitoba Conservation and Water Stewardship.

8.10 Incidental Activities

The construction of new bridges and the demolition of the existing bridge will require activities in three broad categories:

1. Upland Works – These activities occur outside of the river channel and above the ordinary high water mark (OHWM). Examples of project components include abutment works, road tie-ins, and utility relocations. These activities do not directly affect the aquatic environment.
2. Overhead Works – These activities occur within the river channel but above the OHWM. Examples of project components include demolition of the existing bridge superstructure and the construction of the new bridge decks.
3. In-channel Works – These activities occur below the OHWM in the river channel. Examples of project components include pier construction and demolition and erosion protection.

Uplands works and overhead works will not directly affect Mapleleaf Mussel or their habitat. Mitigation measures such as erosion control and catchment decks will prevent any potential effects to individuals and habitat.

In-channel works have the potential to affect Mapleleaf Mussel incidental to carrying out the construction of the new bridges and the demolition of the existing bridge. Potential interactions include direct effects on to individuals and habitat as well as effects to the known host for glochidia: Channel Catfish (Ictalurus punctatus). Works within the river channel can be further subdivided based on the potential to encounter Mapleleaf Mussel and mussel habitat:

a. Works between the OHWM and the normal winter water level (NWWL) are unlikely to encounter Mapleleaf Mussel. Freshwater mussels are relatively sedentary with very low rates of horizontal movement (2.9 m/yr; Balfour and Smock 1995). Although most mussels will undergo vertical migrations during the winter (burrowing into the substrate), mussels exposed by declining water levels, whether burrowed or on the surface, will not survive freezing (Perles et al. 2003). Riverbed areas that are routinely exposed during low water levels therefore do not support mussel beds.
b. Works below the NWWL and below the depth of the normal winter ice cover have the potential to affect Mapleleaf Mussel incidental to carrying out the project. Mapleleaf Mussel are known to have historically occurred in the Assiniboine River upstream and downstream of the project site; however, more recent surveys have not resulted in observations upstream of the PTH 242 crossing, over 100 km downstream from the project site (COSEWIC 2006).

Project activities that may affect Mapleleaf Mussels are therefore limited to works that will occur in-channel below the NWWL. The activity that will occur below the NWWL is the construction and reclamation of temporary work bridges. These work bridges will be required for new pier construction, existing pier demolition, and to provide crane pads for existing bridge demolition and new bridge construction. The temporary work bridges will require the placement of clean rock directly on the riverbed.

Channel Catfish are known to occur in the Assiniboine River at the project site (Stewart and Watkinson 2007). There are no known provincial or federal conservation concerns for the Assiniboine River population. In-channel works above the NWWL will be conducted in the dry, will be temporary, and will be restored. Channel Catfish overwintering in rivers typically seek deep areas in the thalweg, often behind current breaks. In-water works will be conducted in the winter with the temporary work bridges constructed through accretive placement of rock. Work bridge construction will therefore potentially displace any overwintering fish. This will avoid trapping fish and the handling required to recover and relocate. Project activities are therefore not anticipated to have any effects on Channel Catfish populations which could in turn affect Mapleleaf Mussel.

9.0 LOCATION

The project is located within the City of Brandon, Manitoba in the Rural Municipality of Cornwallis (Figure 9.1). The project coordinates are:

Latitude:	49.85078º North
Longitude:	99.93910º West

There is no known proposed or identified critical habitat for Mapleleaf Mussel at the project site. There is no publically accessible Recovery Strategy or Action Plan for the species.

The project does not occur in a land claim settlement area, on an Indian Reserve, or any other lands that are set apart for an Indian band.

10.0 DATE OF PROPOSED ACTIVITIES

Figure 10.1 presents start dates, duration, and finish dates for each activity associated with the project. Activity descriptions are presented in Section 8.

11.0 EFFECTS OF THE ACTIVITIES

Historically, Mapleleaf Mussel occurred throughout the length of the Assiniboine River in Manitoba as assemblages of a few widely separated individuals separated by long stretches of unsuitable habitat (COSEWIC 2006). Recent surveys (1992 to 2004) of the Assiniboine River and its tributaries upstream of the Portage Diversion have result in only a single individual collected near the PTH 242 crossing, 100 km downstream of the project site. The overall trend for Mapleleaf Mussel distribution in Manitoba has been one of decline such that the current distribution in the Assiniboine River is limited to confirmed populations scattered throughout the lower Assiniboine River, downstream of the Portage Diversion (COSEWIC 2006).

The mussels have all but disappeared in the Assiniboine River upstream of Portage la Prairie and a number of reasons are presented for the decline, from changes in habitat availability to changes in water quality (COSEWIC 2006). The major natural limitation to distribution and abundance in the upper Assiniboine River is the availability, distribution and abundance of the fish hosts required for successful completion of the life cycle (COSEWIC 2006). The disappearance of Mapleleaf Mussel from the upper Assiniboine River coincides with the construction and commissioning of the Portage Diversion, a known barrier to upstream movements of fish (COSEWIC 2006; Stewart and Watkinson 2004). The connection between the lower Assiniboine River population and the sustainability of the upper Assiniboine River population is such that COSEWIC (2006) concluded the presence of the Portage Diversion fish barrier precluded any natural establishment of Mapleleaf Mussel upstream in the Assiniboine River.

Mapleleaf Mussel are a long-lived species therefore individuals encountered in the upper Assiniboine River, such as the PTH 242 individual, likely represent the final remnants of a former distribution.

11.1 INDIVIDUALS

A survey has not been conducted at site therefore the numbers of individuals potentially affected by the project cannot be directly estimated. An indirect estimate, derived from the results of previous surveys in the upper Assiniboine River, would conclude that it is highly unlikely that Mapleleaf Mussel will be encountered at the project site: only one individual was observed during the 1992 to 2004 surveys (COSEWIC 2006).

11.1.1 *EFFECTS*

Two potential effects have been identified:

Burial – Construction of the temporary work bridges will require deposit of rock directly on the riverbed. This will result in the mortality of any individuals within the footprint. Burial is a risk during work bridge construction in November of 2016 and 2017. It is likely only adult individuals would be present as recruitment failure in the upper Assiniboine River has led to a near extirpation of the mussels. Mitigation measures are presented in Section 13. Implementation of the relocation plan (Section 13.5) will ensure that work areas will be clear of mussels.

Sedimentation – An increase in sediment load could result from disturbance of upland areas as well as the in-water works. Increased sediment and turbidity could affect individual feeding efficiency and increase stress. Sedimentation is an ongoing risk for the duration of the project with higher risk during removal of the work bridges in March of 2016 and 2017. It is likely only adult individuals would be present as recruitment failure in the upper Assiniboine River has led to a near extirpation of the mussels. Mitigation measures are presented in Section 13. Implementation of the relocation plan (Section 13.5) will ensure that work areas, risk zones, and zone of influence will be clear of mussels. Sediment and erosion control measures included in the EMP will ensure that upland sources are managed appropriately.

11.2 RESIDENCES

Mapleleaf Mussel move little once they settled to the river. Residence is therefore discussed with habitat below.

11.3 HABITAT

Mussels have very low rates of mobility (2.9 m/yr; Perles *et al*. 2003). Because of the low mobility rate, mussels do not seasonally migrate and have little ability to escape changing water levels. Mussels are subject to desiccation during prolonged exposure and will not survive freezing during winter months (Perles *et al*. 2003). Vertical migrations (shallow, seasonal burrowing) do not provide relief from exposure and freezing (Perles *et al*. 2003). Mussel beds therefore require permanent, year-round water cover to remain viable.

Channel areas above the NSWL and below the ordinary high water mark (OHWM) provide only brief, indirect habitat for Mapleleaf Mussel. These areas are normal only wetted during spring freshet and following precipitation events. These areas usually not wetted for sufficient time to provide forage for mussels and host species but may provide lower current migrations routes for the host species during high water events.

Channel areas above the NWWL and below the normal summer water level (NSWL), do not provide direct habitat for mussel beds but may provide seasonal, less direct habitat in the form of forage production and habitat for host species during the open water months. The NSWL was estimated using the mean flows for July and August (43 m^3/s).

Permanent water cover at the project site is defined by the normal winter water level (NWWL). The NWWL was estimated by averaging the November to March flows in the Assiniboine River at Brandon (13 m^3/s) which was then used to establish the water elevation on a detailed bathymetry map of the channel. This is a conservative estimate as the minimum annual flow is lower and, given the sensitivity of mussels to exposure and freezing, more accurately defines the area of potential mussel habitat. The NWWL is therefore used to define the limits of potential habitat in the Assiniboine River channel at the project site. Although accounting is provided for works within the river channel, only changes below the NWWL are considered as alterations, losses, and gains for the purpose of habitat accounting and offsetting.

11.3.1 *PROJECT WORKS*

The project involves three types of habitat effects: temporary loss due to the placement of temporary work bridges for the construction of the new bridges and the demolition of the existing bride; permanent alterations from placement of erosion and scour protection whereby the substrate composition is changed; permanent losses and gains resulting from the placement of new piers and demolition of existing piers, respectively.

11.3.2 *HABITAT CHANGES*

Permanent water cover defined by the NWWL was used to define the potential Mapleleaf Mussel habitat in the project area. Table 11.1 provides the habitat accounting for the project area. Changes to habitat were tallied for each of the three zones: OHWM, NSWL, and NWWL. As identified above, only areas below the NWWL provide direct potential habitat for Mapleleaf Mussel therefore only changes in habitat below the NWWL are discussed below.

11.3.2.1 *TEMPORARY LOSS*

Temporary habitat losses are areas of existing habitat that will be unavailable during the works. The temporary structures will be complete removed and re-exposing the native sediments therefore the loss of use will occur for approximately four months. The temporary works will be staged such that 736 m^2 will be affected during the first winter and 504 m^2 during the following winter.

11.3.2.2 *PERMANENT ALTERATION*

Permanent alteration will occur where there is a permanent change to the substrate composition. This will occur where erosion and scour protection are installed along the banks and around the new pier footings, respectively. The majority of the erosion protection will be installed above the NWWL. Erosion protection at or below the NWWL is not expected to affect Mapleleaf Mussel habitat utilization as affected areas are shallow and within the surface ice formation zone. The scour protection included as a permanent alteration is for the areas that are currently above the NWWL but will be below the NWWL once works have been completed. These alterations will not affect Mapleleaf Mussel habitat utilization. A total of 448 m^2 of habitat at or just below the NWWL will be permanently altered without affecting potential habitat utilization by Mapleleaf Mussel.

11.3.2.3 PERMANENT LOSSES

Permanent losses are those areas currently below the NWWL that will not be available to Mapleleaf Mussel following project completion. Permanent losses include the SU3 pier shafts for each of the new bridges. Scour protection installed around the new piers in areas below the NWWL are also included in this category as the substrate will not be suitable for Mapleleaf Mussel colonization. A total of 111 m^2 of potential Mapleleaf Mussel habitat will be lost.

11.3.2.4 PERMANENT GAINS

Permanent gains in available habitat will occur where the existing SU5 pier is demolished and returned to native substrate. A total of 22 m^2 will be permanently gained following reclamation.

11.3.3 EFFECTS

The temporary and permanent habitat losses as well as the permanent habitat alteration will have little to no effect on individuals. Implementation of the relocation plan will have relocated individuals prior to the works. It is unlikely juvenile mussels are present in the upper Assiniboine River as a recruitment failure from the lower Assiniboine River has likely resulted in the observed population decline. If any Mapleleaf Mussel are encountered during the relocation work, these are likely to be adults.

The works are unlikely to have any effect on the population of Mapleleaf Mussel in Manitoba. Evidence indicates that the upper Assiniboine River population segment is apparently not sustainable without recruitment from the lower Assiniboine River (COSEWIC 2006). Without recruitment, reductions in available habitat will not affect the sustainability and recovery of the species.

Construction of the temporary work bridges will require deposit of rock directly on the riverbed. This will result in the temporary loss of habitat within the footprint. Burial is a risk during work bridge construction in November of 2016 and 2017. Mitigation measures are presented in Section 13. Removal of the work bridges and implementation of the offsetting plan (Section 16) will ensure that additional habitat will be available once the project has been completed. Effects after the implementation of mitigation are unlikely.

12.0 ALTERNATIVES CONSIDERED

A number of alternatives were considered, from design to construction methods that could reduce the potential interaction of the project with Mapleleaf Mussel. These alternatives were assessed for cost, risk to human health and safety, feasibility, and risk to the environment.

12.1 DO NOTHING

PTH 1A is an important transportation route between the City of Brandon and HWY 1. The existing structure is deteriorating and requires reconditioning and strengthening or replacement. As the transportation corridor needs to remain active, continued maintenance until closure is not a viable alternative.

12.2 REFURBISH EXISTING BRIDGE

Refurbishing the existing bridge will require inspection and strengthening of the pier foundations. In order to inspect the pier foundations, temporary work bridges will be required to access the river piers and coffer dams will be required to isolate and excavate the work areas. Until the foundations are exposed it will not be known whether the foundations can be adequately strengthened. If successful, the work will only achieve a moderate extension to the structure lifespan. If the foundations cannot be strengthened, the project will then have to convert to bridge replacement. Given the risks, the unknowns, and potential costs, strengthening is not a viable alternative.

The temporary in-water work area for refurbishment could would be slightly smaller than the area required for the new river pier construction and existing river pier demolition. The reduced number of river piers will also reduce the potential for structures to influent river flows within the channel. If the project has to convert from refurbishment to replacement, the temporary work area would be expanded to that of the replacement works but making the conversion from a refurbishment to a replacement project would likely result in an extension of the schedule for in-water works (refurbishment followed by new pier construction and then existing pier demolition).

12.3 RELOCATION

The project involves the replacement of a fixed crossing in an established transportation corridor with built infrastructure connections and ancillary developments. Relocating the structure to another location on the Assiniboine River is unlikely to avoid the potential for interactions with Mapleleaf Mussel. Relocation of the project is therefore not a viable alternative.

12.4 Clear-span Bridge

A clear-span bridge would avoid in-water activities associated with new construction but would not eliminate the need for in-water activities as temporary work bridges would still be required to demolish the existing piers as per the requirements of the *Navigation Protection Act*. There are several constraints which make this an unviable alternative. The CP rail crossing along the south bank presents a minimum elevation constraint for the underside of the bridge (girders) as clearance must be maintained for the rail crossing. In order to increase the length of the bridge span the depth of the structural steel must be increased. To accommodate deeper girders, the elevation of the bridge deck would need to be increased. Raising the bridge deck encounters constraints at the abutments and approaches.

On the south side, this would require a longer approach, construction of an embankment, and an increase in the approach footprint. Third-party environmental liabilities to the east of the approach precludes expansion of the footprint eastward. The new bridges would therefore have to be shifted west which would require redesign of the existing road tie-ins and expropriation of lands to accommodate the increased footprint and tie-ins.

On the north side, the approach is located in the Assiniboine River flood plain. During high water events the low grade approach floods and allows flood waters to pass unimpeded. Increasing the deck height would require an increase in the height of the abutments and there construction of an approach embankment. The embankment would create a flow constriction on the Assiniboine River during flooding events which would imperil upstream infrastructure and property while creating scour conditions at the project site. Impacts to flood management are not acceptable to the Government of Manitoba.

A clear-span bridge would not eliminate the requirement for in-water works but present the smallest footprint of activities while resulting in a net increase in habitat once the existing piers have been demolished and reclaimed. Design constraints, however, make the changes to the approaches and abutments unviable and would result in unacceptable impacts to flood management in the Assiniboine River. A clear-span is therefore not a viable alternative.

12.5 Barges

Barges were used to great success in the construction of the new Disraeli Bridge on the Red River and were therefore considered as an alternative to temporary work bridges. Barges have the advantage of minimizing the footprint of the temporary works while being adjustable to fluctuating water levels. The barges can be connected to create a modular work platform and are repositionable as required necessary for various stages of construction. The barges are able to provide a stable platform through the use of legs anchored through the riverbed. Access to the barges requires a ramp extending from a temporary abutment onto the barges.

The barges would replace the temporary work bridges but channel access and approaches would be required to access the barges. The barges would not eliminate the need for coffer dams as new pier construction and existing pier demolition would still be require isolation of the work areas. Overall, this alternative would minimize in-water works, limited to coffer dams and barge legs, but physical and logistical constraints within the Assiniboine River channel make barges an unviable alternative.

The channel characteristics at the PTH 1A crossing are significantly different from those of the Red River in Winnipeg. The Red River in Winnipeg is characterized by a wide, deep, and uniform in structure channel resulting from river impoundment by the St. Andrews Lock and Dam structure at Lockport, Manitoba. The Assiniboine River at the project site is narrow and shallow for most of the year and water levels fluctuate with precipitation evens. Positioning and relocating barges requires the services of a tugboat. During normal and low water levels there is insufficient depth and working room to safely operate a tugboat or float the barges. Given these uncertainties, barges were not given further consideration.

13.0 MEASURES TO MINIMIZE IMPACTS

There are a number of mitigation measures that have been included in the design and construction methods to minimize potential interactions with Mapleleaf Mussel. Mitigation measures, including monitoring, maintenance, and review, will be detailed in the project Environmental Management Plan (EMP). The EMP will be established prior to the commencement of site activities.

13.1 River Piers

The new bridges have been designed to reduce the number of piers within the river channel (below the OHWM) and aligned so as to minimize the potential influence of the structures on river flow and channel morphology. The existing bridge has three piers below the OHWM. The new bridges have been designed with only one pier each within the river channels. As a result there will be a net reduction in the number of piers, from three to two, once the project has been complete. In addition, the existing river piers each have a larger footprint than the proposed piers as the existing piers were designed to support a super structure containing four lanes of traffic. The new piers will accommodate two lanes each therefore the pier footprints have been reduced accordingly.

13.2 Sediment and Erosion Control

Erosion and sediment control measures will be established for any work areas where vegetation must be removed and/soil is exposed. Measure include rock armour and silt fencing or similar applications. The disturbed areas will be routinely monitored to ensure effectiveness of measures and to address any non-compliances. Measures will remain in place until a vegetation cover can be re-established. Sediment and erosion control measures will be detailed, along with monitoring, in the project Environmental Management Plan.

13.3 Temporary Work Bridges

The temporary work bridges will be removed by 31 March in 2016 and 2017 to ensure no flow obstructions remain in the Assiniboine River during spring freshet. This will reduce flow velocities, prevent channel scour in the thalweg, and ensure channel constriction does not prevent migration by potential host species.

13.4 Catchment Decks

Catchment decks will be installed during both demolition and construction activities over the Assiniboine River. The purpose of the decks is to contain any loose materials from being deposited in the river. The decks will be monitored and any accumulated debris will be removed for disposal off site.

13.5 Mussel Relocation Plan

There has been no recent freshwater mussel survey in the project area. Mussel relocation from the work area and zone of potential influence are being proposed to avoid any potential interactions with Mapleleaf Mussel and mussel habitat. A relocation plan has been developed using protocols presented in Mackie *et al.* (2008).

13.5.1 *Habitat Mapping*

Prior to mussel collection, baseline habitat data were collected for the work area, the zone of potential influence, and an upstream relocation area. Data collected included a bathymetric profile, extending from 200 m upstream to 750 m downstream of the work site, substrate composition, and aquatic macrophytes. Data were recorded using a Biosonics MX echosounder with Visual Acquisition 6 software mounted on board a 14 foot aluminum jon boat. Substrate composition was periodically verified using grab samplers and probes. Substrate was categorized using a modified Wentworth scale (Wentworth 1922, Table 1), adapted to facilitate categorization of potential mussel habitat. Survey points were also recorded concurrently with sounder recordings using a Trimble GNSS RX-8 RTK 4 system. Surveys of the shoreline, surrounding riparian area, and bridge were also included to provide a detailed topographical profile of the channel that encompassed the prescribed search area (PSA) and prospective relocation areas.

Substrate was classified into three (3) types: cobble/gravel mix (very coarse substrate), silt/sand mix (hard bottom), and sand/silt mix (mud bottom). An analysis of substrate data revealed predominantly coarse substrate around the base of the bridge, with a mixture of sand/silt and sand/clay substrates both upstream and downstream.

13.5.2 *Identification of the Recovery Area*

The potential mussel habitat in the project area was defined as permanently wetted areas of the Assiniboine River channel. Freshwater mussels have very low horizontal movement rates (2.9 m/yr; Perles *et al.* 2003) and therefore do not seasonally migrate nor have the capacity to advance and retreat with changing water levels. Viable mussel beds therefore require sufficient and regular water cover year round to ensure individuals are not exposed or subject to freezing. Available habitat was therefore defined using the NWWL, calculated using hydrometric data and the recent bathymetric survey (Figure 13.1).

The footprint of the temporary work bridges was used to define the activity zone (AZ). This are will see direct disturbance through the placement of rock on the riverbed, The risk zone (RZ) includes the undisturbed channel thalweg and a 10 m zone upstream and downstream of the work bridges. The zone of influence (ZOI) was defined as the 25 m of channel below the NWWL downstream of the RZ). River flows at the time of work bridge construction are at seasonal lows therefore transport risks are at a minimum. Rock placement is incremental which prevents the creation of large sediment plumes. Pier works, both construction and demolition, will be isolated using sheet pile cofferdams surrounded by the work bridges.

The recovery area (RA) is therefore:

AZ + RZ + ZOI = RA

2643 m^2 + 474 m^2 + 1501 m^2 = 4618 m^2

13.5.3 *Identification of the Relocation Area*

Preferred relocation areas are upstream of the proposed activity so as to avoid any re-suspension of sediment or changes to water quality that may occur as a result of the proposed activities (Mackie *et al.* 2008). In addition, freshwater mussel movements tend to be downstream which places the relocated mussels in a position to recolonize the work area once all activities have ceased (Perles *et al.* 2003). The mussel relocation site will be located upstream of the bridge but downstream of the weir on the Assiniboine River, and will be selected to mirror the habitat characteristics of the PSA, based on the following criteria:

- Area: Surface area of the new site must be equal to or greater than the PSA;
- River Depth: Water depths at the new site must encompass all depths at which mussels were removed from within PSA;
- Substrate Types: Substrate type must be comparable to the PSA in terms of heterogeneity and composition, as established by AAE Tech Services' baseline study; and
- Water Velocity: The same extent of pool and riffle habitat, with similar flow characteristics must be present at the relocation site.

Suitable relocation sites are limited by a weir located 230 m upstream of the work site. Upstream of the weir, the Assiniboine River is impounded and depositional. A preliminary review of the bathymetric and substrate data indicates the river channel between the weir and the bridge will provide more than enough suitable relocation habitat. Candidate relocation areas will be further investigated and defined during the survey and relocation fieldwork.

13.5.4 *Mussel Collection*

Adult mussels will be collected from shallow water (<1 m) either by hand or with the use of a mussel rake. Juveniles will be collected by scraping the top 5 – 10 cm of sediment onto a sieve with 7 mm mesh openings. Sampling will progress from the left to right banks, moving downstream to allow for collection of juveniles potentially carried out of the sieve. Locating mussels from the surface will be facilitated with the use of a glass viewing box. If water depths exceed 1 m, mussel collection will be performed by a team of SCUBA divers subcontracted from JSA Diving.

The PSA will be searched using the square metre quadrate system and standard underwater search protocol, as described in Mackie *et al.* (2008). The search area will be defined on a chart, scaled, then divided and subdivided into m² sections with GPS coordinates. If there are areas where SCUBA diving is required, the physical area will be defined and marked with floats, and weighted lines will be positioned within the search area to sub-divide the sections.

A tactile search will be conducted using m² quadrates fabricated from PVC. Each section will be seeded with a determined number of golf balls which are easily identified underwater and represent a similar size to mussels. Recovery of all seeded golf balls within a defined area qualifies the effectiveness of the search and produces a measurable result.

13.5.5 *Mussel Handling and Measurement*

Collected mussels will be transferred into 20 L (or larger) holding tanks located within the river system; 1 cm holes in the walls of the holding tank will allow the continuous exchange of river water through the tank. This will provide water temperatures consistent with that of the river and will increase dissolved oxygen in the tank, greatly reducing potential stress on the mussels. A small 7 mm mesh pouch within each holding tank will be used to contain juveniles. Those mussels collected by SCUBA divers will be initially placed into dive bags with a mesh smaller than 5 mm. When the entire quadrate has been searched, the diver will bring the bag containing the mussels to the support boat, and from there they will be transferred to the holding tanks. Holding tanks will be covered to avoid mussel exposure to direct sunlight, and will be placed deep enough to ensure the mussels are completely submerged at all times.

All captured mussels will be measured, photographed and identified to species by a benthic invertebrate specialist prior to being relocated. Three measurements will be taken for all mussels collected, including length (longest anterior-posterior measurement), height (greatest ventral to dorsal distance) and thickness (greatest side-to-side measurement). Each mussel will be assigned an identification number corresponding to its quadrate number and the order in which it was recorded, linked to a photograph identification number for reference purposes.

13.5.6 MUSSEL RELOCATION

All mussels will be transferred to large transport totes filled with water drawn from the river at the PSA. Mussels will be transported to and replaced at the relocation site at the end of each day by boat. Once on-site, first a hole will be dug in the sediment deep enough for the mussel to stand in it vertically. The mussel is then placed in the hole with the posterior or siphons end up (hinge-down). Sediment is replaced around the mussel, leaving the siphons exposed. If the mussel is displaying (shell open), it will be laid on its side, and will rebury itself. Juveniles would be placed in a shallow hole, with care taken not to avoid damaging the thin shell, and the sediment replaced around it. The sediment type and depth in which the mussels are replaced will reflect the quadrate conditions in which each mussel was found in.

14.0 MONITORING

14.1 Work Site Monitoring

Work site environmental monitoring of mitigation measures will be included in the project EMP.

14.2 Post-construction Monitoring

Mackie *et al.* (2008) recommend a mark-recapture program and monitoring for any relocated mussel populations. These have not been included in the relocation and monitoring study as this would require repeated handling and disturbance of the mussel population. Post-construction monitoring will therefore focus on the re-establishment of native material in the area of works as habitat for Mapleleaf Mussel. The monitoring program will be conducted in 2017 following the completion of all bridge works and the spring freshet. Spring freshet is anticipated to result in the natural transportation and deposition of native materials into the study area.

14.2.1 *Methods*

Monitoring of the work area will employ the same methods used to collect study area habitat information prior to the relocation program. This will provide a consistent comparison of before and after conditions in the river channel. Data will be recorded using a Biosonics MX echosounder with Visual Acquisition 6 software mounted on board a 14 foot aluminum jon boat. Manual substrate sampling using grab samplers and probes will also be conducted to calibrate the echosounder results.

Substrate will be categorized using the modified Wentworth scale, adapted to facilitate categorization of potential mussel habitat, used during the initial site assessment. Survey points will also be recorded concurrently with sounder recordings using a Trimble GNSS RX-8 RTK 4 system and tied into local benchmarks. Substrate classification will follow those used in the initial site assessment: cobble/gravel mix (very coarse substrate), silt/sand mix (hard bottom), and sand/silt mix (mud bottom).

Monitoring results will be mapped and presented in a monitoring report describing the monitoring methods, the baseline site conditions, the as-built substrate in the disturbed and reclaimed areas, and observed conditions during the monitoring program.

14.2.2 STUDY AREA

The monitoring program will included all areas disturbed during the proposed works as well as the zone of influence and a buffer zone upstream and downstream of the work site (Figure 13.1). The upstream relocation area will not be monitored as the area is outside of any potential project effects or influences.

14.2.3 MONITORING SCHEDULE

The monitoring program will be conducted as a one-time follow-up once the in-water works have been completed. In-waterworks are schedule to be completed by 31 March 2017 therefore the monitoring field work will be completed in August 2017. A final report issued by October 2017.

15.0 SURVIVAL AND RECOVERY

Historically, Mapleleaf Mussel occurred throughout the length of the Assiniboine River in Manitoba as assemblages of a few widely separated individuals separated by long stretches of unsuitable habitat (COSEWIC 2006). Recent surveys (1992 to 2004) of the Assiniboine River and its tributaries upstream of the Portage Diversion have result in only a single individual collected near the PTH 242 crossing, 100 km downstream of the project site. The overall trend for Mapleleaf Mussel distribution in Manitoba has been one of decline such that the current distribution is limited to confirmed populations; scattered throughout the lower Assiniboine River, downstream of the Portage Diversion (COSEWIC 2006).

There are a number of reasons presented for the decline, from changes in habitat availability to changes in water quality, with the major natural limitation to distribution and abundance being the availability, distribution and abundance of the fish hosts required for successful completion of the life cycle (COSEWIC 2006). In Manitoba, the only known host for Mapleleaf Mussel glochidia is the Channel Catfish (*Ictalurus puntatus*).

COSEWIC (2006) concluded that Mapleleaf Mussel in Manitoba are a single, diffuse population of widely separated assemblages of individuals. The mussels have all but disappeared in the Assiniboine River upstream of Portage la Prairie since the construction of the Portage Diversion, a known barrier to upstream movements of fish (Stewart and Watkinson 2004). COSEWIC (2006) concluded the presence of the Portage Diversion fish barrier precluded any natural establishment of Mapleleaf Mussel upstream in the Assiniboine River. This is interpreted to mean that Mapleleaf Mussel are no longer established in the upper Assiniboine River and that the historic distribution depended on recruitment from the lower Assiniboine River. Any individuals encountered above the Portage Diversion are likely remnants.

It is unlikely Mapleleaf Mussel will be encountered at the project site. There have been no known mussel surveys at the project site therefore it cannot be said conclusively that there are no individualsl at the project site. As a precaution, mitigation measures were designed into the project and construction mitigation measures have been developed (both described above) to ensure that if Mapleleaf Mussel are encountered, individuals will be relocated and any potential effects to habitat will be minimized. Key mitigation measures include:

1) Minimize project footprint by reducing the number of in-channel piers;
2) Survey, recover, and relocate to suitable habitat all mussels within the work area and zone of influence;

3) Establish sediment and erosion control measures until vegetation cover established; and
4) Monitoring the establishment of native riverbed materials in disturbed areas.

There has been no recovery plan for Mapleleaf Mussel in Manitoba made available to the public. It could be reasonably be assumed that a recovery plan would address the principle threats to survival and recovery identified by COSEWIC (2006):

1) Nutrient inputs from agricultural operations;
2) Damage to river banks and riparian zones;
3) Urban and industrial discharges;
4) Commercial clam harvest and poaching; and
5) Availability, distribution, and abundance of fish hosts.

The project involves the replacement of an existing crossing structure that when combined with proposed offsetting measures (Section 16) will result in a net gain in physical habitat. The project will have no effect on nutrient inputs from agricultural operations, urban and industrial discharges, and poaching. Disturbed river banks will be re-contoured and stabilized with clean rock while erosion and sediment control measures will be used until riparian vegetation has been re-established. The existing structure does not pose a barrier to fish passage and the proposed structures, with a reduced footprint and profile, will also not impact fish passage.

This project will have no effect on the survival and recovery of the species. Mitigation and offsetting measures included in the project design ensure that habitat will be available for Mapleleaf Mussel.

16.0 OFFSETTING MEASURES

Mapleleaf Mussel habitat was categorized by the availability and type of habitat and defined by water levels in the channel (Section 11.3). The nature of the effects were defined by the proposed works and include temporary loss, permanent alteration, and permanent loss. The proposed offsetting measures focus on the permanently wetted channel below the NWWL.

There will be net deficit of 89 m^2 of habitat below the NWWL (Table 16.1). In order to offset the loss, channel restoration works are proposed for the south bank, adjacent to the new river piers (Figure 13.1). The area between the existing pier and the riverbank is normally exposed during low water (above the NWWL) and appears to be composed of coarse fill. It is suspected that this is not a natural channel feature but the remnants of the original work bridge used to install the SU5 river pier during original bridge construction.

The proposed offsetting plan is to remove the old work bridge and restore the original channel profile. The restoration will be conducted in stages, as the temporary work bridges are removed, and will be therefore provide offsetting habitat immediately following losses (Table 16.1). Excavation methods and mitigation will follow those described above for new bridge construction. Material removed from the channel will be disposed of offsite.

Removal and restoration of the old work bridge and demolition of the existing SU5 river pier will create a total of 357 m^2 of channel habitat below the NWWL. Channel habitat losses will result from the installation of SU3 piers for each of the new bridges and total 111 m^3. When all works have been completed there will be a net increase of 246 m^2 of habitat available for Mapleleaf Mussel at the project site. The offsetting to loss ratio is 3.21:1.

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TETRA TECH

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Lead, Fish and Fish Habitat

EXPERIENCE SUMMARY

Mr. Dave Tyson is the Lead, Fish and Fish Habitat for Tetra Tech WEI's Environmental Assessment, Permitting, and Natural Resources group in Canada. Mr. Tyson is a recognized expert in fish and fish habitat, providing testimony in court and expert advice to semi-judicial review boards. Mr. Tyson has extensive technical experience in designing, conducting, and reporting aquatic studies as well as conducting habitat inventories and assessments in lakes and streams and developing and implementing compensation plans under the *Fisheries Act*. Mr. Tyson also leads and manages the preparation of environmental impact statements including environmental baseline studies, project descriptions, effects analysis, monitoring programs, and permitting. Mr. Tyson's project experience extends across power generation and distribution, mining, mineral exploration, orphan mine site reclamation, oil and gas exploration, pipelines, transportation, and community infrastructure.

RELEVANT EXPERIENCE

Fish-out Protocol for the Northwest Territories and Nunavut. Designed and developed fish-out protocols to standardize fish community, habitat, and limnological data collection for lakes and impoundments prior to dewatering. The protocols are based the experience of designing and conducting whole-lake fish-outs, designing and conducting aquatic effects monitoring programs, and the development of a nascent database. The protocols establish data collection methods and complement the database now being managed by DFO. The database is currently being mined by researchers for information on northern aquatic ecosystems.

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Silver Lamprey in the Hudson Bay Drainage, Manitoba. Conducted a review of museum specimen documentation and contemporary references to identify historic collection locations in relation to recent sample sites to establish distribution of Silver Lamprey in the Hudson Bay drainage. Provided correctons to museum databases.

- Tyson, J.D., and D.A. Watkinson. 2013. Historical distribution records and new records confirm and extend the distribution for Silver Lamprey, *Ichthyomyzon unicuspis*, in the Hayes River, Hudson Bay watershed, Manitoba. Can. Field-Nat. 127(3): 262-265.

Impacts to a Fish Community in a Small Tundra Lake, Northwest Territories. Designed and led a multi-year study to quantify multi-source impacts to a coldwater fish community.

EDUCATION

M.Sc., Zoology, 1996 University of Manitoba

B.Sc. (Major), Zoology, 1990 University of Manitoba

AREA OF EXPERTISE

Fish and Fish Habitat Assessment

Mitigation Design

Habitat Compensation

Environmental Impact Assessment

Permitting and Approvals

Environmental Planning

REGISTRATIONS/ AFFILIATIONS

College of Applied Biology of British Columbia

Alberta Society of Professional Biologists

Association of Professional Biology of British Columbia

American Fisheries Society

TRAINING/ CERTIFICATIONS

Habitat Inspector

Habitat Enforcement

Expert Witness

Navigability Assessment

Electrofisher Operation

Small Commercial Vessel Operator Proficiency

OFFICE

Winnipeg, Manitoba

YEARS OF EXPERIENCE

25+

- Tyson, J.D. 2008. The effects of multiple source stressors on a small, tundra lake fish community in the Northwest Territories, Canada. In: Mills, K.H., M. Dyck, and L.A. Harwood. Proceedings of the Second Lake Trout Symposium 2005, Yellowknife, Northwest Territories. Can. Tech. Rep. Fish. Aquat. Sci. 2778:xi + 247 p.

Impacts of Air Guns on Northern Fishes, Northwest Territories. Crew leader responsible for locating and capturing small-body fish species for experiment. Designed, set-up, and maintained livewell system for large- and small-body specimens used in the research.

- Cott, P., and J.D. Tyson. 2005. The Mackenzie River seismic study: impacts of airgun noise on fishes. Presented at the 7th Alaska Forum of the Environment, Anchorage, Alaska, 7 to 11 February, 2005.
- Cott, P.A., A.N. Popper, D.A. Mann, J.K. Jorgenson, and B.W. Hanna. 2012. Impacts of river-based air gun seismic activity on northern fishes. In, The Effects of Noise on Aquatic Life. Adv. Exp. Med. Biol. 730, pp. 367-369.
- Song, J., D.A. Mann, P.A. Cott, B.W. Hanna, A.N. Popper. 2008. The inner ears of northern Canadian freshwater fishes following exposure to seismic air gun sounds. J. Acoust. Soc. Amer. 124 (2), 1360-1366.
- Mann, D.A., P. Cott, B. Hanna, A. MacGillivray, M. Austin, M. Smith, A.N. Popper. Effects of riverine seismic air-gun exposure on fish hearing. J. Acoust. Soc. Amer. 119 (5), 3283-3283.

Husky and Sitidgi Lakes Study, Northwest Territories. Sitidgi Lake Crew leader responsible for leading the fish community survey, limnological characterization, and bathymetry survey.

- Roux, M.-J., Sparling, P., Felix, J., and Harwood, L.A. 2014. Ecological assessment of Husky Lakes and Sitidgi Lake, Northwest Territories, 2000-2004. Can. Tech. Rep. Fish. Aquat. Sci. 3071: ix + 123 p.

Parks Canada Agency and PWGSC, Banff National Park, AB. Technical lead and lead author for an Environmental Impact Analysis of the 40 Mile Creek bank stabilization project. Project involved preparing a project description, developing a description of the existing environment from existing sources, conducting an effects analysis, and developing mitigation measures.

Mackenzie Valley Environmental Impact Review Board, Giant Mine Remediation, NT. Conducted a technical review of the proposed remediation of Giant Mine including the project description, impact assessment, and technical supporting documents. Results were provided in briefings to the Board. Technical focus included fish and fish habitat, traditional harvesting, hydrology, water quality, and contaminants. Participated in technical sessions with the proponent and their expects as well as the public hearings.

Manitoba Science, Technology, Energy and Mines, Sherridon Orphan Mine, MB. Designed and conducted a baseline aquatics study to determine the extent of impacts of acid mine drainage in Kississing Lake. Project included establishing upstream reference sites for post-remediation performance monitoring. Project components included bathymetry, water quality, sediment quality, benthic invertebrates, fish habitat, and fish community parameters.

MSTW Planning District, Lake Minnewasta, MB. Reviewd and assessed existing fish habitat and fish community technical information and provided operational recommendations to minimize effects of reservoir operations on the productivity of an important sport fishery.

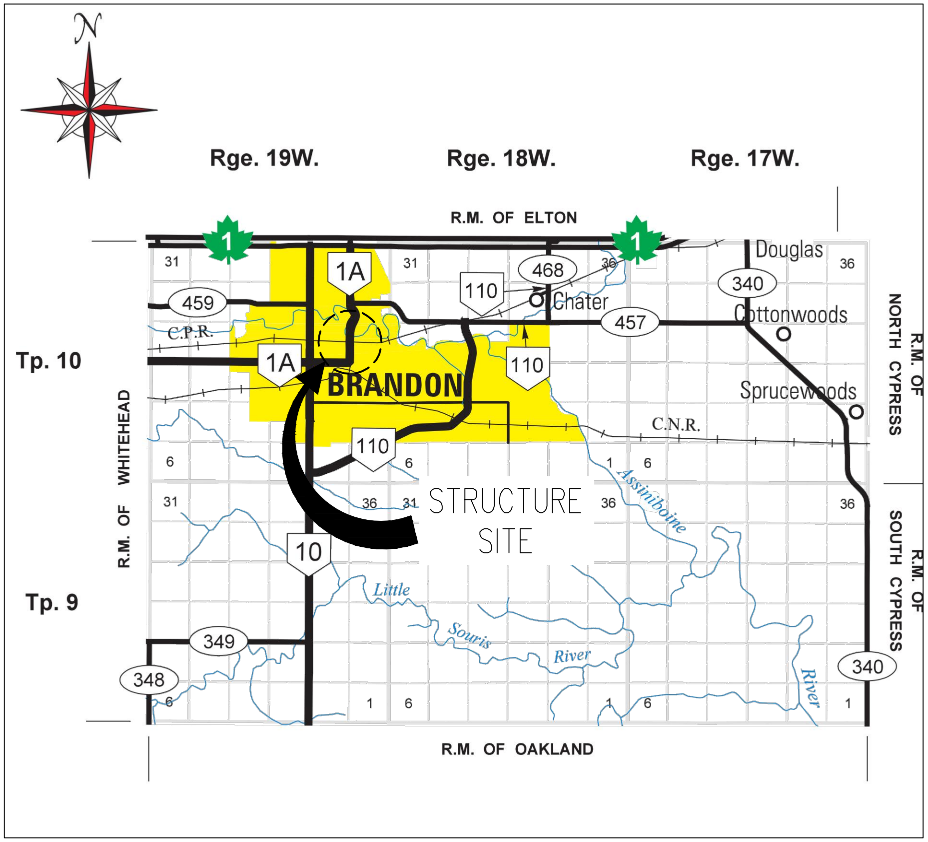
PWGSC and DFO, Athabasca Oil Sands, AB. Developed, conducted, and provided reports for a methodology for an independent winter assessment of fish habitat compensation works, historic habitat alterations, mitigation works, and baseline habitat conditions at the Syncrude Oil Sand Mine, Shell Muskeg River Mine, and the Total Northern Lights project.

Mackenzie Gas Project, NT. Environmental Science Coordinator (liaising between the regulatory and research branches of DFO) for the environmental assessment of the 1,220 km proposed gas pipeline involving 660+ stream crossings. Provided technical support for several projects investigating the effects of oil and gas development activities on fish and fish habitat.

Environmental Assessment Reviews. DFO lead for numerous multi-agency environmental assessments of projects proposed for land use permits and water licenses. Key activities and linear facilities environmental reviews included:

- Conducted screenings under the *Mackenzie Valley Resource Management Act* (MVRMA) and *Canadian Environmental Assessment Act* (CEAA).
- Composed various *Fisheries Act* Authorizations and Letters of Advice for proponents.
- Provided expert *Fisheries Act* and fish biology advice to agencies conducting screenings and environmental assessments under the MVRMA and CEAA.

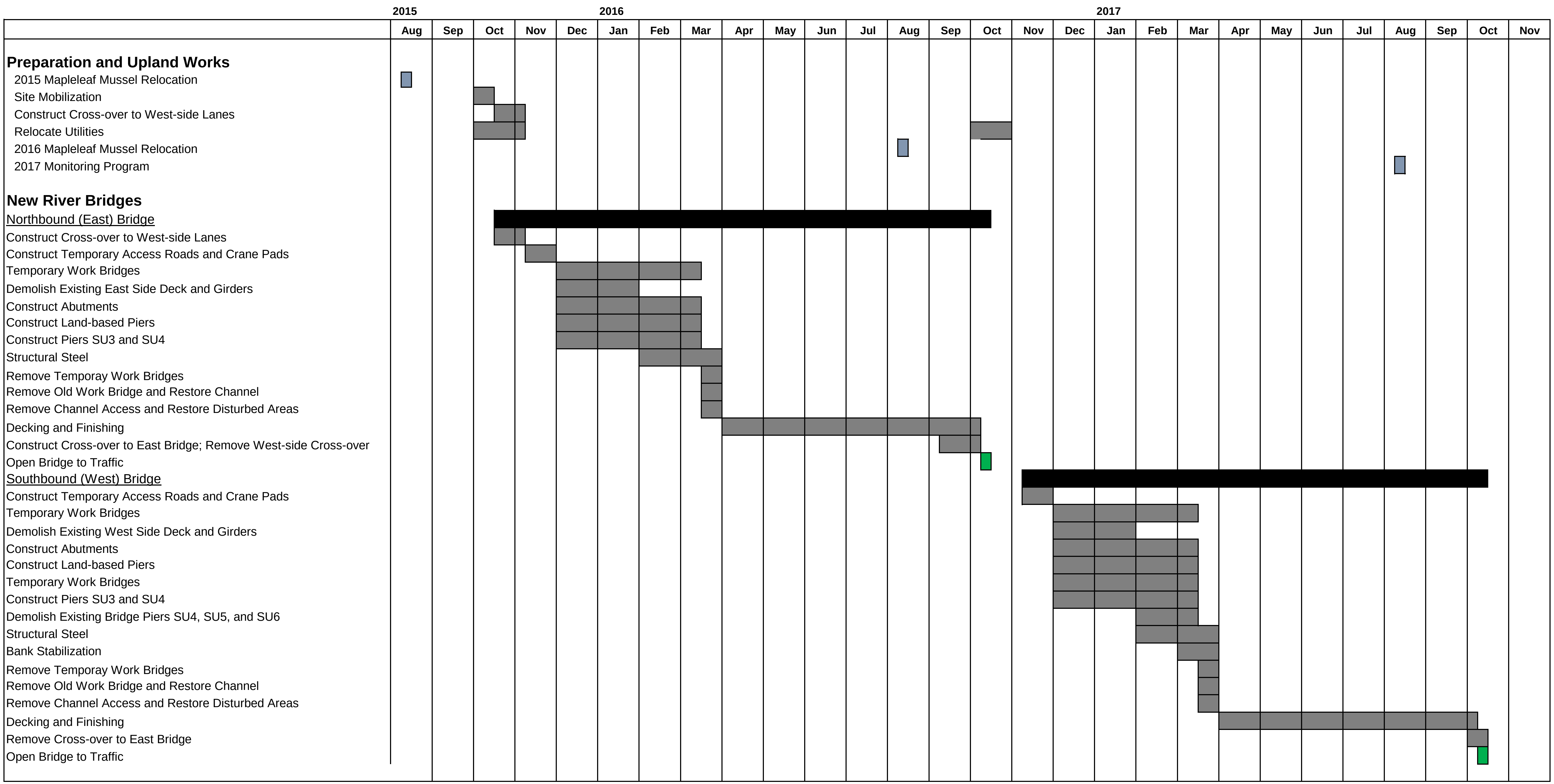
FIGURE 9.1



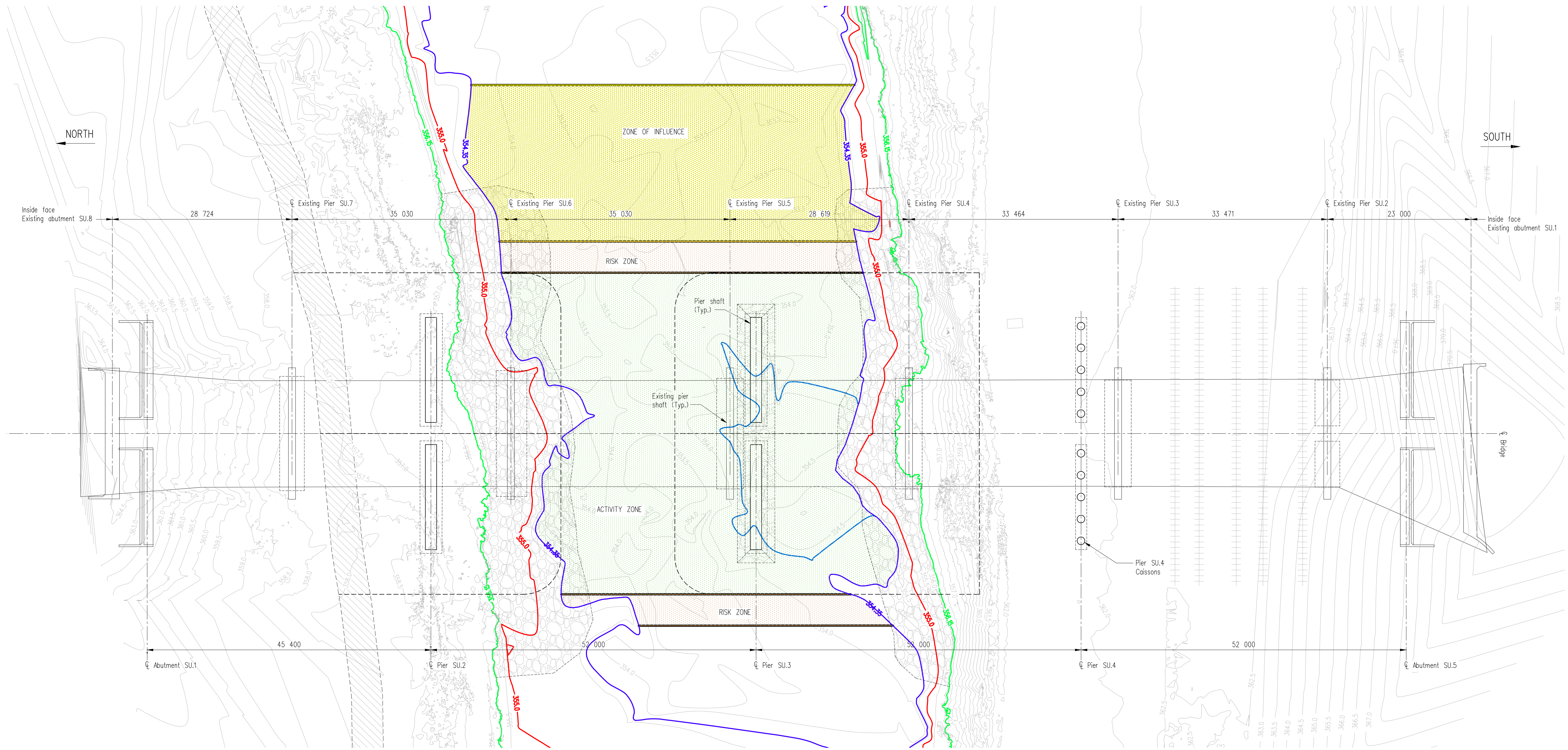
LOCATION MAP

Not to Scale

FIGURE 10.1 - SCHEDULE



X:\N-S\PROVINCE OF MANITOBA - 0016\13001604.00 - PD OF REHAB FOR BRIDGE ON PTH1A OVER ASSINIBOINE RIVER\CAD\ENV\1300160400-SKT-V0001.DWG 15.07.02 2:35 PM ILAS, GERARDO



PLAN

Scale 1 : 300

LEGEND:

Normal Winter Water Level 354.35m
(based November to March Average of 13 m^3/s)

Normal Summer Water Level 355.0m
(based July & August Average of 43 m^3/s)

Ordinary High Water Level 356.15m
(based on 50%Q of 126 m^3/s)

APEGM
Certificate of Authorization
TETRA TECH WEI Inc.
No. 5313 Date: April 30, 2016

TETRA TECH
1300160400-SKT-V0001

REVISIONS		
DATE	BY	DESCRIPTION

DESIGN SEAL | RECORD SEAL

PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

CHANGES TO MAPLE LEAF MUSSEL HABITAT

IN THE ASSINIBOINE RIVER
BRANDON, MANITOBA
ON PTH 1A
NE1/4 SEC. 23-10-19W

R.M. OF CORNWALLIS

Manitoba
Infrastructure and Transportation
Water Management and Structures

RELEASED FOR CONSTRUCTION BY:

DIRECTOR OF STRUCTURES DATE

DESIGN	BY: D.T.	SCALE: 1 : 300
	CHECKED:	SHEET No. FIGURE 13.1
DETAILS	BY: G.I.	or as shown
	CHECKED:	SITE No. 2582

TABLE 11.1

HABITAT CHANGES IN THE ASSINIBOINE RIVER

In-channel Works	Green-Red Ordinary High Water Mark (m^2)	Red-Blue Normal Summer Water Level (m^2)	Blue-Blue Normal Winter Water Level (m^2)	Total (m^2)
Alterations and Disruptions				
Temporary Loss				
2016 North Temporary Work Bridge	209	90	119	418
2016 South Temporary Work Bridge	125	235	617	977
2017 North Temporary Work Bridge	199	68	45	312
2017 South Temporary Work Bridge	130	412	459	1001
Total	663	805	1240	2708
Permanent Alteration				
North Bank Erosion Protection	623	344	307	1274
South Bank Erosion Protection	527	275	141	943
West SU3 Scour Protection		68		68
East SU3 Scour Protection		38		38
Total	1150	619	448	2217
Losses and Gains				
Permanent Loss				
West SU3 Pier Shaft		-25	-6	-31
East SU3 Pier Shaft		-11	-21	-32
West SU3 Scour Protection			-27	-27
East SU3 Scour Protection			-57	-57
Subtotal		-36	-111	-147
Permanent Gain				
SU4 Demolition and Restoration	14			14
SU5 Demolition and Restoration		5	22	27
SU6 Demolition and Restoration	25	1		26
2016 - Remove Feature East			103	103
2017 - Remove Feature West			232	232
Subtotal	39	6	357	402
Net Change	**39**	**-30**	**246**	**255**

TABLE 16.1

HABITAT ACCOUNTING FOR THE ASSINIBOINE RIVER

In-channel Works	Normal Winter Water Level (m^2)
2016	
Permanent Loss	
East SU3 Pier Shaft	-21
East SU3 Scour Protection	-57
Subtotal	-78
Permanent Gain	
Remove Old Work Bridge - East	103
Subtotal	103
2016 Change	25
2017	
Permanent Loss	
West SU3 Pier Shaft	-6
West SU3 Scour Protection	-27
Subtotal	-33
Permanent Gain	
SU5 Demolition and Restoration	22
Remove Old Work Bridge - West	232
Subtotal	254
2017 Change	221
Net Change	**246**