Ness Avenue Crossing Replacement at Sturgeon Creek
Environmental Assessment Report

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PRESENTED TO

Manitoba Infrastructure and Transportation
106 - 1155 Pacific Avenue
Winnipeg, Manitoba R3E 3P1

PRESENTED BY

Tetra Tech WEI Inc.
400 – 161 Portage Ave. E.
Winnipeg, MB R3B 0Y4

P +1-204-954-6800
F +1-204-957-5389
tetratech.com

Prepared by:

Name: Dave Tyson, M.Sc.,R.P.Bio.,P.Biol July 24, 2015
Title: Senior Environmental Study Manager

Authorized by:

Name: Emile Shehata, Ph.D., P.Eng.
Title: Vice President Infrastructure and Environmental July 24, 2015

Reviewed by:

Name: Dave Tyson, M.Sc.,R.P.Bio.,P.Biol. July 24, 2015
Title: Senior Environmental Study Manger

EXECUTIVE SUMMARY

Background

The City of Winnipeg (City) intends to replace the Ness Avenue culvert at Sturgeon Creek. The existing culvert on Ness Avenue over Sturgeon Creek, constructed in 1962, is a 30.82 m long, two-cell concrete box culvert. The existing culvert is undersized which has resulted in channel scour and bank instabilities downstream. In addition, the crossing periodically experiences overflow during high water events which has damaged the roadway and culvert. City intends to replace the existing culvert with an elevated bridge. The bridge will allow for an under bridge pathway that will provide a continuous connection for the existing active transportation pathways. Existing road grades will be increased to not only satisfy the required hydraulic opening, but also to provide minimum clearances for an under bridge pathway. Remediation of existing channel and bank scour will be undertaken and channel erosion protection will be implemented as part of the works. Construction will take place over an eleven month duration between November 2015 and September 2016.

Scope of Work

The Ness Avenue Bridge Project is comprised of the following scope of work:

- Remove existing culvert;
- Construct new high level bridge;
- Reconstruct and rehabilitate roadway and sidewalks;
- Stabilize slopes on southwest bank in vicinity of Alcott cul-de-sac
- Construct under bridge pathway and upgrade existing AT pathways and connect to bridge and roadway sidewalks;
- Protect existing channel against future erosion; and
- Extend land drainage sewers (LDS) and storm relief sewers, undertake other waste water, storm relief, and LDS repairs.

Document Contents

This EIS has been organized under the following main headings:

Section 1: Introduction – Provides a general overview of the Project, information about the City of Winnipeg, background, the regulatory setting and proposed Project schedule.

Section 2: Project Description – Provides a detailed overview of the Project including the Project setting, components, construction activities, construction schedule and health safety and environment plan.

Section 3: Existing Environment – Provides an overview of existing environmental characteristics of the Project site and surrounding area.

Section 4: Effects Assessment, Mitigation and Monitoring – Describes the environmental assessment approach, potential Project related effects on the physical, terrestrial, aquatic and human environments, and the significance of those effects. Also describes proposed mitigation measures and monitoring procedures during construction.

Effects Assessment, Mitigation and Monitoring

A summary of the potential Project effects is presented in Table E1. A more detailed analysis is presented in Section 4. Potential effects are listed by type and source and include the mitigation measures.

Significance of Effects

The Project is being undertaken to address existing risks to public safety and effects to the environment. The Project will have net beneficial effects. Potential negative effects are mitigated through preventative measures designed into the Project or have minor residual effects.

Table E.1.1 Summary of the Environmental Impact Assessment for the Remediation of the Former Dominion Bridge Operations Yard during Construction.

Factor	Potential Effect	Assessment of Effects	Residual Effect
Physical Environment			
Air Quality	Dust and exhaust emissions	Limited, short-term, indistinguishable from adjacent background sources	None
Noise and Vibration	Vibration from construction activities such as heavy equipment operation	Limited, short-term	None
Soil Chemistry and Quality	Spills and fugitive contaminants	Limited, short-term, and reversible with available technology; spill control and clean-up equipment maintained at site	None
Hydrogeology	Spills and fugitive contaminants	Limited, short-term, and reversible with available technology; spill control and clean-up equipment maintained at site	None
Terrestrial Environment			
Vegetation	Clearing vegetation to access banks and conduct stabilization works	Re-vegetate with native species; defragments greenway; make site available for community-led habitat enhancements	Positive and long-term
Wildlife and Habitat	Clearing vegetation to access banks and conduct stabilization works	Re-vegetate with native species; defragments greenway; make site available for community-led habitat enhancements	Positive and long-term
Aquatic Environment			
Surface Hydrology	Isolation of stream to replace culvert with a bridge	Limited and short-term; increased flow capacity; reduced erosion and scour	Positive and long-term

Factor	Potential Effect	Assessment of Effects	Residual Effect
Shoreline and Creek bank Stability	Bank stabilization, culvert removal, trail construction works	Downstream west bank is unstable and reconstruction will result in stable channel; culvert replacement will reduce factors causing instability	Positive and long-term
Surface Water Quality	Spills and fugitive contaminants	Limited, short-term, and reversible with available technology; spill control and clean-up equipment maintained at site	None
Surface Water Quality	Sedimentation and erosion from disturbed areas	Limited, short-term, and reversible with available technology; sediment and erosion control measures maintained until vegetation cover established; rock erosion protection on banks and in channel to prevent scour	Positive and long-term
Sediment Quality	Spills and fugitive contaminants	Limited, short-term, and reversible with available technology; spill control and clean-up equipment maintained at site	None
Fish and Fish Habitat	Isolation of the channel	Works conducted during winter no-flow period; limited, short-term loss of overwintering area for large-body fish; relocate large-body fish prior to isolation;	Positive and long-term
Fish and Fish Habitat	In-channel works for replacement of crossing structure	Removal of culvert and placement of piers will reduce crossing footprint and increase available habitat; reduced flow velocities and erosion protection will reduce sediment and erosion scour downstream as well as potential migration barrier during high flow events	Positive and long-term

Factor	Potential Effect	Assessment of Effects	Residual Effect
Fish and Fish Habitat	Bank stabilization works	Restoration of pre-development stream channel geometry; reduced erosion, scour, and sedimentation; retention of part of scour pool as habitat	Positive and long-term
Human Environment			
Human Health and Safety	Potential interactions with the public during works; worker safety	Site will be secured until made available to the public; site specific safety plans for work at site; limited to Project activities	None
Human Health and Safety	Route changes to Sturgeon Creek Greenway trail	Limited and short-term detours during construction; eliminates level crossing of Ness Avenue for trail	Positive and long-term
Human Health and Safety	Changes to flow capacity in Sturgeon Creek channel during construction and operation	Limited and short-term; increased flow capacity; reduced erosion and scour; eliminates risks from overflow at Ness Avenue	Positive and long-term
Existing or Planned Land Use	Crossing site converted to green space with public access	Area currently occupied by crossing approaches will be converted to green space with public access	Positive and long-term
Aesthetics	Crossing site converted to green space with public access	Area currently occupied by crossing approaches will be converted to green space with public access	Positive and long-term
Effects of the Environment on the Project			
Climate change	Potential increases in precipitation and therefore flow	Replacement of undersized culvert with bridge, bank stabilization, and erosion protection will increase flow capacity of the channel while protecting banks from scour and erosion	Positive and long-term

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1.0 INTRODUCTION

The existing Ness Avenue crossing over Sturgeon Creek in Winnipeg, Manitoba was constructed in 1962 and consists of a two-cell concrete box culvert with concrete sloped wing walls (Figure 1.1). The crossing supports two lanes of traffic and two sidewalks. The culvert is in fair to poor condition with deterioration at the entrance and exit structures and moderate concrete damage in the culvert barrels. The culvert flow capacity has proven to be insufficient with Sturgeon Creek regularly overtopping Ness Avenue during spring freshet and high water events. The high flows force road closures, damage the culvert and embankments, and cause channel scour and bank instability downstream. The Sturgeon Creek Greenway Trail runs parallel to the west bank of Sturgeon Creek and crosses over Ness Avenue west of the box culvert at the existing street level. Alcott Street cul-de-sac is located at the top of the west creek bank directly downstream of the culvert.

Sturgeon Creek flows south at Ness Avenue and crosses at a 17 degree skew. The culvert alignment directs flow towards the west bank directly downstream. As the culvert is undersized, stream flow velocities increase in the culvert and have led to erosion and scour of the west bank. By 2002 the stream channel was significantly wider than preconstruction and west bank instabilities were threatening the adjacent Alcott Avenue cul-de-sac. An Aqua-Terra System was installed to restore and stabilize the creek bank and protect it from future erosion and instability. By 2010, the Aqua-Terra System was failing and there was continued erosion of the west bank.

A preliminary design study of the crossing and channel concluded that replacing the crossing with a bridge and stabilizing the west bank would:

1) Eliminate stream overflow at Ness Avenue;
2) Reduce stream velocities exiting the crossing;
3) Stabilize the west bank;
4) Re-establish the channel profile;
5) Preserve and protect the Alcott Street cul-de-sac; and
6) Eliminate the Sturgeon Creek Greenway trail level crossing at Ness Avenue.

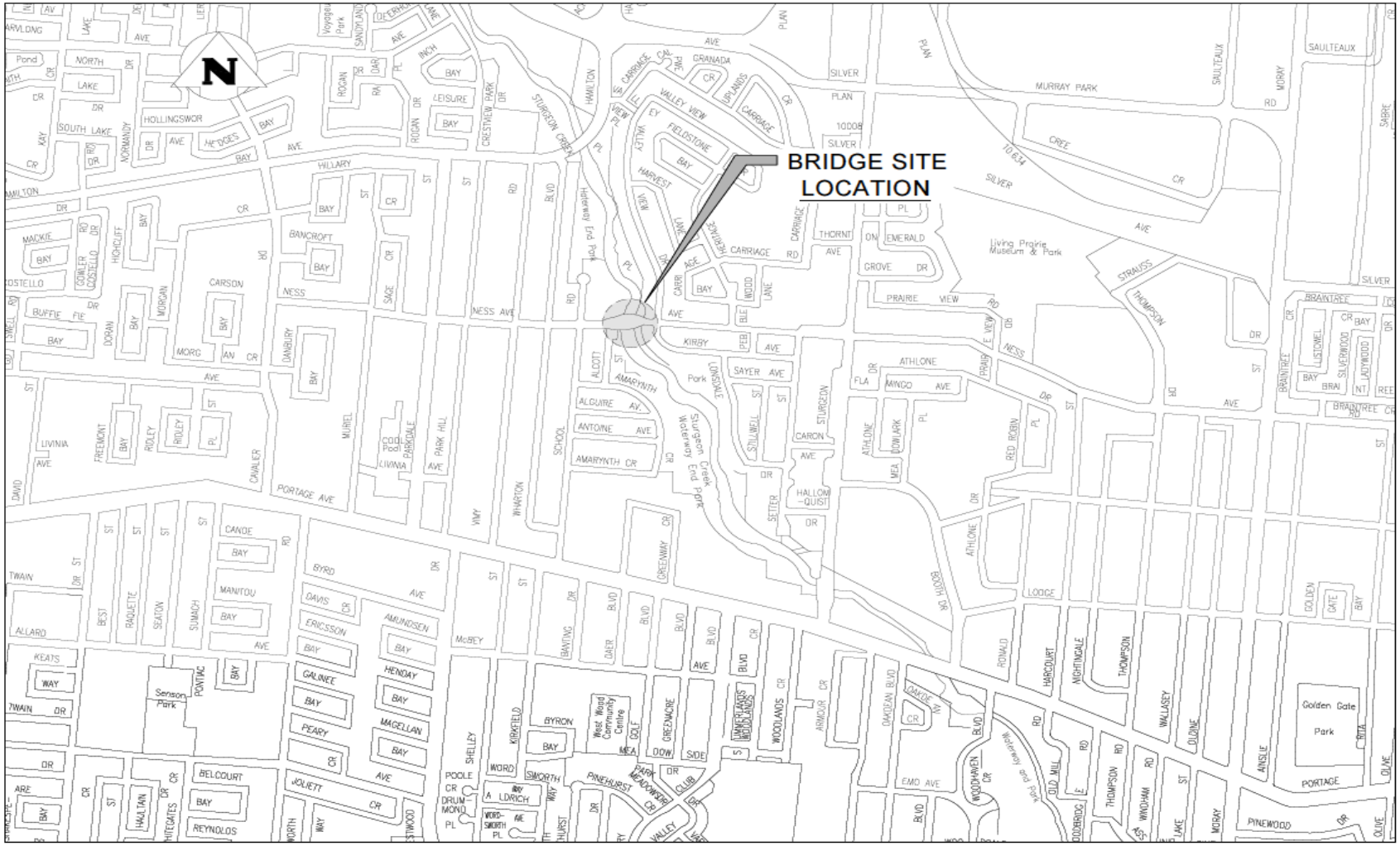
The scope of the Environmental Assessment Report (EAR) is therefore the removal of the existing box culvert, placement of new bridge substructure in the channel, stabilization of the downstream west bank, and the realignment of the Sturgeon Creek Greenway trail.

1.1 PROJECT OVERVIEW

The design was developed satisfying the City's requirements, considering the impact of facility users, condensing and minimizing overall construction duration, minimizing project risk, and achieving the Project goals and objectives. The overall bridge design is simplified by considering and selecting components readily available for fabrication and construction within the local industry, and by considering cost effective design innovations.

The Project includes removing the existing culvert, constructing new high level bridge, reconstructing and rehabilitating roadway and sidewalks within the limits of work, stabilizing slopes on the southwest bank in vicinity of Alcott cul-de-sac, constructing an under bridge pathway and upgrades to the existing active transportation (AT) pathways, protecting the existing channel against future erosion, managing traffic during construction; and extending land drainage sewers (LDS) and storm relief sewers and other waste water, storm relief, and LDS repairs (Appendix B). The stream banks at Ness Avenue will be re-contoured to provide a stable profile and the streambed will be protected with clean rock material. The final bank slope will be regraded to 3H:1V for increased bank stability. The removal of the existing culvert will eliminate the restriction in flow capacity of the channel which will reduce water velocities during high-water events and therefore reduce the overall potential for erosion. The reconstruction of the channel will have a beneficial effect on surface hydrology.

Figure 1.1 Project Location



1.2 ALTERNATIVES

1.2.1 Crossing Structure

After the need for the crossing replacement was established, early planning sessions determined that a bridge structure would be installed at the site. A bridge has the advantages of:

Exceeding the design standards for flow capacity thereby providing capacity for unusual flow evens;

- Reducing the crossing footprint in Sturgeon Creek;
- Reducing fragmentation of the Sturgeon Creek Greenway by connecting the natural areas being established upstream and downstream of the crossing; and
- Allowing AT corridor to be redirected under the bridge from a level crossing at Ness Avenue and reducing public safety concerns.

Alternatives for the bridge structure considered three alternatives: clear span, two span, and three span. The assessment of the alternatives is as follows:

Clear Span Bridge – This alternative would eliminate any supporting structures between the abutments. In order to meet the design load capacities while maintaining road geometry within design standards and without affecting adjacent properties, a clear span structure would require a supporting arch. Arch bridges are technically more complex to design and construct and require more frequent maintenance. An arch bridge would also cost approximately 50% more than a multi-span bridge and would have higher maintenance costs over the service life of the structure. It was determined that the marginal benefits of a reduced footprint were not balanced by the much higher construction and maintenance costs. In addition, this structure would not accommodate an under bridge crossing to meet minimum AT and maintenance requirements.

Two Span Bridge – This alternative would require deeper girders. In order to maintain clearances under the bridge, the deck would have to be installed at a higher grade. A higher deck grade would require longer approaches to the abutments and potential affect adjacent property drainages and grades. In addition, a pier would need to be installed within the Sturgeon Creek channel. For these reasons, this alternative was rejected.

Three Span Bridge – The reduced depth of the girders reduces the deck height and subsequent approach requirements while maintaining required clearances. The piers would be constructed on the banks, outside of the creek channel. This would eliminate effects to fish habitat and flow. Although this option would result in a small reduction in available terrestrial habitat it will still allow for the defragmentation of the Sturgeon Creek Greenway. For these reasons, the three span bridge was selected as the preferred alternative.

1.2.2 Bank Stabilization

Several alternatives were considered for bank stabilization. Key metrics included preserving existing infrastructure, long-term performance, public safety, and minimizing environmental effects. The alternatives consist of the following:

- Re-grading the bank to 3.5H:1V from the edge of the corridor to Alcott Street and placement of rip rap at the toe of the bank. This option would require the removal of the east portion of the Alcott Street cul-de-sac. This alternative was rejected as Alcott Avenue is not a through street and the cul-de-sac is required.
- Replacing the existing Alcott Street cul-de-sac fill with cematrix fill. This alternative was rejected because the cematrix fill would not likely be sufficient on its own to achieve a FS of 1.5 therefore additional stabilization measures would be required. The design would also need to consider protection against buoyancy during flood events, which would be impractical for this site.

- Re-locating the AT corridor up to street level at Alcott Street. This option would still require significant stabilization works (coincident with the measures discussed below), considering the stability of the existing bank is marginal. This alternative was rejected as it does not address the public safety risks associated with existing level crossing.
- Constructing a shear key to extend the silt till with a mechanically stabilized earth wall at the west edge of the corridor and place stone rip-rap at the toe of slope. This option would prevent long-term impact on Alcott Street and minimize the extent of rock fill required within the creek channel. Costs of shear key installation are prohibitive and therefore this alternative was rejected.
- Constructing a tie-back gabion retaining wall or a concrete retaining wall extending into the silt till located at the west edge of the corridor and placing rip rap at the toe of the bank. This option would prevent long-term impact on Alcott Street and minimizes the extent of rock fill required within the creek channel. This was selected as the preferred option.

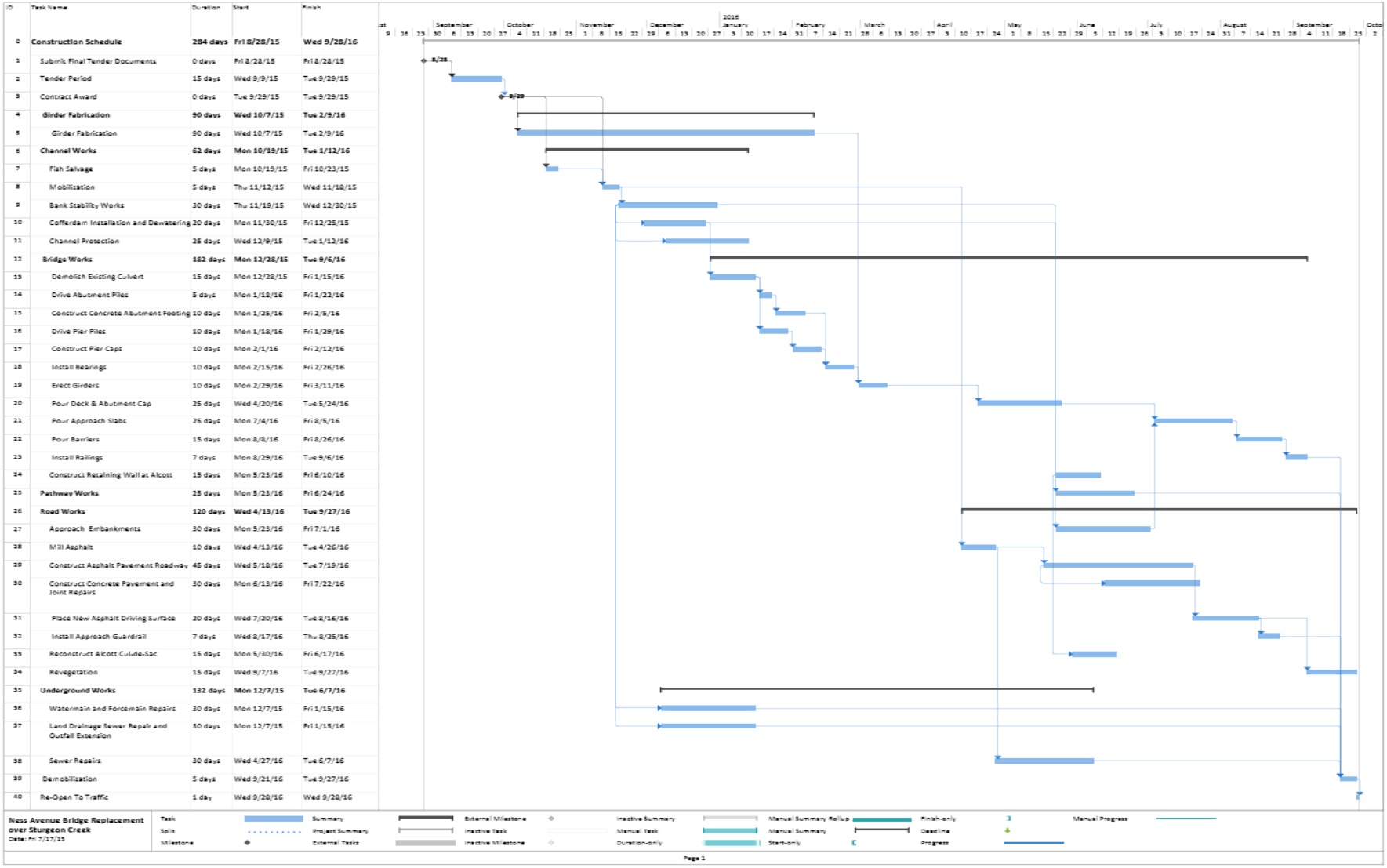
1.3 PROJECT SCHEDULE

The proposed schedule for the Ness Avenue crossing replacement will begin in November 2015 and be completed by late fall 2016 (Figure 1.2). All in-channel works will be completed during the winter of 2015 to 2016. Project components requiring approvals or permits will not commence until the necessary approvals and permits have been received.

1.4 PROPONENT

Project Name:	Ness Avenue Crossing Replacement at Sturgeon Creek
Proponent:	City of Winnipeg
Contact:	Darren Burmey 106 - 1155 Pacific Avenue Winnipeg, Manitoba R3E 3P1 Phone: (204) 986-5409
Environmental Approvals Agent: Contact (Tetra Tech WEI Inc.):	Tetra Tech WEI Inc. Dave Tyson 400 - 161 Portage Avenue East Winnipeg, Manitoba R3B 0Y4 Phone: (204) 954-6918 Fax: (204) 988-0546

Figure 1.2 Ness Avenue Crossing Replacement Construction Schedule



ID	Task Name	Duration	Start	Finish
0	**Construction Schedule**	**284 days**	**Fri 8/28/15**	**Wed 9/28/16**
1	Submit Final Tender Documents	0 days	Fri 8/28/15	Fri 8/28/15
2	Tender Period	15 days	Wed 9/9/15	Tue 9/29/15
3	Contract Award	0 days	Tue 9/29/15	Tue 9/29/15
4	**Girder Fabrication**	**90 days**	**Wed 10/7/15**	**Tue 2/9/16**
5	Girder Fabrication	90 days	Wed 10/7/15	Tue 2/9/16
6	**Channel Works**	**62 days**	**Mon 10/19/15**	**Tue 1/12/16**
7	Fish Salvage	5 days	Mon 10/19/15	Fri 10/23/15
8	Mobilization	5 days	Thu 11/12/15	Wed 11/18/15
9	Bank Stability Works	30 days	Thu 11/19/15	Wed 12/30/15
10	Cofferdam Installation and Dewatering	20 days	Mon 11/30/15	Fri 12/25/15
11	Channel Protection	25 days	Wed 12/9/15	Tue 1/12/16
12	**Bridge Works**	**182 days**	**Mon 12/28/15**	**Tue 9/6/16**
13	Demolish Existing Culvert	15 days	Mon 12/28/15	Fri 1/15/16
14	Drive Abutment Piles	5 days	Mon 1/18/16	Fri 1/22/16
15	Construct Concrete Abutment Footing	10 days	Mon 1/25/16	Fri 2/5/16
16	Drive Pier Piles	10 days	Mon 1/18/16	Fri 1/29/16
17	Construct Pier Caps	10 days	Mon 2/1/16	Fri 2/12/16
18	Install Bearings	10 days	Mon 2/15/16	Fri 2/26/16
19	Erect Girders	10 days	Mon 2/29/16	Fri 3/11/16
20	Pour Deck & Abutment Cap	25 days	Wed 4/20/16	Tue 5/24/16
21	Pour Approach Slabs	25 days	Mon 7/4/16	Fri 8/5/16
22	Pour Barriers	15 days	Mon 8/8/16	Fri 8/26/16
23	Install Railings	7 days	Mon 8/29/16	Tue 9/6/16
24	Construct Retaining Wall at Alcott	15 days	Mon 5/23/16	Fri 6/10/16
25	**Pathway Works**	**25 days**	**Mon 5/23/16**	**Fri 6/24/16**
26	**Road Works**	**120 days**	**Wed 4/13/16**	**Tue 9/27/16**
27	Approach Embankments	30 days	Mon 5/23/16	Fri 7/1/16
28	Mill Asphalt	10 days	Wed 4/13/16	Tue 4/26/16
29	Construct Asphalt Pavement Roadway	45 days	Wed 5/18/16	Tue 7/19/16
30	Construct Concrete Pavement and Joint Repairs	30 days	Mon 6/13/16	Fri 7/22/16
31	Place New Asphalt Driving Surface	20 days	Wed 7/20/16	Tue 8/16/16
32	Install Approach Guardrail	7 days	Wed 8/17/16	Thu 8/25/16
33	Reconstruct Alcott Cul-de-Sac	15 days	Mon 5/30/16	Fri 6/17/16
34	Revegetation	15 days	Wed 9/7/16	Tue 9/27/16
35	**Underground Works**	**132 days**	**Mon 12/7/15**	**Tue 6/7/16**
36	Watermain and Forcemain Repairs	30 days	Mon 12/7/15	Fri 1/15/16
37	Land Drainage Sewer Repair and Outfall Extension	30 days	Mon 12/7/15	Fri 1/15/16
38	Sewer Repairs	30 days	Wed 4/27/16	Tue 6/7/16
39	Demobilization	5 days	Wed 9/21/16	Tue 9/27/16
40	Re-Open To Traffic	1 day	Wed 9/28/16	Wed 9/28/16

1.5 REGULATORY FRAMEWORK

The Project will require reviews or permits by federal, provincial, and municipal agencies (Table 1.1).

Table 1.1 Regulatory Reviews and Permits required for the Ness Avenue Bridge Project.

Permit/Regulation/Act	Agency	Status
Fisheries Act	Fisheries and Oceans Canada	This submission
Environment Act License	Manitoba Conservation and Water Stewardship	This submission
Scientific Collection Permit	Manitoba Conservation and Water Stewardship	To be submitted
Waterway Permit	City of Winnipeg	Submitted

1.5.1 Provincial Environmental Assessment and Permitting

The Project constitutes a Class 2 development as a water development and control project that will result in alterations to a stream channel which will affect fish habitat (*Manitoba Environment Act*, Classes of Development Regulation 164/88). The Project will therefore require an *Environment Act* License (EAL) prior to the initiation of any channel works. An EAL is issued upon the Minister's acceptance of an *Environment Act* Proposal (EAP) and developer's environmental assessment report (EAR). Under the provincial environmental assessment (EA) process, only the Project components requiring a permit should be included in the EAP and DEAR. The scope of provincial EAP and EAR therefore includes the removal of the existing crossing structure, the construction of the new crossing structure, any in-channel works, and the downstream west bank stabilization in the Sturgeon Creek channel.

Sturgeon Creek is not considered a provincial drain by Manitoba Infrastructure and Transportation. The proposed works will therefore not require a Waterway Authorization as per s.14(4) of the *Manitoba Water Resources Administration Act*.

1.5.2 Federal Environmental Assessment and Permitting

The Project does not constitute a designated physical activity under the *Canadian Environmental Assessment Act, 2012* (Regulations Designating Physical Activities SOR/2012-147); therefore a federal environmental assessment will not be required for the Project.

Fisheries and Oceans Canada (DFO) administers the *Fisheries Act* which governs effects to fish and fish habitat in Canada. Amendments to the *Fisheries Act* came into force on 25 November 2013 and subsequently led to policy changes on the administration of the Act. DFO now uses a web-driven self-assessment process to pre-screen projects. The self-assessment provides guidance on how to avoid serious harm to fish and allows proponents to assess their projects and determine whether to engage DFO. If serious harm may occur, a Request for Referral can be submitted to DFO. DFO will then determine whether a *Fisheries Act* s.32(2) authorization is required for the Project. An initial self-assessment the Project indicates that effects to fish habitat in Sturgeon Creek are unavoidable. A Request for Referral, supported by this document, will therefore be submitted to DFO.

The *Navigation Protection Act* (NPA) came into force in April 2014, replacing the *Navigable Waters Protection Act*. The NPA is administered by Transport Canada – Navigation Protection Program. Under the NPA, approvals

are only required for works in, over, or below waterbodies named in the NPA Schedule. Sturgeon Creek is not listed in the Schedule therefore the Project does not require an approval under NPA.

1.5.3 Municipal

Any proposed work within 250 feet of Sturgeon Creek is subject to the City of Winnipeg Waterways By-law No.5888/92. The City riverbank engineer has been engaged throughout the development and design of the Project. A permit application was submitted 14 July 2015.

1.6 PUBLIC ENGAGEMENT

A public information session during was held during the planning phase of the Project on January 13, 2015 at Heritage Park Temple on School Road. Area residents and businesses were invited to attend through mail-outs and advertisements (Appendix D). The session provided the public with information on the Project preliminary design for the new bridge structure, project timelines, detour information, temporary public transit rerouting, environmental management, and other potential effects of the project. The City also maintains a website to provide up to date Project information as well as to provide the public a continuous means of providing feedback. The website will be maintained for the duration of the Project.

The public information session was well attended by local residents, commuters who use Ness Avenue, and users of the Sturgeon Creek Greenway. Comment cards were received from the following:

- 33 - were residents of a neighbourhood close to the bridge site
- 12 - were commuters who use Ness Avenue
- 12 - were individuals who use the Sturgeon Creek Greenway Trail or fishes in Sturgeon Creek

Attendees learned about the Public Information Session from the following sources:

- 3 - from City of Winnipeg website
- 27 - from a letter or notice in the mail
- 7 - from email invite
- 4 - from the newspaper

A questionnaire was distributed to session attendees to solicit public comments and concerns. The response to the project was generally positive with some comments providing specific support for addressing the overflow issue. Concerns with the Project were regarding increased traffic volumes on neighbouring streets, and other traffic and construction related concerns were recorded. There were no comments regarding environmental effects of the Project. Of the attendees providing comment, 26 received enough information to understand the City's bridge reconstruction project, 8 comment that they require additional information as shown below. The following is a selection of concerns, suggestions, or questions related to the construction process for the project.

- 9 - Concerned that current traffic volumes on School Road are not addressed by this project, and will increase during construction. The addition of a traffic light at School Road and Ness Avenue or "no left turn" on School Road northbound at Ness Avenue were suggested. The implementation of "No Parking" on School Road during construction was also suggested. 5 -
- 5 - Concerned with increased in traffic volumes during construction on Valley View Drive, Heritage Blvd., and on adjacent streets west of the culvert.
- Concerned with the condition of School Road, and suggested that curbs on School Road be upgraded as a part of this project.

- 3 - Suggested that Ness Avenue be widened and that a left turn lane from westbound Ness Avenue to School Road be added as part of this project.
- 1 - Concerned that Ness Avenue might be widened as part of this project.
- 2 - Suggested various changes to improve traffic flow on School Road and Ness Avenue including a four way stop at Wharton Blvd. and School Road, or Wharton Blvd. and Ness Avenue, and a longer light from School Road through Portage Avenue.
- 2 - Concerned with the additional distance to the proposed transit stops from Valley View Drive and Heritage Boulevard during construction. A suggestion was made to extend the transit route on Ness Avenue west of Sturgeon Road towards Heritage Boulevard where the old Safeway parking lot could be used as a turnaround for buses.
- 3 - Requested additional information on the proposed traffic control plan and expressed concern that access to their properties be maintained during construction.
- 1 - Inquired as to whether road repairs and the new structure profile will reduce vibrations on houses adjacent to the current bus route.
- 1 - Concerned that the new raised structure would increase road noise in their house adjacent to the new bridge.
- 1 - Concerned that the removal of the culvert may lead to increased flooding downstream of Ness Avenue.
- 3 - Did not find information on the project timeline.
- 1 - Suggested that a larger portion of the west bank of Sturgeon Creek lost to erosion, be recovered.
- 1 - Suggested that the under bridge path be eliminated to minimize project cost.

Responses to concerns will be posted to a “Frequently Asked Questions” page on the City’s Project website:

winnipeg.ca/publicworks/MajorProjects/NessAtSturgeonCreekCulvertReplacement/

2.0 PROJECT DESCRIPTION

2.1 PROJECT SETTING

2.1.1 Existing Site Conditions

The existing culvert on Ness Avenue over Sturgeon Creek, constructed in 1962, is a 30.82 m long, two-cell concrete box culvert. The ends of the culvert are supported on sloped concrete wingwalls (Figure 2.1). The culvert accommodates one lane of traffic each in the Eastbound and Westbound directions, and also accommodates sidewalks on each side of the structure. There is a sag curve between School Road and Valley View Drive, which is lowest at the location of the culvert. Existing land drainage sewer (LDS) outfalls are located on the east bank, approximately 30 m downstream of the culvert, and at the west bank, approximately 10 m downstream of the culvert.

Sturgeon Creek runs north to south and is skewed to the existing culvert. Within the Project limits the creek is mainly a natural channel, although it has been heavily impacted by urban development and transportation infrastructure. The channel grade is approximately 0.06%. Sturgeon Creek contains a number of fish species, along with varieties of mollusks, crustaceans, amphibians, reptiles, birds, and mammals, all of which use the creek as habitat. In the 1990s, efforts were made to improve water quality of the creek and increase fish habitat through the addition of fish ladders and riffles downstream of Portage Avenue. Tall grass vegetation, scattered trees and bushes are present upstream and downstream of Sturgeon Creek. In an effort to stabilize creek banks and increase the biodiversity of the area, a “no mow buffer strip” was implemented for properties along the creek banks.

The culvert is undersized, flooding Ness Avenue floods every few years, and resulting in damage to the crossing (Figure 2.2). The existing structure is in poor condition despite several rehabilitation programs undertaken between 1979 and 1996 for regular maintenance and other repairs following flood damage. The increased discharge velocities exiting the culvert have also resulted in channel and bank scour downstream. The west bank slopes are steep adjacent to the Alcott Street cul-de-sac and will require stabilization works. During spring freshet, the undersized culvert is regularly blocked with ice which results in repeated flooding of Ness Avenue and requires temporary road closures and traffic detours, including pedestrian, vehicle, and transit users.

Figure 2.1 Existing Culvert on Ness Avenue at Sturgeon Creek

Figure 2.2 Overflow on Ness Avenue at Sturgeon Creek during spring freshet.

Creep movements and slope instabilities have been identified along the west creek bank, downstream from the culvert for a distance of approximately 75m (Figure 2.3). The west creek bank adjacent to the Alcott Street cul-de-sac is significantly steeper, with approximate slopes of 2.5H:1V. Creep movements are evidenced by cracking of the asphalt pavement and movement of the street curb towards the creek. Instability downstream of and adjacent to the Alcott Street cul-de-sac is also apparent, as indicated by multiple failure slumps along the banks of the creek. An attempt to stabilize the west bank was undertaken in the early 2000's using the Aqua-Terra System where a series of 1.5 to 2.0 meter cells were installed using geogrid and steel rods. The efforts failed and remnants of the works can be found along the west bank (Figure 2.3). The east bank and channel slopes to the upstream of Ness Avenue are stable.

Figure 2.3 Bank failure and the remnants of the Aqua-Terra System on the west bank of Sturgeon Creek, downstream Of the Ness Avenue crossing.

The Sturgeon Creek Greenway Trail runs along the creek from Woodhaven Park to the south and Saskatchewan Avenue to the north. The trail is designated by the City as a multi-use or active transportation (AT) pathway. The

Ness Avenue culvert bisects the trail and requires users to make a level crossing at the intersection with School Road. The trail is currently less than two metres wide and does not comply with current recommended standards.

2.1.2 Land Ownership and Land use Designation

The Project site is entirely contained within property owned by the City of Winnipeg. The proposed works and activities are compatible with all permitted land use and zoning restrictions for the property.

The Project is located in a residential neighbourhood. The properties bordering the Project site are residential with the exception of the northwest corner which is occupied by the Salvation Army geriatric nursing facility, the Golden West Centennial Lodge.

2.2 STURGEON CREEK PROJECT COMPONENTS

2.2.1 Overview and Scope

Project construction activities will begin in November 2015 with armoring the west bank downstream of the Ness Avenue crossing, from toe to high water mark. The initial armoring is required to stabilize the bank slopes and to provide bank support following channel isolation and partial dewatering when the existing culvert is removed. The stream channel will then be isolated upstream and downstream of the Project site and partially dewatered to provide access to the culvert and installation of the pier foundations for the new structure. Once the piers have been installed, clean armouring will be placed on the creek bed and side slopes for a distance of five meters upstream and downstream of the new bridge. The cofferdams will be removed prior by March 2016. Bridge, road, and pathway works will then be completed. The remaining bank stability works, above the high water mark, will then be completed.

2.2.2 Preconstruction Activities

Preconstruction activities include road closures, traffic diversions, securing the work site, and establishing a construction laydown/parking area on the east bank of Sturgeon Creek. Utility services within the project area will be identified and located in cooperation with the utility companies.

2.2.3 Stream Isolation

Culvert removal, pier installation, and bank stabilization works must be completed in the dry therefore stream isolation and dewatering will be required to complete the works. Isolation and dewatering will occur over the winter of 2015 to 2016 when water levels are lowest, when flow has ceased, and fish migrations do not occur. Temporary coffer dams constructed of clean fill and a waterproof liner will be installed at constrictions in the stream channel 75 m upstream and 150 m downstream of the crossing. There is typically no flow in Sturgeon Creek during the winter months; however a pump will be installed upstream of the upstream coffer dam and should any stream flow occur, the water will be pumped around the channel section and discharged downstream. The isolated stream section will be dewatered downstream. Dewatering will begin after surface ice formation in order to minimize resuspension of sediments from wave action. Dewatering will only proceed to the point that the culvert and pier work areas are exposed. The downstream scour pool will not be fully dewatered; complete dewatering would exacerbate the instability of the west bank.

2.2.3.1 Fish Relocation

The downstream scour pool has the potential to provide overwintering habitat for fish therefore a relocation program will be conducted to recover any large-body fish residing in the isolated stream section. Sturgeon Creek is likely to have surface ice by the time the time the coffer dams are installed therefore the recovery activities will occur prior to freeze-up. Blocking nets will be installed immediately upstream and downstream of the coffer dam

locations. Large-body fish will be captured using seine nets, short-term gill nets, and other non-lethal methods. Capture fish will be identified to species, weighed, measured, and relocated immediately downstream of the site. Any small-body fish species captured, particularly through seine hauls, will be identified, enumerated, and relocated downstream. It is anticipated the partially dewatered scour will provide sufficient overwintering habitat for any small-body fish remaining in the isolated stream section.

2.2.4 Bank Stabilization

Lower bank stabilization works will commence prior to stream isolation and dewatering. This is necessary to stabilize the bank prior to the release of back pressure during channel dewatering. Clean, quarried limestone will be placed along the bank and into the channel using a back hoe. Rock placement in the scour pool will proceed incrementally from the bank into the channel so as to displace rather than bury any remaining small-body fishes. Rock placement and contouring will proceed up to the high water mark and tie into the bank and streambed erosion protection at the former culvert site. Minor bank instabilities both upstream and downstream of the existing crossing will be re-contoured and stabilized resulting in minor changes to the shoreline.

A concrete retaining wall will be installed adjacent to the Alcott cul-de-sac and the greenway trail. The retaining wall will provide bank stability, protect the cul-de-sac, and reduce the amount of rock required to stabilize the west bank. This will maximize the amount of scour pool that can be retained as stream habitat.

2.2.5 Underground Works

An existing LDS collects surface runoff from Ness Avenue and adjacent lands and discharges into Sturgeon Creek through the west bank, downstream of the crossing. The sewer will be directly replaced during the west bank stabilization works, with the new sewer following the existing centerline and elevations. The existing sewer will be excavated and removed and a new pipe and outfall installed. A concrete collar will be buried within the west bank with a corrugated steel pipe outfall emerging from the protected bank. The trench will be backfilled and contoured. The outfall is designed to be submerged at normal summer water levels. At the same time, the storm relief sewer will be repaired and extended so that the outfall passes through the bank stabilization works.

Within the upland Project area, a water main, a force main, and a waste water sewer will be repaired. The pipelines will be exposed, inspected, components replaced, and backfilled. These works will be isolated and contained such that there will be no possibility of discharge to Sturgeon Creek.

2.2.6 Culvert Removal

Culvert removal will begin with the removal of the road bed above the culvert and approaches. The approaches will then be removed to expose the culvert. The culvert will then be broken up and removed. All road, approach fill, and culvert materials will be removed from site and disposed of at an approved facility. The stream channel and banks will be contoured in preparation for bridge construction. A layer of clean, quarried limestone will be placed on the streambed and banks to provide erosion protection and stability.

2.2.7 Bridge Construction

Bridge construction will begin once the culvert and approaches have been removed and the exposed channel and banks have been contoured. The principle tasks include pier construction, abutment construction, superstructure installation, and deck construction and finishing.

2.2.7.1 Pier Construction

The piers will each consist of nine, 610 mm diameter, reinforced concrete filled steel pipe piles with a cast-in-place reinforced concrete pier cap. The piles will be driven to refusal and spaced at 2.0 m on centre. The pile capacity relies upon a combination of shaft friction and end bearing into bedrock. Refusal is anticipated to occur

an elevation of 225.2m. This pier alternative was selected over traditional monolithic piers to minimize pile driving time, and suitable subsurface conditions. In addition, the construction of a pipe pile bent system can be driven without dewatering, which minimizes construction risk associated with dewatering operations.

2.2.7.2 Abutment Details

The bridge will be founded on integral abutments consisting of a reinforced cast-in-place concrete cap founded on steel HP 360x132 piles. A single row of ten piles is used, with weak axis of the piles parallel to the bridge movement. The piles will be driven to refusal and spaced at 1.75 m on centre. The pile will be encased with a 750 mm diameter HDPE sleeve filled with loose sand. This concept also eliminates the need for expansion joints on the structure, which will be a beneficial feature for minimizing future maintenance of a leaking joint.

2.2.7.3 Superstructure and Deck

A total of fourteen precast, pre-stressed, concrete box girders will be lifted into position by crane onto the abutment and pile caps. A 150 mm thick reinforced concrete deck will then be cast-in-place and overlain with 85 mm of asphalt. The total bridge width will be 17.15 m and includes a 9.7 m wide clear two-lane roadway and two 3.0 m wide sidewalks and 300 mm wide curbs with handrails.

2.2.8 Sturgeon Creek Greenway Trail

The Sturgeon Creek Greenway trail crosses the Alcott cul-de-sac and is currently bisected by Ness Avenue. Currently to cross Ness Avenue, users are directed to the School Road intersection, 82 m further west (Figure 1.1). The trail will be redirected under the new bridge following the completion of the bank stabilization works and crossing structure installation. The trail will be comprised of an asphalt or crushed rock surfaced on clay fill. Side paths will connect the trail to the sidewalks on either side of Ness Avenue.

2.2.9 Re-vegetation

Re-vegetation tasks will be conducted in the summer of 2016. A re-vegetation plan is being developed in consultation with the City Naturalist. The intent is to ensure that the vegetation is consistent with the objectives for the Sturgeon Creek Greenway.

2.2.10 Miscellaneous Utility Works

Utilities within the Project limits include Manitoba Hydro, Shaw, MTS, and TeraSpan. Communications have been completed with each utility and relocations for MTS and Manitoba Hydro will be completed in the summer of 2015. TeraSpan's line will be abandoned.

2.2.11 Aesthetics and Landscaping

There are existing brick monuments located on the East bank of Sturgeon Creek which will be effected with the proposed grade changes for the new bridge structure. Monuments will be removed and salvaged, with new monuments to be installed at some future time by the City's Park Department. Landscaping will take place along the Sturgeon Creek Greenway Trail and new multi-use pathways, Alcott Street cul-de-sac, and park areas. All areas disturbed during construction will be restored to their original condition or better.

2.3 HEALTH, SAFETY AND ENVIRONMENT PLAN

A Site Specific Health and Safety Plan (SSSP) will be developed for the Project.

3.0 EXISTING ENVIRONMENT

3.1 PHYSICAL ENVIRONMENT

3.1.1 Climate

The Project is located in the Winnipeg Ecodistrict of the Lake Manitoba Plain Ecoregion of the Prairies Ecozone. The Winnipeg Ecodistrict belongs to the Grassland Transition Ecoclimatic Region in southern Manitoba. The mid-continental climate is characterized by four seasons with short, hot summers and long, cold winters. Baseline climate data for the regional study area were obtained from the Environment Canada (EC) meteorological station located at the James Armstrong Richardson International Airport in Winnipeg (49° 55.2' N / 97° 13.8' W).

Data were assembled for the 30 year period from 1978 to 2007. Monthly averages (Table 3.1) were calculated from daily data supplied by EC.

Hourly wind data were assembled for the years 2003 to 2007. Monthly averages (Table 3.2) were calculated from hourly data supplied by EC. Windrose Pro Ver 2.3.20 was used to create a windrose plot and determine prevailing wind direction for the region. Mean monthly wind speed varied little over the year, ranging from 14.8 km/hr in July to 19.9 km/hr in April, and mean annual wind speed was 17.8 km/hr. Maximum wind gusts reached 119 km/hr. The prevailing wind direction is primarily from the south and secondarily from the north and northwest in the winter and spring months (Table 3.2; Figure 3.1).

In general, precipitation falls primarily as snow during the winter months, with the greatest snowfalls occurring in November, December and January. Annual average precipitation is 512.4 mm with precipitation peaking in June, July and August (Table 3.1). The most recent rainfall frequency data were available up to the year 1996. Mean 24-hour rainfall intensity was 55.1 mm (Table 3.3; Environment Canada 2010).

Table 3.1 Summary of historical meteorological data collected at Winnipeg, MB (1978-2007) (calculated from daily data supplied by Environment Canada 2010).

	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature - Mean	°C	-16.8	-13.7	-6.2	4.3	11.7	16.9	19.7	18.6	12.8	5.0	-4.9	-13.3	2.8
Temperature - Mean Min	°C	-21.8	-18.8	-11.2	-2.1	4.6	10.6	13.5	12.0	6.4	-0.5	-9.3	-18.0	-2.9
Temperature - Extreme Min	°C	-41.0	-41.8	-37.4	-26.3	-10.1	-1.0	2.7	0.0	-7.0	-17.0	-34.0	-37.0	-41.8
Temperature - Mean Max	°C	-11.7	-8.6	-1.1	10.7	18.7	23.2	25.9	25.1	19.0	10.5	-0.5	-8.6	8.6
Temperature - Extreme Max	°C	7.3	9.0	17.0	34.3	37.0	37.8	35.9	38.7	38.8	30.5	18.2	9.7	38.8
Rainfall - Total	mm	0.2	2.4	9.3	19.5	55.7	86.4	75.1	76.1	47.4	30.4	6.6	1.5	410.6
Snowfall - Total	cm	22.8	12.8	16.7	10.4	2.7	0.0	0.0	0.0	0.2	4.5	20.3	22.0	112.3
Precipitation - Total	mm	19.4	13.9	24.3	30.2	58.5	86.4	75.1	76.1	47.6	34.8	25.2	20.8	512.4
Wind Gust - Maximum	km/h	106	80	106	104	98	115	109	98	98	119	106	98	119

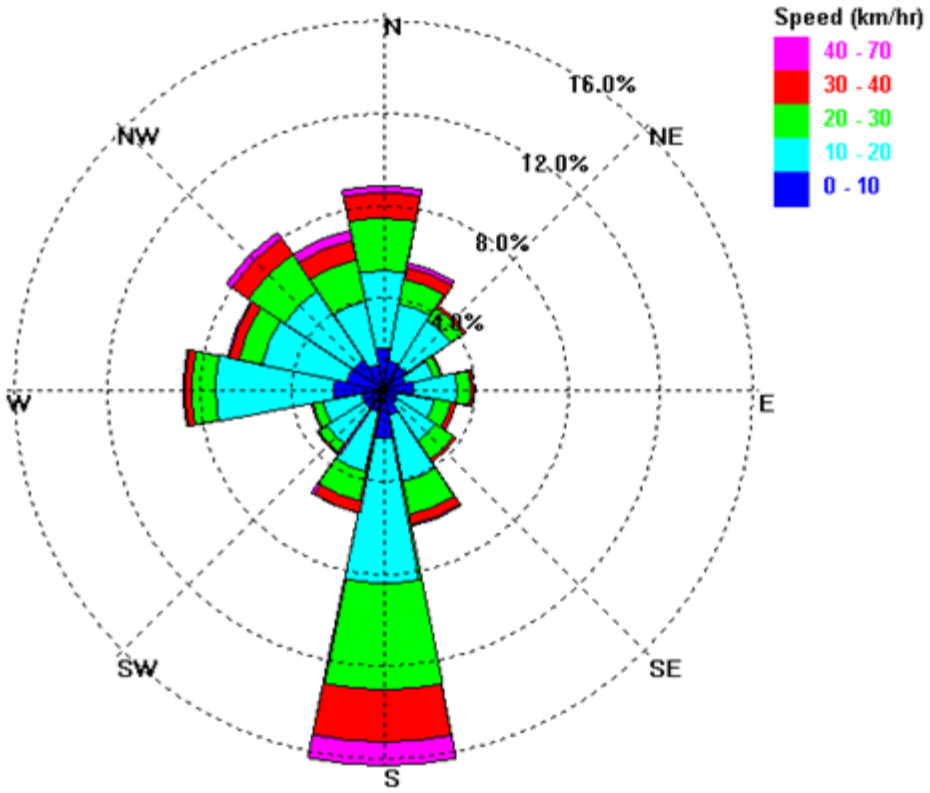
Table 3.2 Monthly prevailing wind conditions at Winnipeg, MB (2003-2007) (calculated from hourly data supplied by Environment Canada 2010).

	Units	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Wind Speed - Mean	km/hr	18.5	16.7	18.5	19.9	18.9	16.9	14.8	16.6	17.3	18.3	18.5	18.1	17.8
Wind Speed - Mean Max	km/hr	56	59	65	63	59	63	57	65	59	63	63	65	65
Wind Direction		WNW & S	S	S	S & N	N & S	S	S	S	S	S	S	S	S

Table 3.3 Rainfall intensity (mm) at Winnipeg, MB (1967-1996) (Environment Canada 2010).

Year	5 Min	10 Min	15 Min	30 Min	1H	2H	6H	12H	24H
1967	12.2	24.1	25.9	31.7	33.0	57.9	63.2	63.5	63.5
1968	17.8	24.6	35.3	39.4	39.4	39.4	48.3	61.2	84.3
1969	7.1	10.4	12.7	15.2	21.8	23.4	25.4	39.1	49.3
1970	11.2	20.8	29.0	37.8	41.1	49.8	54.9	60.5	62.2
1971	4.6	6.1	8.4	11.7	14.5	19.8	25.4	29.0	31.0
1972	9.1	16.5	20.3	35.6	35.6	35.8	35.8	35.8	35.8
1973	6.3	10.4	14.5	19.8	29.7	40.4	45.7	45.7	45.7
1974	9.4	16.3	18.8	25.1	28.7	33.0	37.1	38.9	55.4
1975	9.4	14.5	17.8	22.6	27.9	27.9	44.7	53.8	54.4
1976	15.0	15.7	18.0	21.8	22.1	24.1	26.2	33.3	42.7
1977	7.4	12.4	15.2	19.8	21.6	32.5	50.3	57.7	61.7
1978	10.6	17.6	21.6	24.5	28.0	41.7	52.6	52.6	60.4
1979	10.6	19.1	25.4	36.3	39.3	39.8	40.7	40.7	40.7
1980	7.4	8.8	10.4	15.0	19.3	24.5	25.6	26.6	30.5
1981	10.6	12.4	15.9	18.2	24.1	29.0	53.3	53.4	63.0
1982	8.6	13.0	16.2	22.6	22.7	22.7	32.5	34.9	36.8
1983	13.2	17.2	19.3	23.2	28.0	30.9	51.9	52.3	52.3
1984	12.6	19.0	22.8	39.5	56.2	56.9	60.2	69.5	69.7
1985	5.0	7.3	9.3	12.4	18.4	33.1	61.5	84.0	97.4
1986	10.0	11.8	13.9	16.7	18.5	19.7	28.7	35.4	41.6
1987	7.1	9.0	10.4	20.8	24.8	36.6	46.2	57.2	57.3
1988	7.9	15.8	18.5	22.7	34.8	36.9	39.7	49.7	49.7
1989	4.4	7.7	10.4	12.3	14.1	16.2	34.6	41.1	53.5
1990	9.8	12.7	16.2	19.0	22.0	22.0	22.0	22.5	36.9
1991	11.6	16.4	18.0	18.2	19.3	31.2	43.1	43.5	64.0
1992	8.6	10.2	11.2	17.2	18.0	19.3	21.2	25.2	35.6
1993	6.2	12.4	18.6	29.0	41.6	70.1	72.2	78.4	87.4
1994	8.8	13.1	15.4	24.2	32.2	55.5	67.0	68.2	68.2
1995	7.5	9.9	12.0	18.0	23.0	23.4	35.6	44.0	63.9
1996	8.1	16.1	21.9	43.8	58.6	58.6	58.8	58.8	58.8
MEAN	**9.3**	**14.0**	**17.4**	**23.8**	**28.6**	**35.1**	**43.5**	**48.6**	**55.1**
SD	**3.0**	**4.7**	**6.1**	**8.9**	**11.0**	**13.9**	**14.3**	**15.6**	**16.4**

Figure 3.1 Windrose (2003 – 20007) Winnipeg, Manitoba



3.1.2 Air Quality

In general, Winnipeg has excellent air quality. The sources of airborne pollutants typically include industrial operations, vehicle and equipment emissions, fires, and other specific activities. Ambient air quality in Winnipeg is continuously monitored by two air quality monitoring stations, located at 65 Ellen Street in downtown Winnipeg (approximately 3.6 km northwest of the Project site) and 229 Scotia Street in a residential area (approximately 7.5 km northeast of the Project site). Data for these stations are collected by Manitoba Conservation (2008) and the National Air Pollution Surveillance (2008).

Maximum short-term (1 to 24-hour averages) and annual mean concentrations of air contaminants for the Winnipeg stations are summarized in Table 3.4. There were no exceedances of Manitoba's Air Quality Objectives for carbon monoxide (CO) or nitrogen dioxide (NO_2). In 2005, there was a single exceedance of the 24 hour Canada Wide Standard for Particulate Matter 2.5 ($PM_{2.5}$). The only parameter that regularly exceeds guideline levels is ground level ozone (O_3) – a product primarily of vehicle emissions.

Table 3.4 Summary of short-term maximum and annual average observed concentrations of air pollutants at Winnipeg monitoring sites for 2003-2006 (from NAPS 2008).

Pollutant	Period	Station / Year								Manitoba Air Quality Objective - MTL	Manitoba Air Quality Objective - MAL	Manitoba Air Quality Objective - MDL
		Winnipeg NAPS-070118-R Residential				Winnipeg NAPS-070119-C Downtown						
		2003	2004	2005	2006	2003	2004	2005	2006			
CO (ppm)	1 hour	3.3	2.6	2.9	2.0	4.7	3.5	3.4	2.8	-	31	13
	8 hour	2.0	1.47	1.5	1.3	2.4	1.38	1.9	1.4	17	13	5
	24 hour	-	-	0.9	0.8	-	-	1.0	1.2			
	Annual	0.29	0.24	0.2	0.2	0.52	0.36	0.3	0.4	-	-	-
NO_2 (ppb)	1 hour	93	56	64	54	126	99	67	91	530	213	-
	24 hour	36	32.5*	36	32	40	45	40	36	-	106	-
	Annual	9.7	8.6	8	7	14.2	13.3	12	13	-	53	32
NO (ppb)	1 hour	249	242	249	120	312	282	336	240	-	-	-
	24 hour	71.2	70.9*	56	47	80	95.3*	75	67	-	-	-
	Annual	4.4	4.5	5	3	8.9	9.3	8	7	-	-	-
O_3 (ppb)	1 hour	68	57	60	63	70	53	128	63	200	82	50
	8 hour	-	-	56	57	-	-	53	60		65^	
	24 hour	54	42*	48	48	49	38*	46	44	-	-	-
	Annual	22.9	19.9	20	23	20.5	17.4	19	21	-	15	-
$PM_{2.5}$ ($\mu g/m^3$)	1 hour	-	-	53	59	-	-	391	55			
	24 hour	-	-	22	26	-	-	38	24		30•	
	98th percentile (year)	14	13	14	14	14	13	-	15			
	98th percentile (last 3 years)	-	-	14	14	-	-	14	14			
	Annual	-	-	5	5	-	-	5	5			

MDL - the maximum desirable level is the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of pollution control technology

MAL - The maximum acceptable level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, and personal comfort and well-being

MTL - The maximum tolerable level denotes time-based concentrations of air contaminants beyond which, owing to a diminishing margin of safety, appropriate action is required without delay to protect the health of the general population

*24-hour moving average

^Canada-Wide Standard for ozone: 3-year average of the fourth highest daily maximum 8-hour averages

•Canada-Wide Standard for PM2.5: 3-year average of the annual 98th percentile of daily 24-hour averages

3.1.3 Soils, Sediment and Geology

The general stratigraphy in the Winnipeg area consists of a 12 to 15 m layer of Pleistocene drift composed of Lake Agassiz silt and clay overlying a 9 m layer of silty glacial till. The overburden is deposited on Paleozoic carbonate bedrock composed of dolomite and limestone.

The clays are generally low permeability and contain some degree of fracturing. The clays are often intermixed with layers of silt which may be water bearing. The soils are lacustrine in origin having been deposited as lake bottom sediment in the former glacial Lake Agassiz.

The carbonate bedrock is highly fractured and constitutes the principle potable water aquifer in the area. The glacial tills may also contain ground water; however the water quality is less desirable than that of the carbonate bedrock. The tills and limestone are hydraulically connected.

A geotechnical sub-surface investigation, consisting of drilling, testing and assessment of site conditions, was undertaken for the purposes of confirming existing site geology, carrying out slope stability analysis of the existing creek banks, and providing preliminary recommendations for foundation alternatives. A review of the existing geotechnical information was supplemented by subsurface investigation and soils testing.

3.1.3.1 Slope Stability

An initial visual assessment was undertaken of the existing creek bank conditions 75 m upstream and 150 m downstream of the crossing on 9 June and 20 August 2014 to identify any instabilities and erosion. Creep movements were evident on the west bank adjacent to the Alcott Street cul-de-sac and directly downstream of the existing culvert (Figure 3.2). Failures in the bank adjacent to and downstream of the cul-de-sac were also observed. In other areas, the creek banks are less steep and exhibit signs of minor shoreline erosion but no signs of active instabilities.

Slope stability analyses were performed for preliminary design of the bridge structure and associated works to assess the existing stability of the creek banks, the stability of proposed head slopes of the bridge, and to provide preliminary recommendations for stabilization and erosion protection works. The analyses were performed under assumed long-term groundwater and creek water levels. Creek bank and head slopes with a minimum long-term FS of 1.5 under assumed long-term groundwater and creek water levels are considered to be stable.

Figure 3.2 Slope instability on west bank, downstream of the Ness Avenue culvert.

The stability analysis was conducted using a limit-equilibrium slope stability model (Slope/W) from the GeoStudio 2007 software package (Geo-Slope International Inc.). A static piezometric line was used to represent groundwater and creek water levels. The slope stability model used the Morgenstern-Price method of slices to calculate factors of safety. Critical local and global slip surfaces were identified using a grid and radius slip surface method.

The west bank directly downstream of the culvert crossing and adjacent to Alcott Street cul-de-sac is considered to be marginal with calculated factors of safety ranging between 1.1 and 1.2. The stability of the east bank was also analyzed and the calculated factors of safety were greater than 1.5, indicating acceptable levels of stability.

The stability analyses of the creek banks, to a distance of 75 m upstream of the crossing, resulted in a calculated FS greater than 1.5 at the west and east bank. The analyses for the creek banks downstream of the Alcott Street cul-de-sac to a distance of 150 m downstream of the crossing resulted in calculated FS greater than 1.5 for both banks.

Based on the results of the stability analyses of the existing conditions of the creek banks, stabilization works are required on the west bank directly downstream of the existing culvert adjacent to the Alcott Street cul-de-sac and further downstream at the location of the observed instabilities. Space on the creek bank between the Alcott Street cul-de-sac and Sturgeon Creek is limited which limits the options for stabilization works in the area.

3.1.4 Hydrogeology

Bedrock in the Winnipeg region consists of limestones, dolomites, and calcareous shales. Glaciers deposited the layer of till that presently overlies the bedrock in the Winnipeg area. Meltwater from the last retreating glacier formed Glacial Lake Agassiz, and the sediments deposited in the lake formed the Agassiz clay deposits in the Winnipeg area. Weathering of the Agassiz clay deposits, combined with deposition from periodic flooding of the Red and Assiniboine Rivers, resulted in the current surficial deposits, which include the surface soils of the Winnipeg area (Grove and Pupp 1995).

There are three main lithologic units that control the hydrogeologic conditions in the City of Winnipeg (Grove and Pupp 1995).

(1) The upper unit consists of glaciolacustrine clay deposits, with occasional silt horizons, that contain variable shallow ‘perched’ water table conditions created by infiltration of surface waters.

(2) A complex till zone with intertill sand and gravel deposits underlies the clays at a depth of 15 m to 20 m. The composition of the basal till is highly variable and localized aquifers may exist where the till is predominantly sand and gravel. The bedrock is composed of carbonate and sandstone deposits and occurs at a depth of approximately 20 m to 25 m.

(3) The bedrock aquifers are confined, with the dominant groundwater flow direction towards the centre of the Winnipeg draw down cone near the confluence of the Red and Assiniboine rivers.

3.1.5 Noise and Vibration

Ness Avenue is a main traffic artery and transit route in a primarily residential neighborhood. The properties adjacent to the Project site are primarily residential and commercial. The area is currently subject to noise and vibration from traffic on Ness Avenue, consisting of passenger vehicles, commercial trucks, and buses.

3.2 TERRESTRIAL ENVIRONMENT

3.2.1 Vegetation and Habitat

The Project area is a disturbed urban residential site. The native vegetation was historically cleared during the development of agricultural lands and followed by residential properties. The creek banks were until recently landscaped and maintained as residential lawns. Community-based initiatives have lately promoted the development of a more natural riverbank vegetation through programs such as “no-mow” zones adjacent to the creek.

The City of Winnipeg, Naturalist Services has conducted periodic vegetation surveys along the creek. At the Sturgeon Creek 1, Site 393 (including the project site), 86 plant species comprising a mix of native and introduced species were observed (Table 3.5; City of Winnipeg 2015). This site was classified as Grade C/D habitat which is defined as having a low to minimum sensitivity to disturbance due to being a moderate to heavily disturbed site where vegetation is dominated by weed species with few native species present (City of Winnipeg 2015).

Sturgeon Creek 1 is categorized as Riverbottom Forest habitat. Riverbottom forests can generally be divided into three sections: the channel shelf or riverbank, the floodplain, and the terrace, all of which can also be defined by the plant communities. The project site, through historic clearing, development, and landscaping, retains few, if any, Riverbottom Forest vegetation characteristics.

Table 3.5 Vegetation observed at Sturgeon Creek 1, including the Ness Avenue Bridge Project site (after City of Winnipeg 2015).

Common Name	Scientific Name	Native/Introduced
Manitoba maple	*Acer negundo*	N
Quack- grass, Couch-grass	*Agropyron repens*	I
Wheatgrass	*Agropyron spp.*	
Perennial ragweed	*Ambrosia psilostachya*	N
Great ragweed	*Ambrosia trifida*	N
Spreading dogbane	*Apocynum androsaemifolium*	N
Absinthe	*Artemisia absinthium*	I
Garden asparagus	*Asparagus officinalis*	I
Heath aster	*Aster ericoides var. pansus*	N
Small blue aster	*Aster simplex*	N
Aster	*Aster spp.*	
Purple milk-vetch	*Astragulus danicus*	
Pigweed	*Axyris spp.*	
Common beggarticks	*Bidens frondosa*	N
Wild mustard	*Brassica kaber*	I
Mustard	*Brassica spp.*	
Smooth brome	*Bromus inermis*	I
Creeping bluebell	*Campanula rapunculoides*	I
Canada thistle	*Cirsium arvense*	I
Hedge bindweed, Wild	*Convolvulus sepium*	N
morning-glory		

Common Name	Scientific Name	Native/Introduced
Red osier dogwood	*Cornus stolonifera*	N
Wild cucumber	*Echinocystis lobata*	N
Rocket	*Erysimum spp.*	
Leafy spurge	*Euphorbia esula*	I
Black ash	*Fraxinus nigra*	N
Green ash	*Fraxinus pennsylvanica*	N
Northern bedstraw	*Galium boreale*	N
Wild licorice	*Glycyrrhiza lepidota*	N
Foxtail barley	*Hordeum jubatum*	N
Rush	*Juncus spp.*	
Lesser duckweed	*Lemna minor*	N
Purple loosestrife	*Lythrum salicaria*	I
Two-leaved Soloman's-	*Maianthemum canadense*	N
seal,Wild lilly of the valley		
Pineappleweed	*Matricaria matricarioides*	I
Black medick	*Medicago lupulina*	I
Alfalfa	*Medicago sativa*	I
White sweet-clover	*Melilotus alba*	I
Yellow sweet-clover	*Melilotus indica*	I
Sweet clover	*Melilotus spp.*	I
Yellow parilla	*Menispermum canadense*	N
Yellow wood-sorrel	*Oxalis stricta*	N
Reed canary grass	*Phalaris arundinacea*	N
Little seed canary grass	*Phalaris minor*	
White spruce	*Picea glauca*	N
Common plantain	*Plantago major*	I
Kentucky blue grass	*Poa pratensis*	N/I
Water smartweed	*Polygonum amphibium*	N
Doorweed	*Polygonum aviculare*	I
Water smartweed	*Polygonum coccineum*	
Smartweed	*Polygonum spp.*	
Balsam poplar	*Populus balsamifera*	N
Cottonwood	*Populus deltoides*	N
Silverweed	*Potentilla anserina*	N
Bur oak	*Quercus macrocarpa*	N
Macoun	*Ranunculus macounii*	N
Poison ivy	*Rhus radicans var. rydbergii*	
Low prairie rose	*Rosa arkansana*	N
Rose	*Rosa spp.*	
Curled dock	*Rumex crispus*	I
Sandbar willow	*Salix exigua*	N

Common Name	Scientific Name	Native/Introduced
Willow	*Salix spp.*	
Chair-maker's rush	*Scirpus americanus*	N
Bulrush	*Scirpus spp.*	
Foxtail	*Setaria spp.*	
Star-flowered Solomon's-seal	*Smilacina stellata*	N
Perennial sow-thistle	*Sonchus arvensis*	I
Sow thistle	*Sonchus spp.*	I
Prairie cord grass	*Spartina pectinata*	N
Marsh hedge-nettle	*Stachys palustris*	N
Western snowberry	*Symphoricarpos occidentalis*	N
Tansy	*Tanacetum vulgare*	I
Dandelion	*Taraxacum officinale*	I
Dandelion	*Taraxacum spp.*	
Tall meadow-rue	*Thalictrum dasycarpum*	N
Stinkweed, Field pennycress	*Thlaspi arvense*	I
Alsike clover	*Trifolium hybridum*	I
Clover	*Trifolium spp.*	
Nodding trillium	*Trillium cernuum*	N
Common cat-tail	*Typha latifolia*	N
Cat-tail	*Typha spp.*	
American elm	*Ulmus americana*	N
Stinging nettle	*Urtica dioica*	N
Tufted vetch	*Vicia cracca*	I
Cocklebur	*Xanthium strumarium*	N

3.2.2 Wildlife

Community groups have reported observations of a number of wildlife species within the greenway. Mammals that can occur in Winnipeg urban green spaces include chipmunks (*Tamias* spp.), eastern cottontail rabbit (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), American red squirrel (*Tamiasciurus hudsonicus*), ground squirrels (*Spermophilus spp.*), meadow voles (*Microtus pennsylvanicus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), muskrat (*Ondatra zibethicus*), and red fox (*Vulpes vulpes*). Amphibians that could reasonably be expected to occur along the greenway and make use of permanent water cover include Northern Leopard Frog (*Lithobates pipiens*), Wood Frog (*Lithobates sylvaticus*), and Boreal Chorus Frog (*Pseudacris maculata*) (NatureNorth 2015). Migratory and resident birds could also be expected to make use of the greenway.

3.2.3 Terrestrial Species of Concern

The Project site is within the historic or existing ranges of a number of bird species of concern identified through the Manitoba *Endangered Species and Ecosystems Act* (MESEA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and the *Species at Risk Act* (SARA). The Sturgeon Creek Greenway habitat at the Project site is characterized as a moderate to heavily disturbed area disturbed site where vegetation is dominated by weed species with few native species present. Although recent

community-based initiatives, such as no-mow zones, have recently been adopted to help the re-establishment of native vegetation communities along the creek, it will be a number of years before the effects of years of disturbance can be reversed. It is unlikely that any of the potential bird species of concern occur in the Project area beyond passing through during migration.

The Northern Leopard Frog (*Lithobates pipiens*) is known to occur within the Regional Study Area although there are no recent observations within the Project area (NatureNorth 2015). Northern Leopard Frogs require three habitat types in close proximity in order to carry-out lifecycle stages:

- Spring breeding habitat: characterized by warm, shallow waters with some degree of permanence and containing no predatory fish.
- Summer foraging habitat: consists of moist riparian or upland areas that are neither heavily wooded nor sparsely vegetated.
- Winter habitat: consists of cold, well oxygenated waterbodies that do not freeze solid during the winter.

The Sturgeon Creek riparian zone could provide summer foraging habitat but the presence of predatory fish in the creek reduces the quality of breeding habitat. The scour pool downstream of the culvert does not freeze solid could provide overwintering habitat. The viability of the pool as overwintering habitat is questionable. Water quality monitoring results during the open water season show total phosphorus consistently exceeds Manitoba Water Quality Standards, Objectives, and Guidelines values and indicate the creek is eutrophic. Eutrophication combined with no-flow in the winter often result in low oxygen concentrations. Marginal overwintering and foraging habitat along with separation from preferred breeding areas suggests that available habitat in the Project area has a limited potential for supporting Northern Leopard Frogs.

3.3 AQUATIC ENVIRONMENT

Sturgeon Creek is a small, fourth-order prairie stream originating in the Municipality of Woodlands and flowing southeast through the municipalities of Rosser and Assiniboia before discharging into the Assiniboine River at Winnipeg. The upstream reaches in Woodlands and Rosser are part the Manitoba agricultural drain system; however, the lower reaches in Assiniboia and Winnipeg are not designated as an agricultural drain (Water Resources Branch Designation of Drains (DES) Map No. 26, Sturgeon Creek and Associated Watersheds). The Sturgeon Creek watershed is approximately 556 km^2 at the project site while the mouth is located 2.6 km downstream. When compared to prairie streams of similar size, the low sinuosity of Sturgeon Creek indicates that the stream has likely been confined and channelized during the growth of adjacent developments.

3.3.1 Hydrology

Several streamflow gauges were utilized for analyzing the area hydrology. Upstream of the Project, the Water Survey of Canada streamflow gauge (Sturgeon Creek near Perimeter Highway - WSC 05MJ011) was selected to reflect the hydrological conditions of Sturgeon Creek within the Project limits. Downstream of the Project, the Manitoba Water Stewardship streamflow gauge (Sturgeon Creek at St James – 05MJ004) was correlated with overlapping data from the upstream gauge site record enabling the extension of the streamflow records at the upstream site for years when data was not recorded.

The selected design discharge for the replacement structure is the 1% flood discharge of 76 m^3/s. Consideration was also made for the stage-discharge relationship, fish passage discharge (3QD10 of 49 m^3/s), and navigation discharge (50% flood discharge of 22 m^3/s).

3.3.1.1 Hydraulics

A hydraulic assessment of the existing Sturgeon Creek was undertaken to determine the hydraulic characteristics of the waterway and downstream structures which influence the overall hydraulics of the channel. The model was developed using an existing HEC-RAS model previously used for other hydraulic studies. The model confirmed that even for a flood event of 50% (downstream water level of 232.52m), the clearance to the underside of the existing box culvert soffit would be 0.3m submerged, and for any flood event of 10% or greater (downstream water level of 233.28m), Ness Avenue would be overtopped with water.

Hydraulic and regulatory design criteria for the proposed replacement structure is as follows:

- Design discharge for 1% flood event (76 m3/s);
- Maximum headloss of 0.3m during the passage of the design discharge;
- Bridge opening velocities < 1.5m/s for discharges up to the design discharge (for Q1%, bridge opening velocity = 0.95 m/s); and
- Underside of girder elevation to remain ≥ 0.3m above the water surface during passage of the design discharge (for Q1%, clearance to underside of girder = 1.78m).

The replacement structure will require the removal of the existing box culvert and the excavation and armouring of the channel slopes. The channel headslopes beneath the bridge will be excavated with an effective slope of 4:1 extending down from the abutments to the channel base. Class 450 rock, over non-woven geotextile, will be placed to a thickness of 0.6m to armour the channel base and slopes. The channel base will be reshaped to a width of 6.0m, with a finished elevation of 229.80m. Armouring of the channel will be required 5m upstream and downstream of the new bridge structure.

The western shoreline and the channel downstream of the Ness Avenue crossing has been heavily scoured by high velocities and turbulent flow exiting the undersized box culvert. A new bridge structure, however, will provide considerably greater conveyance area, resulting in lower stream velocities, even under extreme flows. Concerns related to continued scour of the channel and the shoreline, therefore, have been addressed and will be minimized. Channel armouring during the Detailed Design phase (Phase 2) will investigate the use of the most suitable material, including investigation into the use of cable concrete for stabilizing of the western shoreline downstream of the bridge.

3.3.2 Water Quality

The City of Winnipeg, Water and Waste Department has been undertaking water quality monitoring during the open water season in Sturgeon Creek since 2007. The monitoring is part of a program to measure the health of Winnipeg's waterways. The program tests for 17 parameters, including nutrients, dissolved oxygen and bacteria. Sturgeon Creek is sampled at two locations: upstream of the Project site at the Perimeter Highway (PTH 101) crossing; and downstream of the Project site at the Portage Avenue crossing. Results for 2014 are presented in tables 3.6 and 3.7. Total phosphorous concentrations indicate Sturgeon Creek is eutrophic between the Perimeter Highway and Portage Avenue.

Table 3.6 City of Winnipeg 2014 small streams survey water quality monitoring results for Sturgeon Creek at the Perimeter Highway.

Location		Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy	Sturgeon Ck at Perimeter Hwy
Sampling Date	**Unit**	**14-May-14**	**28-May-14**	**11-Jun-14**	**June 25, 104**	**9-Jul-14**	**23-Jul-14**	**6-Aug-14**	**20-Aug-14**	**3-Sep-14**	**17-Sep-14**	**1-Oct-14**	**15-Oct-14**	**28-Oct-14**
Temperature	° C	8.2	20.1	15.5	18.3	20.3	19.6	18.6	18.9	16.4	11.7	12.3	8.9	6.2
Dissolved Oxygen	mg/L	10.3	10.4	7.6	6.2	6.0	9.0	7.7	7.8	7.2	10.7	9.2	10.7	10.8
Oxygen Saturation[1]	%	87	115	76	66	67	98	81	84	73	99	86	93	87
Biochemical Oxygen Demand	mg/L	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	3
pH	units	7.78	8.25	7.76	7.51	7.45	7.84	7.83	7.79	7.79	8.16	8.03	8.07	7.85
Total Solids	mg/L	474	620	1170	462	520	1000	1350	1350	1420	1000	1130	1250	1290
Total Suspended Solids	mg/L	17	<3	4	15	15	8	8	4	4	3	4	5	8
Turbidity	n.t.u.	30.0	10.3	5.0	38.6	38.9	8.1	7.6	5.3	7.2	4.5	6.2	5.1	6.5
Total Organic Carbon	mg/L	20	21	13	26	25	18	10	17	21	23	9	13	12
Chlorophyll a	ug/L	1	13	1	3	2	5	6	3	6	<1	4	1	22
Ammonia Nitrogen	mg/L N	0.010	<0.003	0.013	0.034	0.046	0.031	0.039	0.009	0.098	0.056	0.012	0.02	0.094
Nitrate Nitrogen	mg/L N	0.042	0.020	0.015	0.078	0.083	0.013	<0.003	0.013	0.074	0.009	0.006	0.023	0.032
Total Kjeldahl Nitrogen	mg/L N	1.5	2.5	1.6	3.1	1.1	1.3	0.9	0.7	1.7	<0.5	<0.5	2.100	0.7
Total Nitrogen[1]	mg/L N	1.5	2.5	1.6	3.2	1.2	1.3	0.9	0.7	1.8	<0.5	<0.5	2.1	0.7
Soluble Phosphorus	mg/L P	0.31	0.33	0.07	0.49	0.70	0.30	0.02	0.04	0.42	0.06	0.07	0.0	0.07
Total Phosphorus	mg/L P	0.50	0.40	<0.20	0.60	1.00	0.50	0.20	<0.20	0.50	<0.20	0.30	0.30	0.40
Escherichia Coliform	MPN/100 mL	9	43	43	230	230	230	NR	43	43	23	75	43	230
Fecal Coliform	MPN/100 mL	23	430	43	230	230	230	NR	43	93	23	150	43	230

Notes [1] = Calculated Values
NR = no results for coliforms due to contract lab error

Table 3.7 City of Winnipeg 2014 small streams survey water quality monitoring results for Sturgeon Creek at Portage Avenue.

Location		Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave	Sturgeon Ck at Portage Ave
Sampling Date	**Unit**	**14-May-14**	**28-May-14**	**11-Jun-14**	**June 25, 104**	**9-Jul-14**	**23-Jul-14**	**6-Aug-14**	**20-Aug-14**	**3-Sep-14**	**17-Sep-14**	**1-Oct-14**	**15-Oct-14**	**28-Oct-14**
Temperature	º C	8.9	20.2	18.6	18.2	20.2	21.6	22.2	21.0	17.2	12.5	13.3	9.0	6.7
Dissolved Oxygen	mg/L	10.5	10.3	7.4	7.5	7.4	8.2	8.0	3.6	8.2	9.7	7.3	10.6	9.6
Oxygen Saturation[1]	%	91	113	79	80	81	93	91	39	85	91	69	92	78
Biochemical Oxygen Demand	mg/L	<3	4	<3	<3	<3	<3	4	<3	<3	<3	<3	<3	4
pH	units	7.97	8.19	8.04	7.59	7.56	8.16	8.27	7.63	8.10	8.38	8.02	8.36	8.05
Total Solids	mg/L	498	754	1420	504	492	1220	1660	1340	1400	1050	1020	1390	1350
Total Suspended Solids	mg/L	15	20	10	64	37	16	27	8	13	11	8	9	14
Turbidity	n.t.u.	33.2	22.6	10.6	94.0	52.2	12.9	19.4	4.1	12.0	8.2	8.4	7.9	10.3
Total Organic Carbon	mg/L	20	23	14	26	23	20	14	16	14	23	9	10	15
Chlorophyll a	ug/L	1	40	1	1	4	27	13	8	3	6	7	4	27
Ammonia Nitrogen	mg/L N	0.0009	<0.003	0.058	0.084	0.638	0.010	0.049	<0.003	0.114	0.046	0.067	0.08	0.156
Nitrate Nitrogen	mg/L N	0.105	0.045	0.076	0.096	0.127	0.125	0.146	<0.003	0.172	0.085	0.588	0.459	0.313
Total Kjeldahl Nitrogen	mg/L N	1.5	2.8	1.7	10.2	0.8	2.1	1.0	0.7	1.7	<0.5	<0.5	<0.5	1.3
Total Nitrogen[1]	mg/L N	1.6	2.8	1.8	10.3	0.9	2.2	1.1	0.7	1.9	<0.5	0.8	0.7	1.6
Soluble Phosphorus	mg/L P	0.29	0.17	0.12	0.58	0.67	0.25	0.08	0.08	0.14	0.07	0.07	0.04	0.28
Total Phosphorus	mg/L P	0.40	0.30	0.20	0.80	0.90	0.60	0.20	<0.20	0.20	<0.20	<0.2	0.30	0.30
Escherichia Coliform	MPN/100 mL	43	430	93	230	230	230	NR	430	150	43	430	28	93
Fecal Coliform	MPN/100 mL	430	430	93	230	430	430	NR	430	750	93	2300	28	93

Notes [1] = Calculated Values
NR = no results for coliforms due to contract lab error

3.3.3 Fish and Fish Habitat

3.3.3.1 Fish Habitat

Sturgeon Creek is a natural watercourse that has been historically confined through agricultural and later residential developments. As a result, the channel a low sinuosity ratio and low degree of physical habitat heterogeneity. Channel gradient at the Project site is low, 0.06%, and the existing Ness Avenue culvert acts as a hydraulic control during periods of high flow. The low gradient and control combine to create a depositional channel. Normal summer water depth in the channel ranges from 0.5 m to 1.5 m with incidental pools of greater depth. The wetted channel width ranges from 9.0 m to 15.0 m but widens to 30.0 m at the scour pool downstream of the Ness Avenue culvert. Creek bed substrate is composed mainly of fine silt and clays resulting from upstream transport and deposition at the Project site. During high flow, discharges through the culvert are accelerated and directed towards the west bank. This has resulted in an erosional scarp, doubling the width of the channel, and a scour pool with depths exceeding 3.0 m.

The stream banks are fully vegetated with secondary growth that is dominated by grasses with occasional shrubs. Incidental trees are beginning to grown up along the banks. Cattail (*Typha latifolia*) have colonized the entire streambed in the upstream portion of creek and are gradually reduced to the margins of an open channel downstream. Dense beds of submerged macrophytes such as common waterweed (*Elodea candensis*), milfoil (*Myriophyllum* sp.), and pondweed (*Potamogeton* sp.) occur in the open channel. The margins of the creek have been classified the City Naturalist Services as Grade C wetland (City of Winnipeg 2015a). Grade C habitat is characterized by a low sensitivity to disturbance resulting from prior moderate disturbance, a significant number of weed species which have replaced native species, and few native species present. The no-mow zone is expected to facilitate the return of native species.

During normal summer water levels habitat in the creek is a shallow, slow run (uniform flow) or flat (standing water), dependent on precipitation events for flow. Large-body fish migration through the reach but is likely impeded by high discharge velocities through the existing culvert. Overwintering habitat in the LSA is likely available for small-body species in the occasional deeper pools. The scour pool provides deeper overwintering habitat that could support large-body species, however; the high phosphorus load and resulting organic biomass in the stream during open water months may reduce available oxygen therefore viability of the of the pool as overwintering habitat for large-body species.

Sturgeon Creek has been designated as Type A habitat (complex habitat, indicator fish species) on Map 062H14 in Milani (2013). The City of Winnipeg Naturalist Services has classified Sturgeon Creek at the Project site as Grade C habitat, characterized by a low sensitivity to disturbance resulting from prior moderate disturbance (City of Winnipeg 2015a).

3.3.3.2 Fish Community

A species list compiled by Manitoba Conservation and Water Stewardship – Fisheries Branch for the City of Winnipeg Naturalist Services contains over 30 species of fish with the potential to use Sturgeon Creek (City of Winnipeg 2015a). The list includes a disclaimer that the presence of some species is in question therefore it is likely the list is based on the possibility for species known to occur in the Assiniboine and Red rivers to access the creek using references such as Stewart and Watkinson (2004). If so, the list can be updated to include 43 species (Table 3.8). The number of species that can actually occur, as residents or seasonally, is likely much less and is borne out by the results of recent fish community surveys. A migration barrier in the lower reaches at Grant's Old Mill likely inhibited or prevented migration upstream of fishes from the lower reaches and Assiniboine River. In the 1990s, habitat rehabilitation works that included riffles and fishways were undertaken to restore the migration corridor.

Fish community surveys were conducted in Sturgeon Creek upstream of the Project site, within the City limits (Penner 2008) and farther upstream (Milani 2013). The surveys found seven fish species, including two native large-body species, Northern Pike (*Esox lucius*) and White Sucker (*Catostomus commersoni*), one invasive large-body species, Common Carp (*Cyprinus carpio*), and four small-body species (Table 3.8). The large-body species are known to migrate up streams to spawn and may not be year-round residents. The presence of the large-body species may be more of an indication of the effectiveness of the migration barrier rehabilitation works. Three of the small-body species, Brook Stickleback (*Culea inconstans*), Central Mudminnow (*Umbra limi*), and Fathead Minnow (*Pimephales promelas*), are known to be able to colonize oxygen-deficient waters (Stewart and Watkinson 2004). The occurrence of these species is indicative of oxygen-deficient habitats such as bogs and agricultural drains and often the absence of large-body species (Stewart and Watkinson 2004). The presence of these species indicates that the upstream reaches likely undergo seasonal oxygen stress and that overwintering areas likely occur as microhabitats.

Fish community surveys were conducted in the lower reaches by Penner (2008). The surveys resulted in the capture of eight fish species (Table 3.8). Only three species, White Sucker, Brook Stickleback, and Fathead Minnow, were also observed upstream of the Project site. The remaining five species were all large-body and are typically found in medium to large rivers (Stewart and Watkinson 2004). It is unlikely these five species are residents of Sturgeon Creek but rather Assiniboine River fish making seasonal use of the lowest reaches of the creek.

All fish species observed in Sturgeon Creek are either spring or summer spawners.

Table 3.8 Fish species observed in Sturgeon Creek.

Common Name	Scientific Name	Creek Mouth	Upstream of Project
Bigmouth Buffalo	*Ictiobus cyprinellus*	X	
Black Bullhead	*Ameiurus melas*		
Black Crappie	*Pomoxis nigromaculatus*		
Western Blacknose Dace	*Rhinichthys obtusus*		
Blacknose Shiner	*Notropis heterolepis*		
Bluntnose Minnow	*Pimephales notatus*		
Brassy Minnow	*Hybognathus hankinsoni*		
Brook Stickleback	*Culaea inconstans*	X	X
Brown Bullhead	*Ameiurus nebulosus*		
Common Carp	*Cyprinus carpio*		X
Central Mudminnow	*Umbra limi*		X
Channel Catfish	*Ictalurus punctatus*	X	
Common Shiner	*Luxilus cornutus*		X
Creek Chub	*Semotilus atromaculatus*		
Emerald Shiner	*Notropis atherinoides*		
Fathead Minnow	*Pimephales promelas*	X	X

Common Name	Scientific Name	Creek Mouth	Upstream of Project
Flathead Chub	*Platygobio gracilis*		
Freshwater Drum	*Aplodinotus grunniens*		
Golden Redhorse	*Moxostoma erythrurum*		
Golden Shiner	*Notemigonus crysoleucas*		
Goldeye	*Hiodon alosoides*	X	
Johnny Darter	*Etheostoma nigrum*		
Logperch	*Percina caprodes*		
Longnose Dace	*Rhinichthys cataractae*		
Mooneye	*Hiodon tergisus*		
Northern Pike	*Esox lucius*		X
Quillback	*Carpiodes cyprinus*		
River Shiner	*Notropis blennius*		
Rock Bass	*Ambloplites rupestris*	X	
Sand Shiner	*Notropis stramineus*		
Sauger	*Sander canadensis*		
Shorthead Redhorse	*Moxostoma macrolepidotum*	X	
Silver Chub	*Macrhybopsis storeriana*		
Silver Lamprey	*Ichthyomyzon unicuspis*		
Silver Redhorse	*Moxostoma anisurum*		
Slimy Sculpin	*Cottus cognatus*		
Spottail Shiner	*Notropis hudsonius*		
Stonecat	*Noturus flavus*		
Tadpole Madtom	*Noturus gyrinus*		
Trout-perch	*Percopsis omyscomacus*		
Walleye	*Sander vitreus*		
White Sucker	*Catostomus commersoni*	X	X
Yellow Perch	*Perca flavescens*		
Sources: Milani 2013; Penner 2008; Stewart and Watkinson (2004)			

3.3.3.3 Aquatic Species of Concern

No aquatic species of concern have been observed at the Project site in Sturgeon Creek. Two aquatic species of concern are known to occur near the in or near Sturgeon Creek.

Bigmouth Buffalo (*Ictiobus cyprinellus*) are listed as Special Concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and have a *Species at Risk Act* (SARA) status as Schedule 1, Special Concern (COSEWIC 2009; Environment Canada 2015a). Bigmouth Buffalo have been observed at the mouth of Sturgeon Creek but are not likely creek residents. Bigmouth Buffalo prefer still or slow-moving water of large rivers or lakes and move into shallow water in marshes and flooded riverbanks to spawn (Stewart and Watkinson 2004). It would be atypical for Bigmouth Buffalo to migrate upstream within Sturgeon Creek.

Mapleleaf Mussel (*Quadrula quadrula*) are listed as Endangered by COSEWIC and have a SARA status as Schedule 1, Endangered (COSEWIC 2006; Environment Canada 2015b). Mapleleaf Mussel have not been observed in Sturgeon Creek but are known to occur in the lower Assiniboine River (COSEWIC 2006). Mapleleaf Mussel are known to occur in medium to large rivers with slow to moderate current, big river embayments, shallow lakes and in deep river impoundments (COSEWIC 2006). The known host species, Channel Catfish (*Ictalurus puntatus*), is known to enter Sturgeon Creek but has not been recorded upstream of the Portage Avenue crossing (Milani 2013; Penner 2007). Sturgeon Creek, particularly at the Project site, does not provide preferred habitat therefore it is highly unlikely that Mapleleaf Mussel would be found in the creek upstream of Grant's Old Mill.

3.4 HUMAN ENVIRONMENT

3.4.1 Regional Economy

Manitoba has a well-diversified economy. Major industries include: agri-foods, transportation equipment, resource-based industries, chemicals, machinery and equipment, furniture and building products, paper products, fabricated metal products, plastics, printing, apparel, electronics, information technology and telecommunications, aerospace, farm equipment, hydroelectric generation, life sciences and biotechnology, environmental services, and culture and tourism. Manufacturing is Manitoba's largest industry, accounting for approximately 12% of the province's GDP, followed by the province's primary industries (mining, agriculture and forestry) which account for approximately 7% of the economy (Province of Manitoba 2010). Service industries account for 72% of the GDP. Provincial GDP, employment and import/export statistics for the years 2004 to 2008 are detailed in Table 3.11.

Table 3.9 Manitoba Economic Characteristics (2004 - 2008).

Economic Indicators	2004	2005	2006	2007	2008
Real GDP (mkt prices) % growth	2.2	2.7	3.9	3.1	2.2
Real GDP per Capita (mkt prices) $	32,009	32,753	33,851	34,627	34,955
Employed (thousands)	577	580	587	597	607
Unemployment Rate (%)	5.3	4.8	4.3	4.4	4.2
CPI, All Items (2002 =100)	104	107	109	111	113
Total Private Investment ($ million)	5,082	5,091	5,811	6,267	7,221
Manufacturing shipments ($ million)	13,262	13,702	14,854	16,111	16,409
Exports ($ million)	9,297	9,301	10,195	12,192	12,830
Imports ($ million)	10,565	11,796	12,426	13,151	15,292

Source: Province of Manitoba 2010

In the Winnipeg Census Metropolitan Area (CMA), healthcare, manufacturing, business and finance, government, transportation, and sales and services are the largest employers. Winnipeg's diverse economy experienced significant growth in recent years and was one of only a few Canadian cities to experience any overall growth in 2009. The unemployment rate in the third quarter of 2009 was 5.1% compared to the national average of 8.2% (Destination Winnipeg 2010).

3.4.2 Community and Neighbourhood Characteristics

The Project is located in the Sturgeon Creek and Heritage Park neighbourhoods of the St. James – Assiniboia West neighbourhood cluster. The neighbourhoods are bound by Portage Avenue to the south, Sturgeon Road to the east, Saskatchewan Avenue to the north, Muriel Street to the west, and separated by Sturgeon Creek. Both neighbourhoods are residential with some commercial developments along major roads. (City of Winnipeg 2015).

3.4.3 Land Use

The Sturgeon Creek and Heritage Park neighbourhoods are zoned for residential and small commercial developments. Sturgeon Creek is located within the Sturgeon Creek Greenway which runs from Saskatchewan Avenue south to the Assiniboine River.

3.4.3.1 Existing Land Use

The Sturgeon Creek Greenway is zoned as a civic park. A multi-use trail runs the length of the park adjacent to the creek. Community-based, volunteer stream stewardship groups have been actively involved in preserving, protecting, and restoring the natural habitat along Sturgeon Creek. Activities include stream clean-up and greening activities, fish habitat enhancements, and protection of riparian zones.

3.4.3.2 Planned Land Use

There are no changes planned for the Sturgeon Creek Greenway.

3.4.4 Heritage Resources

Sturgeon Creek at the Project site has been confined by development. The Project site was disturbed during the construction of the existing culvert and installation of buried utilities. During the construction of roads and residences, the ground was leveled and contoured using clay fill.

A review of heritage resources databases, including the Heritage Resources Branch (HRB), Manitoba Historical Society (MHS), City of Winnipeg Heritage Conservation, and Canada's Historic Places (CHP) websites, was conducted to determine if any heritage resources or historical sites are located within the Project site or LSA (HRB 2015; MHS 2015; City of Winnipeg 2015b). No historic resources were identified in the LSA.

3.4.5 Aboriginal Interests

The City of Winnipeg is located in Treaty No.1, signed in 1871 between the Government of Canada and the Chippewa and Swampy Cree Indian Tribes. The nearest reserve lands are located over 50 km outside the City of Winnipeg (Table 3.10; INAC 2015). There are no known outstanding aboriginal land claims or active traditional use for lands in the RSA.

Table 3.10 Proximity to First Nations Reserves.

Reserve Name	First Nations Band	Distance from Winnipeg (km)	Direction
Broken Head Indian Reserve 4	Brokenhead Ojibway Nation	64	NE
Dakota Plains 6A	Dakota Plains	74	W
Roseau River 2	Roseau River Anishinabe First Nation Government	80	S

Source: Indian and Northern Affairs Canada (INAC) 2015

4.0 EFFECTS ASSESSMENT, MITIGATION AND MONITORING

4.1 ENVIRONMENTAL ASSESSMENT APPROACH

4.1.1 Scope of Project

The Project includes the replacement of the Ness Avenue crossing at Sturgeon Creek, stabilization of the downstream west bank, and the realignment of the Sturgeon Creek Greenway trail. The works include isolation and partial dewatering of Sturgeon Creek during the winter and the repair of and replacement of sewers and water pipes. The stream flow capacity of the creek will be increased, the greenway will be defragmented, and the trail will be realigned to pass under the new bridge. All Project works within the stream channel were included in the assessment of Project-related effects.

4.1.2 Spatial Boundaries

4.1.2.1 Project Site

The Project site is defined as the area that will be directly disturbed by Project construction and/or operation. The Project site consists of the Sturgeon Creek channel and banks from 45 m upstream to 95 m downstream of the Ness Avenue crossing.

4.1.2.2 Local Study Area

The local study area (LSA) is defined as the area in which direct effects are anticipated to occur. The LSA for this Project is Sturgeon Creek and the riparian zones between the Hamilton Avenue crossing upstream (585 m) to the first AT crossing downstream (500 m) and the neighbourhoods of Heritage Park and Sturgeon Park.

4.1.2.3 Regional Study Area

The regional study area (RSA) is defined as the area in which both direct and indirect effects are anticipated to occur. The RSA for this Project is the City of Winnipeg, west of the Red River, north of the Assiniboine River and comprising the neighbourhood clusters of St. James-Assiniboia West and St. James-Assiniboia East.

4.1.3 Temporal Boundaries

Project-related tasks at site are planned to begin on October 18, 2015 and to be completed by September 15, 2016. All in-channel works will be complete by January 15, 2016.

4.1.4 Methods for Identifying, Predicting, and Assessing Effects

The environmental factors considered in the environmental impact assessment are listed in Table 4.1. Environmental effects of the project were identified, predicted or assessed using a stepwise approach. The first step involved characterization of the interaction between the project and environmental components, with respect to the nature of the interaction, the location, duration, and, where appropriate the magnitude/severity/intensity of the interaction. The reversibility of the interaction also was examined.

Table 4.1 List of factors to be considered in the Ness Avenue Crossing Replacement at Sturgeon Creek.

Physical Environment	Air Quality
	Noise and Vibration
	Hydrogeology
Terrestrial Environment	Vegetation
	Wildlife and Habitat
Aquatic Environment	Surface Hydrology
	Shoreline and Creek bank Stability
	Surface Hydrology
	Surface Water Quality
	Sediment Quality
	Fish and Fish Habitat
Human Environment	Human Health and Safety
	Existing or Planned Land Use
	Aesthetics
Accidental Release of Hazardous Materials	
Effects of the Environment on the Project	Climate change

4.1.4.1 Mitigation and Residual Effects

As much as possible, measures to prevent adverse effects have been built into the Project design and proposed construction methods. Mitigation measures were developed for any significant impacts identified during the determination of significance. To the extent possible, positive effects will be enhanced.

Residual impacts were determined by measuring mitigation measures against the predicted Project effects. If present, the severity, extent, and duration of any residual effects were identified.

4.1.4.2 Determination of Significance

A determination of the significance of any potential effects of the project on environmental components was conducted after the application of mitigation measures.

The mitigation measures to be applied to this project have been integrated into the project design; consequently, it is only the residual effects of the project which require assessment. The criteria employed in the assessment of effects significance and the associated methods for criteria application are described below.

Assessment of the significance of environmental effects of the Project involved the consideration and evaluation of specific characteristics, or attributes, of the effects. The attributes examined included the magnitude and geographic extent of the effects; the frequency of occurrence of the effects and their duration; the ecological and socio-economic context; the reversibility of the effect, and, the likelihood the effect will occur.

Significance assessment involves the evaluation of each effect attribute against a three-level significance ranking scale:

- Level I - a negligible or limited potential to contribute to an overall significant environmental effect;
- Level II – a moderate potential to contribute to an overall significant environmental effect;
- Level III - a high potential to contribute to an overall significant environmental effect.

The effects attributes and evaluation criteria for the environmental components identified are defined in Tables 4.2 through 4.4.

An effect defined as significant in this assessment meets both of the following criteria:

- A Level II or III rating is attained for ecological and/or socio-economic context; and,
- A Level II or III rating is attained for all of the attributes involving magnitude/extent, duration and frequency.

A Level I rating for any of the attributes involving magnitude/geographic extent, duration, or frequency; or, if a Level I rating is achieved for both ecological and socio-economic contexts (where applicable), then the effect is considered to be “not significant”.

Effects are also assessed as to their likelihood, recognizing that there is some overlap in the concepts of duration, frequency and likelihood.

4.2 ENVIRONMENTAL ASSESSMENT RESULTS

The environmental assessment results are presented in Table 4.5 while the overall effects of the Project are described in the following sections.

Table 4.2 Environmental Impact Significance Criteria.

Significance Level	Context		Extent		Frequency	Reversibility	Likelihood of Occurrence
	Ecological	Socio-Economic[1]	Magnitude / Geographic Extent	Duration			
I	No meaningful adverse ecosystem effects – effects within the range of natural variation	No meaningful adverse effects to socioeconomic interests – effects within year to year variation	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur infrequently, or not at all (i.e., <once per year)	Effect is readily Reversible over a relatively short period (i.e., ≤ period of construction)	Unlikely to occur
II	Adverse effects outside the range of natural variation, but Involving only common species or communities, or affecting resources of limited importance	Adverse effects involve measurable disturbance to local residents or land users, or to community character or services in portions of the study area	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur intermittently, possibly with some degree of regularity (i.e., <once per month)	Effect is reversible at substantial cost, and/or over long period (i.e., lifespan of project)	Could reasonably be expected to occur
III	Adverse effects involve locally, regionally, or nationally important species, communities, or resources	Adverse effects involve measurable disturbance to livelihoods, Traditional Use activities, community character, or to services throughout the study area	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur regularly or continuously (i.e., >once per month)	Effect is not reversible	Will occur, or is likely to occur

1 –Limited to consideration of environmentally (biophysical) induced socio-economic effects.

Table 4. 1 Environmental Impact Significance Criteria.

Significance Level	Context		Extent		Frequency	Reversibility	Likelihood of Occurrence
	Ecological	Socio-Economic[1]	Magnitude / Geographic Extent	Duration			
I	No meaningful adverse ecosystem effects – effects within the range of natural variation	No meaningful adverse effects to socioeconomic interests – effects within year to year variation	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur infrequently, or not at all (i.e., <once per year)	Effect is readily Reversible over a relatively short period (i.e., ≤ period of construction)	Unlikely to occur
II	Adverse effects outside the range of natural variation, but Involving only common species or communities, or affecting resources of limited importance	Adverse effects involve measurable disturbance to local residents or land users, or to community character or services in portions of the study area	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur intermittently, possibly with some degree of regularity (i.e., <once per month)	Effect is reversible at substantial cost, and/or over long period (i.e., lifespan of project)	Could reasonably be expected to occur
III	Adverse effects involve locally, regionally, or nationally important species, communities, or resources	Adverse effects involve measurable disturbance to livelihoods, Traditional Use activities, community character, or to services throughout the study area	See Table 4-3 for specific criteria	See Table 4-4 for group specific criteria	Effect expected to occur regularly or continuously (i.e., >once per month)	Effect is not reversible	Will occur, or is likely to occur

1 –Limited to consideration of environmentally (biophysical) induced socio-economic effects.

Table 4.3 Significance Criteria – Magnitude and Geographic Extent.

Component	Factor	Level I	Level II	Level III
Physical Environment	Air Quality	Emissions above background but within applicable federal and provincial regulations and guidelines; or if guidelines exceeded, effects limited to the project footprint	Emissions have the potential to exceed federal or provincial guidelines for areas beyond project footprint, resulting in potential for meaningful adverse environmental effects to resources (land, water, biota) or residents outside the project footprint.	Emissions are likely to exceed federal or provincial guidelines for areas beyond project footprint, resulting in meaningful, and unacceptable adverse environmental effects to resources (land, water, biota or residents outside the project footprint.
	Climate and meteorology	Greenhouse gas emissions of <0.1% of Canada's target CO_2 emission rate reduction of 240 Mt/a	Greenhouse gas emissions of 0.1 to 1.0% of Canada's target CO_2 emission rate reduction of 240 Mt/a	Greenhouse gas emissions of >1.0% of Canada's target CO_2 emission rate reduction of 240 Mt/a
	Water Quality - Surface	Water quality effects in receiving waters within applicable federal and provincial regulations and guidelines; or if guidelines exceeded, no anticipated adverse environment effects beyond any defined mixing zones	Water quality effects in receiving waters exceed applicable federal and provincial regulations and guidelines and have the potential to adversely affect[1] drinking water uses, aquatic life, and/or wildlife, beyond any defined mixing zones	Water quality effects in receiving waters applicable federal and provincial regulations and guidelines are likely to adversely affect[1] drinking water uses, aquatic life, and/or wildlife, beyond any defined mixing zones, likely resulting in an unacceptable effect
	Water Quantity - Surface	Change to creek flows is <15% of seasonal average	Change to creek flows is15 to 25% of seasonal average	Change to creek flows is >25% of seasonal average
	Water Quality - Ground	Water quality effects in receiving waters within applicable federal and provincial regulations and guidelines; or if guidelines exceeded, no anticipated adverse environment effects beyond any defined mixing zones	Water quality effects in receiving waters exceed applicable federal and provincial regulations and guidelines and have the potential to adversely affect drinking water uses, aquatic life, and/or wildlife, beyond any defined mixing zones	Water quality effects in receiving waters applicable federal and provincial regulations and guidelines are likely to adversely affect[1] drinking water uses, aquatic life, and/or wildlife, beyond any defined mixing zones, likely resulting in an unacceptable effect
Biological Environment	Aquatic Environment (aquatic life, fish, and fish habitat)	In water work or structures necessary but no net loss of the productive capacity of fish habitats[1]	In water work or structures necessary resulting in a net loss of the productive capacity of local fish habitat[1]	In water work or structures necessary resulting in a net loss of the productive capacity of regional fish habitat[1]

Component	Factor	Level I	Level II	Level III
	Vegetation	Effect considered minor (i.e., only affecting common species or communities), and confined to the project footprint.	Activity has the potential to measurably affect vegetation communities or species outside of the project footprint but effect limited to common species or communities.	Activity is likely to measurably affect vegetation communities or species outside the project footprint and may affect rare or protected species
	Wildlife and habitat, including: • Amphibians and reptiles • Migratory birds • Furbearers	Effect considered minor, occurring at the level of individuals and not affecting population size to a degree distinguishable from natural variation. Habitat alteration/loss restricted to project footprint.	Activity has the potential to measurably affect population size and/or habitat availability outside the project footprint.	Activity is likely to measurably affect population size and/or and habitat availability outside the project footprint.
Human Environment (changes to resulting from a direct change in the natural environment)	Human health and safety (safety, noise, air quality, aesthetics, recreational use)	Selected parameter changes by <10% from baseline conditions within project study area	Selected parameter changes by 10 to 20% from baseline conditions within project study area	Selected parameter changes by >20% from baseline conditions within project study area
	Heritage/archaeological structures/sites	Heritage/archaeological resources disturbed by the project but are recovered	Heritage/archaeological resources of local importance are disturbed by the project but are not recoverable	Heritage/archaeological resources of regional/national importance are disturbed by the project but are not recoverable

1 - Determined by DFO in consultation with Manitoba Water Stewardship.

Table 4.4 CEAA Significance Criteria – Duration.

Component	Level I	Level II	Level III
Physical and biological environment	Short-term - Effect not measurable beyond construction period (< 1 year)	Medium-term – Effect likely to persist though first 10 years of project operation	Long-term – Effect likely to persist beyond 10 years of project operation
Human environment (indirect effects resulting from a direct change in the environment)[1]	Short-term - Effect will occur for ≤ 1 year (construction phase)	Medium-term - Effect likely to persist though first 10 years of project operation	Long-term - Effect likely to persist beyond 10 years of project operation

Table 4.5 Environmental Assessment Results.

Factor	Potential Effect	Mitigation	Context		Extent					Residual Effects	Determination of Effects	Monitoring/Follow up
			Ecological	Socio-economic	Magnitude	Duration	Frequency	Reversibility	Likelihood			
Physical Environment												
Air Quality	Fugitive dust generated by equipment operation	None	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Intermittent Level I	Reversible Level I	Could reasonably be expected to occur Level II	Negligible	Not significant	None
	Exhaust generated by equipment operation	Limit vehicle idling; regular vehicle/equipment maintenance	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Not detectible beyond Project site Level I	Construction phase Level I	Regular Level II	Reversible over time Level I	Will occur Level III	Negligible	Not significant	None
Noise and Vibration	Vibration from construction activities such as heavy equipment operation	Investigate and respond to public concerns; adapt work activities to minimize effects	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Intermittent Level I	Reversible Level I	Could reasonably be expected to occur Level II	Negligible	Not significant	On-site monitoring
Soil Quality	Reduced soil quality as result of deleterious substance spills	Spill control and clean-up equipment maintain at site; fuel and service equipment in designated, contained area; excavate and treat any contaminated soils	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Could reasonably be expected to occur Level II	Negligible	Not significant	On-site monitoring
Groundwater Quality	Reduced ground water quality as result of deleterious substance spills	Spill control and clean-up equipment maintain at site; fuel and service equipment in designated, contained area; excavate and treat any contaminated soils	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible within a short period Level I	Could reasonably be expected to occur Level II	Negligible	Not significant	On-site monitoring
Terrestrial Environment												
Riparian Vegetation	Vegetation clearing of the Project site due to bank stabilization works and contouring	Retain trees, if possible; replant with native species and maintain until established	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site Level I	Construction and monitoring phases Level I	Once Level I	Reversible within a short period Level I	Will occur Level III	Negligible	Not significant	On-site monitoring; sediment control measures and re-vegetation works will be regularly monitored until vegetation re-established
Wildlife and Habitat	Vegetation clearing of the Project site due to bank stabilization works and contouring	Retain trees, if possible; replant with native species and maintain until established; conduct works outside of nesting season	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site	Construction and monitoring phases	Once	Reversible within a short period	Will occur	Negligible	Not significant	On-site monitoring; sediment control measures and re-vegetation works will be regularly

Factor	Potential Effect	Mitigation	Context		Extent					Residual Effects	Determination of Effects	Monitoring/Follow up
			Ecological	Socio-economic	Magnitude	Duration	Frequency	Reversibility	Likelihood			
			Level I	Level I	Level I	Level I	Level I	Level I	Level III			monitored until vegetation re-established
Aquatic Environment												
Stream Bank Stability	Use of heavy equipment along stream banks; loss of vegetation cover	Project involves bank stabilization works; retain trees, if possible; replant with native species and maintain until established	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site	Construction and monitoring phases	Once	Reversible within a short period	Will occur	Negligible	Not significant	On-site monitoring; sediment control measures and re-vegetation works will be regularly monitored until vegetation re-established
			Level I	Level I	Level I	Level I	Level I	Level I	Level III			
Surface Hydrology	Isolation of channel sections will restrict stream flow	Works to be conducted in the winter months when stream flow does not occur; monitor water levels; install pump to direct any potential flow around the isolated channel	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site	Construction and monitoring phases	Once	Reversible	Unlikely to occur	Negligible	Not significant	On-site monitoring
			Level I	Level I	Level I	Level I	Level I	Level I	Level I			
Surface Water Quality	Reduced water quality due to disturbance and transport of sediment	Conduct works during winter months when no stream and allow sediment to drop; isolate channel to limit sediment transport; protect disturbed areas to prevent erosion and scour; maintain upland sediment and erosion protection measures until vegetation cover established	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site	Construction and monitoring phases	Incidental	Reversible	Unlikely to occur	Negligible	Not significant	On-site monitoring
			Level I	Level I	Level I	Level I	Level I	Level I	Level I			
	Reduced water quality as result of deleterious substance spills	Spill control and clean-up equipment maintain at site; fuel and service equipment away from channel	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site	Construction and monitoring phases	Incidental	Reversible	Could reasonably be expected to occur	Negligible	Not significant	On-site monitoring; sediment control measures and re-vegetation works will be regularly monitored until vegetation re-established
			Level I	Level I	Level I	Level I	Level I	Level I	Level II			
Sediment Quality	Reduced sediment quality as result of deleterious substance spills	Spill control and clean-up equipment maintain at site; fuel and service equipment in designated, contained area	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site works	Construction phase	Incidental	Reversible	Unlikely to occur	Negligible	Not significant	On-site monitoring
			Level I	Level I	Level I	Level I	Level I	Level I	Level I			
Fish and Fish Habitat	Serious harm to fish from isolation and dewatering of stream channel	Works scheduled during winter months when no fish migration; capture and relocate all large-body fish prior to partial dewatering; capture and relocate small-body fish to reduce resident population in isolated channel	No adverse ecosystem effects	No adverse effects to socio-economic interests	Limited to Project site works	Construction phase	Incidental	Reversible	Unlikely to occur	Negligible	Not significant	On-site monitoring
			Level I	Level I	Level I	Level I	Level I	Level I	Level I			

Factor	Potential Effect	Mitigation	Context		Extent					Residual Effects	Determination of Effects	Monitoring/Follow up
			Ecological	Socio-economic	Magnitude	Duration	Frequency	Reversibility	Likelihood			
	Serious harm to fish from placement of bank stabilization rock in the stream channel	Works scheduled during winter months when no fish migration; capture and relocate all large-body fish prior to works; place rock incrementally using how and working out from stream bank to displace any remaining fish and prevent burial	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring
	Disruption of fish passage through Project site by isolation dams	Works scheduled for winter months when no stream flow; complete works prior to spring freshet	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring
	Disruption of fish habitat through the resuspension of stream sediments and sedimentation from upland works	Conduct works during winter months when no stream and allow sediment to drop; isolate channel to limit sediment transport; protect disturbed areas to prevent erosion and scour; maintain upland sediment and erosion protection measures until vegetation cover established	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring
	Alteration of fish habitat through placement of rock features	Conduct works during winter months when habitat not in use; stream bed reconstructed to grade with clean material	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring
Human Environment												
Human Health and Safety	Interactions with general public	Project site is fenced to exclude the general public; communications maintained as activities change	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring
Human Health and Safety	Worker safety	Adherence to Manitoba Workplace Safety and Health guidelines	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	On-site monitoring; inspection by Workplace Safety and Health
Existing or Planned Land Use	Project site will be unavailable during the works	Create detours around the Project site for duration of works; re-establish vegetation cover	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Continuous Level III	Reversible Level I	Will occur Level III	Negligible	Not significant	None

Factor	Potential Effect	Mitigation	Context		Extent					Residual Effects	Determination of Effects	Monitoring/Follow up
			Ecological	Socio-economic	Magnitude	Duration	Frequency	Reversibility	Likelihood			
Aesthetics and Recreational Use	Project site will be disturbed and unavailable for recreational use during works	Conduct works during the winter when potential use is minimal; re-establish vegetation cover	No adverse ecosystem effects Level I	No adverse effects to socio-economic interests Level I	Limited to Project site works Level I	Construction phase Level I	Incidental Level I	Reversible Level I	Unlikely to occur Level I	Negligible	Not significant	None

4.2.1 Physical Environment

4.2.1.1 Air Quality

Effects and Mitigation

Potential effects of the Project on air quality include dust emissions from Project activities and exhaust emissions from construction equipment.

Dust may be generated during excavation. Dust emissions will be short-term, limited to the duration of the specific construction phase (i.e., days to weeks), and the spatial extent will be localized to the Project site.

The exhaust emissions from construction equipment will be short-term (limited to the construction phase), the spatial extent will be localized to the Project site, and the incremental contribution to vehicular exhaust emissions at the Project site will be negligible in comparison to the emissions from the daily vehicle traffic adjacent to the Project site.

Residual Effects

Effects of the Project on air quality will be limited to the Project site during the period of restoration and reconstruction.

4.2.1.2 Noise and Vibration

Effects and Mitigation

A noise attenuation assessment was completed to evaluate anticipated noise levels during all construction activities, following completion of construction activities, and how these may impact adjacent residents and businesses. Traffic noise was predicted under current and year 20 conditions for each of the alternatives, and the assessment was completed using the City's Traffic Noise Guidelines. The assessment has noted that majority of the Project limits will be unaffected by noise levels. However, the assessment did show that the property at the northeast corner of the bridge site will require a small sound barrier wall. Further discussion is required with this resident to discuss potential alternatives and concerns, as the construction of a sound barrier wall will obstruct the view of the creek. A more in depth review, using all available City baseline data will be completed during Detailed Design. Noise and vibration resulting from construction will be limited to daytime hours and the spatial extent will be localized to the Project site. Noise and vibration during the restoration and reconstruction phase of the Project will result from operation of equipment and vehicles on site and activities such as pile driving and excavation.

Residual Effects

Any noise or vibration related to Project activities will not extend beyond the duration of the Project works.

4.2.1.3 Soil Quality

Effects and Mitigation

There is a potential for spills from fuel and hydraulic lines to affect soil quality. Spill kits will be maintained on site to contain and remove any contamination. All vehicles will be fueled and serviced in a designated and contained area. Frozen ground during winter construction will aid in containing spills. In order to mitigate the risk, any spills will be excavated and the material sent to the appropriate facility for treatment.

Residual Effects

There are no anticipated residual effects of the Project on soil quality.

4.2.1.4 Groundwater Quality

Effects and Mitigation

There is a possible, though not likely, potential for downward migration of spills from fuel and hydraulic lines to affect groundwater quality. Spill kits will be maintained on site to contain and remove any contamination. All vehicles will be fueled and serviced in a designated and contained area. Frozen ground during winter construction will aid in containing spills preventing downward migration. In order to mitigate the risk, any spills will be excavated and the material sent to the appropriate facility for remediation.

Residual Effects

There are no anticipated residual effects of the Project on groundwater quality.

4.2.2 Terrestrial Environment

4.2.2.1 Vegetation

Effects and Mitigation

Existing vegetation will be cleared or affected during crossing replacement, bank stabilization, and trail realignment works. Existing vegetation is an unmaintained secondary growth mix of weeds, invasive species, and native species. Impacted areas and the newly exposed riparian zone will be planted with native grasses and perennials. Effects will be limited to the Project site and planted areas will be maintained until established. The removal of the culvert approaches will result in a defragmentation of the greenspace and extend the continuous length of riparian zone along Sturgeon Creek.

Residual Effects

The existing vegetation will be replaced with a more natural mix of native species. Defragmentation and extended continuity of the riparian will have a beneficial effect.

4.2.2.2 Wildlife and Habitat

Effects and Mitigation

Terrestrial habitat will be disrupted during the crossing replacement, bank stabilization, and trail realignment works. By conducting the activities during the winter disturbance of nesting birds is avoided. Nesting habitat will be disrupted until the vegetation has re-established. Any terrestrial animals using the Project site will be temporarily displaced.

Defragmentation of the greenspace along Sturgeon Creek will result in a net increase in available terrestrial habitat and longer, continuous corridor for wildlife using the riparian zones. Birds and terrestrial animals are expected to colonize the Project site once vegetation has been re-established.

Residual Effects

The defragmentation and net increase in terrestrial habitat from the crossing replacement will be a benefit for wildlife and habitat.

4.2.3 Aquatic Environment

4.2.3.1 Stream Bank Stability

Effects and Mitigation

The existing stream banks are unstable and show slippage into the stream channel. The reduced slopes and added aquatic habitat structures will improve stream bank stability and therefore reduce the risk of bank slippage and erosional events within the stream channel. The Project effects are expected to be beneficial.

Residual Effects

The beneficial effects of improved stream bank stability are expected to extend beyond the duration of the Project.

4.2.3.2 Surface Hydrology

Effects and Mitigation

In general, works within a stream channel present the risk of restricted flow and increased erosion during in-channel works. Works will be conducted during the winter when there is no flow so there will be no effect on surface flow.

The replacement of the culvert with a bridge will increase the flow capacity of the channel which will reduce water velocities during high-water events and therefore reduce the overall potential for erosion. The replacement of the culvert will have a beneficial effect on surface hydrology.

Residual Effects

The benefits to surface hydrology of the crossing replacement are expected to extend beyond the duration of the Project.

4.2.3.3 Surface Water Quality

Effects and Mitigation

There is potential for reduced water quality during the in-channel works through sedimentation from disturbed areas. The stream channel will be isolated and works will be conducted during the winter when there is no flow in the stream. Sediment and erosion control measures will be installed prior to spring freshet and maintained until the vegetation cover has been established.

There is a potential for spills from fuel and hydraulic lines to affect water quality. Spill kits will be maintained on site to contain and remove any contamination. All vehicles will be fueled and serviced upland and out of the channel in a designated area. Stream isolation will aid in containing spills reaching surface water.

The removal of the flow constriction and bank stabilization works are anticipated to be a net benefit to surface water quality.

Residual Effects

The benefits to surface water quality are expected to extend beyond the duration of the Project.

4.2.3.4 Sediment Quality

Effects and Mitigation

There is a potential for spills from fuel and hydraulic lines to affect sediment quality. Spill kits will be maintained on site to contain and remove any contamination. All vehicles will be fueled and serviced upland and out of the channel in a designated area. Stream isolation will aid in containing spills reaching surface water.

Residual Effects

There are no anticipated residual effects of the Project on sediment quality.

4.2.3.5 Fish and Fish Habitat

Effects and Mitigation

There is a potential for the loss of fish due to construction activities, a temporary loss of habitat and a migration barrier during isolation and dewatering, a reduction in the area and volume of the downstream scour pool, and shoreline contouring. A fish relocation will be conducted prior to the in-channel works. Partial dewatering will preserve part of the scour pool as overwintering habitat.

Loss of fish will be mitigated by conducting the in-channel works during the winter months when fish use at a minimum. The Project site will be isolated and a fish relocation program will be conducted prior to ice-up and in-channel works. Partial dewatering will preserve a portion of the scour pool as overwintering habitat for any fish escaping relocation efforts.

Migration effects will be mitigated by conducting the in-channel works during the winter months when migration does not occur and seasonally migrant species have retreated to the Assiniboine River. The works will be completed before spring freshet, when fish begin seasonal migrations through the Project site.

The reduction in the scour pool is unavoidable as prior bank stabilization measures have failed and more invasive measures are required. The pool is not a natural feature but the result of impacts to stream flow from the existing crossing. Bank stabilization works have been designed to minimize the in-channel footprint while achieving the necessary safety factor for the bank slopes. This will preserve part of the pool. Shoreline contouring is necessary to stabilize banks and protect nascent erosional scarps from developing. Offsetting the changes to habitat are the results of the culvert removal. The reconstructed channel will include the reclamation of the creek channel currently covered by the culvert approaches. This will also eliminate barrier to migration during high flow events. The stabilized banks will prevent scour and sedimentation and the crossing replacement will eliminate the migration barrier during high water events.

Residual Effects

The beneficial effects of the remediation and reconstruction of Sturgeon Creek will extend beyond the duration of the Project.

4.2.4 Human Environment

4.2.4.1 Human Health and Safety

Effects and Mitigation

Replacement of the existing culvert with a bridge will address risks to the Ness Avenue crossing during high flows and the potential for downstream effects in the event of a crossing failure. Slope stability of the west bank of Sturgeon Creek will be improved and the risk to infrastructure and public users of the greenway from a progressively eroding bank will be reduced. Safe work conditions will be maintained for all project personnel during the construction works and the project has been designed and will be completed with the safety of the project personnel and current and future public use of the site in mind.

Residual Effects

The benefits of improved flow capacity of the crossing, elimination of roadway overtopping and subsequent risk of embankment failure, in improved west bank slope stability will extend beyond the duration of the Project.

4.2.4.2 Construction

Occupational Health and Safety

The City and Tetra Tech are dedicated to providing and maintaining a safe and healthy work environment for all personnel throughout the construction and maintenance period of the Project. Occupational health and safety measures include:

- Effective implementation and utilization of Site Specific Safety Plan.
- Effective communication systems including site orientations/training, hazard assessments/control, safe work procedures, and regular tailgate meetings.
- The project team, including design and contractors, will maintain a valid Certificate of Recognition (COR) recognized in Manitoba confirming compliance with Manitoba legislated safety requirements.
- All construction activities will comply with Manitoba's *Workplace Safety and Health Act*.

Public Health and Safety

Public health and safety measures during the construction phase of the project include:

- Barriers surrounding construction areas, if required, will be placed to ensure public users of the greenway are aware of the location of open excavations.
- Staging the construction activities will be completed to minimize the disruption to the public at the site.
- When not in use, heavy equipment will be secured and parked in a common location on the project site, as per normal industry standard.
- Detours will be posted for the Sturgeon Creek Greenway trail to ensure users are directed around the Project site.

The realignment of the trail from the level crossing on Ness Avenue to an uninterrupted route passing under the new bridge will reduce the risk of trail users interacting with traffic.

Residual Effects

There are no anticipated residual effects of the Project on human health and safety during the construction phase. The realignment of the trail will have a beneficial effect extending beyond the duration of the Project.

4.2.4.3 Existing or Planned Land Use

Effects and Mitigation

The Project site is currently bisects a greenspace and trail users are directed to a level crossing on Ness Avenue. The greenspace within the Project site will be disturbed an inaccessible to the public for 11 months. Trail detours will direct users around the Project site. The work schedule includes winter months when greenspace and trail use are at annual minimums. At the completion of the project, there will be a defragmentation of the greenspace and a net increase where culvert approaches have been removed. The trail will be realigned to pass under the new bridge and eliminate the need to cross over Ness Avenue to proceed along the trail. The defragmentation and net increase in greenspace and realignment of the trail are beneficial while having no effect on adjacent land uses.

Utility services could inadvertently be disrupted during the construction activities. Service providers have been engaged and utility locates have been conducted using provided information. Communications with services providers will be maintained throughout the Project activities to ensure any disruptions to services are minimized.

Residual Effects

The benefits of the Project site to the greenspace and trail will extend beyond the duration of the Project.

4.2.4.4 Aesthetics and Recreational Uses

Effects and Mitigation

The Project site will be disturbed during the crossing replacement, bank stabilization works, and realignment of the Sturgeon Creek Greenway trail. The site will not be accessible by the general public during the period of works. The completed works will result in defragmentation of the greenspace and trail. Greenspace will be added at the former culvert approaches and the trail will be realigned to pass under the bridge from the current level crossing on Ness Avenue. Site aesthetics and recreational uses are expected to increase.

Residual Effects

The benefits of improved aesthetics and defragmentation of the greenspace and trail will extend beyond the duration of the Project.

4.2.5 Effect of the Environment on the Project

4.2.5.1 Climate Change

Effects and Mitigation

Potential effects of climate change include changes to the amount of precipitation and potential stream flow in Sturgeon Creek. The replacement of the culvert with a bridge will eliminate the scouring effects of the culvert and increase the flow capacity of the channel at the Project site which in turn will reduce the potential for channel erosion from higher flows. The bank stabilization works will provide erosion protection. The elimination of the scour effects, increased flow capacity, and bank stabilization works will be beneficial.

Residual Effects

The beneficial effects of the crossing replacement and bank stabilization works in Sturgeon Creek will extend beyond the duration of the Project.

4.2.6 Cumulative Effects

The City of Winnipeg undergoes a constant process of urban maintenance and renewal. The vast majority of these activities do not require an environmental assessment or EAL in order to proceed. The majority of the potential effects, particularly with respect to the human environment, will be short-term and within the range of periodic urban renewal activities occurring within the Project neighbourhood.

The bank stabilization, reclamation of the culvert approaches, and the increase in flow capacity at the crossing are anticipated to a positive cumulative effect in the restoration of Sturgeon Creek. Community-drive restoration measures, such as no-mow zones and fishways, have been implemented and maintained and resulted in an incremental restoration process for the creek. Reclamation of the culvert site will also result in a defragmentation of the terrestrial habitat. It is expected that the completed Project will be a positive contribution to the overall restoration process for the creek. These beneficial effects on the human, terrestrial, and aquatic environments will extend past the duration of the Project.

4.3 MONITORING

4.3.1 Sediment and Erosion Control Measures

Sediment and erosion control measures will be implemented to prevent sedimentation into Sturgeon Creek. Temporary and permanent measures will be included in the design. As part of the Project design, the majority of the measures will be permanent in the form of rock protection along slopes and newly reclaimed channel areas. These measures will be installed before the spring thaw and will be monitored for the duration of the Project.

Temporary measures will include silt fencing and other best management practices to control erosion and sedimentation from upland exposed soils. These measures will be monitored daily until for the duration of the Project. Permanent erosion control measures in the form of re-vegetation will be implemented prior to Project completion. Re-vegetation progress and temporary measures will be monitored for the duration of the Project. Once the vegetative cover has been established the temporary measures will be removed.

4.3.2 Public Health and Safety

Public feedback, communicated directly to site personnel or through the website will be monitored to identify any public health and safety issues which may arise. Issues will be investigated and operational changes will be made, if necessary.

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APPENDIX A ENVIRONMENTAL ACT LICENCE PROPOSAL FORM

APPENDIX B PROJECT DRAWINGS

APPENDIX C BHC – HYDROLOGIC AND HYDRAULIC ASSESSMENT STURGEON CREEK AT NESS AVENUE CROSSING REPLACEMENT

APPENDIX D PUBLIC ENGAGEMENT

Environment Act Proposal Form

Manitoba
Conservation and Water Stewardship

Name of the development:
Ness Avenue Bridge Construction at Sturgeon Creek

Type of development per Classes of Development Regulation (Manitoba Regulation 164/88):
Class 2 - 8. Water Development and Control

Legal name of the applicant:
City of Winnipeg

Mailing address of the applicant: 106 - 1155 Pacific Avenue

Contact Person: Darren Burmey, P. Eng.

City: Winnipeg Province: Manitoba Postal Code: R3E 3P1

Phone Number: (204) 986-5409 Fax: (204) 986-5302 email: see below

Location of the development: City of Winnipeg, Ness Avenue at Sturgeon Creek

Contact Person: Darren Burmey, P. Eng.

Street Address: 106 - 1155 Pacific Avenue

Legal Description: Ness Avenue Bridge Construction at Sturgeon Creek

City/Town: Winnipeg Province: Manitoba Postal Code: R3E 3P1

Phone Number: (204) 986-5409 Fax: (204) 986-5302 email: see below

Name of proponent contact person for purposes of the environmental assessment:
Darren Burmey, P. Eng.

Phone: (204) 986-5409
Fax: (204) 986-5302

Mailing address: 106 - 1155 Pacific Avenue
Winnipeg, Manitoba R3E 3P1

Email address: dburmey@winnipeg.ca

Webpage address: www.winnipeg.ca

Date: July 24/2015

Signature of proponent, or corporate principal of corporate proponent:

Printed name: DARREN BURMEY, P. ENG.

A complete **Environment Act Proposal (EAP)** consists of the following components:

- **Cover letter**
- **Environment Act Proposal Form**
- **Reports/plans supporting the EAP** (see "Information Bulletin - Environment Act Proposal Report Guidelines" for required information and number of copies)
- **Application fee** (Cheque, payable to Minister of Finance, for the appropriate fee)

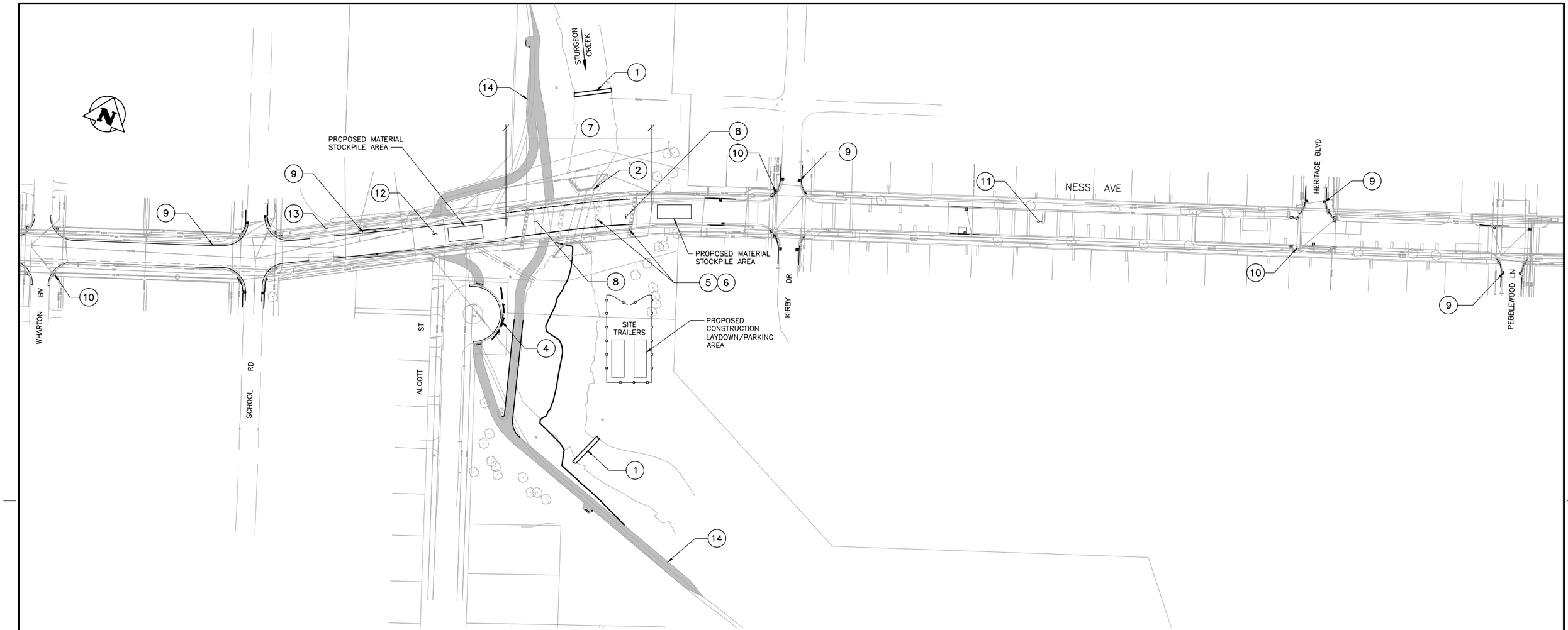
Per Environment Act Fees Regulation (Manitoba Regulation 168/96):

Class 1 Developments	$1,000
Class 2 Developments	$7,500
Class 3 Developments:	
Transportation and Transmission Lines	$10,000
Water Developments	$60,000
Energy and Mining	$120,000

Submit the complete EAP to:

Director
Environmental Approvals Branch
Manitoba Conservation and Water Stewardship
Suite 160, 123 Main Street
Winnipeg, Manitoba R3C 1A5

For more information:
Phone: (204) 945-8321
Fax: (204) 945-5229
http://www.gov.mb.ca/conservation/eal



SCOPE OF WORK		
ITEM	DESCRIPTION	SHEET No.
1	INSTALL COFFERDAM AND DEWATER CREEK (DURING WINTER)	
2	DEMOLISH EXISTING BOX CULVERT, AND RELOCATE EXISTING ENTRANCE MARKERS	
3	REPLACE STORM RELIEF SEWER AND LAND DRAINAGE SEWER OUTFLOW PIPES	
4	PERFORM BANK STABILITY WORKS AND CONSTRUCT RETAINING WALL AT ALCOTT STREET	
5	DRIVE HP PILES, PIPE PILES FOR NEW BRIDGE FOUNDATIONS	
6	CONSTRUCT CONCRETE PIERS AND ABUTMENTS	
7	ERECT GIRDERS, CONSTRUCT BRIDGE AND APPROACH SLABS	
8	COMPLETE APPROACH EMBANKMENTS AND SLOPE PAVING	
9	REHABILITATE, REPLACE, AND INSTALL NEW CATCHBASINS AND MANHOLES	
10	COMPLETE POINT REPAIRS OF GRAVITY SEWERS	
11	CONSTRUCT NEW PLAIN DOWELED CONCRETE PAVEMENT AND ASPHALTIC CONCRETE OVERLAY	
12	CONSTRUCT ASPHALT PAVEMENT ROADWAY	
13	CONSTRUCT NEW CONCRETE SIDEWALK, AND BARRIER CURB	
14	CONSTRUCT PEDESTRIAN PATHWAY	

1 / -|- SITE PLAN – SCOPE OF WORK
1 : 1000

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2016

B.M. ELEV. F.B.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY	D.M.	CHECKED BY	
DRAWN BY	B.M.	APPROVED BY	
HOR. SCALE: VERTICAL:	AS NOTED	ACCEPTED BY	DATE
DATE	14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER	

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION
CONSULTANT DRAWING NO.
1400070800-DWG-S0003

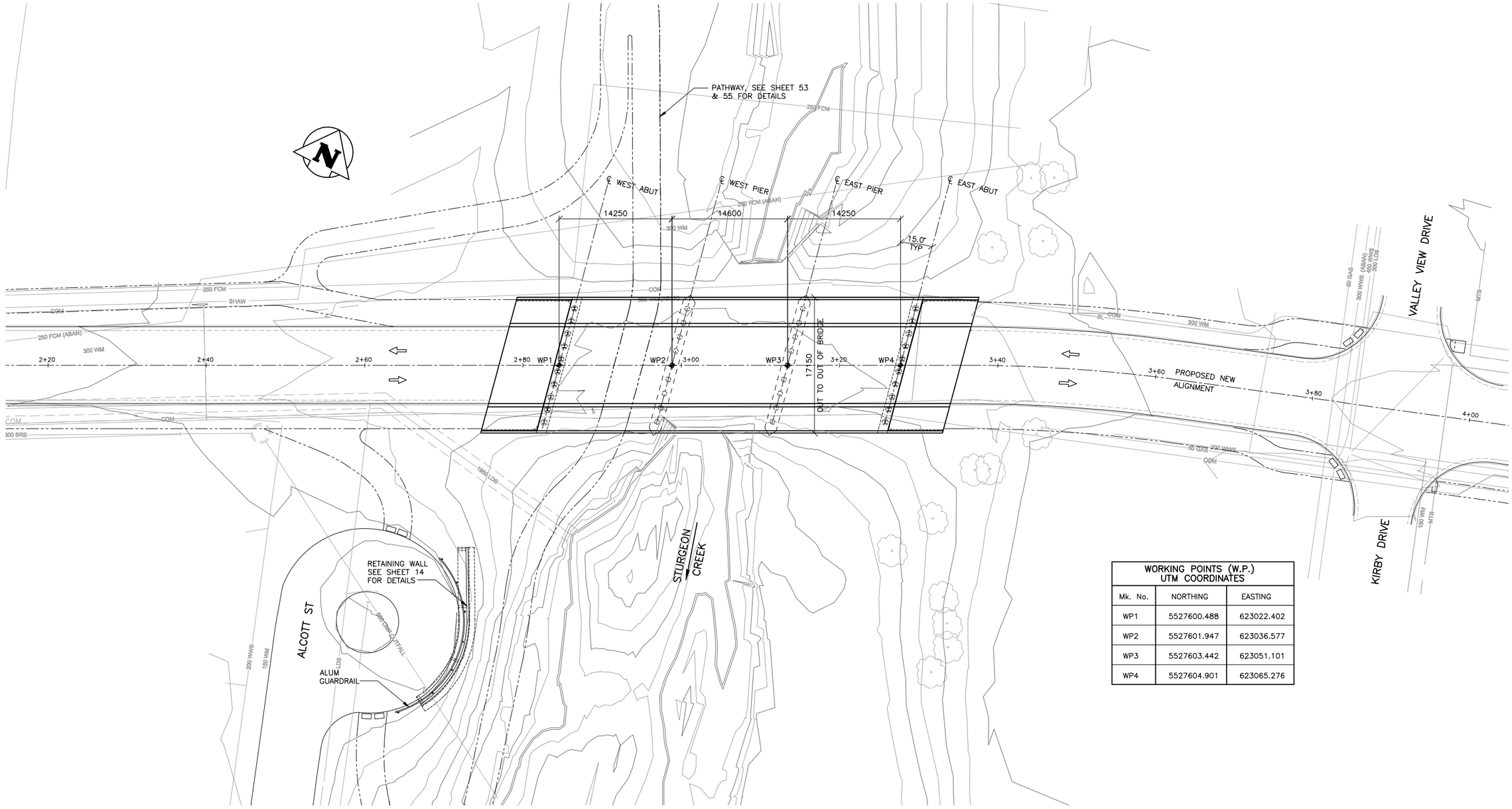
Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER: B243-15-003
SHEET 3 OF

SITE PLAN AND SCOPE OF WORK

3



WORKING POINTS (W.P.) UTM COORDINATES		
Mk. No.	NORTHING	EASTING
WP1	5527600.488	623022.402
WP2	5527601.947	623036.577
WP3	5527603.442	623051.101
WP4	5527604.901	623065.276

1 / – – PLAN – BRIDGE
1 : 250

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2016

B.M. ELEV.		F.B.		
NO.	REVISIONS	DATE	BY	

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-S0004

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

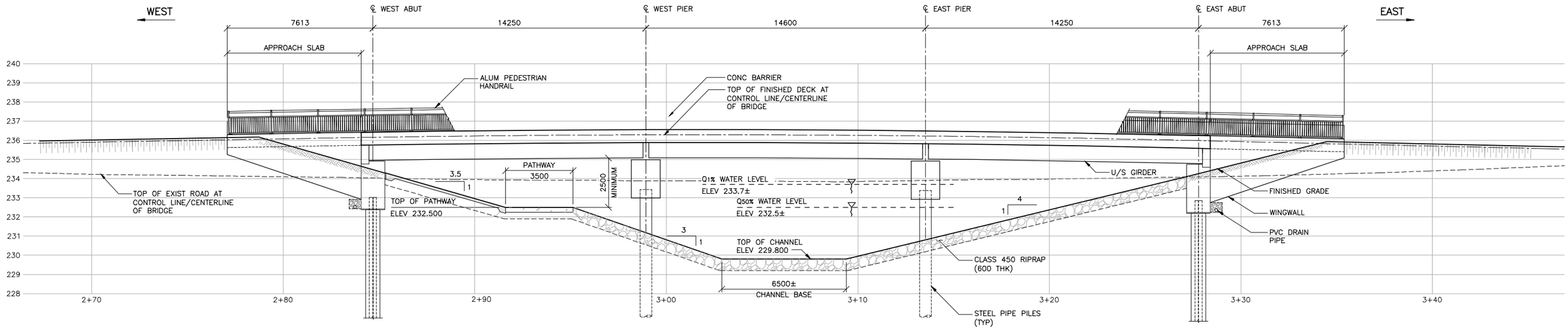
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-004

SHEET 4 OF

GENERAL ARRANGEMENT – PLAN

4

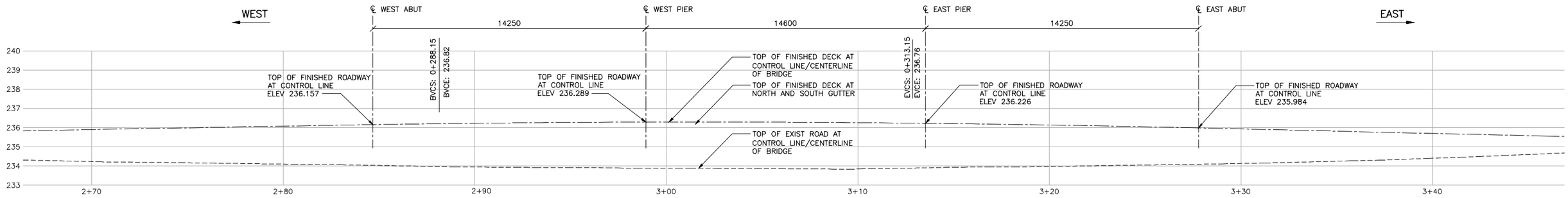


1 / – / –

SECTION AT CENTERLINE OF BRIDGE

1 : 100

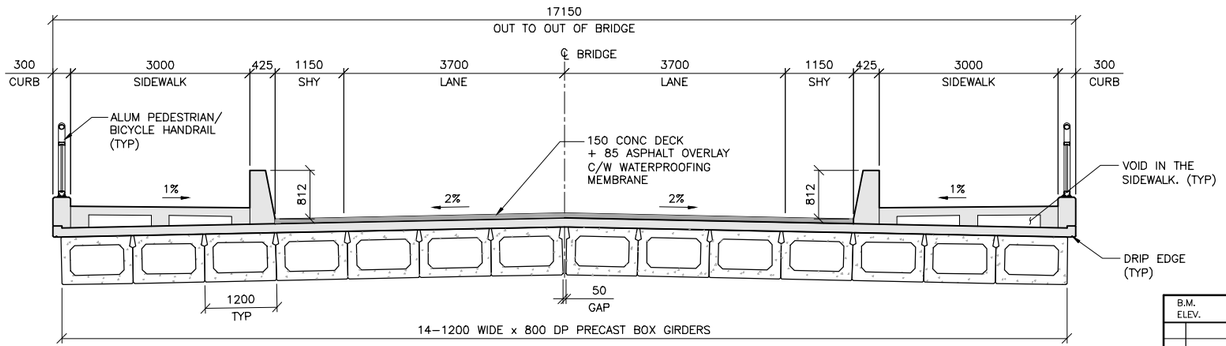
– SHOWING FINAL CHANNEL CROSS SECTION AT THE BRIDGE



2 / – / –

BRIDGE PROFILE

1 : 100



3 / – / –

TYPICAL CROSS SECTION

1 : 50

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TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2015

B.M. ELEV.			
NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-S0005

75% SUBMISSION
JUNE 29, 2015

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

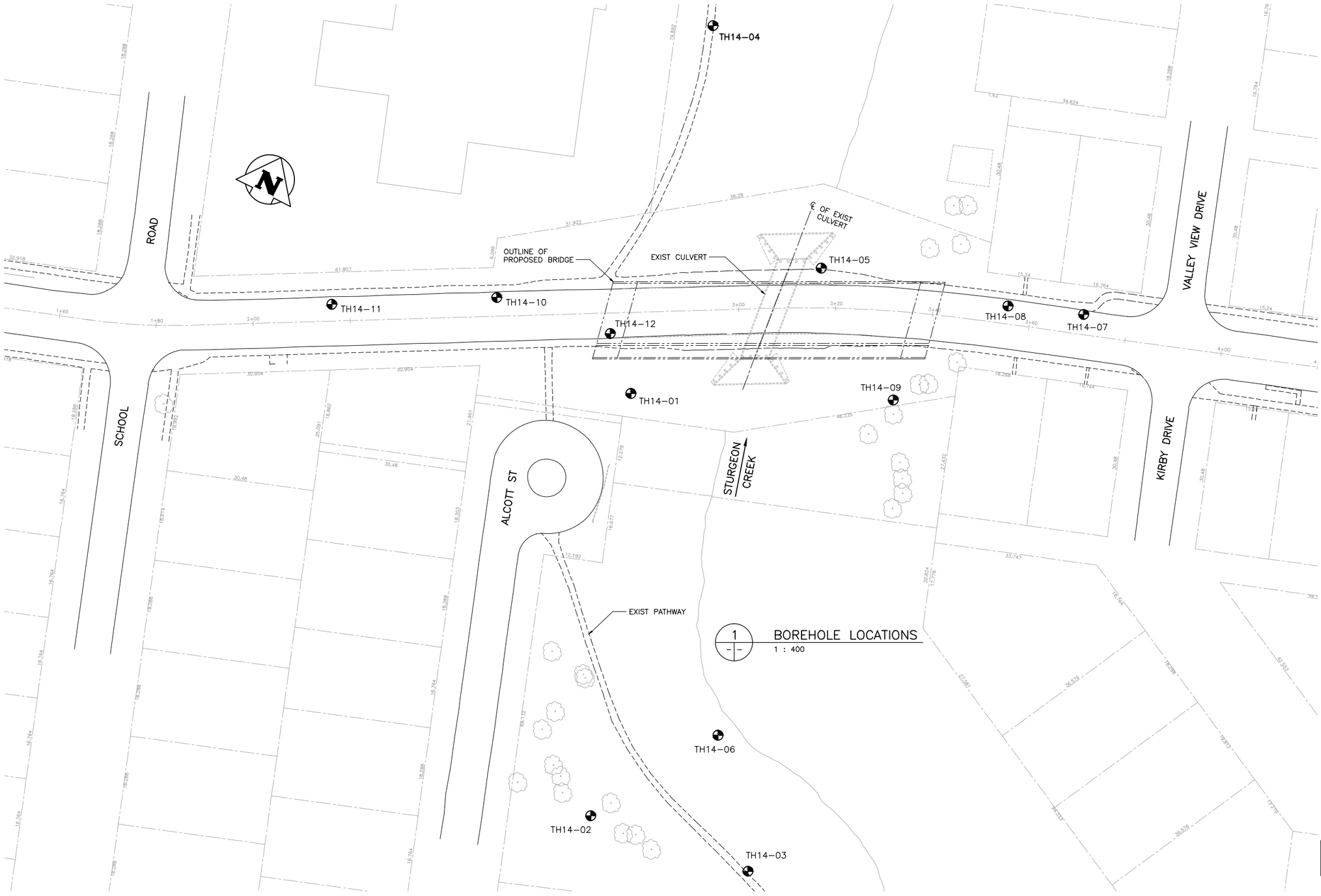
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-005

SHEET 5 OF

GENERAL ARRANGEMENT
ELEVATION AND CROSS SECTION

5



1 BOREHOLE LOCATIONS
1 : 400

75% SUBMISSION
JUNE 29, 2015

NOTES:

1. TH REFERS TO BOREHOLE TEST LOGS. TEST HOLES WERE TAKEN BY TREK GEOTECHNICAL BETWEEN AUGUST 20 AND 22, 2014.
2. THE TEST HOLE LOGS PROVIDED FOR THIS PROJECT HAVE BEEN COMPILED FOR DESIGN PURPOSES ONLY. WHILE IT IS BELIEVED TO CORRECTLY REPRODUCE OR SUMMARIZE OBSERVATIONS MADE DURING TESTING, THE INFORMATION IS VALID ONLY FOR THE PRECISE LOCATIONS SHOWN AND IS NOT TO BE CONSTRUED AS GUARANTEEING THE PRESENCE, ABSENCE, OR EXTENT OF BOULDERS, HARD OR SOFT FORMATIONS, WATER TABLES, ARTESIAN CONDITIONS AND OTHER VARIABLES. IT IS THE RESPONSIBILITY OF OTHERS USING THIS INFORMATION TO ENSURE THAT IT IS ADEQUATE FOR THEIR PURPOSES OR TO SUPPLEMENT IT WITH ADDITIONAL INFORMATION.
3. STANDPIPE PIEZOMETERS WERE INSTALLED IN THE BEDROCK AND SILT LAYER TO ASSES GROUNDWATER LEVELS IN TH14-01, TH14-04 AND TH14-06.

APEGM
Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2018

B.M. ELEV.			
NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 14.12.01	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-S0006

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-006

SHEET 6 OF 6

BOREHOLE LOCATIONS

TREK GEOTECHNICAL

Sub-Surface Log

TH14-01
1 of 3

Client:	Tetra Tech Inc.	Project Number:	0002 017 00
Project Name:	Ness Avenue at Sturgeon Creek Culvert Replacement	Location:	UTM N-5527584.8, E-623017.1
Contractor:	Paddock Drilling Ltd.	Ground Elevation:	233.37 m
Method:	170 mm Hollow Stem Auger, Acker SX Track Mount	Date Drilled:	August 20, 2014

Sample Type: Grab (G), Shelby Tube (T), Split Spoon (SS), Split Barrel (SB), Core (C)

Particle Size Legend: Fines, Clay, Silt, Sand, Gravel, Cobbles, Boulders

Backfill Legend: Bentonite, Cement, Drill Cuttings, Filter Pack Sand, Grout, Slough

Columns: Elevation (m) | Depth (m) | Soil Symbol | Standpipe | MATERIAL DESCRIPTION | Sample Type | Sample Number | RQD (%) | SPT (N) | Bulk Unit Wt (kN/m³) 16 17 18 19 20 21; Particle Size (%) 0 20 40 60 80 100; PL MC LL 0 20 40 60 80 100 | Undrained Shear Strength (kPa) Test Type: △ Torvane △, Pocket Pen., ⊠ Qu ⊠, ○ Field Vane ○ 0 30 60 90 120 150

Elevation (m)	Depth (m)	Material Description	Sample Number
	0.0	CLAY (FILL) - silty, trace sand, trace gravel, trace rootlets, trace silt inclusions (< 5 mm dia.) - dark grey to black - moist, stiff to very stiff - intermediate plasticity	SB001, SB002, SB003, SB004, SB005, SB006
231.8	1.5	CLAY (ALLUVIAL) - silty, some organics, trace sand, trace gravel, trace silt inclusions (< 5 mm dia.), trace oxidation, trace rootlets, trace wood pieces - black - moist, firm - high plasticity - dark grey below 2.4 m	SB007, SB008, SB009, SB010, SB011
230.3	3.0	CLAY (LACUSTRINE) - silty, trace till inclusions (< 5 mm dia.) - mottled brown and grey - moist, stiff - high plasticity - dark grey below 4.0 m	SB012, SB013, SB014, SB015, SB016, SB017, SB018, SB019, SB020
227.6			

Logged By: Beta Taryana   Reviewed By: James Blatz   Project Engineer: Ryan Belbas

SUB-SURFACE LOG LOGS 2014-08-26 NESS AT STURGEON 0_DRAFT 0002 017 00.GPJ TREK GEOTECHNICAL.GDT 10/10/14

TREK GEOTECHNICAL

Sub-Surface Log

TH14-01
2 of 3

Elevation (m)	Depth (m)	Material Description	Sample Number	RQD (%)	SPT (N)
		SILT (TILL) - trace clay, trace sand, trace gravel - light grey - wet to 5.9 m, moist below 5.9 m - loose to 5.9 m, compact below 5.9 m - low plasticity - moist to dry, dense below 6.7 m	SB021, SB022, SB023, G024, SS025		52 / 101mm
225.8	7.6	CALCAREOUS MUDSTONE (STONY MOUNTAIN FORMATION - GUNN MEMBER) - limestone nodules in a argillaceous matrix - weak to medium strong - iron staining - minor fracturing - soft argillaceous layers at 8.8, 9.1 and 13.1 m - fossiliferous 40.8 MPa unconfined compressive strength between 8.2 and 8.5 m	C026	50	
			C027	76	
		28.6 MPa unconfined compressive strength between 11.4 and 11.8 m	C028	75	
		35.0 MPa unconfined compressive strength between 12.3 and 12.5 m			

Logged By: Beta Taryana   Reviewed By: James Blatz   Project Engineer: Ryan Belbas

SUB-SURFACE LOG LOGS 2014-08-26 NESS AT STURGEON 0_DRAFT 0002 017 00.GPJ TREK GEOTECHNICAL.GDT 10/10/14

TREK GEOTECHNICAL

Sub-Surface Log

TH14-01
3 of 3

Elevation (m)	Depth (m)	Material Description	Sample Number	RQD (%)
	13.0		C029	84
219.7	13.7			

END OF TEST HOLE AT 13.7 m IN BEDROCK
Notes:
1. Power auger refusal at 7.6 m in silt (till). HQ coring completed in bedrock to 13.7 m depth.
2. Seepage between 5.8 m to 5.9 m depth.
3. Water level measured at 4.3 m below the ground surface after completion of drilling prior to coring.
4. Standpipe SP-01 installed from 13.7 m to 0.1 m below ground surface.
5. Water level reading in SP-02 was recorded at the elevation of 229.8 m on September 15, 2014.
6. Test Hole backfilled with sand to 8.5 m below ground surface, bentonite to 3.0 m below ground surface and auger cuttings to top of ground surface.

Logged By: Beta Taryana   Reviewed By: James Blatz   Project Engineer: Ryan Belbas

SUB-SURFACE LOG LOGS 2014-08-26 NESS AT STURGEON 0_DRAFT 0002 017 00.GPJ TREK GEOTECHNICAL.GDT 10/10/14

75% SUBMISSION
JUNE 29, 2015

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

B.M.
ELEV.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M. | CHECKED BY
DRAWN BY G.I. | APPROVED BY
HOR. SCALE: AS NOTED VERTICAL: | ACCEPTED BY DATE
DATE 15.03.27 | D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO. 1400070800-DWG-S0007

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

BOREHOLE LOGS
SHEET 1 OF 4

CITY DRAWING NUMBER B243-15-007
SHEET 7 OF
7

Sub-Surface Log

TH14-02
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 170 mm Hollow Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527497.451, E-623017.7866
Ground Elevation: 232.23 m
Date Drilled: August 20, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
231.9	0.0		CLAY (FILL) - silty, trace sand, trace gravel, trace rootlets, trace silt inclusions (< 10 mm dia.), black, dry to 0.1 m, moist below 0.1 m, very stiff, intermediate plasticity		S8030		
	0.5		CLAY (ALLUVIAL) - silty, trace sand, trace gravel, trace silt inclusions (< 5 mm dia.), trace oxidation, trace organics, trace rootlets, trace wood pieces - black - moist, firm - high plasticity		S8031		
	1.0				S8032		
	1.5				S8033		
	2.0				S8034		
230.1	2.1		- silt seam (75 mm thick) at 1.8 m		S8035		
	2.5		CLAY (LACUSTRINE) - silty, trace till inclusions (< 5 mm dia.) - mottled brown and grey - moist, stiff - high plasticity		S8036		
	3.0				S8037		
	3.5				S8038		
	4.0		- trace till inclusions, soft below 3.7 m		S8039		
227.7	4.5				T040		
227.3	4.9		SILT (TILL) - trace clay, trace sand, trace gravel, light grey to 4.7 m and brown below 4.7 m, wet to 4.7 m, moist below 4.7 m, loose to 4.7 m, dense below 4.7 m, low plasticity		S8041		
					S8042		
					S8043		
					S8044		
					S8045		54 / 78mm

POWER AUGER REFUSAL AT 5.0 m IN SILT (TILL)
Notes:
1. Seepage between 4.6 m to 4.7 m depths.
2. Test Hole backfilled with bentonite and auger cuttings.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-03
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527489.404, E-623051.1739
Ground Elevation: 231.67 m
Date Drilled: August 20, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
231.5	0.0		ORGANIC CLAY - silty, trace sand, trace gravel, trace rootlets, black, dry to moist, intermediate plasticity		G046		
230.1	1.5		CLAY (ALLUVIAL) - silty, trace silt inclusions (< 5 mm diam.) - dark grey - moist, firm to stiff - high plasticity		G047		
					G048		
			CLAY (LACUSTRINE) - silty, trace silt inclusions (< 5 mm diam.) - dark grey to grey - moist, firm - high plasticity				
	2.5		- trace gravel, soft below 2.1 m		G049		
	3.0		- trace to some till inclusions below 3.0 m		G050		
227.7	4.0		SILT (TILL) - trace clay, trace sand, trace gravel - light grey, wet, loose to compact - low plasticity		G051		
					G052		
227.1	4.6		- brown, dry, dense below 4.4 m		G053		

POWER AUGER REFUSAL AT 4.6 m IN SILT (TILL)
Notes:
1. Seepage between 4.0 m to 4.4 m depth.
2. Test Hole backfilled with bentonite and auger cuttings.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-04
1 of 2

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527661.873, E-623026.1585
Ground Elevation: 232.45 m
Date Drilled: August 21, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders
Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
	0.0			CLAY (FILL) - silty, trace sand, trace gravel, trace silt incusions (< 10 mm diam.), trace rootlets - grey - dry to 0.3 m, moist below 0.3 m, stiff - intermediate plasticity		G054		
	0.5							
	1.0					G055		
230.9	1.5					G056		
				CLAY (ALLUVIAL) - silty, trace sand, trace gravel, trace silt inclusions (< 5 mm dia.), trace oxidation, trace organics, trace rootlets, trace wood pieces - black - moist, firm - high plasticity				
229.4	3.0			CLAY (LACUSTRINE) - silty, trace till inclusions (< 5 mm dia.) - mottled brown and grey - moist, stiff - high plasticity		G057		
	4.0							
	4.5					G058		
	5.0							
	5.5			- some till inclusions, soft below 5.2 m		G059		
226.7	5.8							

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-04
2 of 2

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
	6.0			SILT (TILL) - trace clay, trace sand, trace gravel - brown - dry, dense - low plasticity		S060		
225.6	6.5					S061		

POWER AUGER REFUSAL AT 6.9 m IN SILT (TILL)
Notes:
1. Seepage between 5.8 m to 6.1 m depth.
2. Standpipe SP-02 installed from 6.9 m below ground surface to 1.0 m above ground surface.
3. Water level reading in SP-02 was recorded at the elevation of 229.7 m on September 15, 2014.
4. Test Hole backfilled with sand to 5.8 m below ground surface and bentonite to top of ground surface.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2016

B.M.
ELEV.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 15.03.27	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-S0008

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-008
SHEET 8 OF

BOREHOLE LOGS
SHEET 2 OF 4

8

Sub-Surface Log

TH14-05
1 of 2

Client: Tetra Tech Inc.
Project Number: 0002 017 00
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Location: UTM N-5527614.473, E-623053.4575
Contractor: Paddock Drilling Ltd.
Ground Elevation: 232.59 m
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Date Drilled: August 21, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
232.1	0.0		CLAY (FILL) - silty, trace sand, trace gravel, trace silt inclusions (< 10 mm diam.), trace rootlets - black - moist to dry, firm to stiff - intermediate plasticity	G	G062		
231.1	1.5		CLAY (ALLUVIAL) - silty, some organics, trace gravel, trace silt inclusions (< 5 mm diam.) - black - moist, stiff - high plasticity	G	G063		
				G	G064		
			CLAY (LACUSTRINE) - silty, trace gravel - grey - moist, firm - high plasticity	G	G065		
				G	G066		
			grey below 3.0 m				
			wet at 4.3 m	T	T067		
			trace till inclusions, soft below 5.6 m	G	G068		

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100 — PL MC LL
Undrained Shear Strength (kPa): Test Type — Torvane, Pocket Pen, Qu, Field Vane; 0 30 60 90 120 150

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-05
2 of 2

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
226.5	6.0		SILT (TILL) - trace clay, trace sand, trace gravel - brown - moist to dry, compact to dense - low plasticity	G	G069		
				G	G070		
225.6	6.9			G	G071		
			CALCAREOUS MUDSTONE (STONY MOUNTAIN FORMATION - GUNN MEMBER) - limestone nodules in a argillaceous matrix - weak to medium strong - iron staining - very minor fracturing - soft argillaceous layers at 8.2 and 9.8 m - fossiliferous 14.8 MPa unconfined compressive strength between 7.8 and 8.2 m	C	C072	85	
			15.2 MPa unconfined compressive strength between 9.2 and 9.5 m	C	C073	87	
				C	C074	88	
			16.3 MPa unconfined compressive strength between 11.6 and 11.9 m	C	C075	98	
220.4	12.2		END OF TEST HOLE AT 12.2 m IN BEDROCK Notes: 1. Power auger refusal at 6.9 m depth. 2. Seepage at 4.3 m depth. 3. Test Hole squeezed at 3.7 m depth. 4. Test Hole backfilled with bentonite to ground surface.				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100 — PL MC LL
Undrained Shear Strength (kPa): Test Type — Torvane, Pocket Pen, Qu, Field Vane; 0 30 60 90 120 150

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-06
1 of 2

Client: Tetra Tech Inc.
Project Number: 0002 017 00
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Location: UTM N-5527516.627, E-623042.1601
Contractor: Paddock Drilling Ltd.
Ground Elevation: 232.16 m
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Date Drilled: August 21, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders
Backfill Legend: Bentonite | Cement | Drill Cuttings | Filter Pack Sand | Grout | Slough

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
231.9	0.0			CLAY (FILL) - silty, trace sand, trace gravel, trace rootlets, trace silt inclusions (< 10 mm dia.), black, dry to 0.1 m, moist below 0.1 m, very stiff, intermediate plasticity	G	G076		
				CLAY (ALLUVIAL) - silty, trace sand, trace gravel, trace silt inclusions (< 5 mm dia.), trace oxidation, trace organics, trace rootlets, trace wood pieces - black - moist, firm - high plasticity	G	G077		
					G	G078		
229.1	3.0			CLAY (LACUSTRINE) - silty, trace till inclusions (< 5 mm dia.) - mottled brown and grey - moist, stiff - high plasticity	G	G079		
				- trace till inclusions, soft below 4.3 m	G	G080		
					G	G081		
227.0	5.1			SILT (TILL) - trace to some clay to 5.0 m, trace clay below 5.0 m, trace sand, trace gravel - light grey - moist to wet to 5.0 m, wet below 5.0, loose to compact to 5.0 m, loose below 5.0 m - low plasticity	G	G082		

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100 — PL MC LL
Undrained Shear Strength (kPa): Test Type — Torvane, Pocket Pen, Qu, Field Vane; 0 30 60 90 120 150

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-06
2 of 2

Elevation (m)	Depth (m)	Soil Symbol	Standpipe	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
226.1	6.0			- dry, dense below 5.6 m	G	G083		
				END OF HOLE AT 6.1 m IN SILT (TILL) Notes: 1. Seepage between 4.6 m to 5.6 m depth. 2. Suspected sloughing between 5.0 m to 5.6 m depths. 3. Standpipe SP-03 installed from 6.9 m below ground surface to 0.8 m above ground surface. 4. Water level reading in SP-02 was recorded at the elevation of 228.6 m on September 15, 2014. 5. Test Hole backfilled with sand to 4.6 m below ground surface and bentonite to top of ground surface.				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100 — PL MC LL
Undrained Shear Strength (kPa): Test Type — Torvane, Pocket Pen, Qu, Field Vane; 0 30 60 90 120 150

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-07
1 of 1

Client: Tetra Tech Inc.
Project Number: 0002 017 00
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Location: UTM N-5527610.535, E-623108.2078
Contractor: Paddock Drilling Ltd.
Ground Elevation: 235.31 m
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
235.3	0.0		ASPHALT (45 mm thick)	G	C084		
235.1	0.2		CONCRETE (178 mm thick)	G	C085		
235.0	0.3		CRUSHED LIMESTONE - 19 mm down	G	G086		
234.7	0.6		CLAY (FILL) - silty, trace gravel - black - moist, very stiff - intermediate plasticity	G	G087		
234.5	0.8		SILT - trace clay, trace oxidation, brown, moist, compact, low plasticity	G	G088		
			CLAY (LACUSTRINE) - silty, trace gravel, trace oxidation, trace silt inclusions (< 10 mm diam.) - brown - moist, stiff - high plasticity	G	G089		
232.3	3.0		firm below 2.9 m	G	G090		
			END OF HOLE AT 3.0 m IN CLAY (LACUSTRINE) Notes: 1. Test Hole backfilled with auger cuttings to 0.2 m below top of pavement and concrete to the top of pavement.				

Bulk Unit Wt (kN/m³): 16 17 18 19 20 21
Particle Size (%): 0 20 40 60 80 100 — PL MC LL
Undrained Shear Strength (kPa): Test Type — Torvane, Pocket Pen, Qu, Field Vane; 0 30 60 90 120 150

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2016

B.M.
ELEV.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M. | CHECKED BY
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HOR. SCALE: AS NOTED | ACCEPTED BY DATE
VERTICAL:
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D.N. BURMEY, P.ENG.
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NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-009
SHEET 9 OF

BOREHOLE LOGS
SHEET 3 OF 4

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Sub-Surface Log

TH14-08
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527610.674, E-623092.5082
Ground Elevation: 234.96 m
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
234.9	0.0		ASPHALT (38 mm thick)	G	G091		
234.7			CONCRETE (178 mm thick)	G	G092		
234.6	0.3		CRUSHED LIMESTONE - 19 mm down	G	G093		
				G	G094		
234.2	0.7		CLAY (FILL) - silty, trace sand, trace gravel, trace oxidation - mottled brown and black - moist, stiff - intermediate plasticity	G	G095		
	1.0		CLAY (LACUSTRINE) - silty, trace sand, trace gravel, trace oxidation, trace silt inclusions (< 5 mm dia.) - mottled grey and brown - moist, stiff - high plasticity				
	1.5		- brown, firm to stiff below 1.4 m	G	G096		
	2.0						
	2.5		- firm below 2.9 m	G	G097		
231.9	3.0		END OF HOLE AT 3.0 m IN CLAY (LACUSTRINE)				

Notes:
1. Test Hole backfilled with auger cuttings to 0.2 m below top of pavement and concrete to the top of pavement.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-09
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527589, E-623071
Ground Elevation: 234.32 m
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
234.3	0.0		ASPHALT (70 mm thick)	G	C098		
234.1			CONCRETE (178 mm thick)	G	C099		
234.0	0.3		CRUSHED LIMESTONE - 19 mm down	G	G100		
	0.5		CLAY (FILL) - silty, trace sand, trace gravel, trace oxidation - mottled brown and black - moist, stiff to very stiff - intermediate plasticity				
233.3	1.0		CLAY (ALLUVIAL) - silty, trace sand, trace gravel, some organics, trace silt inclusions (< 10 mm dia.) - black - moist, very stiff - high plasticity	G	G101		
	1.5		- stiff below 1.4 m	G	G102		
	2.0			T	T103		
	2.5						
231.3	3.0			G	G104		
			END OF HOLE AT 3.0 m IN CLAY (ALLUVIAL)				

Notes:
1. Test Hole backfilled with auger cuttings to 0.2 m below top of pavement and concrete to the top of pavement.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-10
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527601.625, E-622987.6074
Ground Elevation: 234.55 m
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
234.5	0.0		ASPHALT (51 mm thick)	G	C105		
234.3			CONCRETE (178 mm thick)	G	C106		
234.1	0.4		CRUSHED LIMESTONE - 19 mm down	G	G107		
	0.5		CLAY (FILL) - silty, trace sand, trace gravel - black - moist, very stiff - intermediate plasticity	G	G108		
233.8	0.7		CLAY (ALLUVIAL) - silty, trace gravel, some organics, trace silt inclusions (< 10 mm dia.) - black - moist, very stiff - high plasticity				
	1.0						
	1.5		- stiff below 1.4 m	G	G109		
232.4	2.0		CLAY (LACUSTRINE) - silty, trace oxidation, trace silt inclusions (< 5 mm dia.) - brown - moist, stiff - high plasticity				
	2.5						
231.5	3.0			G	G110		
			END OF HOLE AT 3.0 m IN CLAY (LACUSTRINE)				

Notes:
1. Test Hole backfilled with auger cuttings to 0.2 m below top of pavement and concrete to the top of pavement.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-11
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527596.751, E-622953.946
Ground Elevation: 235.16 m
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
235.1	0.0		ASPHALT (51 mm thick)	G	C111		
			CONCRETE (241 mm thick)	G	C112		
234.8	0.3		CRUSHED LIMESTONE - 19 mm down	G	G113		
234.5	0.6		CLAY (FILL) - silty, trace sand, trace gravel, trace silt inclusions (< 10 mm dia.) - black - moist, stiff, intermediate plasticity	G	G114		
	1.0		CLAY (LACUSTRINE) - silty, trace silt inclusions (< 5 mm dia.) - grey - moist, stiff - high plasticity				
	1.5			G	G115		
	2.0						
232.1	3.0		- firm to stiff below 2.9 m	G	G116		
			END OF HOLE AT 3.0 m IN CLAY (LACUSTRINE)				

Notes:
1. Test Hole backfilled with auger cuttings to 0.3 m below top of pavement and concrete to the top of pavement.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

Sub-Surface Log

TH14-12
1 of 1

Client: Tetra Tech Inc.
Project Name: Ness Avenue at Sturgeon Creek Culvert Replacement
Contractor: Paddock Drilling Ltd.
Method: 125 mm Solid Stem Auger, Acker SX Track Mount
Project Number: 0002 017 00
Location: UTM N-5527596.636, E-623011.6245
Ground Elevation: 234.15 m
Date Drilled: August 22, 2014

Sample Type: Grab (G) | Shelby Tube (T) | Split Spoon (SS) | Split Barrel (SB) | Core (C)
Particle Size Legend: Fines | Clay | Silt | Sand | Gravel | Cobbles | Boulders

Elevation (m)	Depth (m)	Soil Symbol	MATERIAL DESCRIPTION	Sample Type	Sample Number	RQD (%)	SPT (N)
234.1	0.0		ASPHALT (38 mm thick)	G	C117		
233.9			CONCRETE (178 mm thick)	G	C118		
233.8	0.3		CRUSHED LIMESTONE - 19 mm down	G	G119		
	0.5		CLAY (FILL) - silty, trace sand, trace gravel, trace silt inclusions (< 10 mm dia.) - black - moist, stiff - intermediate plasticity	G	G120		
	1.0			T	T121		
232.6	1.5		CLAY (LACUSTRINE) - silty, trace gravel, trace silt inclusions (< 5 mm - dark grey - moist, firm to stiff - high plasticity	G	G122		
	2.0						
	2.5						
231.1	3.0		- very stiff below 2.9 m	G	G123		
			END OF HOLE AT 3.0 m IN CLAY (LACUSTRINE)				

Notes:
1. Test Hole backfilled with auger cuttings to 0.2 m below top of pavement and concrete to the top of pavement.

Logged By: Beta Taryana | Reviewed By: James Blatz | Project Engineer: Ryan Belbas

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2016

B.M.
ELEV.

NO. | REVISIONS | DATE | BY

TETRA TECH

DESIGNED BY D.M. | CHECKED BY
DRAWN BY G.I. | APPROVED BY
HOR. SCALE: AS NOTED | ACCEPTED BY DATE
VERTICAL:
DATE 15.03.27 | D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-S0010

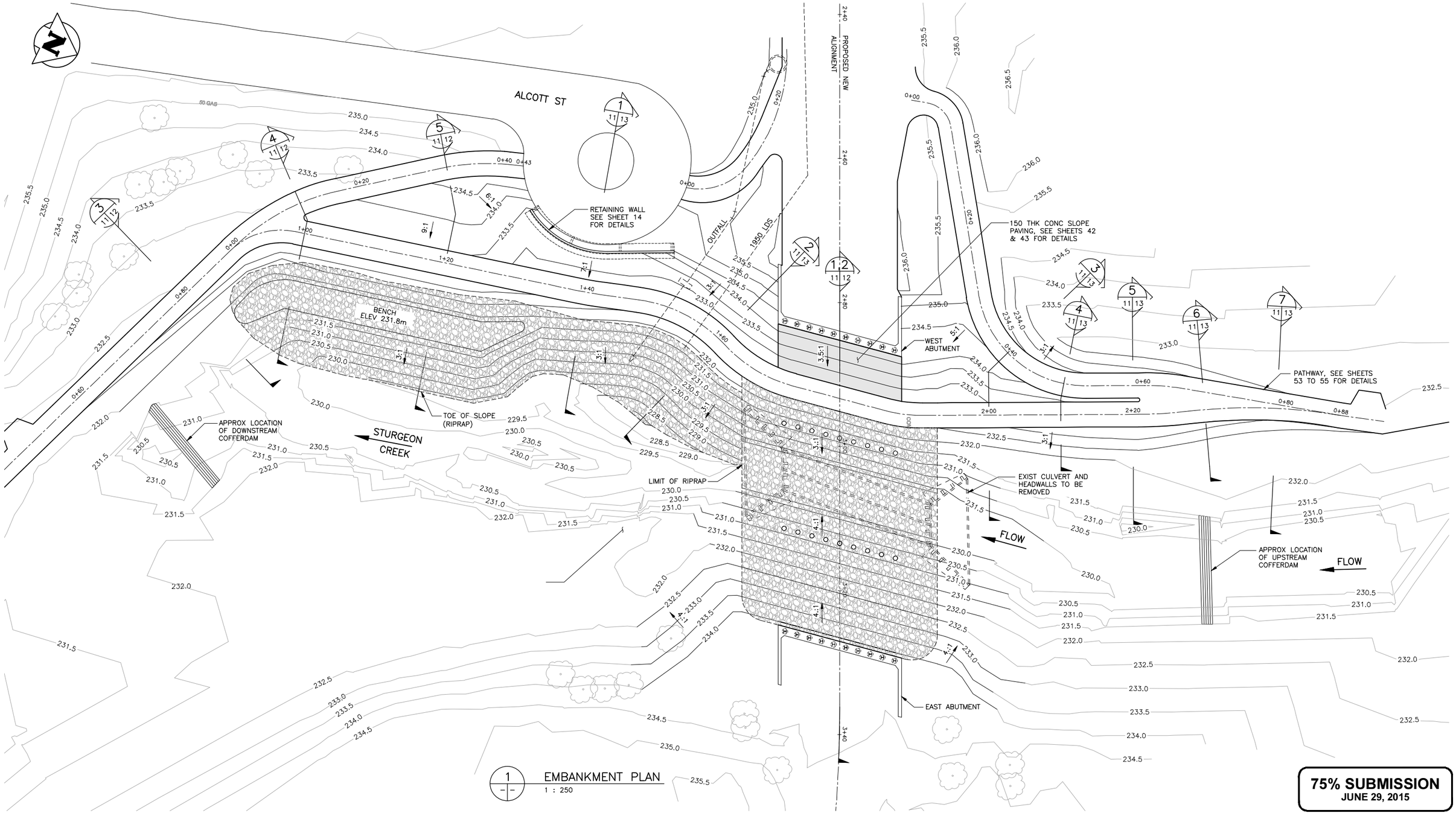
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-010

SHEET 10 OF 10

BOREHOLE LOGS
SHEET 4 OF 4



1 EMBANKMENT PLAN
1 : 250

75% SUBMISSION
JUNE 29, 2015

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No. 6313 Date: April 30, 2016

NO.	REVISIONS	DATE	BY

B.M. ELEV. F.B.

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DATE 14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

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Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

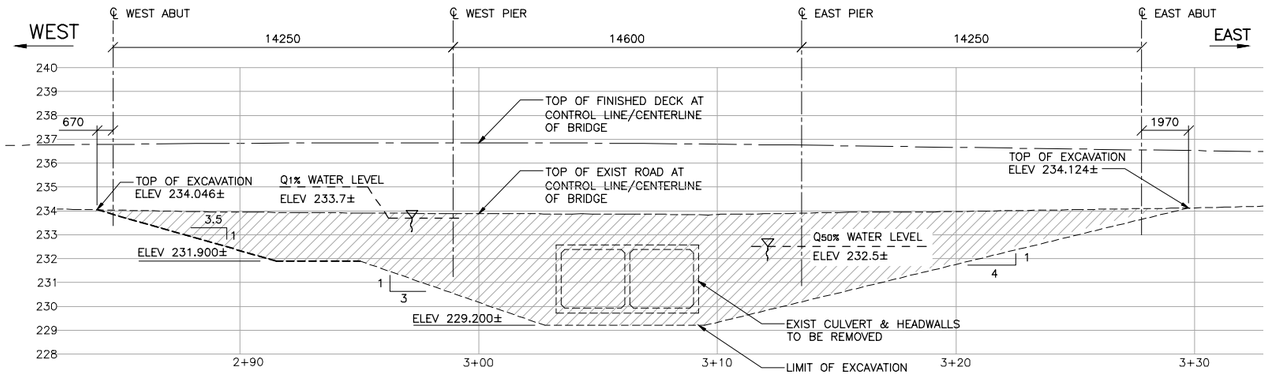
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-011

SHEET 11 OF

EMBANKMENT AND CHANNEL WORKS
EXISTING CULVERT REMOVAL AND
EMBANKMENT DETAILS

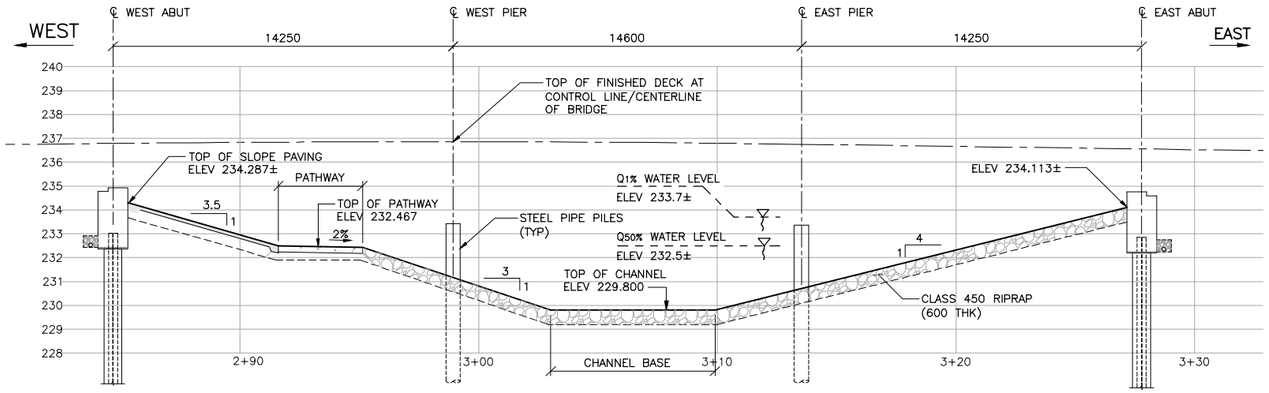
11



1 / 11 12 — EXISTING SECTION AT CENTERLINE OF BRIDGE

1 : 125

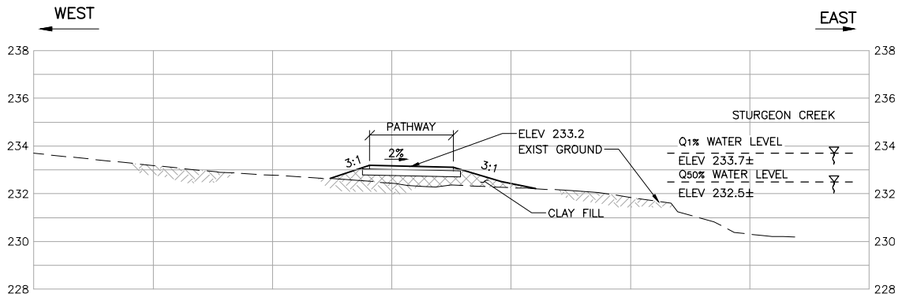
– SHOWING LIMIT OF DEMOLITION AND EXCAVATION



2 / 11 12 — CROSS SECTION AT CENTERLINE OF BRIDGE

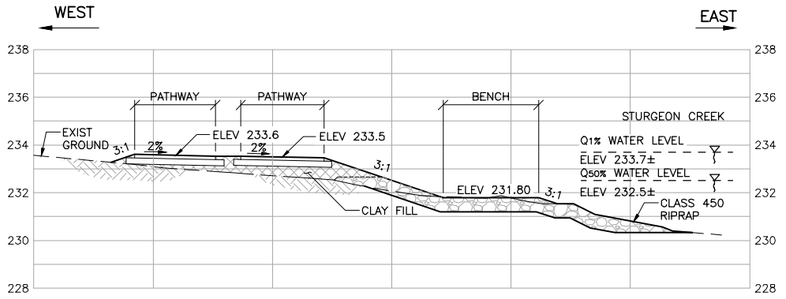
1 : 125

– SHOWING FINAL CHANNEL CROSS SECTION AT THE CENTERLINE OF BRIDGE



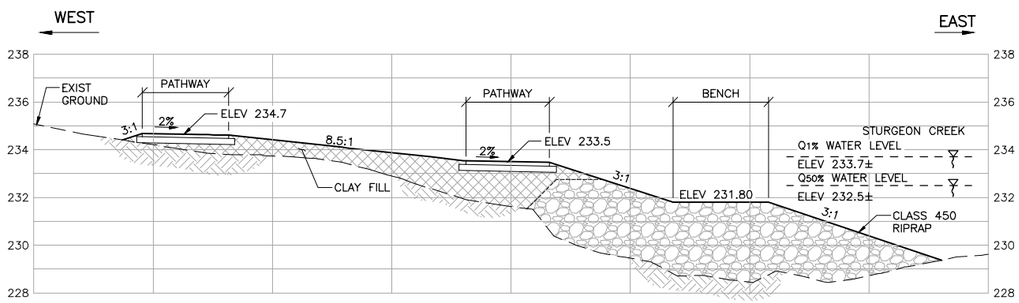
3 / 11 12 — SECTION AT STA. 0+80

1 : 125



4 / 11 12 — SECTION AT STA. 1+00

1 : 125



5 / 11 12 — SECTION AT STA. 1+20

1 : 125

DEMOLITION NOTES:

1. THE INTENT OF THIS DRAWING IS TO SHOW THE GENERAL LAYOUT OF THE EXISTING CULVERT. REFER TO THE EXISTING DRAWINGS OF THE CREEK FOR COMPLETE DETAILS.
2. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS OF EXISTING STRUCTURES.
3. DEMOLITION INCLUDES ALL COMPONENTS OF THE EXISTING CULVERT, INCLUDING HEADWALLS.
4. THE CONTRACTOR IS RESPONSIBLE FOR SAFETY AND INTEGRITY OF THE STRUCTURES DURING DEMOLITION.
5. SUBMIT DEMOLITION PLAN IN ACCORDANCE WITH THE SPECIFICATIONS.
6. DO NOT DISPOSE OF ANY MATERIALS IN ANY PORTION OF THE CREEK.
7. SALVAGED ITEMS AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

LIST OF SALVAGE ITEMS:

1. ALUMINUM BALANCED BARRIER INCLUDING POSTS, RAILING, SPLICE BARS AND CLAMP BARS.
2. WELDED WIRE RAILING AND POST.

75% SUBMISSION
JUNE 29, 2015

APEGM Certificate of Authorization TETRA TECH WEI Inc. No. 6313 Date: April 30, 2015

B.M. ELEV.	F.B.			NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO. 1400070800-DWG-S0012

Winnipeg

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

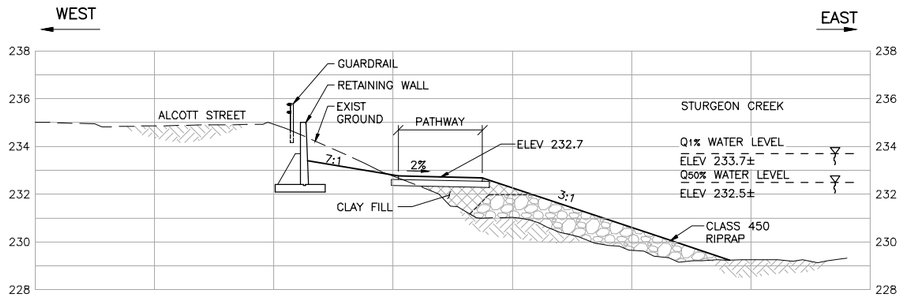
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER B243-15-012

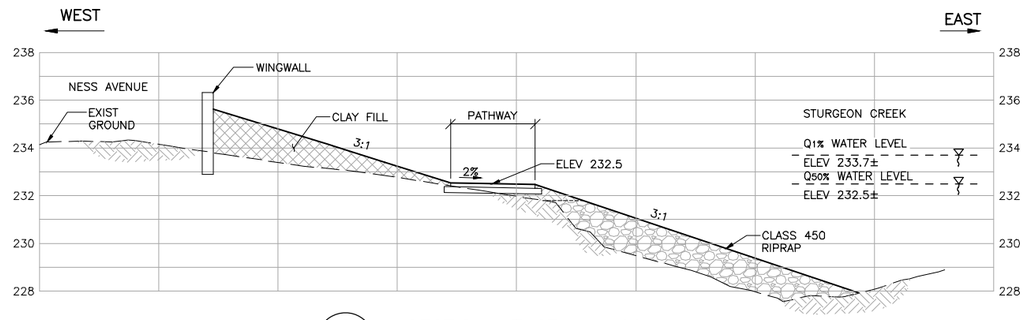
SHEET 12 OF

EMBANKMENT AND CHANNEL WORKS
EXISTING CULVERT REMOVAL AND
EMBANKMENT SECTIONS

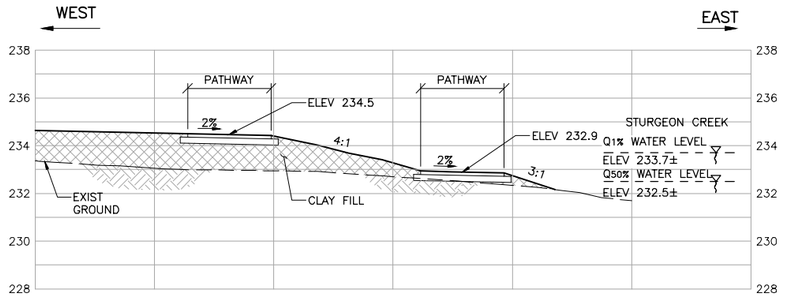
12



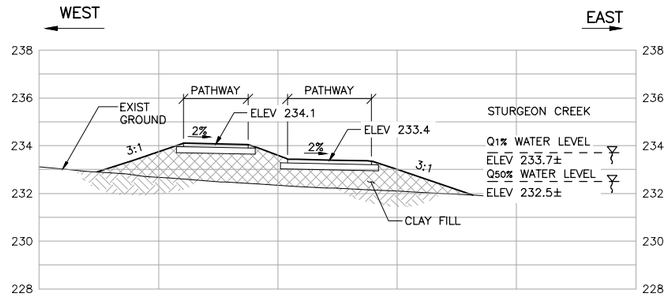
1 | 11 | 13 SECTION AT STA. 1+40
1 : 125



2 | 11 | 13 SECTION AT STA. 1+60
1 : 125



3 | 11 | 13 SECTION AT STA. 2+00
1 : 125



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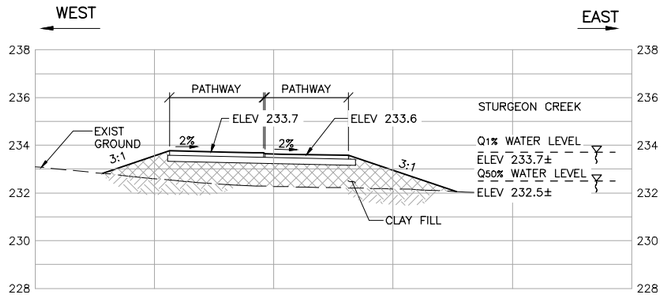
1 : 125



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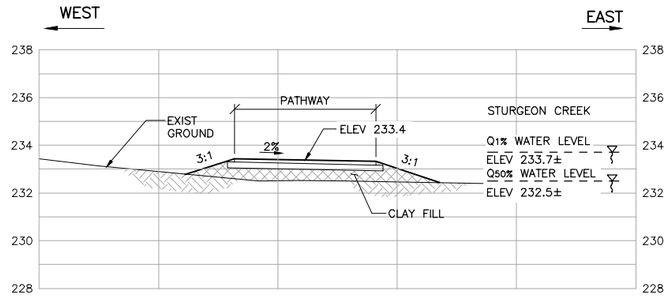
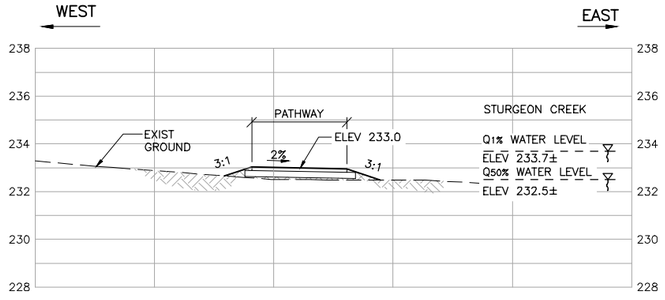
1 : 125



6 | 11 | 13 SECTION AT STA. 2+30
1 : 125



7 | 11 | 13 SECTION AT STA. 2+40
1 : 125

75% SUBMISSION
JUNE 29, 2015

APEGM
Certificate of Authorization
TETRA TECH WEI Inc.
No. 6313 Date: April 30, 2018

NO.	REVISIONS	DATE	BY
	B.M. ELEV.		

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
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CONSULTANT DRAWING NO.
1400070800-DWG-S0013

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

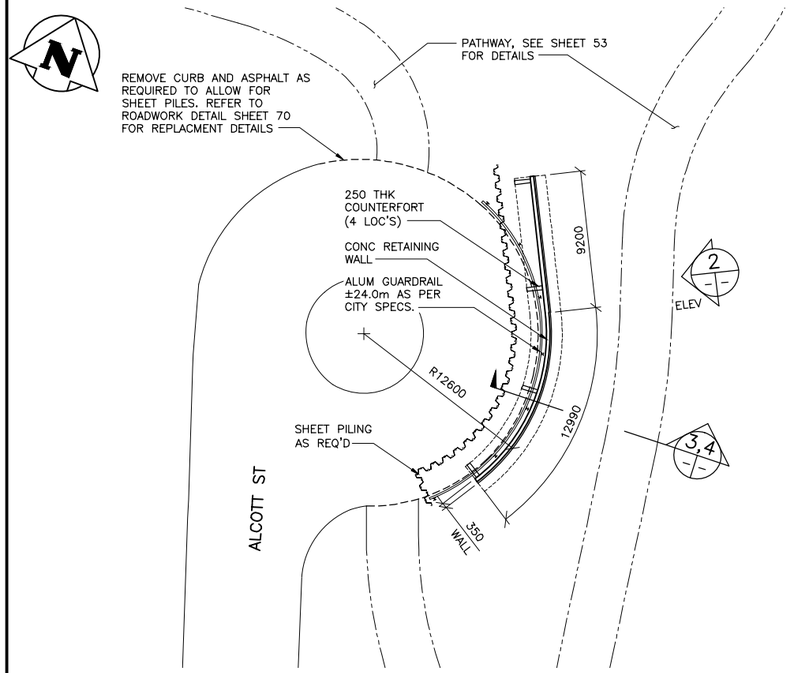
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-013

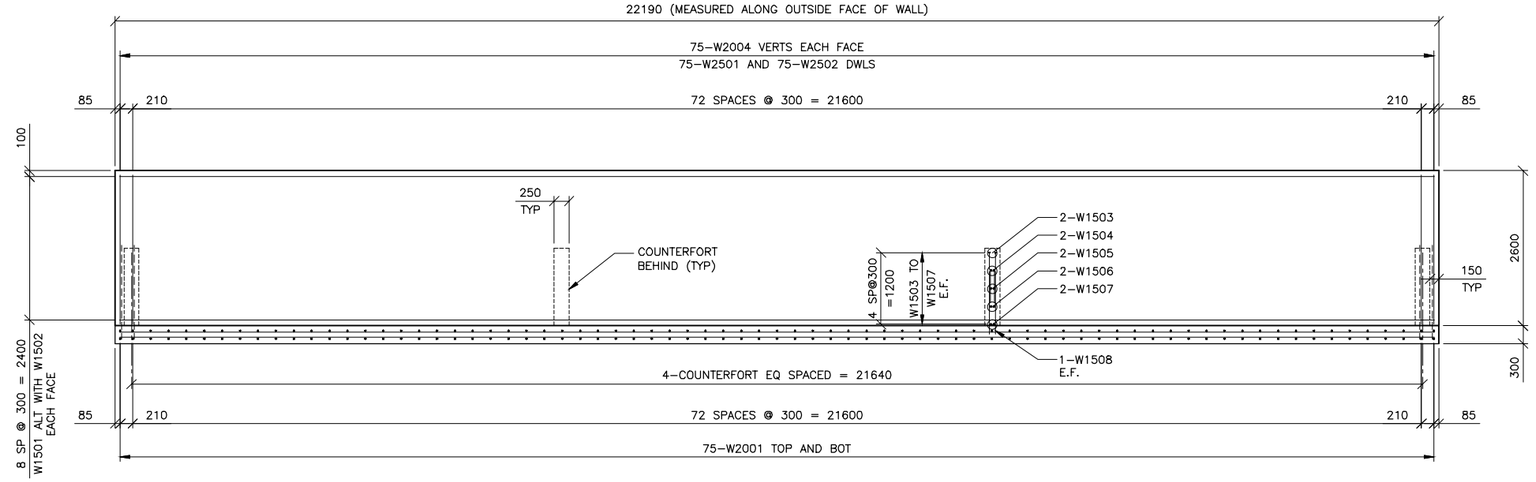
SHEET 13 OF

EMBANKMENT AND CHANNEL WORKS
SECTIONS AND DETAILS

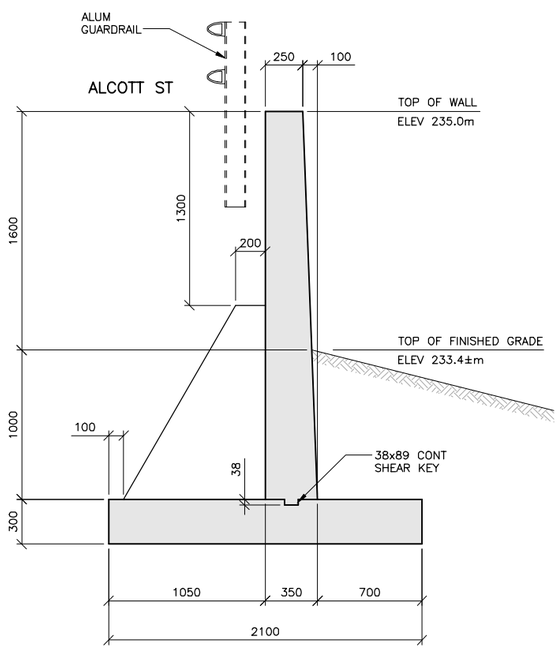
13



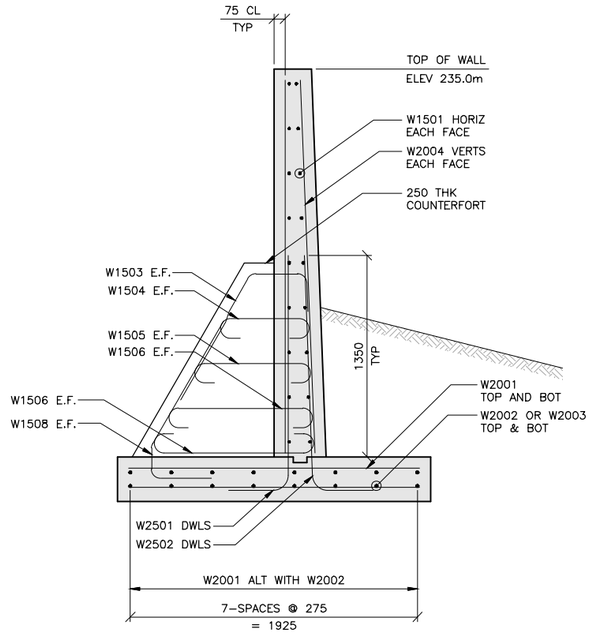
1 RETAINING WALL – PLAN
1 : 200



2 RETAINING WALL – ELEVATION
1 : 50



3 RETAINING WALL – SECTION
1 : 20



4 RETAINING WALL – REINFORCING SECTION
1 : 20

75% SUBMISSION
JUNE 29, 2015

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No. 6313 Date: April 30, 2018

B.M. ELEV.			
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PRELIMINARY DRAWING
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CONSULTANT DRAWING NO.
1400070800-DWG-S0014

THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

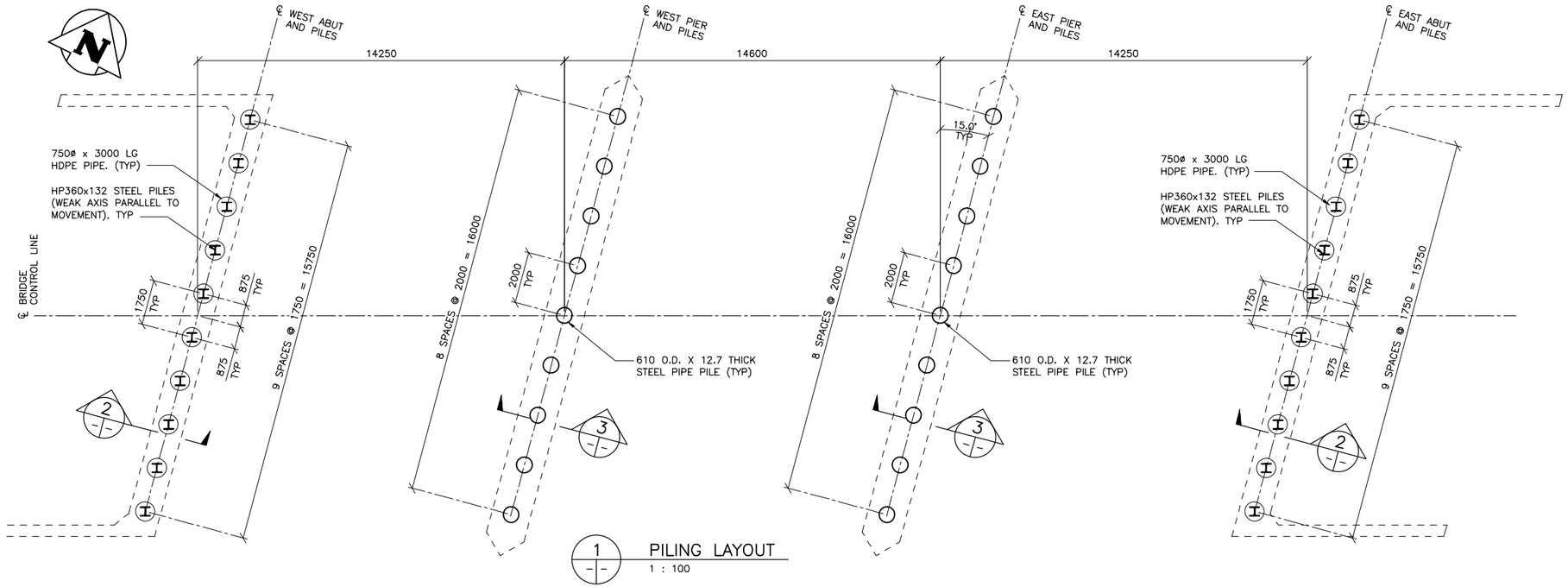
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-014

SHEET 14 OF

EMBANKMENT RETAINING WALLS
CONCRETE DETAILS

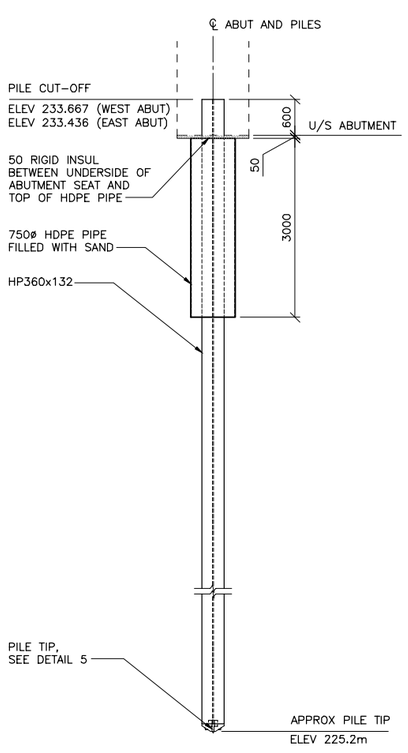
14



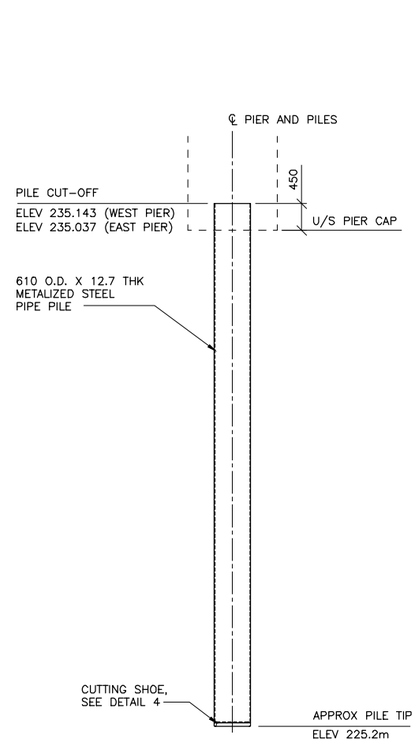
1 PILING LAYOUT
1 : 100

GENERAL NOTES:

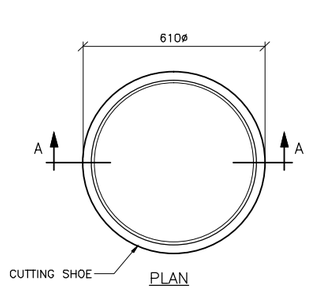
1. SPACING OF PILES, FOR ALL FOOTINGS AS SHOWN, IS AT THE BOTTOM OF FOOTINGS.
2. HP AND PIPE PILES SHALL BE DRIVEN TO REFUSAL, 0.5m INTO THE BEDROCK LAYER. REFUSAL IS EXPECTED TO BE REACHED AT A MINIMUM TIP ELEVATION OF 225.2m.
3. PRIOR TO INFILLING THE PIPE PILES WITH CONCRETE, ALL SOIL IN THE PILE ABOVE THE BEDROCK IS TO BE REMOVED.
4. REFER TO SHEETS 6 TO 10 FOR GEOTECHNICAL INFORMATION.
5. REFER TO SHEET 22 FOR PIPE PILES REINFORCING DETAILS.



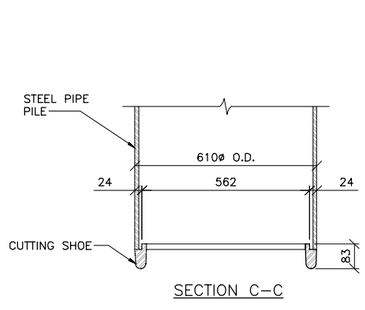
2 SECTION AT ABUTMENT
1 : 50



3 SECTION AT PIER
1 : 50



PLAN

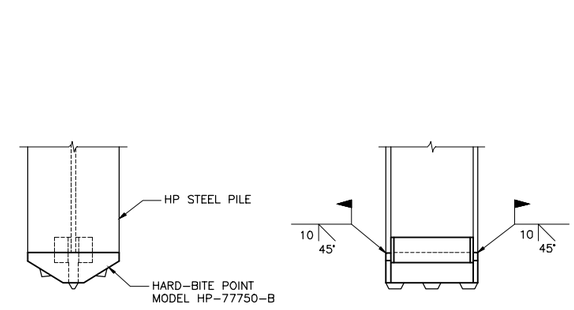


SECTION C-C

4 PIPE PILE CUTTING SHOE DETAIL
1 : 10

NOTE: (PIPE PILE CUTTING SHOE)

1. CUTTING SHOE SHALL BE INSIDE FLANGE TYPE WITH THE EXTERIOR FACE OF THE CUTTING SHOE FLUSH WITH STEEL PIPE PILE EXTERIOR FACE.
2. SLIP SHOE SHALL BE ATTACHED WITH A MINIMUM 8mm FILLET WELD AT THE TOP OF THE FLANGE. WELD ALL AROUND WITH A 70xx SERIES ROD.



5 STEEL HP PILE TIP DETAIL
1 : 10

WELDING: (STEEL HP PILE)

1. LOW HYDROGEN E480 SERIES ELECTRODES SHALL BE USED.
2. THE MINIMUM ROOT PASS SHALL BE 6mm.
3. BEFORE UNDERTAKING THE BACK WELDS, THE WELD PREPARATION SHALL BE CARRIED OUT WITH A CARBON ARC-AIR GOUGER.

75% SUBMISSION
JUNE 5, 2015

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No. 5313 Date: April 30, 2016

B.M. ELEV.

NO.	REVISIONS	DATE	BY

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HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 15.03.27	D.N. BURNEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
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CONSULTANT DRAWING NO.
1400070800-DWG-S0015

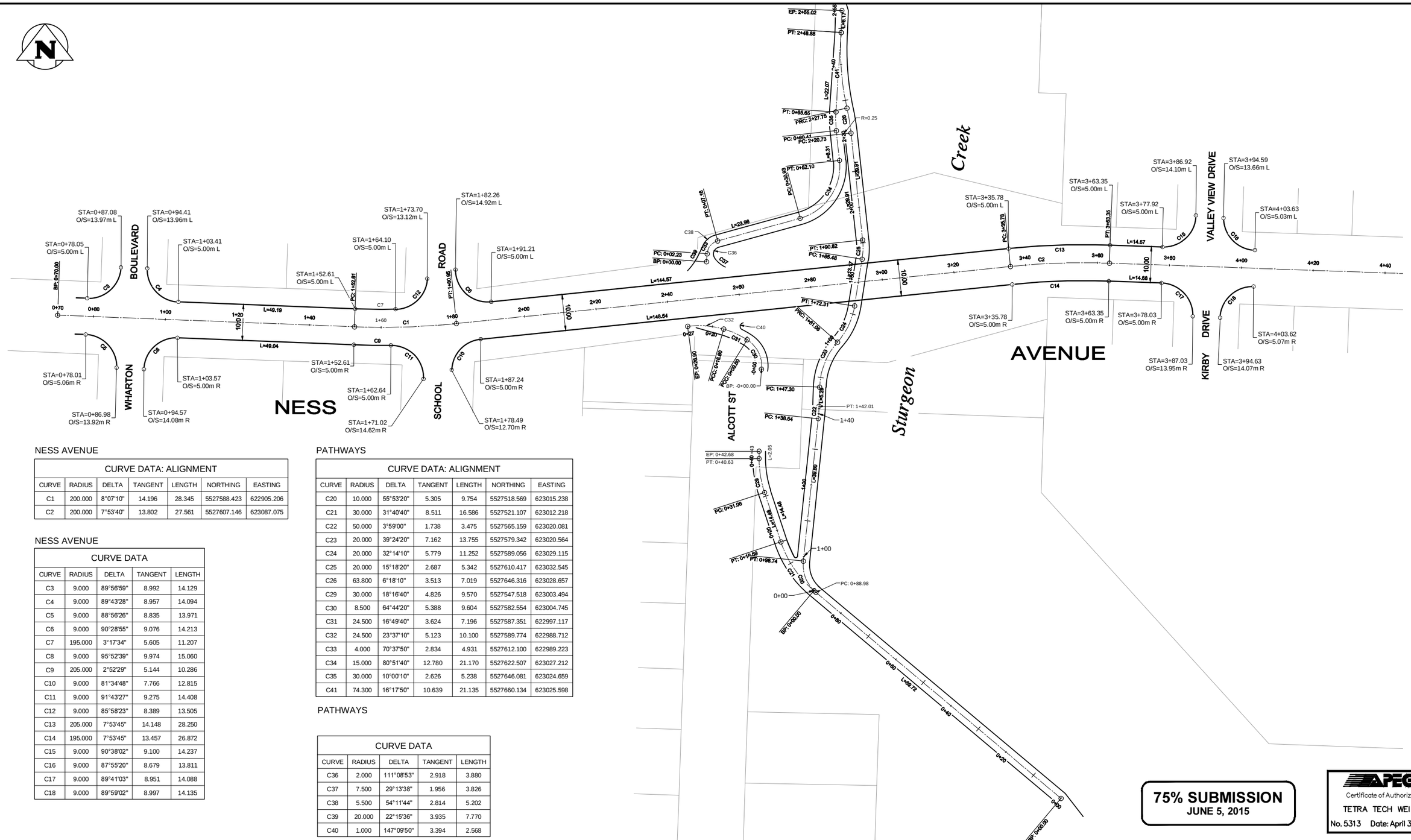
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-015

SHEET 15 OF 15

PILING LAYOUT AND DETAILS



NESS AVENUE

CURVE DATA: ALIGNMENT						
CURVE	RADIUS	DELTA	TANGENT	LENGTH	NORTHING	EASTING
C1	200.000	8°07'10"	14.196	28.345	5527588.423	622905.206
C2	200.000	7°53'40"	13.802	27.561	5527607.146	623087.075

NESS AVENUE

CURVE DATA				
CURVE	RADIUS	DELTA	TANGENT	LENGTH
C3	9.000	89°56'59"	8.992	14.129
C4	9.000	89°43'28"	8.957	14.094
C5	9.000	88°56'26"	8.835	13.971
C6	9.000	90°28'55"	9.076	14.213
C7	195.000	3°17'34"	5.605	11.207
C8	9.000	95°52'39"	9.974	15.060
C9	205.000	2°52'29"	5.144	10.286
C10	9.000	81°34'48"	7.766	12.815
C11	9.000	91°43'27"	9.275	14.408
C12	9.000	85°58'23"	8.389	13.505
C13	205.000	7°53'45"	14.148	28.250
C14	195.000	7°53'45"	13.457	26.872
C15	9.000	90°38'02"	9.100	14.237
C16	9.000	87°55'20"	8.679	13.811
C17	9.000	89°41'03"	8.951	14.088
C18	9.000	89°59'02"	8.997	14.135

PATHWAYS

CURVE DATA: ALIGNMENT						
CURVE	RADIUS	DELTA	TANGENT	LENGTH	NORTHING	EASTING
C20	10.000	55°53'20"	5.305	9.754	5527518.569	623015.238
C21	30.000	31°40'40"	8.511	16.586	5527521.107	623012.218
C22	50.000	3°59'00"	1.738	3.475	5527565.159	623020.081
C23	20.000	39°24'20"	7.162	13.755	5527579.342	623020.564
C24	20.000	32°14'10"	5.779	11.252	5527589.056	623029.115
C25	20.000	15°18'20"	2.687	5.342	5527610.417	623032.545
C26	63.800	6°18'10"	3.513	7.019	5527646.316	623028.657
C29	30.000	18°16'40"	4.826	9.570	5527547.518	623003.494
C30	8.500	64°44'20"	5.388	9.604	5527582.554	623004.745
C31	24.500	16°49'40"	3.624	7.196	5527587.351	622997.117
C32	24.500	23°37'10"	5.123	10.100	5527589.774	622988.712
C33	4.000	70°37'50"	2.834	4.931	5527612.100	622989.223
C34	15.000	80°51'40"	12.780	21.170	5527622.507	623027.212
C35	30.000	10°00'10"	2.626	5.238	5527646.081	623024.659
C41	74.300	16°17'50"	10.639	21.135	5527660.134	623025.598

PATHWAYS

CURVE DATA				
CURVE	RADIUS	DELTA	TANGENT	LENGTH
C36	2.000	111°08'53"	2.918	3.880
C37	7.500	29°13'38"	1.956	3.826
C38	5.500	54°11'44"	2.814	5.202
C39	20.000	22°15'36"	3.935	7.770
C40	1.000	147°09'50"	3.394	2.568

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B.M. ELEV.			
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DRAWN BY GMD	APPROVED BY
HOR. SCALE: 1 : 500 VERTICAL:	ACCEPTED BY DATE
DATE 15.01.29	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
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CONSULTANT DRAWING NO. 1400070800-DWG-C0047

Winnipeg

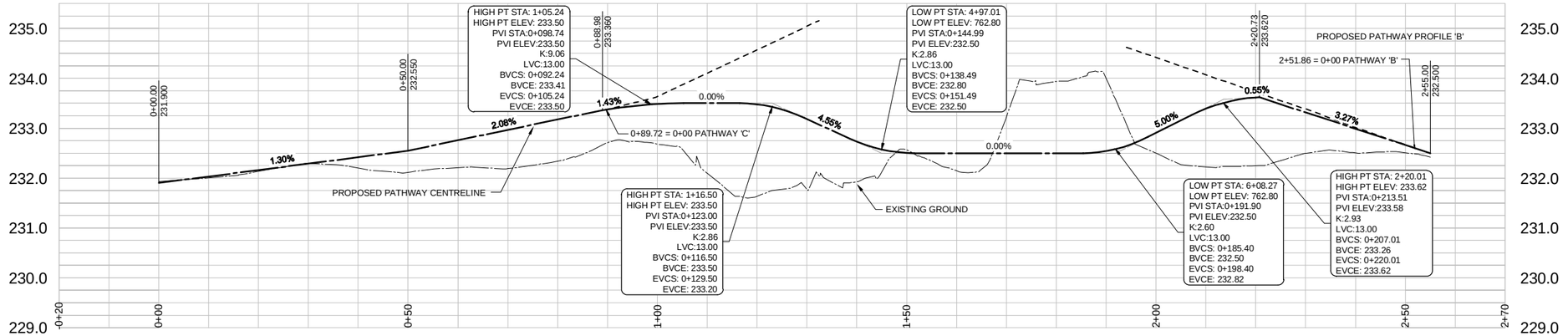
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

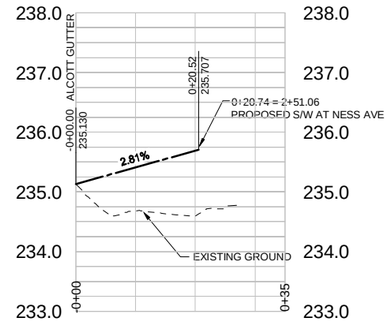
CITY DRAWING NUMBER P-3465-15-001
SHEET 47 OF

HORIZONTAL GEOMETRY
PROPOSED NESS AVENUE AND PATHWAYS

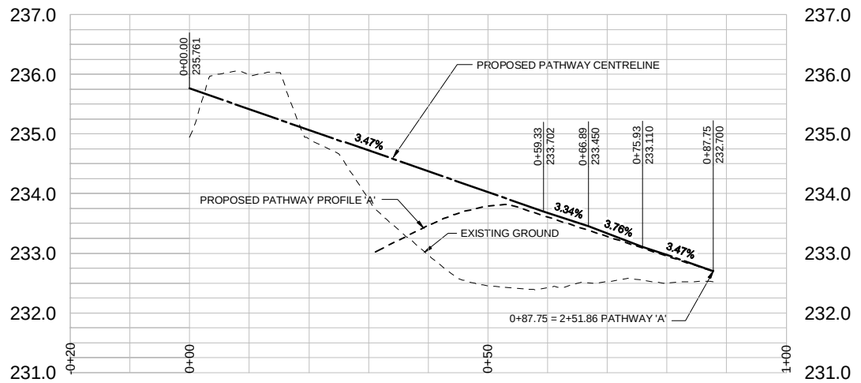
47



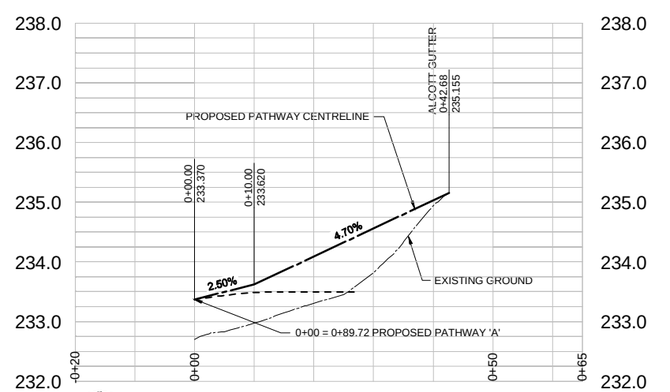
1 PATHWAY 'A' PROFILE
HOR 1 : 500, VER 1 : 50



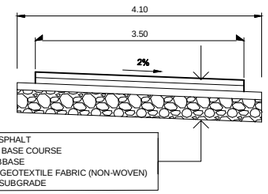
6 PATHWAY 'D' PROFILE
HOR 1 : 500, VER 1 : 50



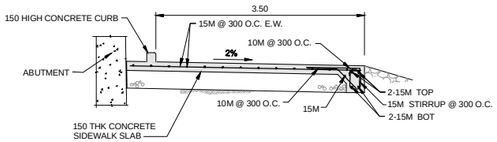
2 PATHWAY 'B' PROFILE
HOR 1 : 500, VER 1 : 50



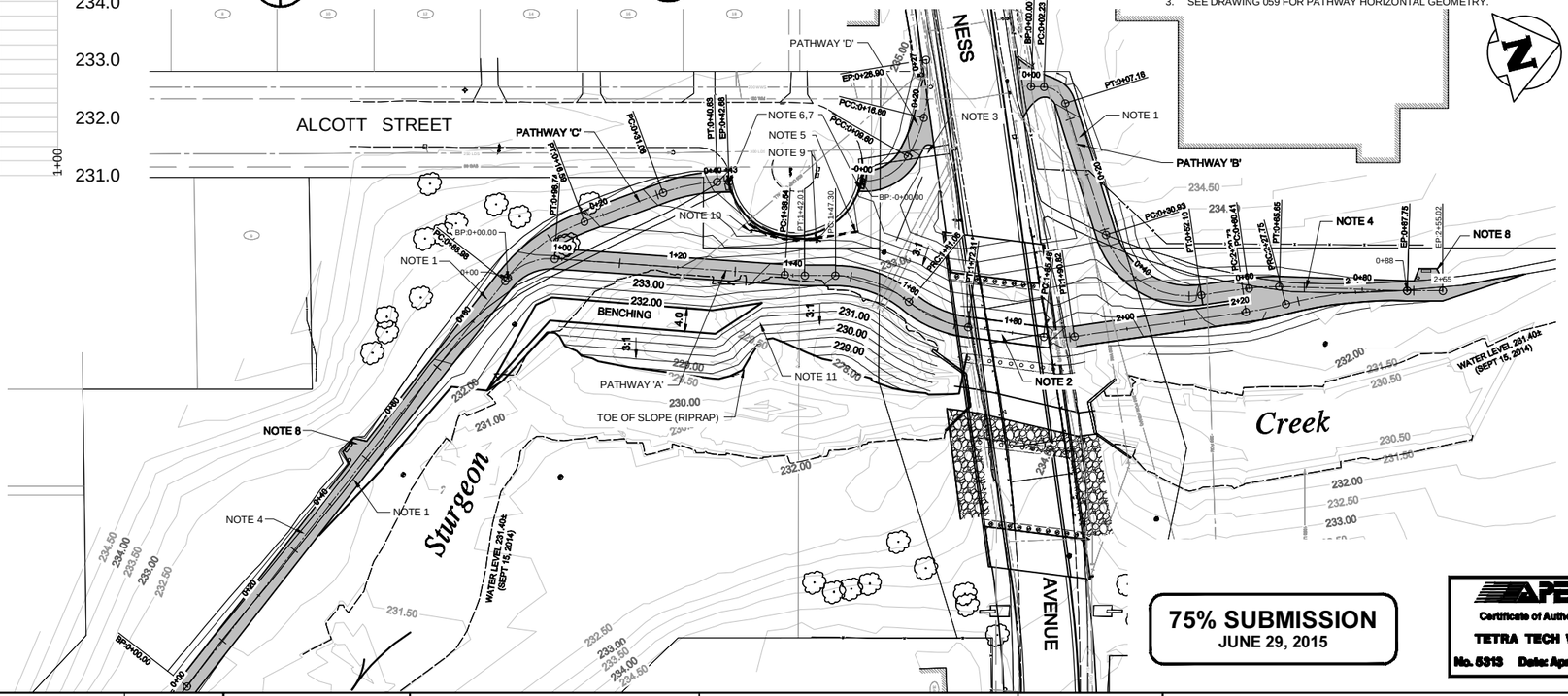
3 PATHWAY 'C' PROFILE
HOR 1 : 500, VER 1 : 50



4 TYPICAL PATH SECTION
HOR 1:50, VER 1:20



5 CONCRETE PATH SECTION AT BRIDGE
1 : 50



CONSTRUCTION NOTES:

1. CONSTRUCT 75 THICK ASPHALT PATHWAY.
2. CONSTRUCT 150 THICK CONCRETE SIDEWALK SLAB.
3. REMOVE CONCRETE SIDEWALK.
4. REMOVE ASPHALT PATH.
5. REMOVE GUARDRAIL.
6. INSTALL NEW RAMP CURB.
7. INSTALL DETECTABLE WARNING SURFACE TILES.
8. CONSTRUCT ACCESSIBLE REST AREA. SEE DRAWING 067 FOR DETAIL.
9. CONSTRUCT CONCRETE RETAINING WALL.
10. INSTALL GUARDRAIL
11. CONSTRUCT 450 RIPRAP ALONG SLOPE.

GENERAL NOTES:

1. CHAINAGE IS ALONG CENTRELINE OF PROPOSED PATHWAYS.
2. SEE DRAWINGS 012 AND 013 FOR BANK CROSS SECTIONS.
3. SEE DRAWING 059 FOR PATHWAY HORIZONTAL GEOMETRY.

75% SUBMISSION
JUNE 29, 2015

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

150 WM	WATERMAIN	150 WM		SWALE			RIGHT-OF-WAY	
400 FM	FEEDERMAIN	400 FM	○	MANHOLE	●		GAS	
300 LDS	LAND DRAINAGE SEWER	300 LDS	□	CATCHBASIN	■		HYDRO	
250 WWS	WASTEWATER SEWER	250 WWS	H	HYDRO BOX			MTS	
300 CS	COMBINED SEWER	300 CS	•	HYDRO POLE			DETECTABLE WARNING TILE	
200 FCM	FORCEMAIN	200 FCM		LIGHT STANDARD		×31.175	ELEVATION	32.000
	JUNCTIONS			ANCHOR			SIDEWALK	
	HYDRANT			TREE			CURB	
⊗	VALVE	⊗		SURVEY BAR			ASPHALT	
	CURB STOP		⊠	SIGNAL CONTROLLER			CONCRETE	
EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE DATE

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE. BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M. ELEV.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY GAC, GMD	CHECKED BY
DRAWN BY GMD	APPROVED BY
HOR. SCALE: 1 : 500 VERTICAL: 1 : 50	ACCEPTED BY DATE
DATE 15.02.05	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-C0053

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

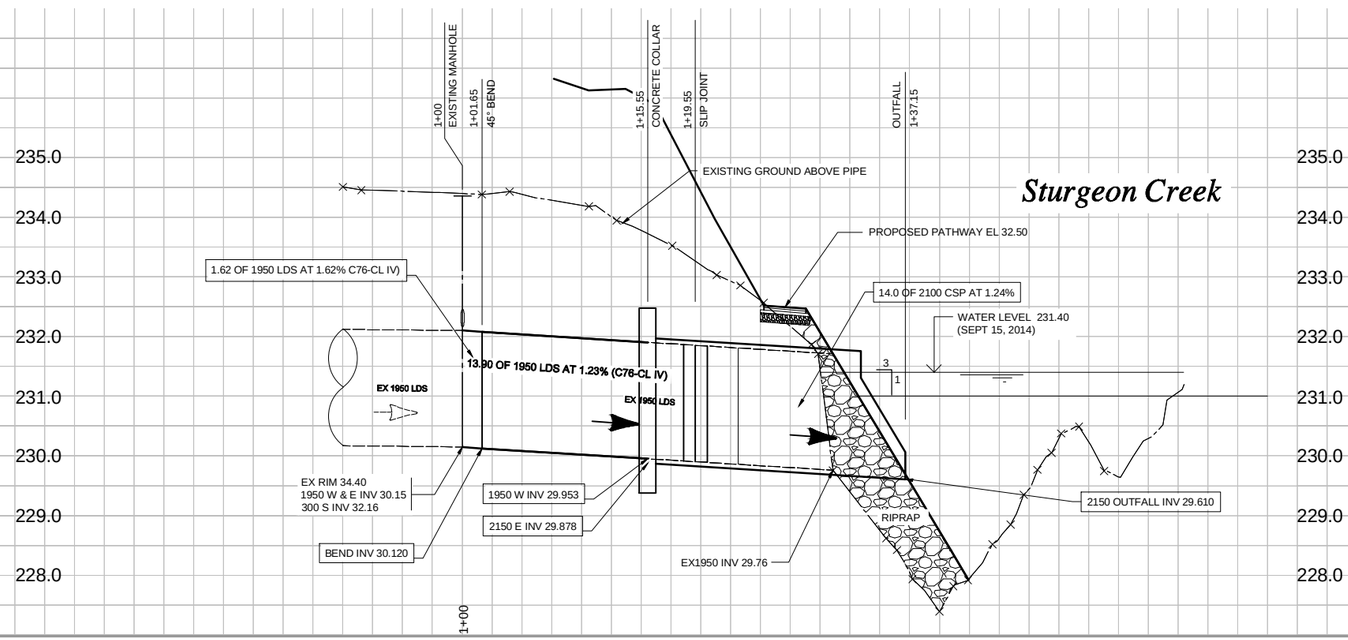
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

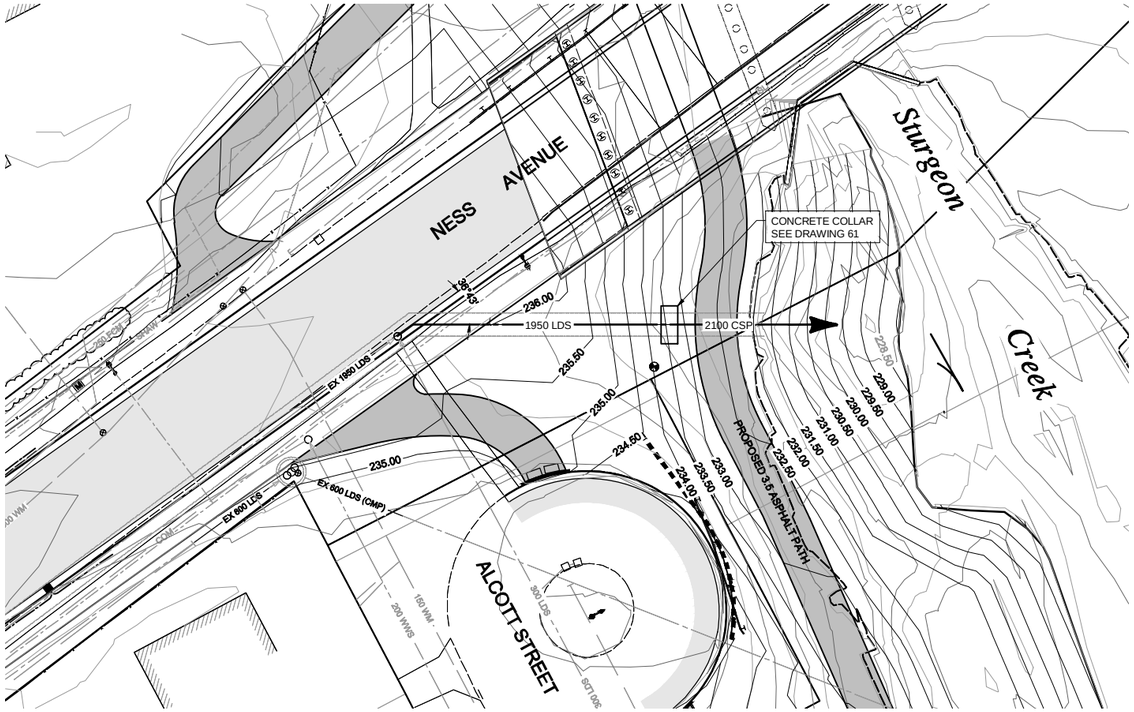
CITY DRAWING NUMBER
P-3465-15-007

SHEET 53 OF

STURGEON CREEK PATHWAY
PLAN, PROFILES AND BANK STABILIZATION

53





CONSTRUCTION NOTES:

1. OUTFALL PIPING TO BE INSTALLED WITH CLASS B BEDDING, 300mm DRAINAGE COURSE (TYPE 3 MATERIAL), GRANULAR PIPE BEDDING AND BACKFILL (TYPE 2 MATERIAL) AND CLASS 4 BACKFILL.
2. PIPE SURROUND TO INCLUDE GEOTEXTILE WRAP.

GENERAL NOTES:

1. CHAINAGE IS ALONG CENTRELINE OF PROPOSED 1950 LAND DRAINAGE SEWER.
2. SEE SPECIFICATIONS FOR DETAILED TEST HOLE INFORMATION.

75% SUBMISSION
JUNE 29, 2015

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

B.M. ELEV.	NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY GWC	CHECKED BY
DRAWN BY GMD	APPROVED BY
HOR. SCALE: 1 : 250	ACCEPTED BY DATE
VERTICAL: 1 : 50	
DATE 15.03.30	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-C0058

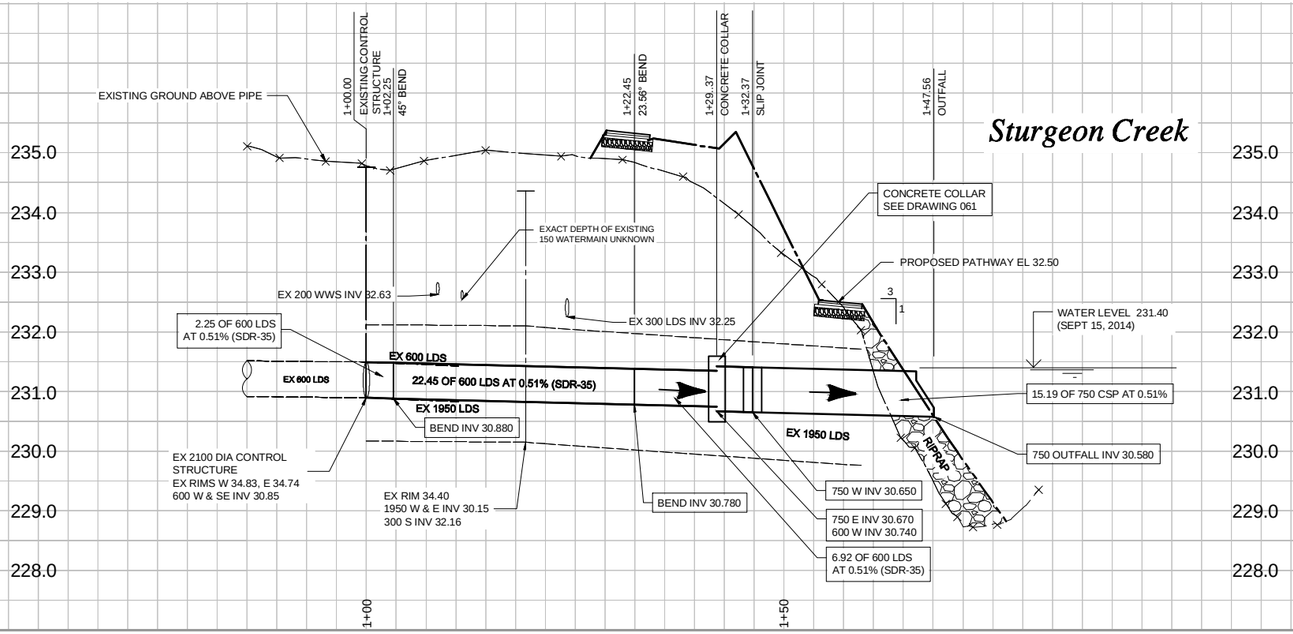
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

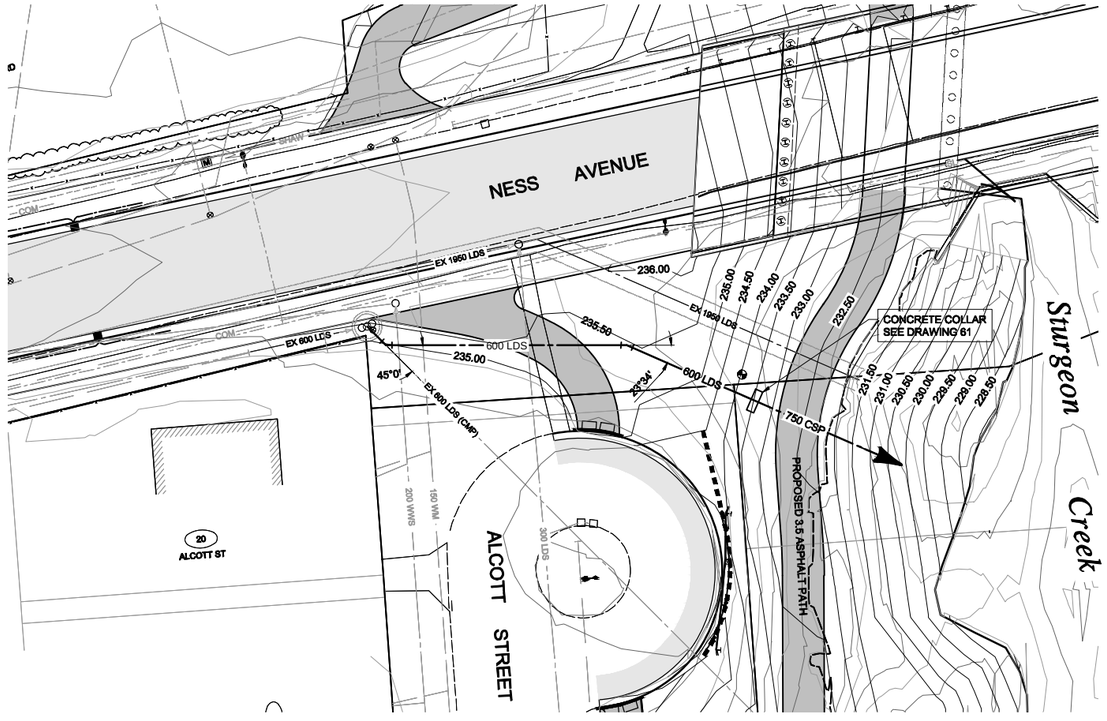
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER P-3465-15-012
SHEET 58 OF

PROPOSED 1950 LAND DRAINAGE SEWER & OUTFALL

58





CONSTRUCTION NOTES:

1. OUTFALL PIPING TO BE INSTALLED WITH CLASS B BEDDING, 300mm DRAINAGE COURSE (TYPE 3 MATERIAL), GRANULAR PIPE BEDDING AND BACKFILL (TYPE 2 MATERIAL) AND CLASS 4 BACKFILL.
2. PIPE SURROUND TO INCLUDE GEOTEXTILE WRAP.

GENERAL NOTES:

1. CHAINAGE IS ALONG CENTRELINE OF PROPOSED 600 LAND DRAINAGE SEWER.
2. SEE SPECIFICATIONS FOR DETAILED TEST HOLE INFORMATION.

75% SUBMISSION
JUNE 29, 2015

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

EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PLAN	PROPOSED
150 WM	WATERMAIN	150 WM		SWALE			RIGHT–OF–WAY	
400 FM	FEEDERMAIN	400 FM	○	MANHOLE	●		GAS	
300 LDS	LAND DRAINAGE SEWER	300 LDS	□	CATCHBASIN	■		HYDRO	
250 WWS	WASTEWATER SEWER	250 WWS	H	HYDRO BOX			MTS	
300 CS	COMBINED SEWER	300 CS	●	HYDRO POLE			DETECTABLE WARNING TILE	
200 FCM	FORCEMAIN	200 FCM		LIGHT STANDARD		×31.175	ELEVATION	32.123
	JUNCTIONS			ANCHOR			SIDEWALK	
	HYDRANT			TREE			CURB	
⊗	VALVE	⊗		SURVEY BAR			ASPHALT	
	CURB STOP		⊠	SIGNAL CONTROLLER			CONCRETE	

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE DATE

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE. BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

NO.	REVISIONS	DATE	BY
	B.M. ELEV.		

TETRA TECH

DESIGNED BY GWC	CHECKED BY
DRAWN BY GMD	APPROVED BY
HOR. SCALE: 1 : 250	ACCEPTED BY DATE
VERTICAL: 1 : 50	
DATE 15.03.30	D.N. BURNEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

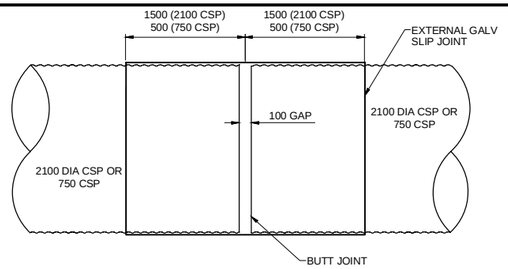
CONSULTANT DRAWING NO.
1400070800–DWG–C0059

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

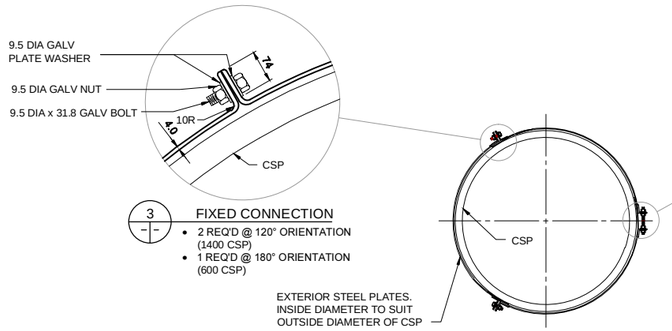
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER P–3465–15–013
SHEET 59 OF 59

PROPOSED 600 LAND DRAINAGE SEWER & OUTFALL

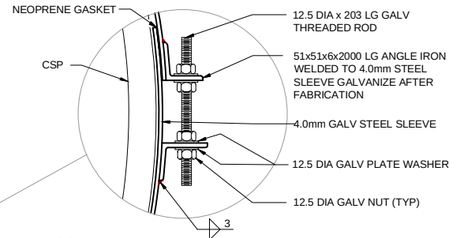


1 - - EXTERNAL SLIP JOINT
NTS

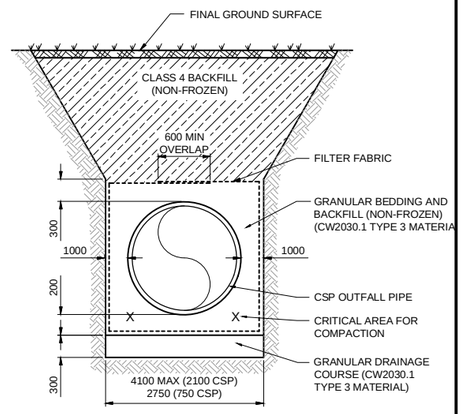


3 - - FIXED CONNECTION
- 2 REQ'D @ 120° ORIENTATION (1400 CSP)
- 1 REQ'D @ 180° ORIENTATION (600 CSP)

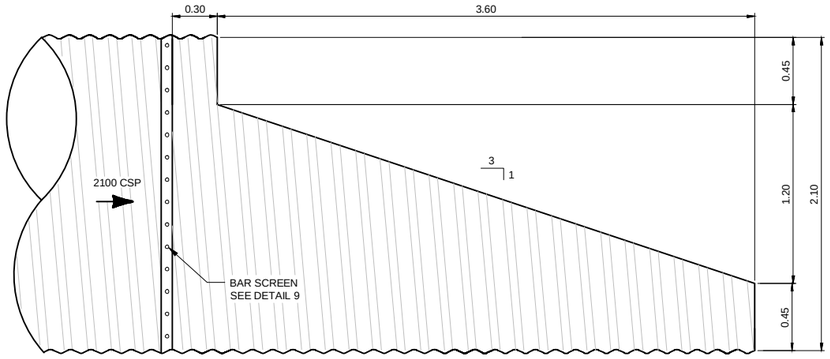
2 - - SECTION THROUGH SLIP JOINT
1 : 25



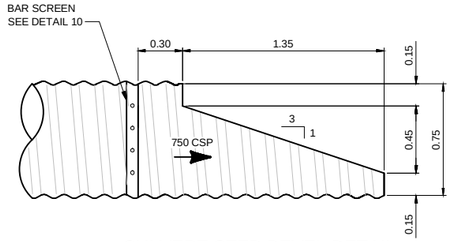
4 - - ADJUSTABLE CONNECTION



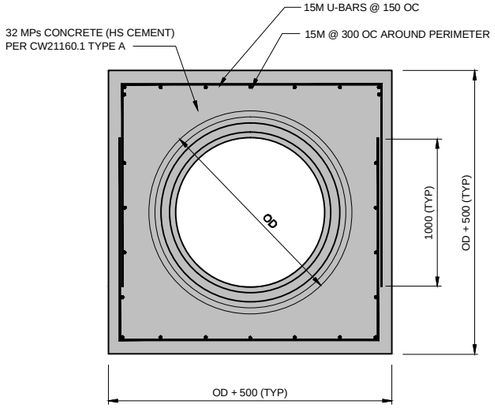
5 - - CSP TRENCH
NTS



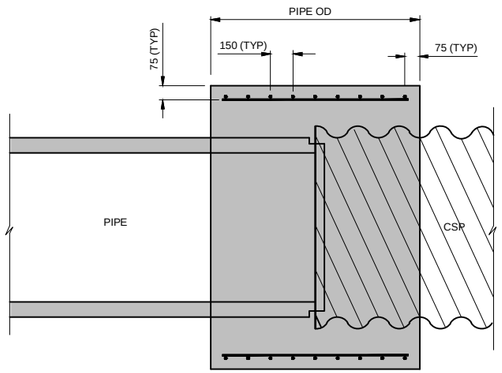
6 - - CULVERT STEP BEVEL DETAIL 2100 CSP
1 : 20



7 - - CULVERT STEP BEVEL DETAIL 750 CSP
1 : 20

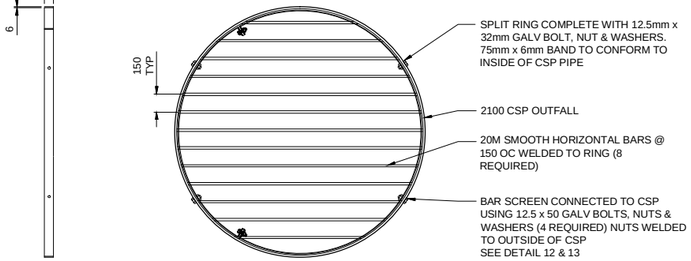


SECTION

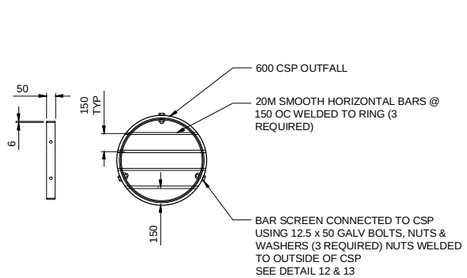


ELEVATION

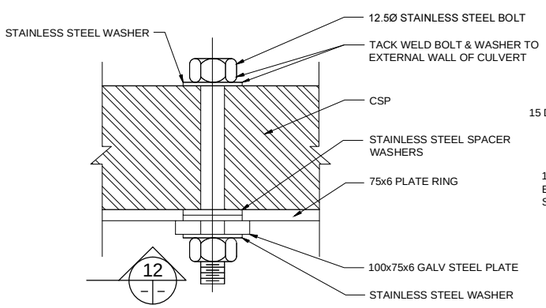
8 - - CONCRETE COLLAR
1 : 50



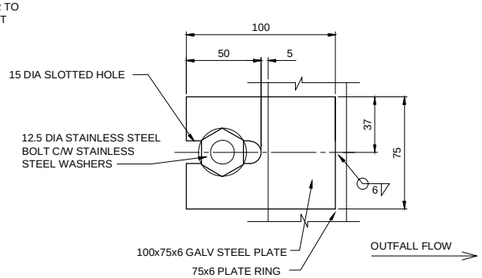
9 - - BAR SCREEN (FOR 2100 CSP)
1 : 25
GALVANIZE AFTER FABRICATION



10 - - BAR SCREEN (FOR 750 CSP)
1 : 25
GALVANIZE AFTER FABRICATION



12 - - BAR SCREEN BOLTING DETAIL
NTS



12 - - BAR SCREEN REMOVAL PLATE DETAIL
NTS

75% SUBMISSION
JUNE 29, 2015

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

B.M. ELEV.			
NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY KJM	CHECKED BY
DRAWN BY GMD	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 15.06.09	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-C0060

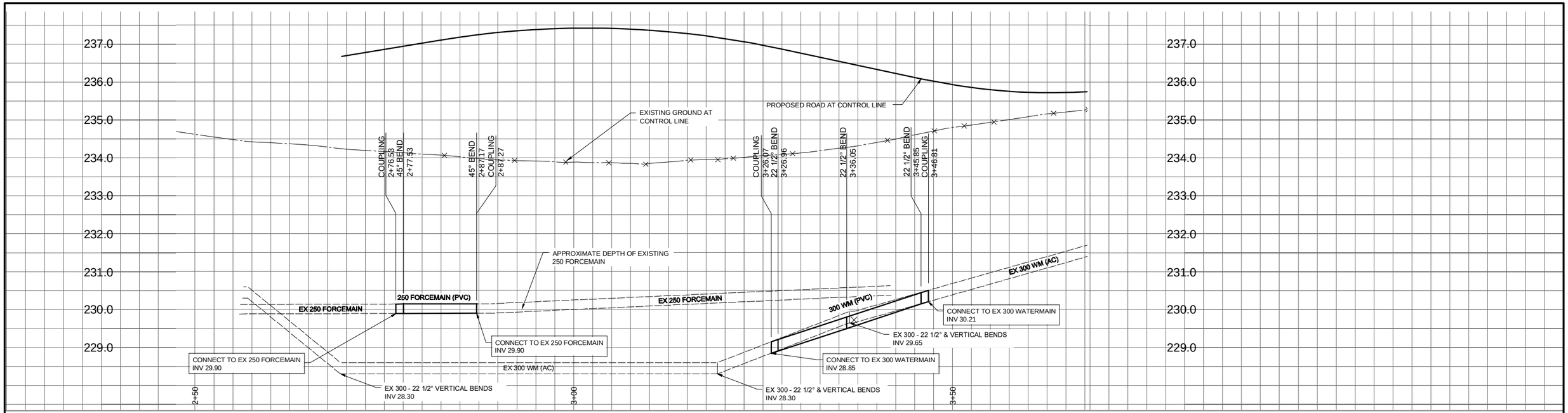
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

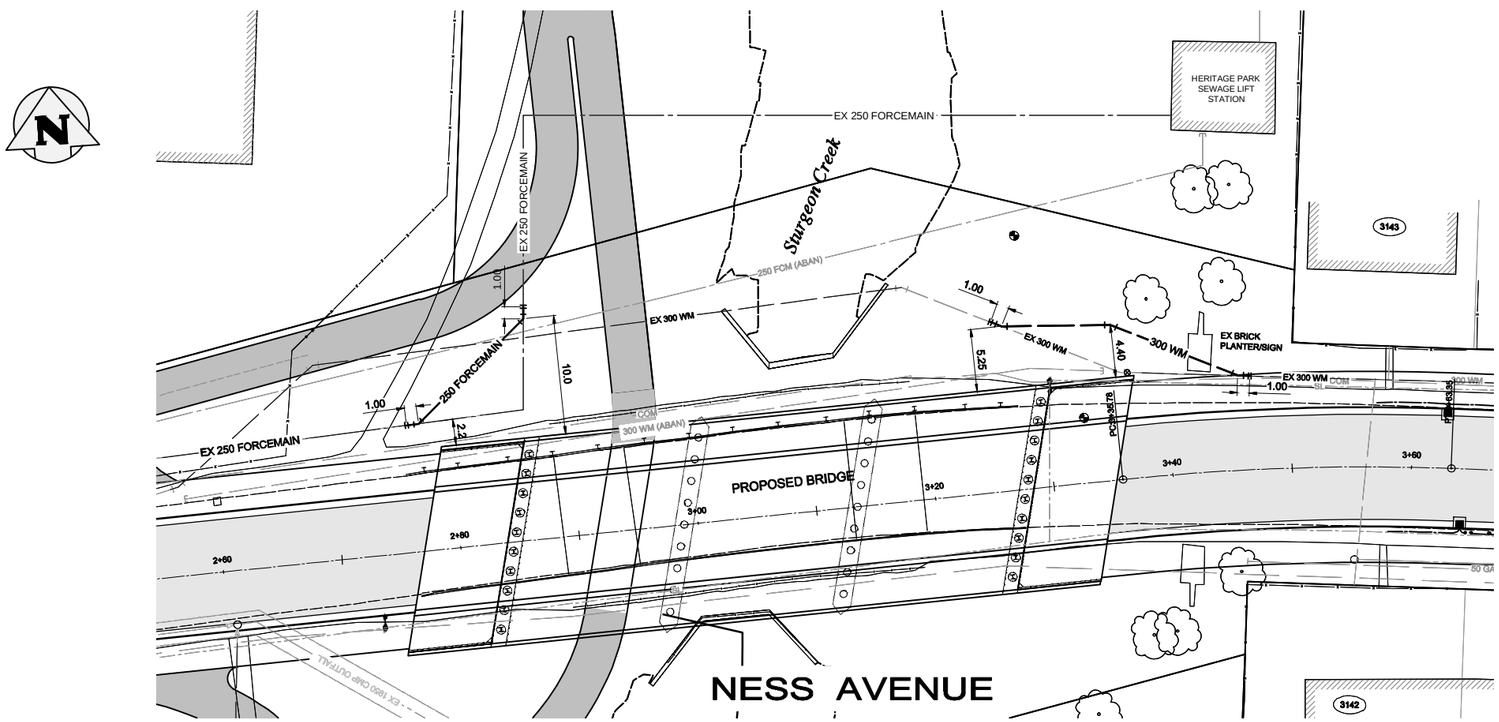
NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER P-3465-15-014
SHEET 60 OF

OUTFALL DETAILS

60





CONSTRUCTION NOTES:

1. LOCATION OF ALL SEWER AND WATER LINES TO BE CONFIRMED IN THE FIELD.
2. SEWER AND WATER SERVICES SHOWN ON DRAWINGS ARE APPROXIMATE ONLY.
3.

GENERAL NOTES:

1. CHAINAGE IS ALONG CONTROL LINE OF NESS AVENUE.
2. SEE SPECIFICATIONS FOR DETAILED TEST HOLE INFORMATION.

75% SUBMISSION
JUNE 29, 2015

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

EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PLAN	PROPOSED	EXISTING	LEGEND–PLAN	PROPOSED
150 WM	WATERMAIN	150 WM		SWALE			RIGHT–OF–WAY	
400 FM	FEEDERMAIN	400 FM	○	MANHOLE	●		GAS	
300 LDS	LAND DRAINAGE SEWER	300 LDS	□	CATCHBASIN	■		HYDRO	
250 WWS	WASTEWATER SEWER	250 WWS	H	HYDRO BOX			MTS	
300 CS	COMBINED SEWER	300 CS	•	HYDRO POLE			DETECTABLE WARNING TILE	
200 FCM	FORCEMAIN	200 FCM		LIGHT STANDARD		×31.175	ELEVATION	32.123
	JUNCTIONS			ANCHOR			SIDEWALK	
	HYDRANT			TREE			CURB	
⊗	VALVE	⊗		SURVEY BAR			ASPHALT	
	CURB STOP		⊠	SIGNAL CONTROLLER			CONCRETE	

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE DATE

NOTE:
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B.M.
ELEV.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY GWC	CHECKED BY
DRAWN BY GMD	APPROVED BY
HOR. SCALE: 1 : 250	ACCEPTED BY DATE
VERTICAL: 1 : 50	
DATE 16.06.17	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

CONSULTANT DRAWING NO.
1400070800-DWG-C0062

Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER P-3465-15-016
SHEET 62 OF

300 WATERMAIN &
250 FORCEMAIN RELOCATION
ON NESS AVENUE

62

Sturgeon Creek at Ness Avenue
Crossing Replacement
Hydrologic and Hydraulic Assessment

July 2015
Rev1

City of Winnipeg
Public Works

Bruce Harding Consulting Ltd

Sturgeon Creek at Ness Avenue
Crossing Replacement
Hydrologic and Hydraulic Assessment

APEGM
Certificate of Authorization
Bruce Harding Consulting Ltd.
No. 4652 Expiry: April 30, 2016

Prepared by: Bruce Harding, P.Eng.

July 2015
Rev1

City of Winnipeg
Public Works

Table of Contents

1 Introduction

This report summarizes the results of our hydrologic analysis and hydraulic sizing for a replacement crossing of Sturgeon Creek by Ness Avenue in the City of Winnipeg. The location of the site is indicated on Figure 1. The existing double cell concrete box culvert has reached the end of its service life and requires replacement.

Pertinent features of the project area are as follows:

- Municipality - City of Winnipeg
- Watercourse - Sturgeon Creek
- Stream Order - 4th order
- Flow Direction - Southeast
- Designation of Drain Map - No. 26
- UTM Coordinates - 623040E, 5527605N (Zone 14)

Fisheries and Oceans Canada has indicated that this reach of Sturgeon Creek near the site has Type A – complex habitat with indicator species[1] (refer to appended map) , therefore the design of the proposed crossings will adhere to the Manitoba Stream Crossing Guidelines[2] with respect to providing fish passage.

Transport Canada has indicated that Sturgeon Creek is navigable[3]; therefore the proposed crossing will be subject to the specific requirements for vertical and horizontal clearances under the Navigable Water Protection Act.

The existing box culvert crossing has been proposed to be replaced with a multi-span bridge structure on the same alignment. Additional details with respect to the hydrologic assessment and the hydraulic sizing of the replacement structure options are summarized in the following sections.

1 "Fish Habitat Classification for Manitoba Agricultural Watersheds", Map 062H14, March 2008, Fisheries and Oceans Canada.
2 "Manitoba Stream Crossing Guidelines for the Protection of Fish and Fish Habitat", Manitoba Natural Resources –Fisheries Department and the Canadian Department of Fisheries and Oceans, May 1996.
3 "Application for approval of Sturgeon Creek Culverts and Omand's Creek Overpass Crossing, Province of Manitoba", Letter from Matt Klaverkamp, Transport Canada to Don McRitchie, MIT dated September 2, 2009. Transport Canada File No. 8200-09-10644/10645/10646 and 8200-09-10687

2 Hydrology

2.1 Flood Hydrology

The contributing drainage area of Sturgeon Creek to the project site has been delineated as 556 km^2 from the watershed map. A streamflow gauge had been operated by Water Survey of Canada on Sturgeon Creek (Sturgeon Creek near Perimeter Highway – WSC 05MJ011) in upstream of thee project site for the period from 1978 to 1994. The flood hydrology derived for this streamflow gauge was selected to reflect the hydrological conditions of Sturgeon Creek within the project site.

The flood hydrology and regional discharge coefficients for the Sturgeon Creek gauge 05MJ011 were developed by Manitoba Water Stewardship (MWS) utilizing recorded and correlated data for Sturgeon Creek. MWS utilized a downstream streamflow gauge on Sturgeon Creek (Sturgeon Creek at St James – 05MJ004) with a longer streamflow record to extend the data set for the upstream gauge through correlation. The historical data from the downstream gauge was correlated with the overlapping data from the upstream gauge site record enabling the extension of the streamflow records at the upstream site for years when data was not recorded. Table 1 summarizes the regional discharge coefficients for Sturgeon Creek. The flood hydrology for Sturgeon Creek at Ness Avenue is summarized in Table 1.

Table 1
Sturgeon Creek at Ness Avenue Crossing
Flood Hydrology – Regional Coefficients and Flood Estimates

Probability	Regional Discharge Coefficient Sturgeon Creek near Perimeter Highway Gauge 05MJ011 Drainage Area = 538 km^2	Flood Estimate Sturgeon Creek at Ness Avenue Drainage Area = 556 km^2 (m^3/s)
50%	0.175	22
20%	0.333	42
10%	0.423	53
5%	0.494	62
2%	0.566	71
1%	0.606	76

* - from Regional Flood Formulae Tables, Zone 3, Manitoba Water Stewardship, April 2010, n=0.765

The 1% flood discharge of 76 m^3/s will be selected as the design discharge for the crossing replacement.

A streamflow gauge has been operated by Water Survey of Canada just downstream of the Ness crossing at the Sturgeon Road bridge (Sturgeon Creek at St James – 05MJ004). This downstream streamflow gauge on Sturgeon Creek was not used to develop site hydrology for the project as Water Survey of Canada has recently revised the stage-discharge relationship applied at that location which may have resulted in the overestimation of discharge, particularly under high flows. The revision was in response to changes in the technique employed at this location to measure discharge. As indicated, the historical discharges noted at this location are slightly overestimated which is confirmed by a correlation assessment between the two Sturgeon Creek gauges. The historical discharge data at this downstream gauge may be reduced by a factor of approximately 0.8 depending on the correction factor adopted. It is interesting to note that there is only a 30 km^2 increase in drainage area between the upstream (538 km^2) and downstream (568 km^2) gauges however the peak flows are much higher at the downstream gauge. With the adjustment factor applied, the observed peaks and the derived flood hydrology are comparable. Note that this identified difference will not affect the extension of the upstream gauge data set as the correlation technique would have taken the adjustment factor into account.

2.2 Stage-Discharge Relationship

As indicated, Water Survey of Canada has operated a streamflow gauge downstream of Ness Avenue at Sturgeon Road (Gauge 05MJ004). The stage-discharge relationship for this gauge has been revised and would be indicative of current conditions on Sturgeon Creek. The data used in the derivation of the stage-discharge relationship would reflect discharges following the change in discharge metering technique at this location. The stage-discharge relationship at the downstream gauge (05MJ004), as presented on Figure 2, will be used to aid in model calibration.

2.3 Fish Passage Discharge

If a watercourse is considered fish habitat, then a crossing of the watercourse should not restrict upstream fish passage during a spawning migration period for flows up to a specified fish passage discharge. As indicated, Sturgeon Creek within this reach is considered fish habitat, therefore the proposed crossings will be designed to enable upstream fish passage. The spring migration period is considered the critical period for this site on the basis of the large bodied freshwater species (northern pike, sucker, etc.) that may exist within the creek. The spawning migration period was assumed to extend from April 1 to May 31 (Table 4 of the fisheries guidelines).

The fish passage discharge is estimated from the results of frequency analyses that consider the streamflow for each year that corresponds to the *largest streamflow that is equalled or exceeded for 3 consecutive days during the spawning migration period*. The 3 day delay discharge with a 10% probability (3DQ10) of exceedence is typically selected as the fish passage discharge. This analysis requires daily streamflow records from which to derive this discharge.

The 3QD10 discharge coefficient, estimated as 0.389 by MWS, was derived from an analysis of streamflow records for the Sturgeon Creek near the Perimeter Highway gauge (05MJ011) during the spring migration period. The 3DQ10 discharge at the Sturgeon Creek at the Ness Avenue crossing has estimated as 49 m^3/s.

2.4 Navigation Discharge

As indicated, Sturgeon Creek is considered navigable, therefore sufficient vertical and horizontal clearance must be provided through the structure openings to ensure the safe passage of watercraft. The required vertical clearance beneath a structure is referenced from a water level based on a specific probability of exceedence. The water level at the 50% discharge will be selected for this assessment. The clearances will be assessed to ensure that the specific requirements have been met.

3 Hydraulic Assessment – Existing Conditions

The existing Ness Avenue crossing of Sturgeon Creek is a double 2.4 high by 2.4 wide by 21.9 m long cast-in-place concrete box culvert. The existing crossing has reached the end of its service life and requires replacement. Additionally it must be noted that the existing culverts are undersized resulting in the frequent surcharge of the culverts and subsequent overtopping of Ness Avenue.

Sturgeon Creek within the study reach is for the most part a natural channel; however the creek has been heavily impacted by urban development and transportation infrastructure. The channel grade is approximately 0.06%. Photographs of Sturgeon Creek and the Ness Avenue crossing are appended for reference.

A hydraulic assessment of Sturgeon Creek within the project area was undertaken to determine the hydraulic characteristics of the waterway and downstream structures which influence the hydraulics of the channel. An existing HEC- RAS model of Sturgeon Creek previously developed for other hydraulic studies was used for the assessment. The steady-state backwater model of Sturgeon Creek within the study reach was developed using the US Army Corps of Engineers River Analysis System HEC-RAS model. The HEC-RAS model is a one-dimensional backwater model, which is considered to be the universal standard for computing steady-state water surface profiles. The backwater model extends upstream approximately 8000 m from the Portage Avenue crossing and includes the Grants Mills Dam, Sturgeon Creek Bridge, Ness Avenue Culvert Crossing, Hamilton Avenue Bridge, Saskatchewan Avenue Culvert Crossing, CPR Culvert Crossing, Summit Road Bridge and the two new Centreport Crossings. The existing backwater model was assembled from cross-sections, channel profiles and details of the crossing structures surveyed by Denis Andrews Consulting (2002), City of Winnipeg (2005) and MMM Group (2009). The model was further updated with additional detailed surveys in the Ness Avenue reach by GDS Surveys (2014).

The backwater model has been developed to the level of detail required to estimate the relative effect of the proposed replacement crossing at Ness Avenue. In general the model has not been calibrated over the entire modelled length, however the stage-discharge relationship at Sturgeon Road (WSC 05MJ004) was used for calibration in the reach of primary interest for the replacement of the Ness Avenue crossing. The hydraulic parameters required for calibration within this primary reach, such as channel roughness, are within the standard range expected for Sturgeon Creek. The results of the calibration with the stage-discharge relationship are presented on Figure 2.

The estimated water surface profiles for Sturgeon Creek within the study area under existing conditions (circa August 2014), with the Ness Avenue box culvert crossing are shown on Figure 3. Table 2 summarizes the hydraulic assessment for the existing crossing.

Table 2
Sturgeon Creek at Ness Avenue Crossing
Hydraulic Summary for Existing Box Culvert

Probability	Discharge (m^3/s)	Water Level Downstream of Crossing (m)	Headloss (m)	Clearance to Underside of Soffit * (m)	Culvert Velocities (m/s)
50%	22	232.52	0.19	0.3 submerged	1.85
20%	42	233.03	0.76	1.35 submerged	3.55
10%	53	233.28	0.95 **	1.8 submerged **	4.05 **
5%	62	233.46	0.92 **	1.95 submerged **	4.15 **
2%	71	233.62	0.89 **	2.1 submerged **	4.25 **
1%	76	233.71	0.85 **	2.15 submerged **	4.3 **
3DQ10	49	233.19	0.94 **	1.7 submerged **	3.95 **

* - underside of soffit (existing box culvert) at approximately el 232.43 m

** - Ness Avenue overtopped

4 Hydraulic Assessment – Proposed Crossing Replacement

4.1 General

The proposed replacement crossing will be a multiple span bridge structure. A bridge is proposed due to the site geometry and the flow conditions observed at this location. As proposed, the structure will be a 3 span bridge with the centre span clearing the main channel of Sturgeon Creek.

4.2 Hydraulic and Regulatory Design Criteria

The hydraulic design criterion selected for the replacement crossing is as follows:

- Design discharge – 1%.
- Maximum headloss of 0.3 m during the passage of the design discharge.
- Bridge opening velocities less than 1.5 m/s for discharges up to the design discharge
- Underside of girder elevation to remain minimum of 0.3 m above water surface during passage of design discharge.

Sturgeon Creek has been judged to be navigable by Transport Canada; therefore any proposed crossing will be subject to the specific requirements for vertical and horizontal clearances under the Navigable Water Protection Act. The following vertical and horizontal clearances for small watercraft (canoes, kayaks, etc.) were assumed to be provided:

- Provide a minimum vertical clearance of 1.5 m from the underside of girder to the water surface corresponding to the 50% (Q2) discharge.
- Provide a minimum clear horizontal width of 3 m within the bridge opening at the water surface corresponding to the 50% (Q2) discharge.

Bridge structures do not typically require the same strict limiting velocity requirements for fish passage as those of culvert type structures. The shape of the bridge opening with sloping banks at the abutments, provides lower velocity fringe zones to permit upstream fish passage. As such, the requirement for limiting velocity is typically not applied except under extenuating circumstances. On that basis, there are no concerns or design requirements with respect to fish passage with a bridge structure at this location.

4.3 Replacement Structure

The proposed replacement structure for this site is as follows:

- Three span 43 m long concrete girder bridge. The 43 m long bridge, as proposed by Tetra Tech consists of 13.5 m long approach spans with a 16 m long centre span.
- The proposed structure would be centred on the existing crossing structure on the same road alignment. A 20 degree skew is proposed.
- The proposed underside of girder elevation of 235.5 has been selected to provide 3.0 m of clearance from the proposed pedestrian pathway located under the west span of the bridge. This underside of girder elevation provides approximately 1.8 m of clearance from the design discharge water level of 233.7. The minimum underside of girder elevation that should be considered at this location would be 234.0 m which provides 0.3 m of clearance from the design water level.
- The proposed replacement structure will require the removal of the original box culvert and the excavation and armouring of the channel slopes. The channel slopes (headslopes) beneath the bridge will be excavated with an effective slope of 4:1 extending down from the abutments to the channel base. The channel base and slopes would be armoured with a 0.55 m thickness of Class 350 rock placed over non-woven geotextile. The channel base would be reshaped with a width of 6.0 m and a finished elevation of 229.80.
- Channel reshaping and rock armour to extend 5 m upstream and downstream of the outside faces of the replacement bridge structure.
- All Class 350 rock to be well-graded, rounded, sound field stone or quarried rock with the following gradation: 100% < 350 mm, 50% > 200 mm, and 80% > 100 mm. 30% granular material by volume will be blended with the Class 350 rock prior to placement in order to fill the interstitial space/voids within the rock. The granular will be clean gravel or crushed rock with the following gradation: 100% <100 mm, 50% > 20mm and 80% > 3mm.
- Refer to the detail sketches of the proposed bridge structure on Figures 4 and 5.

The backwater model of Sturgeon Creek was modified to incorporate the proposed bridge replacement structure. The estimated water surface profiles for Sturgeon Creek with the proposed replacement bridge structure are shown on Figure 6 while Table 3 summarizes the hydraulic assessment.

Table 3
Sturgeon Creek at Ness Avenue Crossing
Hydraulic Summary for Proposed 43 m long Bridge

Probability	Discharge (m^3/s)	Water Level Downstream of Crossing (m)	Headloss (m)	Clearance to Underside of Girder * (m)	Bridge Opening Velocities (m/s)
50%	22	232.52	< 0.05	2.97	0.5
20%	42	233.03	< 0.05	2.46	0.7
10%	53	233.28	< 0.05	2.21	0.8
5%	62	233.46	< 0.05	2.03	0.85
2%	71	233.62	< 0.05	1.87	0.9
1%	76	233.71	< 0.05	1.78	0.95
3DQ10	49	233.19	< 0.05	2.30	0.75

* - underside of girder at 235.5 m

4.4 Downstream Shoreline Stabilization

The west shoreline and the channel downstream of the Ness Avenue crossing has been heavily scoured by the turbulence and high velocities exiting the undersized box culvert. The new bridge however provides considerably greater conveyance areas and as such has lower velocities even under extreme flows. As such, the concerns related to continued scour of the channel and shoreline will be minimized, and therefore no shoreline protection is necessary to counter the hydraulic forces. Note however that geotechnical concerns with respect to slope stability require that the west riverbank downstream of the bridge be stabilized.

Shoreline stabilization measures have been proposed as shown in Appendix C. These stabilization measures include the placement of rock riprap on the west riverbank downstream of the bridge. This rock riprap extends into the existing channel and scourhole reducing the channel conveyance area and increasing channel velocities. These stabilization measures were assessed as part of the bridge replacement and not found to have a detrimental effect on the replacement bridge hydraulics or the hydraulics of the creek itself.

As indicated, the encroachment of the stabilization measures into the creek will result in an increase in channel velocities, however these velocities are well within the range observed within the length of the creek away from the bridge site. Any shoreline stabilization measures should use a minimum class 350 rock riprap armoring, however larger rock can be utilized if that benefits stability.

5 Other Considerations

Best Management Practices for working near waterways including the appropriate implementation of sediment and erosion control measures should be followed. Exposed slopes not covered with rock should be revegetated and covered with erosion control blanket. Construction activities within the creek shall not take place between April 1 and June 15 of any given year. An Environmental Management Plan should be prepared which details the specific environmental management requirements and sediment and erosion control.

Water management during construction can be an important aspect of any project and may influence the cost and scheduling for crossing replacement. The largest flows within the creek are expected to occur during the spring runoff period and following a heavy summer rainfall event. Construction should take place in the late fall and winter period when the potential for runoff is reduced thereby minimizing water management requirements. Although minimal, flows continue throughout the winter and should be considered as part of the water management plan with appropriate measures taken to deal with the flow. Additionally there is a considerable volume of water within the downstream scourhole and creek upstream which has to be taken into consideration for water management and during construction.

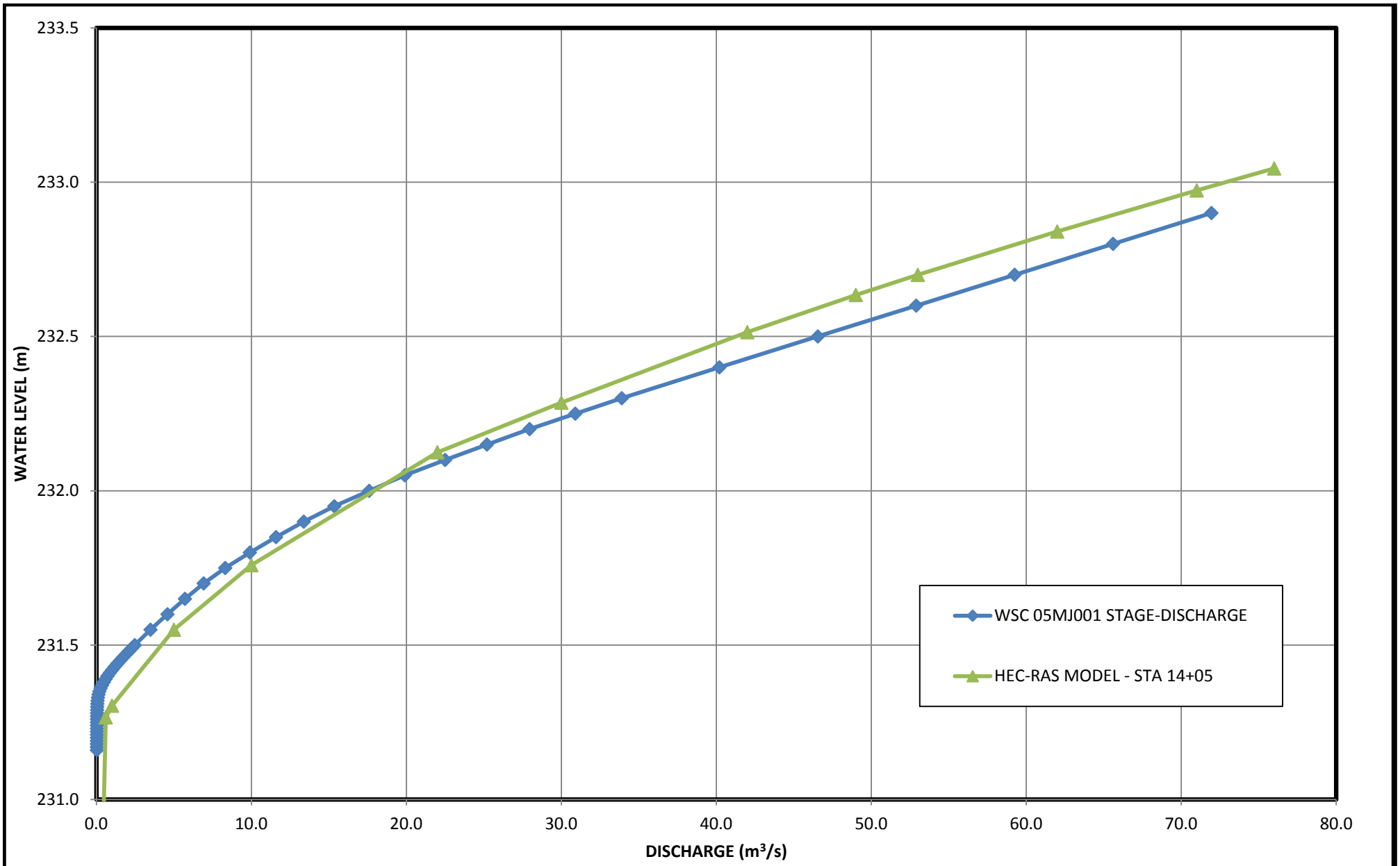
A pedestrian pathway exists along the west side of Sturgeon Creek and it is proposed that the pedestrian pathway be routed under the west span of the proposed bridge. In general the existing pathway is at elevation 231.9 to 232.5, which would be flooded during the spring runoff, but would be clear of normal summer flows. Normal summer level at the bridge is approximately 231.3 to 231.4. The pathway elevation under the bridge has been selected to be equal to the 50% water level of 232.5, which closely matches the elevation of the existing pathway just upstream and downstream of the existing crossing.

Figures

SCALE

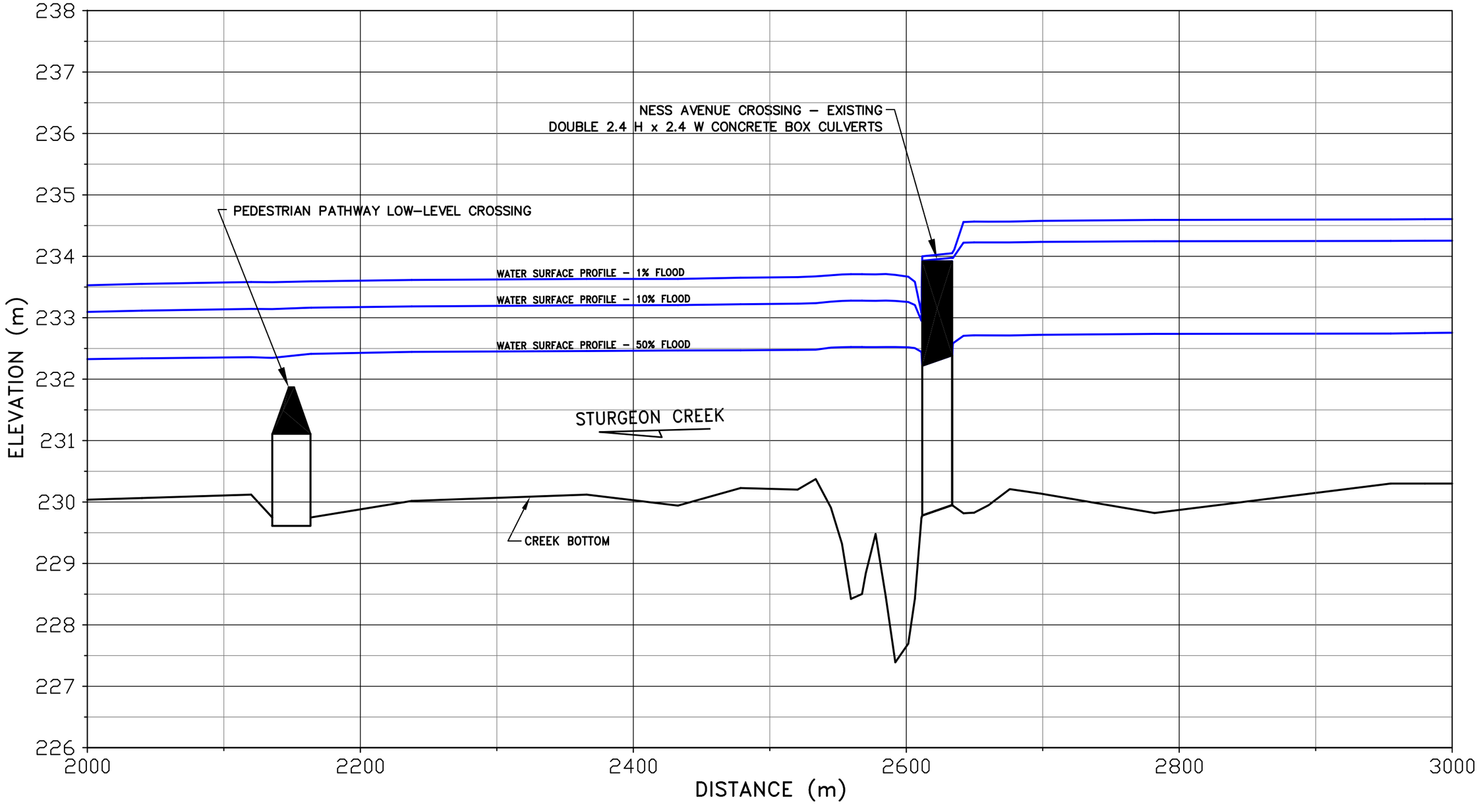
200 0 200 400

STURGEON CREEK AT NESS AVE
CROSSING REPLACEMENT
LOCATION PLAN
FIGURE 1



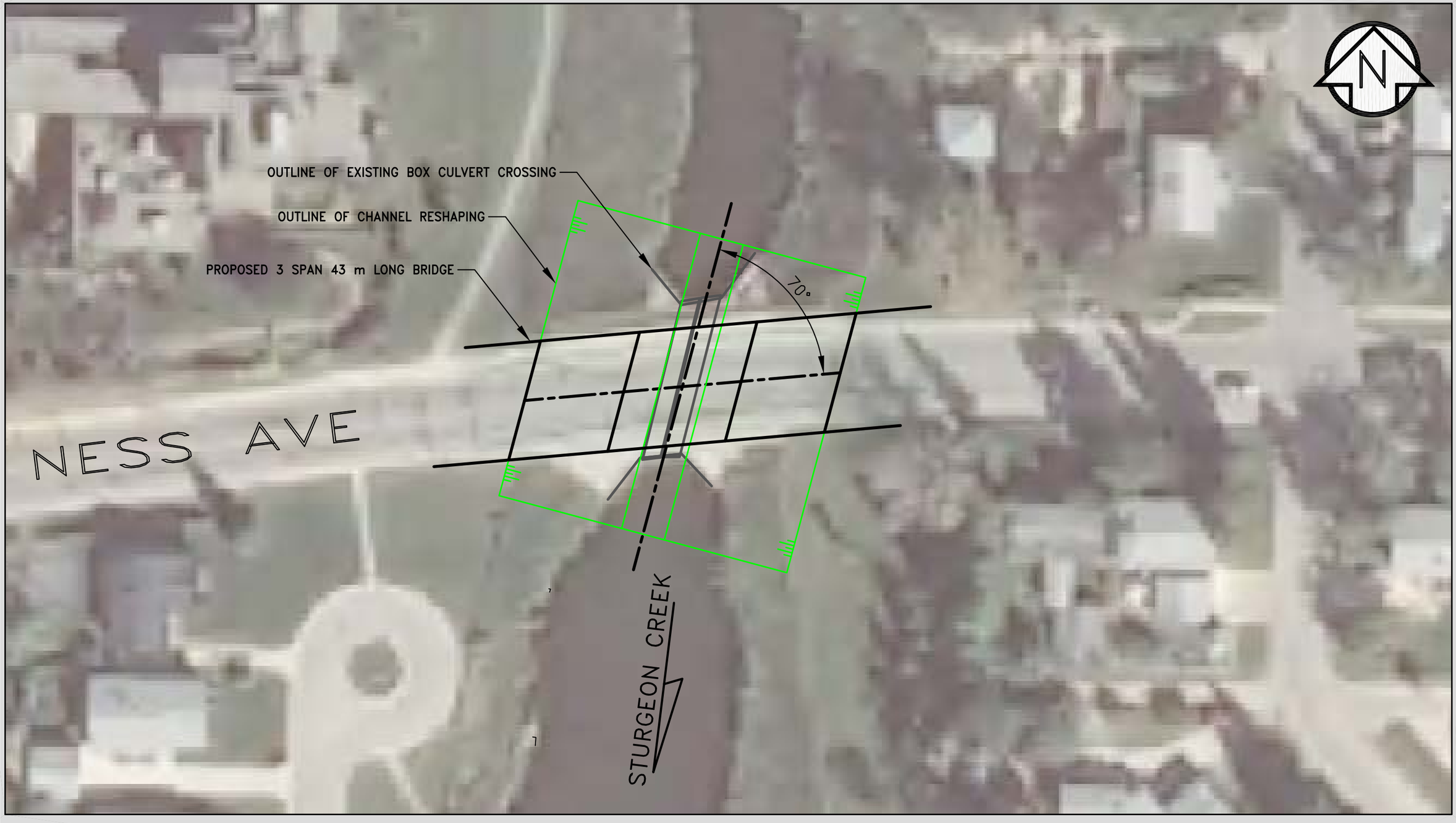
NOTE:
1) STAGE-DISCHARGE RELATIONSHIP DERIVED FROM OBSERVED WATER LEVEL AND DISCHARGE DATA AT THE WATER SURVEY OF CANADA GAUGE (05MJ004 - STURGEON CREEK NEAR ST JAMES) FOR THE PERIOD FROM 2011 TO 2014
2) HEC-RAS DATA FROM OCTOBER 2014 STURGEON CREEK MODEL FOR LOCATION JUST UPSTREAM OF STURGEON ROAD.

STURGEON CREEK WSC 05MJ004
STAGE-DISCHARGE RELATIONSHIP
FIGURE 2



NOTES:
1) HEC–RAS MODEL DEVELOPED FROM COMPREHENSIVE STURGEON CREEK MODEL WITH ADDITIONAL DETAILED SECTIONS WITHIN PROJECT AREA SURVEYED AUGUST 2014
2) WATER SURFACE PROFILES REFLECT HYDRAULIC CONDITIONS WITH EXISTING DOUBLE 2.4 H x 2.4 W CONCRETE BOX CULVERT AT NESS AVENUE

STURGEON CREEK AT NESS AVENUE
WATER SURFACE PROFILES
EXISTING CONDITIONS
FIGURE 3

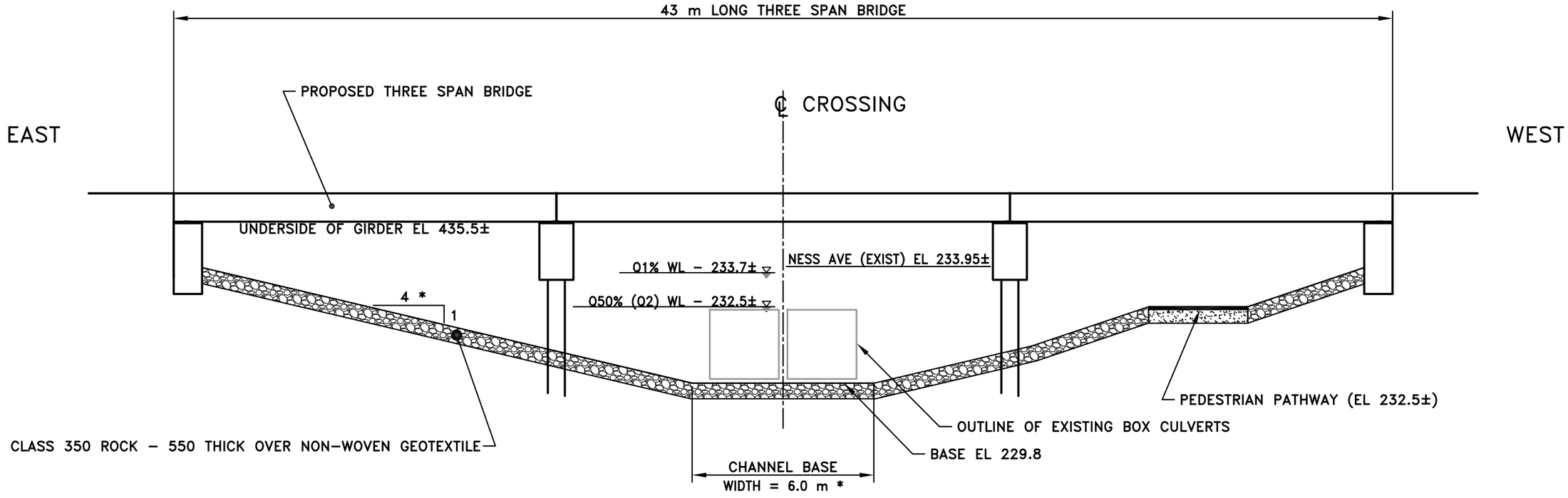


NOTE: RIPRAP NOT SHOWN FOR CLARITY

SCALE 1:500 (METRES)

25 0 25 50

STURGEON CREEK AT NESS AVENUE
LAYOUT PLAN
PROPOSED REPLACEMENT STRUCTURE
FIGURE 4



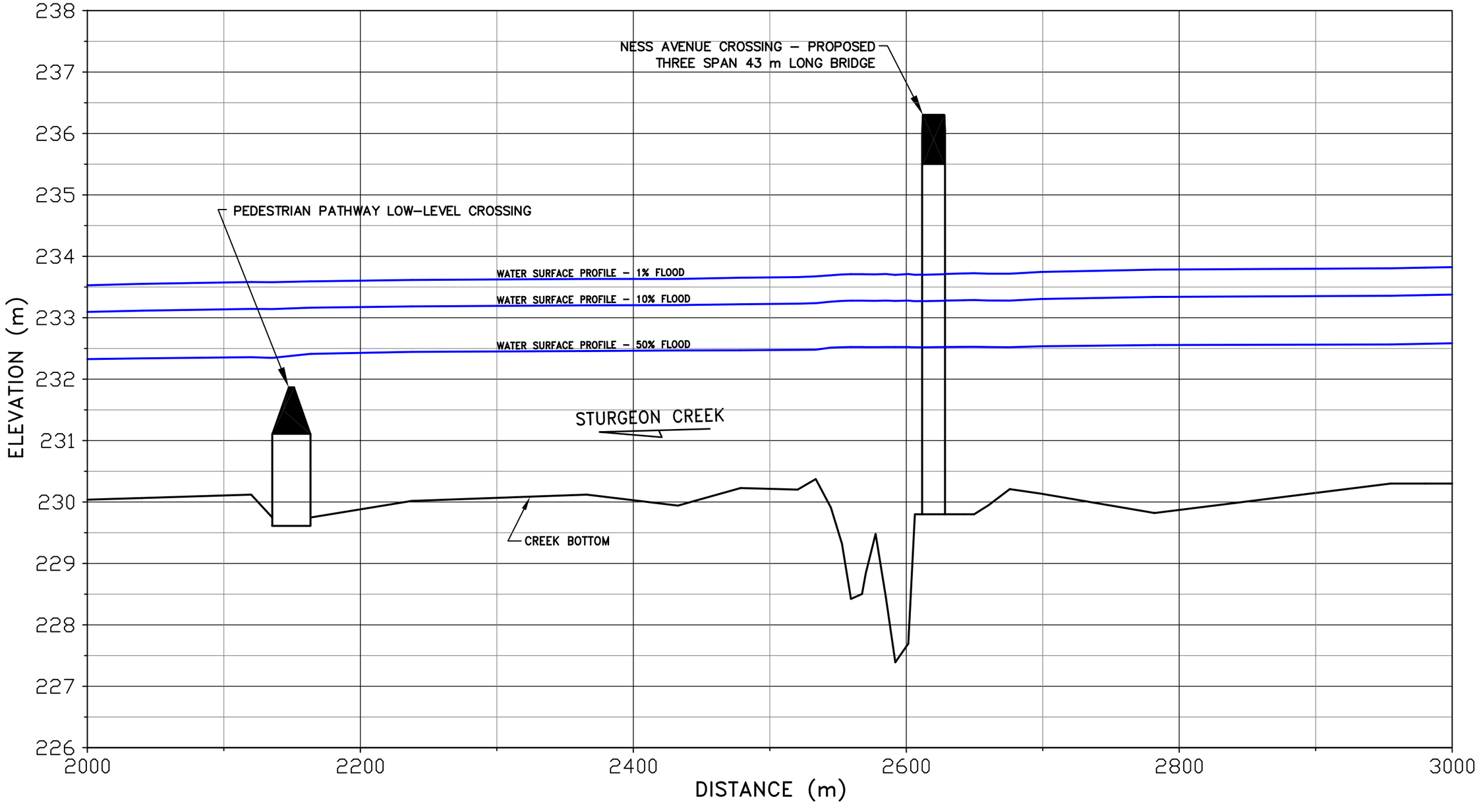
* – DIMENSIONS AND SLOPE WITHOUT SKEW

UPSTREAM ELEVATION

SCALE

7.5 0 7.5 15

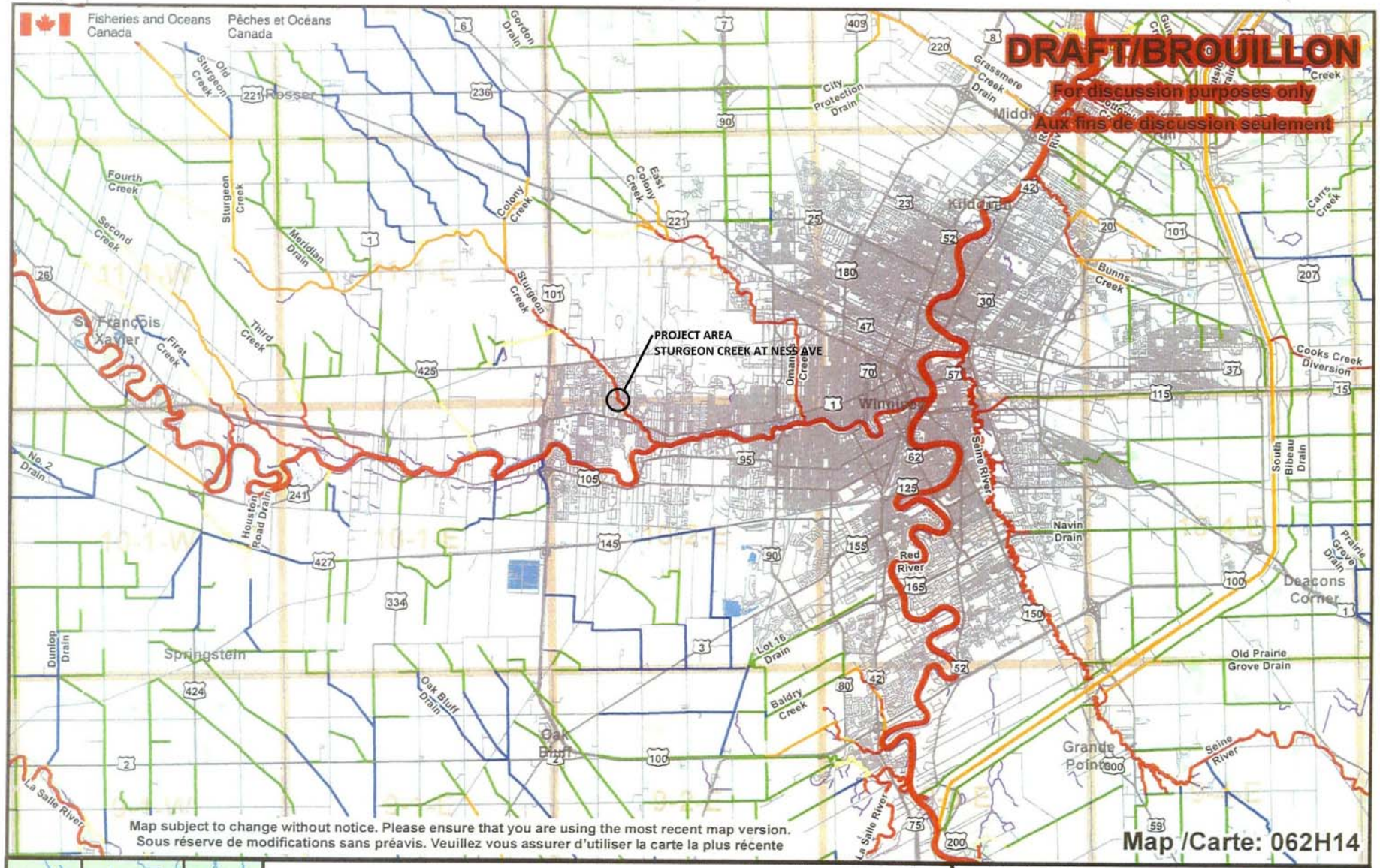
STURGEON CREEK AT NESS AVENUE
UPSTREAM ELEVATION
PROPOSED REPLACEMENT STRUCTURE
FIGURE 5



NOTES:
1) HEC–RAS MODEL DEVELOPED FROM COMPREHENSIVE STURGEON CREEK MODEL WITH ADDITIONAL DETAILED SECTIONS WITHIN PROJECT AREA SURVEYED AUGUST 2014
2) WATER SURFACE PROFILES REFLECT HYDRAULIC CONDITIONS WITH PROPOSED 3 SPAN 43 m LONG BRIDGE AT NESS AVENUE

STURGEON CREEK AT NESS AVENUE
WATER SURFACE PROFILES
PROPOSED REPLACEMENT STRUCTURE
FIGURE 6

Appendix A
Fish Habitat Classification Map



062I04	062I03	062I02
062H13	062H14	062H15
062H12	062H11	062H10

Kilometers 0 1 2 4 6 8 10 Kilomètres

Miles 0 1 2 4 6 Milles

Map not to be used for navigation/
Ne pas utiliser pour la navigation

Habitat Type/ Type d'habitat	Color/ Couleur
A	
B	
C	
D	
E	
Unclassified/ Non classifié	

Fish Habitat Classification for Manitoba Agricultural Watersheds/ Classification de l'habitat du poisson par rapport aux bassins hydrographiques agricoles au Manitoba

Version 1.0

Valid until March 31, 2008
Valide jusqu'au 31 mars 2008

Canada

Appendix B
Photographs

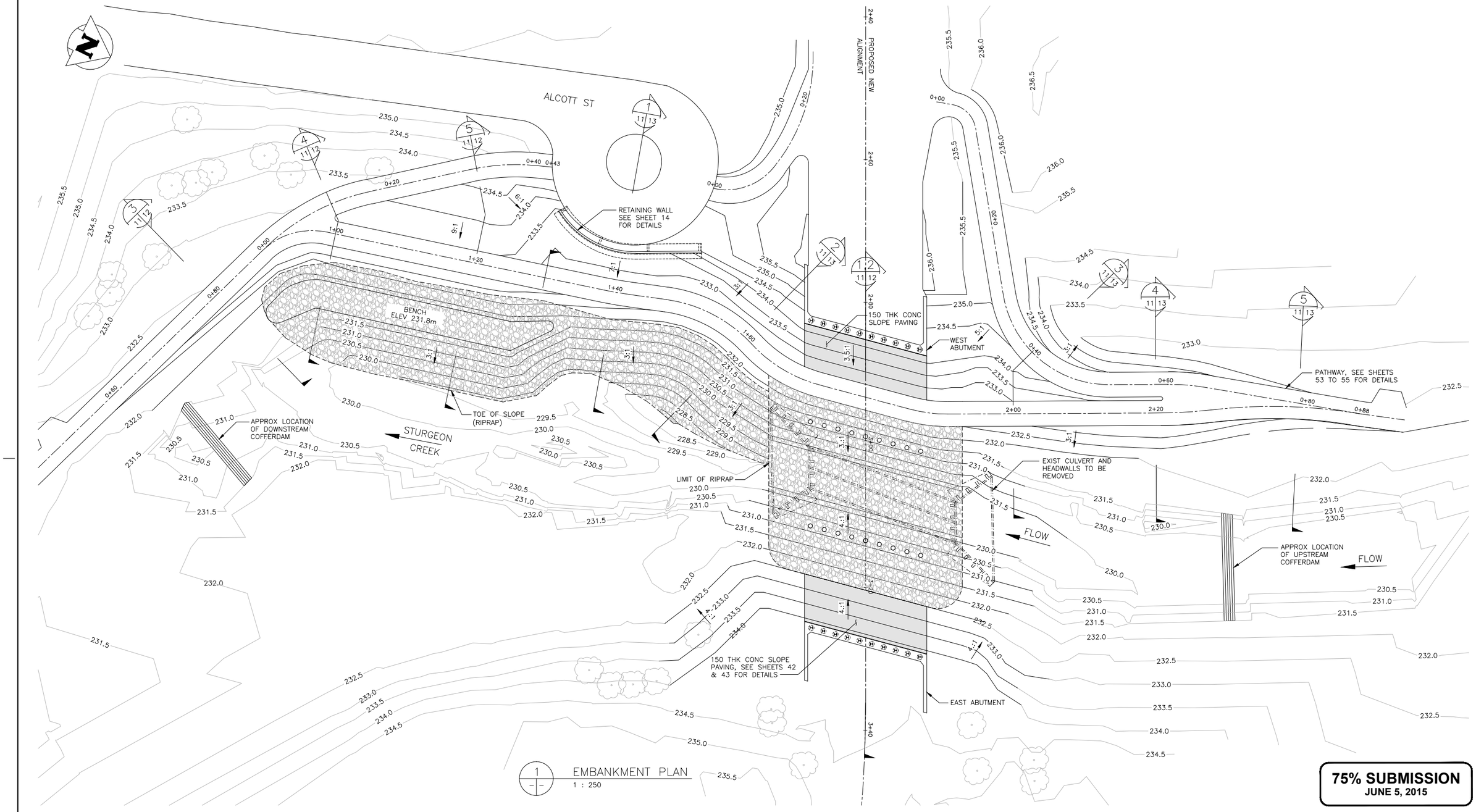
Photo No. 1 Creek upstream of Ness Avenue Crossing – June 4, 2014

Photo No. 2 Upstream side of Ness Avenue Crossing – August 13, 2014

Photo No. 3 Downstream side of Ness Avenue Crossing – August 13, 2014

Photo No. 4 Creek upstream of Ness Avenue Crossing – June 4, 2014

Appendix C
Shoreline Stabilization Measures



1 EMBANKMENT PLAN
1 : 250

75% SUBMISSION
JUNE 5, 2015

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

B.M. ELEV.	F.B.

NO.	REVISIONS	DATE	BY

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

PRELIMINARY DRAWING
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1400070800-DWG-S0011

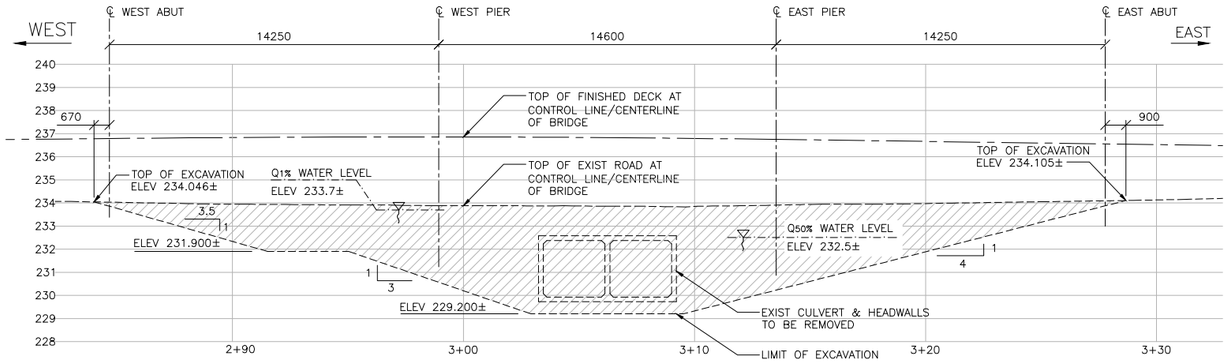
Winnipeg
THE CITY OF WINNIPEG
PUBLIC WORKS DEPARTMENT
ENGINEERING DIVISION

NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-011
SHEET 11 OF

EMBANKMENT AND CHANNEL WORKS
EXISTING CULVERT REMOVAL AND
EMBANKMENT DETAILS

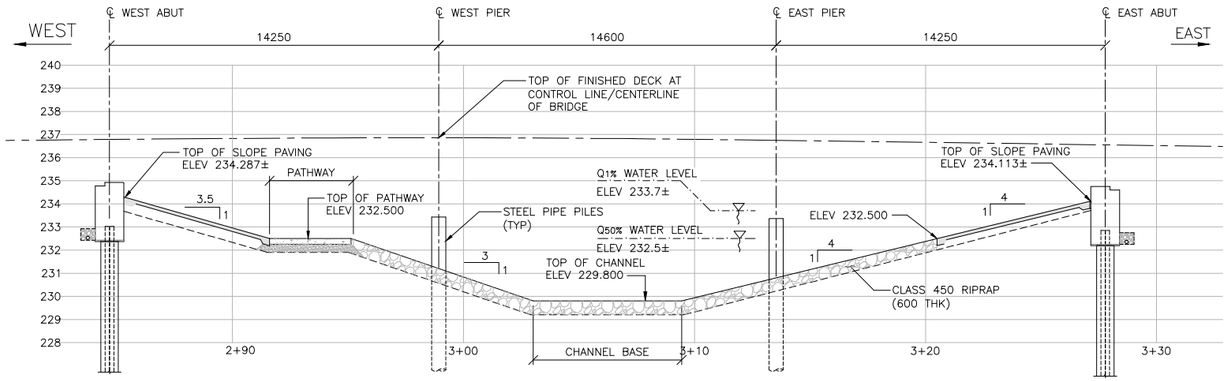
11



1 / 11 12 EXISTING SECTION AT CENTERLINE OF BRIDGE

1 : 125

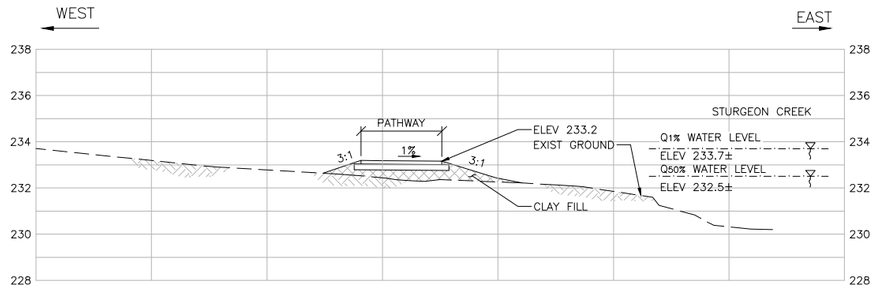
– SHOWING LIMIT OF DEMOLITION AND EXCAVATION



2 / 11 12 CROSS SECTION AT CENTERLINE OF BRIDGE

1 : 125

– SHOWING FINAL CHANNEL CROSS SECTION AT THE CENTERLINE OF BRIDGE



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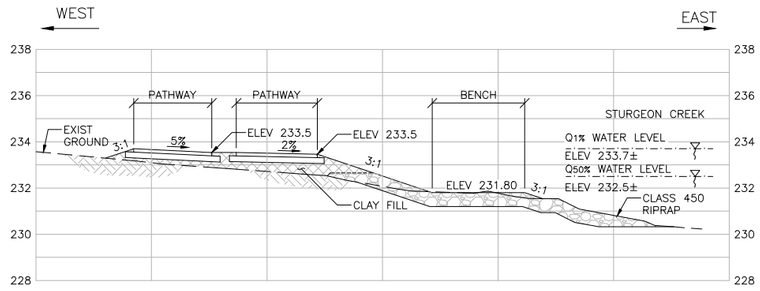

4 / 11 12 SECTION AT STA. 1+00

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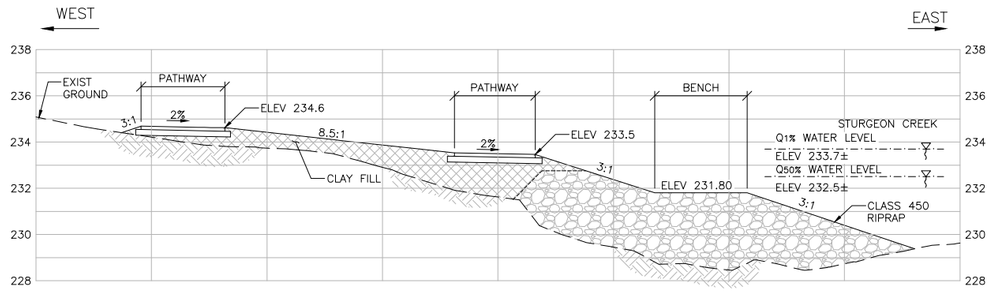

5 / 11 12 SECTION AT STA. 1+20

1 : 125

DEMOLITION NOTES:

1. THE INTENT OF THIS DRAWING IS TO SHOW THE GENERAL LAYOUT OF THE EXISTING CULVERT. REFER TO THE EXISTING DRAWINGS OF THE CREEK FOR COMPLETE DETAILS.
2. THE CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL DIMENSIONS OF EXISTING STRUCTURES.
3. DEMOLITION INCLUDES ALL COMPONENTS OF THE EXISTING CULVERT, INCLUDING HEADWALLS.
4. THE CONTRACTOR IS RESPONSIBLE FOR SAFETY AND INTEGRITY OF THE STRUCTURES DURING DEMOLITION.
5. SUBMIT DEMOLITION PLAN IN ACCORDANCE WITH THE SPECIFICATIONS.
6. DO NOT DISPOSE OF ANY MATERIALS IN ANY PORTION OF THE CREEK.
7. SALVAGED ITEMS AS DIRECTED BY THE CONTRACT ADMINISTRATOR.

LIST OF SALVAGE ITEMS:

1. ALUMINUM BALANCED BARRIER INCLUDING POSTS, RAILING, SPLICE BARS AND CLAMP BARS.
2. WELDED WIRE RAILING AND POST.

75% SUBMISSION
JUNE 5, 2015

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TETRA TECH WEI Inc.
No. 5313 Date: April 30, 2016

B.M. ELEV.		F.B.		
NO.	REVISIONS	DATE	BY	

TETRA TECH

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DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE 14.10.14	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

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BRIDGE CONSTRUCTION

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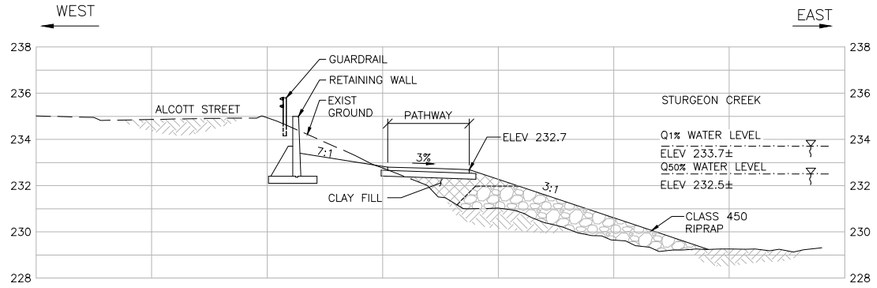
B243-15-012

SHEET 12 OF

EMBANKMENT AND CHANNEL WORKS
EXISTING CULVERT REMOVAL AND
EMBANKMENT SECTIONS

12



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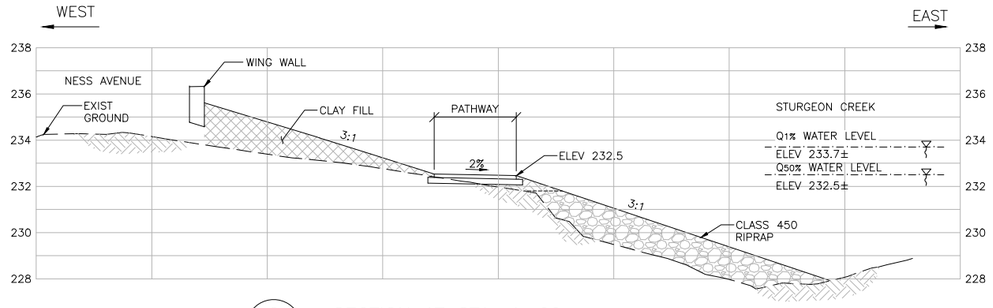

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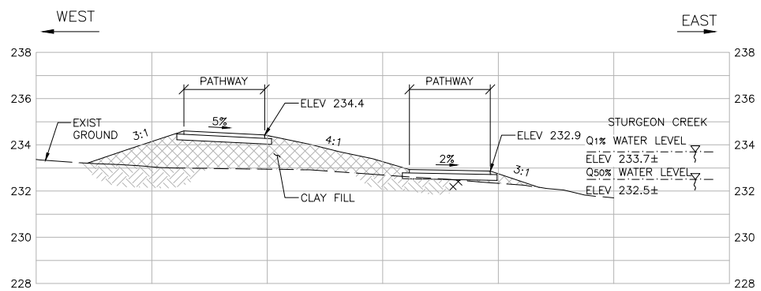

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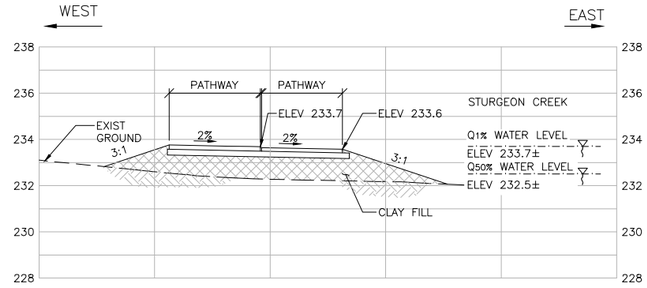

4 SECTION AT STA. 2+20
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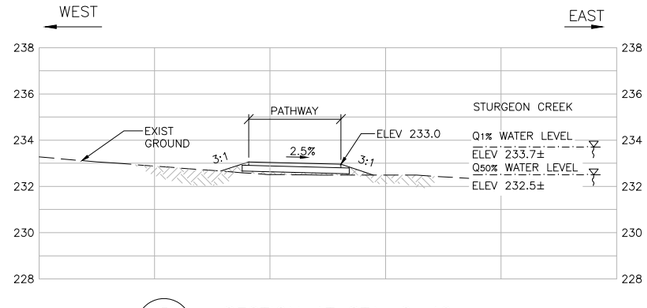

5 SECTION AT STA. 2+40
11 13
1 : 125

75% SUBMISSION
JUNE 5, 2015

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

NO.	REVISIONS	DATE	BY

B.M.
ELEV.

TETRA TECH

DESIGNED BY D.M.	CHECKED BY
DRAWN BY G.I.	APPROVED BY
HOR. SCALE: AS NOTED VERTICAL:	ACCEPTED BY DATE
DATE	D.N. BURMEY, P.ENG. BRIDGE PROJECTS ENGINEER

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NESS AVENUE AT STURGEON CREEK
BRIDGE CONSTRUCTION

CITY DRAWING NUMBER
B243-15-013

SHEET 13 OF 13

EMBANKMENT AND CHANNEL WORKS
SECTIONS AND DETAILS

NESS AVENUE AT STURGEON CREEK CULVERT REPLACEMENT
PUBLIC INFORMATION SESSION

In early 2016, the City of Winnipeg will begin replacing the Ness Avenue at Sturgeon Creek Culvert with a bridge.

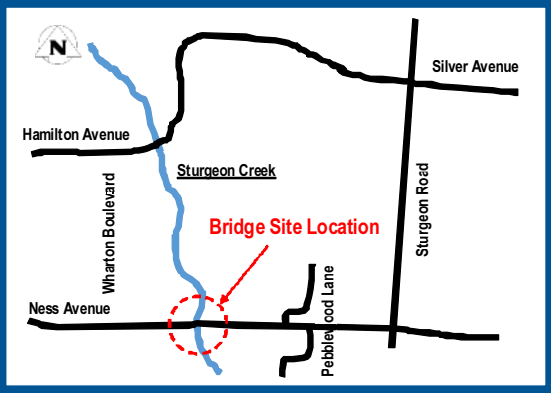
Please join us for a public information session, where engineers and planners will be on hand to answer your questions and listen to your concerns.

Tuesday, January 13th

Heritage Park Temple

825 School Road

Drop in anytime between 6 PM and 8 PM.



At the public open house, you can learn about:

- **Traffic in the area**
- **Potential detours**
- **Access during construction**
- **Transit detours**
- **Project timeline**
- **Environmental impacts**

If you are unable to attend please contact us for more information.

TETRA TECH

311 City Services

Winnipeg

For more information contact:

Kimberly Yathon

Tetra Tech

(204) 954-6896

kimberly.yathon@tetratech.com

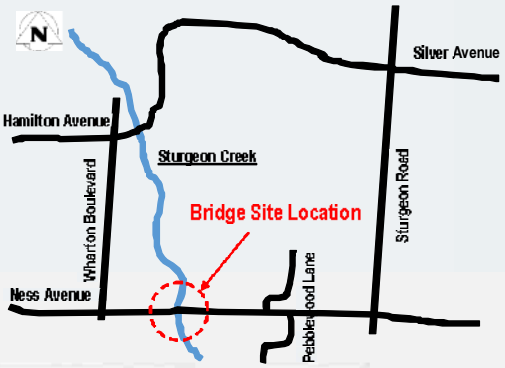
YOU'RE INVITED!

Ness Avenue at Sturgeon Creek Culvert Replacement Public Information Session

Tuesday, January 13th

Heritage Park Temple,
825 School Road

Drop in anytime between
6:00 p.m. and 8:00 p.m.



In early 2016, the City of Winnipeg will begin replacing the Ness Avenue at Sturgeon Creek Culvert with a bridge.

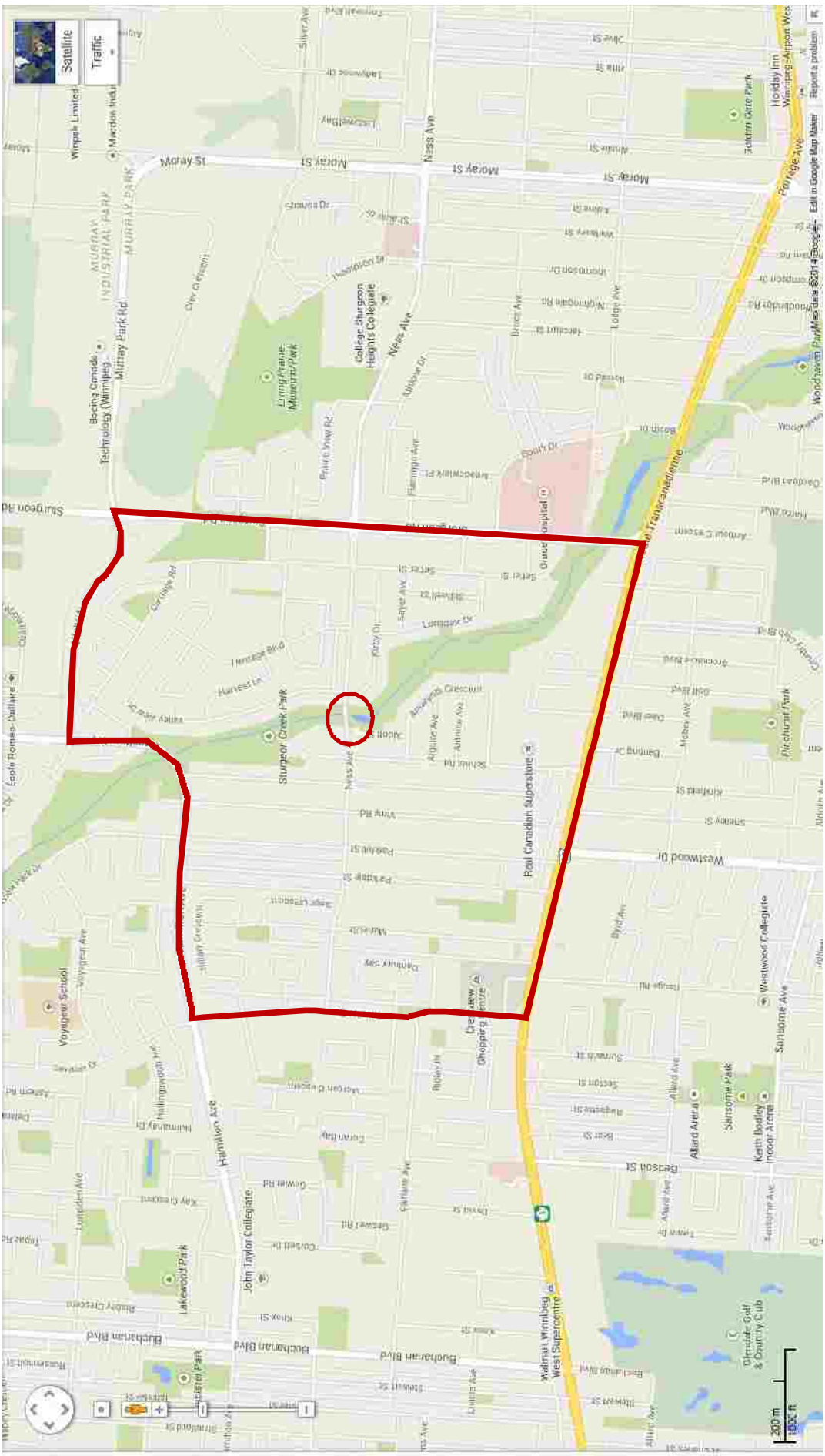
Please join us for a public information session where you can view the design for the new bridge and learn about the project timeline, potential detours and access during construction.

For more information contact:
Kimberly Yathon • Tetra Tech
204.954.6896 • kimberly.yathon@tetratech.com

TETRA TECH

Winnipeg

311 city services


Satellite
Traffic
Moray St
Nairn Ave
Ness Ave
Murray Park Rd
College Sturgeon Heights Collegiate
Living Prairie Museum/Park
Sturgeon Rd
Grace Hospital
Trans-Canada Hwy
Sturgeon Creek Park
Real Canadian Superstore
Westwood Dr
Voyageur School
Westwood Collegiate
Sansome Park
Keith Bradley Indoor Arena
Allard Arena
Bessot St
Hamilton Ave
John Taylor Collegiate
Lakewood Park
Buchanan Blvd
Waverley West Supercentre
Glendale Golf & Country Club
Portage Ave
Woodhaven Park
Holiday Inn Winnipeg-Airport West
Edit in Google Map Maker
Report a problem
200 m
500 ft

PUBLIC INFORMATION SESSION

Ness Avenue at Sturgeon Creek Culvert Replacement

Tuesday, January 13, 2015

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FLOODING AND EXISTING CULVERT HYDRAULICS

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PURPOSE OF PROJECT

Replace the existing culvert with a new high level bridge crossing

- Provide bridge with 75 year lifespan
- Improve safety and functionality
- Increase hydraulic opening to prevent roadway flooding
- Provide bank stability of channel and protect channel against erosion
- Reconstruct and rehabilitate existing roadways
- Improve active transportation through the site

PROJECT AREA

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PROJECT TIMELINE

Site Investigation & Review of Existing Information

(August – September 2014)

Preliminary Design

(October 2014 – January 2015)

Public Information Session

(January 2015)

WE ARE HERE

Detailed Design & Tender

(February – October 2015)

Construction

(January 2016 – Fall 2016)

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PROPOSED CONSTRUCTION WORKS

- Remove existing culvert
- Construct new high level bridge
- Reconstruct and rehabilitate roadway and sidewalks
- Stabilize slopes on Southwest bank of Sturgeon Creek
- Construct under bridge pathway, upgrade existing Active Transportation pathways
- Provide channel erosion protection
- Undertake underground repairs
- Manage traffic during construction

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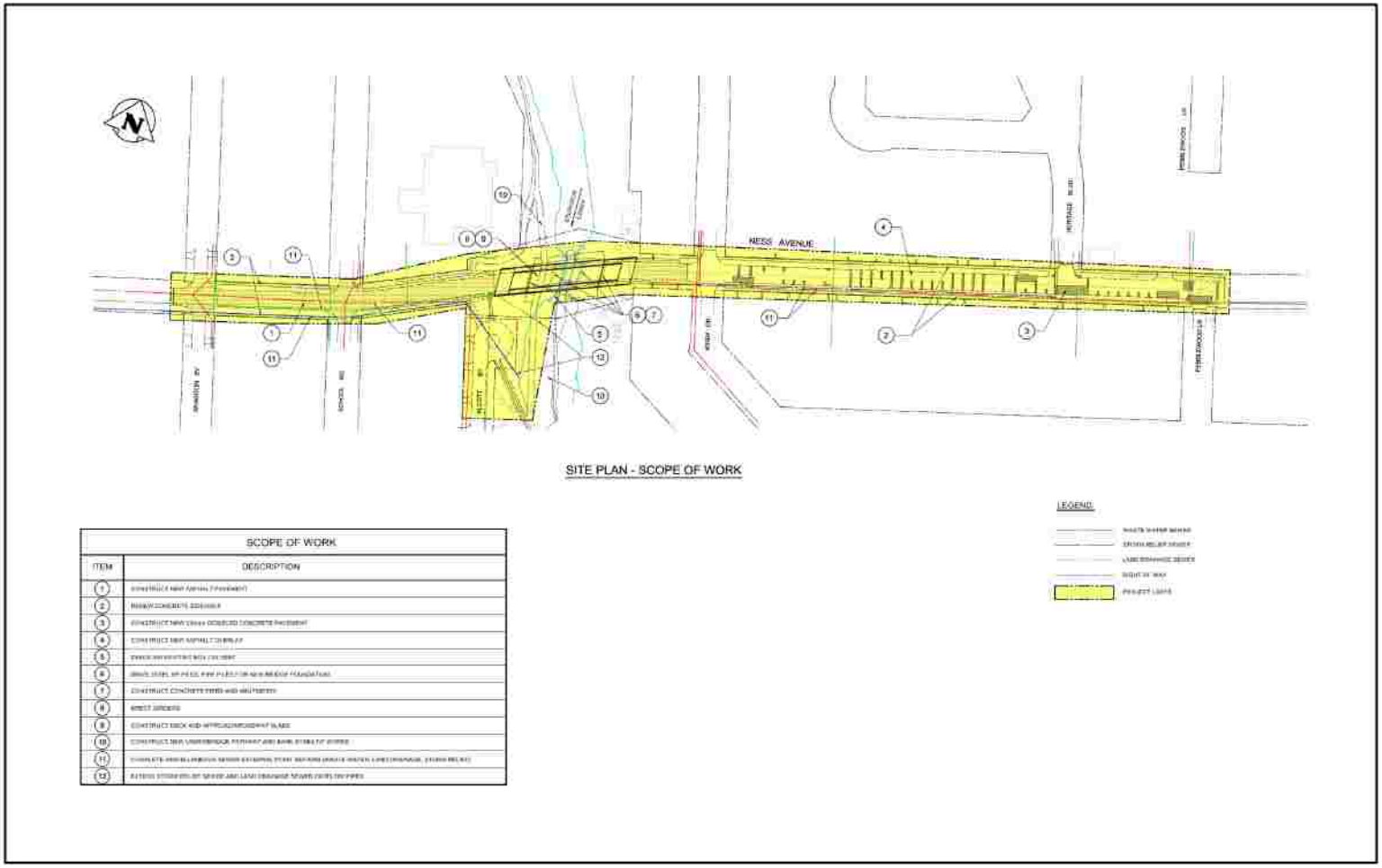
PROPOSED CONSTRUCTION WORKS



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PROPOSED CONSTRUCTION WORKS

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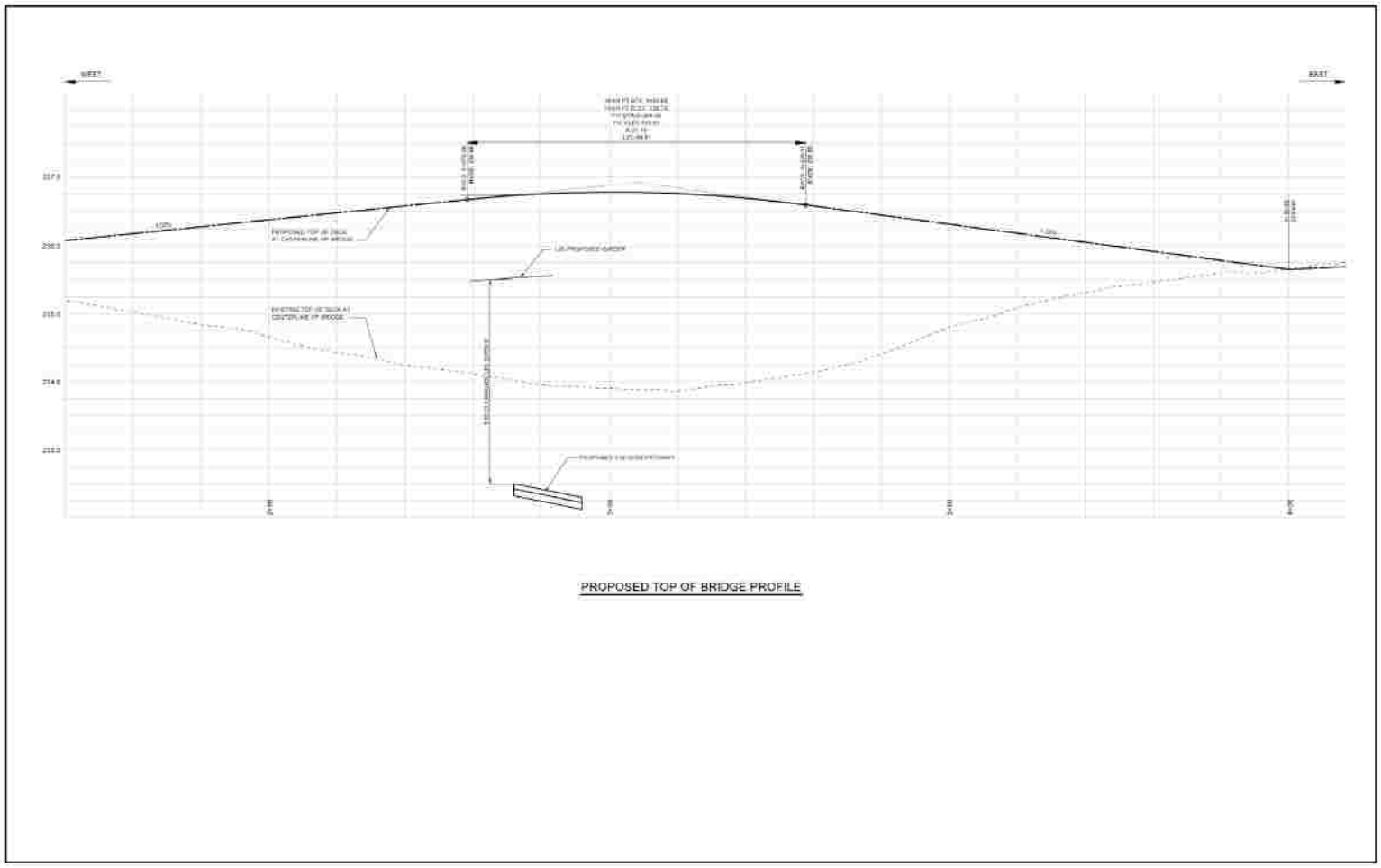

PROPOSED TOP OF BRIDGE PROFILE

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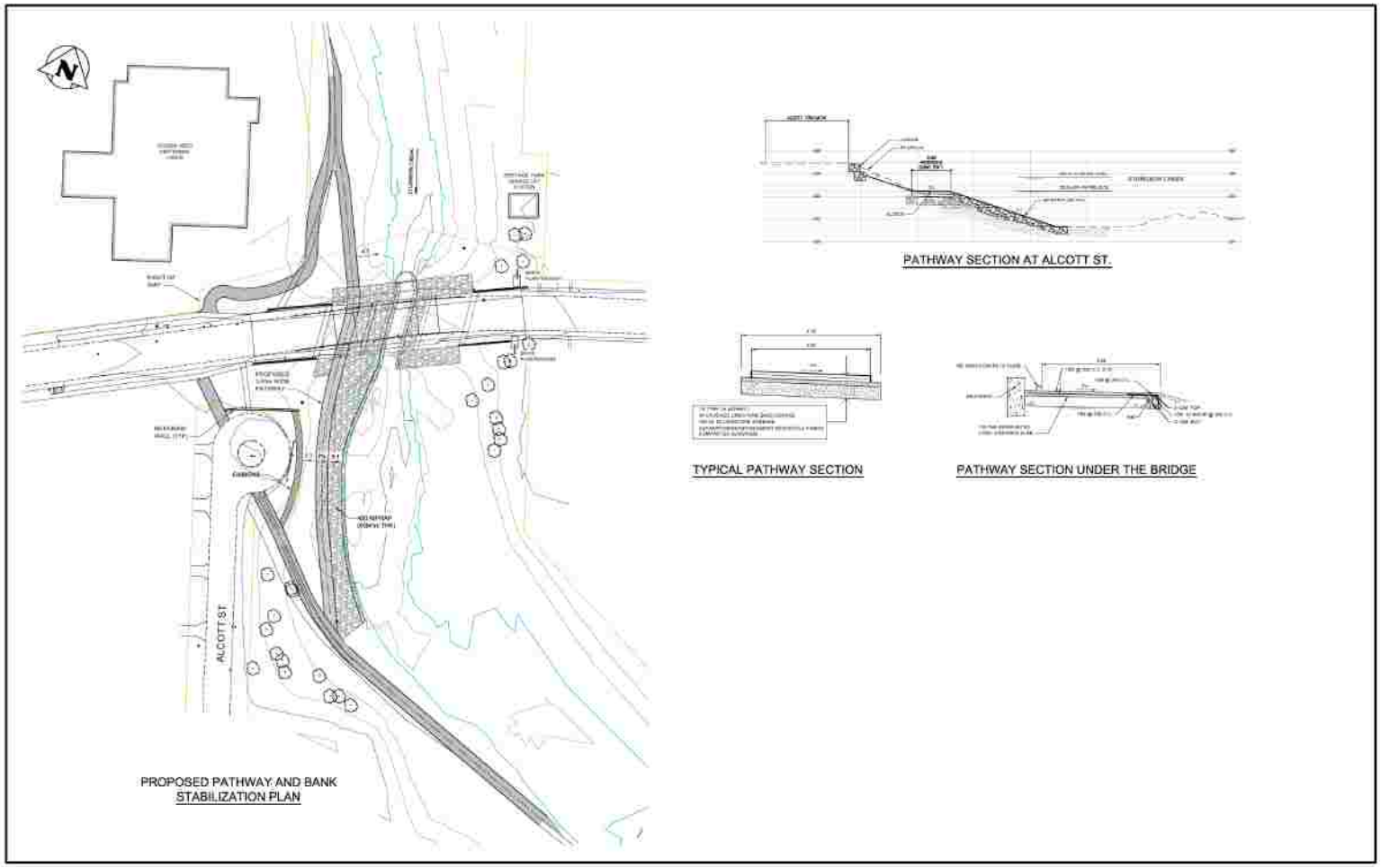
PROPOSED CONSTRUCTION WORKS



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TRAFFIC MANAGEMENT

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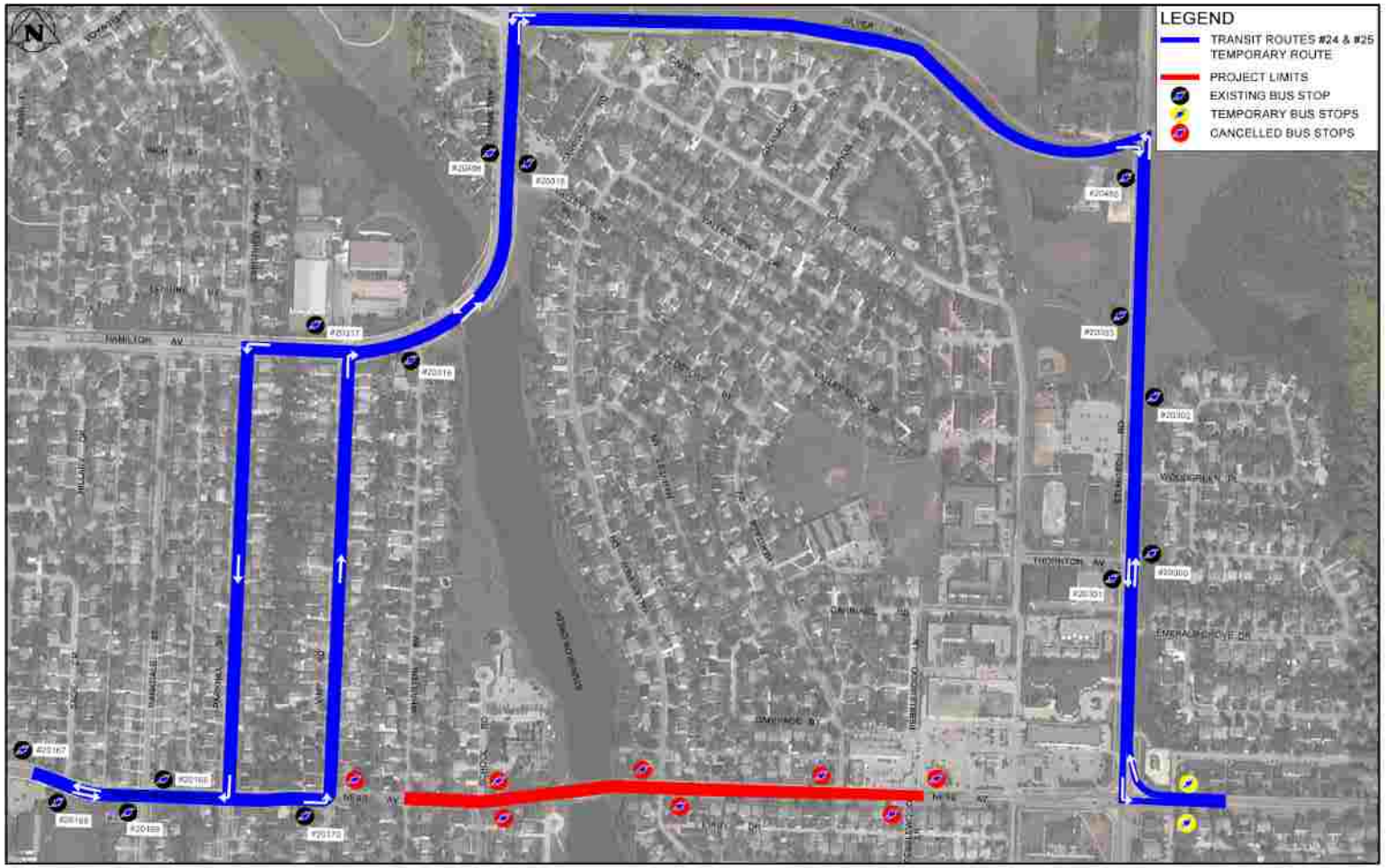
WINNIPEG TRANSIT DETOURS



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ENVIRONMENTAL MANAGEMENT

The design will incorporate best practices to protect the creek environment and aquatic habitat. These measures include:

- Permitting no construction in Sturgeon Creek during spring migration and spawning period (Northern Pike, Sucker)
- Stabilizing southwest riverbank at the Alcott cul-de-sac, while reducing infill of the toe of channel slope
- Preserving riverbanks and returning to their natural state
- Maintaining spawning shoals
- Maintaining and enabling upstream fish passage

SURVEY RESULTS FOR NESS AVENUE OVER STURGEON CREEK CULVERT REPLACEMENT

Public Information Session – January 13, 2015

1. Comment cards were received from the following:

33 - were residents of a neighbourhood close to the bridge site
12 - were commuters who use Ness Avenue
12 - were individuals who use the Sturgeon Creek Greenway Trail or fishes in Sturgeon Creek

2. Attendees learned about the Public Information Session from the following sources:

3 - from City of Winnipeg website
27 - from a letter or notice in the mail
7 - from email invite
4 - from the newspaper

3. Of the attendees providing comment, 26 received enough information to understand the City's bridge reconstruction project, 8 comment that they require additional information as shown below.

The following is a selection of concerns, suggestions, or questions related to the construction process for the project.

9 Concerned that current traffic volumes on School Road are not addressed by this project, and will increase during construction. The addition of a traffic light at School Road and Ness Avenue or "no left turn" on School Road northbound at Ness Avenue were suggested. The implementation of "No Parking" on School Road during construction was also suggested.

5 Concerned with increased in traffic volumes during construction on Valley View Drive, Heritage Blvd., and on adjacent streets west of the culvert.

2 Concerned with the condition of School Road, and suggested that curbs on School Road be upgraded as a part of this project.

3 Suggested that Ness Avenue be widened and that a left turn lane from westbound Ness Avenue to School Road be added as part of this project.

1 Concerned that Ness Avenue might be widened as part of this project.

2 Suggested various changes to improve traffic flow on School Road and Ness Avenue including a four way stop at Wharton Blvd. and School Road, or Wharton Blvd. and Ness Avenue, and a longer light from School Road through Portage Avenue.

2 Concerned with the additional distance to the proposed transit stops from Valley View Drive and Heritage Boulevard during construction. A suggestion was made to extend the transit route on Ness Avenue west of Sturgeon Road towards Heritage Boulevard where the old Safeway parking lot could be used as a turnaround for buses.

3 Requested additional information on the proposed traffic control plan and expressed concern that access to their properties be maintained during construction.

1 Inquired as to whether road repairs and the new structure profile will reduce vibrations on houses adjacent to the current bus route.

1 Concerned that the new raised structure would increase road noise in their house adjacent to the new bridge.

1 Concerned that the removal of the culvert may lead to increased flooding downstream of Ness Avenue.

3 Did not find information on the project timeline.

1 Suggested that a larger portion of the west bank of Sturgeon Creek lost to erosion, be recovered.

1 Suggested that the under bridge path be eliminated to minimize project cost.