TETRA TECH

September 6, 2013

1000070300-REP-V0011-00

Ms. Monique Buckberger, P.Eng.
PCL Constructors Canada Inc.
PO Box 1066
1540 Gamble Place,
Winnipeg, MB 3T 1N6

Dear Monique

Subject **Excavation of Potentially-Impacted Soil**
New Disraeli Bridge, Winnipeg, Manitoba

Tetra Tech WEI Inc. (Tetra Tech) is pleased to present this report summarizing the excavation and off-site disposal of potentially-impacted soil as part of the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba.

Potentially-impacted soil was excavated to facilitate pile and caisson installation and footing construction for the abutment and piers on the south side of the Red River adjacent to Disraeli Street and Rover Avenue. A Remedial Action Plan (RAP) was submitted to Manitoba Conservation on May 6, 2010 and approval was received on March 1, 2011. A supplemental RAP for the revised construction methodology at pier SU5 was submitted to Manitoba Conservation on April 5, 2011 and approval was received on April 14, 2011.

Potentially-impacted soil was excavated to facilitate the relocation of site services and the construction of new road works. The site services were underground utilities on the south side of the river adjacent to Gladstone Street and Rover Avenue. The new underground utilities include a 250 mm diameter watermain, a 300 mm diameter feedermain, and associated appurtenances. The new road works consisted of the relocation of a portion of Gladstone Street to intersect with Rover Avenue on the east side of Disraeli Freeway. A RAP for this portion of work was submitted to Manitoba Conservation on December 1, 2010 and approval was received on March 1, 2011.

Potentially-impacted soil was excavated to facilitate the reconstruction of existing pier 5 for the pedestrian bridge's south landing proximate to the intersection of Gladstone Street and Rover Avenue. It was proposed that the excavated soil be managed in accordance with the RAP previously submitted to Manitoba Conservation on December 1, 2010. Approval was received on October 17, 2012.

The RAPs and approvals are presented in Appendix A.

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SITE BACKGROUND

Site Setting

The Disraeli Bridge project comprised the construction of a new bridge structure spanning the Red River. The existing roadway was realigned to the new bridge and exits and entrances were redesigned. The new four lane bridge structure is located to the west of the existing bridge structure. The existing Disraeli Bridge structure was reconfigured as a pedestrian bridge.

For the purposes of the RAPs for the land-based construction activities, the new bridge site is located between Disraeli Street and the existing Disraeli Freeway, and north of Gladstone Street. A site plan is presented on Figure 1 in Appendix B. Surrounding land uses, prior to construction of the new bridge, included the Red River to the north; Disraeli Street to the west, across which is a playground (temporarily used as a construction yard by PCL Constructors Canada Inc. [PCL]); the former extension of Gladstone Street to the south; and the existing Disraeli Freeway to east, across which is commercial property. The commercial property is occupied by Manitoba Hydro and is the location of a former manufactured gas plant (MGP).

Overview of Site Impact

Based on information presented in the 2003 and 2006 UMA Engineering Ltd. (UMA) reports, the potential impacts in the area of the land-based construction activities were summarized as follows:

- Maximum historical naphthalene concentration of 8,890 mg/kg in test pit TP01-01 (near piers SU4 and SU5) at 0.6 m below the base of the excavation for the outfall structure, and a concentration of 1,300 mg/kg at 1.2 m below grade in borehole TH2K-14 (near piers SU4 and SU5).
- Maximum historical benzo(a)pyrene concentration of 346 mg/kg in test pit TP01-01 at 0.6 m below the base of the excavation for the outfall structure, and a concentration of 628 mg/kg in test pit TP01-01 at 2.0 m below the base of the excavation for the outfall structure.
- Maximum historical ethylbenzene and xylene concentrations of 2.95 mg/kg and 1.55 mg/kg, respectively, in borehole BH01-47 (near pier SU4) at 1.4 m below grade.
- Maximum historical concentrations of polycyclic aromatic hydrocarbons (PAHs), phenanthrene; pyrene, benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; indeno(1,2,3-cd)pyrene; and dibenzo(a,h)anthracene of 2,250 mg/kg, 1,230 mg/kg, 311 mg/kg, 225 mg/kg, 134 mg/kg, 133 mg/kg, and 25.1 mg/kg, respectively, in borehole TH2K-14 at 1.22 m to 1.52 m below grade.

The results of the limited site investigation conducted by Wardrop Engineering Inc. in February 2010 in the area of the land-based construction activities were summarized as follows:

- The soil sample collected from borehole W3 (near pier SU3) at 1.5 m below grade exhibited a naphthalene concentration of 0.270 mg/kg and a phenanthrene concentration of 0.278 mg/kg.

- The soil sample collected from borehole W4 (near pier SU4) at 1.5 m below grade exhibited an indeno(1,2,3-cd)pyrene concentration of 2.61 mg/kg, a benzo(a)pyrene concentration of 2.74 mg/kg, a naphthalene concentration of 0.051 mg/kg, and a phenanthrene concentration of 0.382 mg/kg.
- The soil sample collected from borehole W5 (near pier SU5) at 0.8 m below grade revealed a benzene concentration of 2.1 mg/kg, a toluene concentration of 1.6 mg/kg, a naphthalene concentration of 4.95 mg/kg, and a phenanthrene concentration of 0.218 mg/kg.
- The soil sample collected from borehole W5 at 1.6 m below grade exhibited a benzene concentration of 6.2 mg/kg, a toluene concentration of 3.6 mg/kg, and PHC fractions F2 and F3 concentrations of 549 mg/kg and 463 mg/kg, respectively. Acenaphthene, benzo(a)pyrene, fluorene, naphthalene and phenanthrene were detected at concentrations of 2.30 mg/kg, 1.23 mg/kg, 1.50 mg/kg, 22.7 mg/kg, and 3.55 mg/kg, respectively, within the soil sample.

The results of an investigation conducted by AECOM in February 2010 in the area of pier SU5 were summarized as follows:

- The soil sample collected from borehole TH10-01 at 0.10 m to 0.30 m below grade exhibited a naphthalene concentration of 1260 mg/kg and a benzo(a)pyrene concentration of 134 mg/kg.
- The sample collected from borehole TH10-01 at 1.8 m to 2.0 m below grade exhibited a naphthalene concentration of 4600 mg/kg and a benzo(a)pyrene concentration of 702 mg/kg. This sample was reportedly recovered from an apparent coal tar seam.

REMEDIAL ACTION PLANS

Exposure Pathways

The UMA report prepared for Manitoba Hydro in 2006 and entitled: *Comprehensive Environmental Management Plan for Residuals from Historical Operations at the Sutherland Avenue Former Gas Plant* identified three major human health exposure pathways:

- Direct exposure to PAH-impacted soil (i.e. dermal contact, soil ingestion, and particle inhalation);
- Exposure to volatile components of subsurface coal tar impact in the outdoor environment; and,
- Exposure to volatile components of subsurface coal tar impact via soil vapour intrusion into the indoor environment.

The land-based construction activities for the new Disraeli Bridge did not change the identified exposure pathways. Since the new bridge construction activities did not involve an indoor environment, only the first two exposure pathways were considered applicable for the RAP. Land-based activities related to the new bridge involved soil excavation for pile placement and footing construction, as well as underground utility relocation and construction of new road works. Access to the construction area was restricted to authorized personnel. Authorized personnel were made aware by PCL of encountering potentially-impacted soil

during excavation activities. Unnecessary exposure to authorized personnel was avoided through the development and implementation of PCL's work procedures that detailed the use of protective clothing and respirators, and decontamination after working in the excavations exposing potentially-impacted soil.

Description of Remedial Action Plans

The purpose of the RAPs was to address the potentially-impacted soil that may be excavated during the land-based construction activities on the south side of the river. The RAPs generally consisted of the following:

- Excavation of potentially-impacted soil to facilitate pile installation and footing construction for the abutment and piers.
- Excavation of potentially-impacted soil to facilitate the relocation of underground utilities and construction of new road works.
- Excavation of potentially-impacted soil to facilitate the reconstruction of existing pier 5 for the pedestrian bridge.
- Off-site disposal of potentially-impacted soil containing constituents of concern at concentrations exceeding the referenced Canadian Council of Ministers of the Environment (CCME) guidelines.
- Backfilling of excavations and around the new substructures, when necessary, with compacted "clean" excavated material, pending confirmatory analytical results indicating that concentrations of constituents of concern do not exceed the referenced CCME guidelines, and/or imported "clean" backfill.

Applicable Guidelines/Standards

The UMA (2006) report referenced the CCME (2002) Residential/Parkland soil quality guidelines as applicable for the locations surrounding the MGP site and the riverbank. For the purposes of the RAPs, the CCME *Canadian Environmental Quality Guidelines* (2007), *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil* (2008), and the *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons* (2008) soil quality guidelines were used for comparison purposes.

It was not the intent to remediate, beyond the limits of excavation, any impacted soil that was encountered during the land-based construction activities. The purpose was only to address the disposal of potentially-impacted soil that was excavated during the land-based construction activities.

Excavation of Potentially-Impacted Soil

Land-based activities related to the new Disraeli Bridge involved soil excavation at five substructure locations for pile placement and footing construction adjacent to Disraeli Street and Rover Avenue. Footing excavations extended to approximately 2 m below grade. Pre-drilling for installation of the 406-mm diameter precast concrete piles at abutment SU1 extended to approximately 4.5 m (vertical pile) or 6 m (battered pile) below the base of the footing excavation.

Land-based activities related to the new Disraeli Bridge also involved soil excavation for the installation of a new watermain, feedermain, and associated appurtenances. The piping was installed approximately 2.5 m below grade.

Land-based activities related to the pedestrian bridge involved soil excavation for the reconstruction of existing pier 5. Excavation at pier 5 extended to approximately 3.4 m below the existing road grade of Rover Avenue. Pre-drilling for installation of the steel H-piles for shoring adjacent to pier 5 extended to depths of up 8 m below existing grade. Soil was also excavated in an area directly beneath and to the west of the pedestrian bridge. The excavation ranged from 0.3 m below grade to 1 m below grade and was backfilled with 100 mm (4 inch) limestone to create a temporary access road to the pedestrian bridge.

Land-based activities related to the pedestrian bridge also involved soil excavation for the installation of a new watermain, feedermain, hydrant, and associated appurtenances. The piping was installed beneath the existing Rover Avenue at approximately 2.5 m below grade.

Land-based activities related to the extension of Gladstone Street to Rover Avenue involved the demolition and removal of existing bridge piers 2 to 4 to a depth of 2 m below grade and the excavation of soil for the road base approximately 30 m long by 4 m wide and extending to depths varying from 0.5 m to 1.5 m below grade.

During excavation, soil was assessed in the field based on visual observations, headspace vapour concentration measurements, noticeable odours, and available analytical results from previous investigations. Soil assessed in the field to be "clean" (i.e., no visual evidence of impact and no noticeable odour) was stockpiled on the site for potential later use as backfill material, pending confirmatory analytical results. The "clean" soil was stockpiled on polyethylene sheeting adjacent to the excavation from which the soil was removed, or stockpiled on polyethylene sheeting in PCL's construction yard located on the west side of Disraeli Street.

Excavated soil assessed in the field to be potentially impacted (i.e., visual evidence of impact and/or noticeable odours) was loaded directly onto trucks for off-site disposal, or onto roll-off bins for temporary storage on the site.

Excavated material assessed in the field to be coal tar or coal tar-impacted (i.e. visual evidence of coal tar) was loaded directly onto roll-off bins for temporary storage on the site. The bins were temporarily located within a fenced area accessible only to authorized personnel. The bins remained on the site until a sufficient quantity of the coal tar or coal tar-impacted soil has been collected for off-site disposal.

Off-Site Disposal

Based on the results of the Wardrop and AECOM 2010 investigations, the excavated potentially-impacted soil was considered by MidCanada Environmental Services Ltd. (MidCanada) to be suitable for disposal its treatment facility in Ile des Chenes, Manitoba. Disposal of the impacted soil at MidCanada required approval from the Director of Manitoba Conservation. The approval was requested by MidCanada and granted by Manitoba Conservation.

Coal tar or coal tar-impacted soil was to remain on the site until sufficient quantity had been accumulated to be transported for disposal to Clean Harbor's hazardous landfill in Lambton,

Ontario. However, to minimize potential odour issues in the adjacent residential neighbourhood, the coal tar or coal tar-impacted soil was removed from the site for temporary storage at MidCanada.

MidCanada sampled the soil for analysis to assess treatability to offer an alternative local disposal option.

Confirmatory Sampling

Since it was not the intent to remediate, beyond the limits of excavation, any potentially-impacted soil that may have been encountered during the land-based construction activities, confirmatory sampling at the limits of the excavations was not undertaken.

INVESTIGATION RESULTS

During land-based construction activities for the new Disraeli Bridge, Tetra Tech was on the site to assess the potentially-impacted soil that was excavated for the abutment, piers, underground utilities, road works, and pier 5 reconstruction activities on the west side of the Red River. The excavated soil was assessed in the field based on visual observations, headspace vapour concentration measurements, noticeable odours, and available analytical results from previous investigations. The following chronologically summarizes the land-based excavation activities.

March 10 – 11, 2011

A stockpile of soil was generated during the pre-drilling for the precast piles at abutment SU1. The soil was assessed in the field to be "clean" (i.e., no visual evidence of impact and no noticeable odour), pending confirmatory analytical results. One sample was collected from the stockpile and submitted to ALS Canada Ltd. (ALS) in Winnipeg, Manitoba for analysis of benzene, toluene, ethylbenzene, xylenes (BTEX), petroleum hydrocarbon fractions F1 to F4, and PAHs. The analysed parameters were not detected at concentrations exceeding the referenced environmental quality guidelines (EQG). The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D.

A stockpile of soil was generated during the excavation of the footings for pier SU2. The soil was assessed in the field to be "clean" (i.e., no visual evidence of impact and no noticeable odour), pending confirmatory analytical results. One sample was collected from the stockpile and submitted to ALS for analysis of BTEX, petroleum hydrocarbon fractions F1 to F4, and PAHs. PAHs, including naphthalene and phenanthrene, were detected at concentrations exceeding the referenced EQG. The remaining analysed parameters were not detected at concentrations exceeding the referenced EQG. The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D.

Prior to receiving the laboratory analytical results, the two stockpiles were combined into one stockpile by the contractor. Based on the analytical results for the sample of soil excavated from the footings for pier SU2, the combined stockpile was transported off the site for disposal at MidCanada.

March 31 – April 18, 2011

Soil was excavated to facilitate the relocation of underground utilities adjacent to the new Disraeli Bridge. Based on the soil analytical data obtained during Wardrop's investigation in

2010, as well as observed staining and noticeable odour, the excavated soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

A hydrovac was used to expose portions of the existing underground utilities. Based on the soil analytical data obtained during Wardrop's investigation in 2010, as well as staining and noticeable odour in the soil, the hydrovac slurry was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

Apparent coal tar-impacted soil was observed during excavation for the utility relocation. The apparent coal tar-impacted soil was segregated directly into a roll-off bin for temporary storage at the site. The soil was subsequently transported off the site in the roll-off bin to MidCanada for temporary storage while determining the appropriate disposal option. During the construction period, water accumulated in the footing excavations at pier SU2. A sample of the water was submitted to ALS for analysis of BTEX, petroleum hydrocarbon fractions F1 and F2, PAHs, and metals. Dissolved PAHs and metals were detected at concentrations exceeding the referenced EQG. The analytical results are presented on Tables 2 and 3 in Appendix C and the laboratory reports are presented in Appendix D. The accumulated water was removed from the footing excavations for off-site disposal by A-1 Environmental Services.

April 19, 2011

Soil was excavated to facilitate the construction of the footings at pier SU3. Based on the soil analytical data obtained during Wardrop's investigation in 2010, as well as observed staining and noticeable odour, the soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

Apparent coal tar impacted-soil was observed during the excavation at pier SU3. The apparent coal tar-impacted soil was segregated directly into a roll-off bin for temporary storage at the site. The soil was subsequently transported off the site in the roll-off bin to MidCanada for temporary storage while determining the appropriate disposal option.

June 10, 2011

Soil was excavated in the vicinity of the proposed pier SU4 as part of the site preparation activities. Based on the soil analytical data obtained during Wardrop's investigation in 2010, the excavated soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

June 14, 2011

Soil was excavated to facilitate the construction of the footings at pier SU4. Based on the soil analytical data obtained during Wardrop's investigation in 2010, as well as observed staining and noticeable odour, the soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

Boreholes were drilled by Manitoba Hydro to the south of abutment SU1 to facilitate the installation of poles for temporary street lighting. A composite soil sample was collected from the drill cuttings and submitted to ALS for analysis of BTEX, petroleum hydrocarbon fractions F1 and F2, and PAHs. Naphthalene was detected at a concentration exceeding the referenced EQG. The remaining analysed parameters were not detected at concentrations exceeding the referenced EQG. The analytical results are presented on Table 1 in

Appendix C, and the laboratory reports are presented in Appendix D. Based on the analytical results, the drill cuttings were transported off the site for disposal at MidCanada.

July 7, 2011

Soil was excavated from pits to facilitate the installation of relocated underground utilities along Gladstone Street. Based on the observed staining and noticeable odour, the soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

During the construction period, water accumulated at the base of some pits. Based on previous analytical results, the water in the pits was considered to be potentially impacted. The accumulated water was removed from the pits for off-site disposal by A-1 Environmental Services.

August 18 – September 23, 2011

Soil cuttings were generated during drilling to facilitate the construction of the five caissons at pier SU5. Based on historical soil analytical data, as well as observed staining and noticeable odour, the soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada.

Apparent coal tar-impacted soil was observed during the drilling of three of the five caissons. The apparent coal tar-impacted soil was segregated directly into a roll-off bin for temporary storage at the site. The soil was subsequently transported off the site in the roll-off bin to MidCanada for temporary storage while determining the appropriate disposal option. Water that accumulated in the containment sleeves of each caisson was removed for off-site disposal by A-1 Environmental Services.

November 15, 2011

Soil was excavated at the base of existing bridge pier 6 to facilitate the erection of scaffolding for pier rehabilitation activities. Based on historical soil analytical data, the soil was expected to be potentially impacted and was transported off the site for disposal at MidCanada.

November 28 – 29, 2012

Soil cuttings were generated during pre-drilling to facilitate the installation of H-piles for shoring during the reconstruction of existing bridge pier 5 at the pedestrian bridge. Based on historical soil analytical data, as well as observed staining and noticeable odour, the soil cuttings were placed in a roll-off bin for temporary storage at the site. Apparent coal tar-impacted soil was also observed during the pre-drilling. The apparent coal tar-impacted soil was segregated directly into a separate roll-off bin for temporary storage at the site. One waste characterization sample was collected from the apparent coal tar-impacted soil. The analytical results were submitted to MidCanada. Based on analytical results, the two roll-off bins were subsequently transported off the site for disposal at MidCanada. The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D.

December 3 – 4, 2012

Soil was excavated to facilitate the reconstruction of existing bridge pier 5 at the pedestrian bridge. Based on soil analytical data from November 2012, the soil was expected to be potentially impacted and was transported off the site for disposal at MidCanada.

March 25, 2013

Soil was excavated to facilitate the reconstruction of existing bridge pier 5 at the pedestrian bridge. Based on soil analytical data from November 2012, the soil was expected to be potentially impacted and was transported off the site for disposal at MidCanada.

July 10, 2013

Soil was excavated from the bank of the Red River, on the west side of the pedestrian bridge, for the purpose of extending the existing temporary access road up to and beneath the pedestrian bridge. Based on field observations, noticeable odour, and historical soil analytical, the soil was expected to be potentially impacted and was transported off the site for disposal at MidCanada. One waste characterization sample of the excavated soil was collected and the analytical results were submitted to MidCanada. The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D.

Road base material consisting of 100 mm (4 inch) limestone rock was placed on top of a geotextile fabric, along the length of the temporary access road extension, which was subsequently left in place as rip-rap.

July 12 – August 7, 2013

Soil was excavated from pits, on Rover Avenue, to facilitate the installation and connection of a new watermain, and associated fixtures, to the new watermain running beneath the pedestrian bridge. Based on the analytical data from November 2012, observed staining and noticeable odour, the soil was considered to be potentially impacted and was transported off the site for disposal at MidCanada. Apparent coal tar-impacted soil was observed when two abandoned pipes were uncovered during the excavation of one of the pits. The apparent coal tar-impacted soil was segregated directly into a lined roll-off bin and stored on the site pending analytical results. Three waste characterization samples were collected (two from soil excavated from the pits and one from the apparent coal tar-impacted soil in the roll-off bin) and the analytical results were submitted to MidCanada. The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D. The excavated soil was subsequently transported off the site to MidCanada.

Water that accumulated in the pits was removed for off-site disposal by A-1 Environmental Services.

July 20 – 25, 2013

Soil was excavated from the area beneath the former Disraeli Bridge footprint on the south side of Rover Avenue to the existing road surface of Gladstone Street, for the purpose of creating a new road bed for the Gladstone Street extension north to Rover Avenue. Based on field observations of staining, odour and debris, the soil was expected to be potentially impacted. The soil was excavated and stockpiled on the site until it could be transported off

the site for disposal at MidCanada. Five waste characterization samples were collected from the soil stockpile and the analytical results were submitted to MidCanada. The analytical results are presented on Table 1 in Appendix C, and the laboratory reports are presented in Appendix D.

Off-Site Disposal

Based on the load summaries provided by MidCanada, approximately 3269 tonnes of excavated potentially-impacted soil were transported off the site for disposal at the MidCanada soil treatment facility in Ile des Chenes, Manitoba.

Based on the load summaries provided by MidCanada, four roll-off bins containing approximately 44 tonnes of apparent coal tar-impacted soil were transported to MidCanada for temporary storage while determining the appropriate disposal option. Three of the roll off bins were sampled and analysed by MidCanada in April 2012 to assess the suitability for local treatment and disposal. The impacted soil was determined by laboratory analysis to be suitable for treatment by MidCanada. The soil was subsequently treated and disposed at MidCanada's facility. The laboratory report presenting the analytical results for a soil sample collected from the soil treated in April 2012 was provided by MidCanada and is attached in Appendix D. The fourth roll-off bin was transported to MidCanada in July 2013. The analytical results of the waste characterization sample, taken from the soil in the roll-off bin, were submitted to MidCanada to determine disposal options. The laboratory report presenting the analytical results for the waste characterization sample collected in July 2013 is attached and in Appendix D.

Please contact Andrew Eason at (204) 954-6843 if you have any questions or comments.

Sincerely

TETRA TECH WEI INC.

Andrew Eason, P.Eng.
Senior Environmental Engineer

PROVINCE OF MANITOBA
A. EASON
13/9/16
REGISTERED PROFESSIONAL ENGINEER

Reviewed by

TETRA TECH WEI INC.

Michel Gregoire, P.Eng., P.Geo.
Senior Environmental Engineer

AE/ac

Copy Chris Fisher, PCL Constructors Canada Inc.

Attachments
Appendix A – RAPs and Approvals
Appendix B – Figure
Appendix C – Tables
Appendix D – Laboratory Reports

APEGM
Certificate of Authorization
TETRA TECH WEI Inc.
No. 5313 Date: April 30, 2014

REFERENCES

AECOM, 2010. *Analytical results from 2009/2010 Sutherland Environmental Management Plan, Sediment Sampling Work Plan.*

Canadian Council of Ministers of Environment, 2007. *Canadian Environmental Quality Guidelines.*

Canadian Council of Ministers of Environment, 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil.*

Canadian Council of Ministers of Environment, 2008. *Canadian Soil Quality Guidelines, Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs).*

UMA Engineering Ltd., 2003. *Manitoba Hydro Former Manufactured Gas Plant, 35 Sutherland Avenue, Winnipeg, Manitoba, Supplemental Environmental Site Investigation.*

UMA Engineering Ltd., 2006. *Comprehensive Environmental Management Plan for Residuals From Historic Operations at Sutherland Avenue Former Manufactured Gas Plant.*

Wardrop Engineering Inc., 2010. *Environmental Investigation, Soil Characterization, South Substructure Units, Disraeli Bridge, Winnipeg, Manitoba.*

Limitations

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Tetra Tech WEI Inc. makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgment, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which are assumed to be correct. Except as provided, Tetra Tech WEI Inc. has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of sample points, and the number of samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based will consequently change Tetra Tech WEI Inc.'s conclusions and recommendations.

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TETRA TECH

APPENDIX A

RAPS AND APPROVALS

WARDROP
A TETRA TECH COMPANY

May 6, 2010 1000070300-LTR-V0003-02

Mr. Randy Webber
Regional Supervisor
Winnipeg District
Manitoba Conservation
160 – 123 Main Street
Winnipeg, MB R3C 1A5

Dear Mr. Webber

Subject Remedial Action Plan
Adjacent to the Disraeli Bridge – Winnipeg, Manitoba

Wardrop Engineering Inc. (Wardrop) is planning to proceed with the offsite disposal of potentially impacted soil excavated as part of the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The potentially impacted soil will be excavated to facilitate pile installation and footing construction for the abutment and piers on the south side of the river adjacent to Disraeli Street and Rover Avenue. The area of the land-based construction activities is shown on Figure 1, attached. Our proposed remedial action plan (RAP) is detailed in the following sections.

PROJECT DESCRIPTION – DISRAELI BRIDGE PROJECT

The Disraeli Bridge project will comprise the construction of a new bridge structure spanning the Red River. The existing roadway will be realigned to the new bridge and exits and entrances will be redesigned. The new four lane bridge structure will be located to the west of the current structure. The current bridge structure will be converted to a pedestrian bridge.

SITE BACKGROUND

Site Setting

The site is located between Disraeli Street and Disraeli Freeway, and north of Gladstone Street. A site plan is presented on Figure 1, attached. The area encompasses a grassed area as well as a portion of the riverbank. Surrounding land uses include the Red River to the north; Disraeli Street to the west, across which is a playground; the extension of Gladstone Street to the south; and Disraeli Freeway to east, across which is commercial property. The commercial property is occupied by Manitoba Hydro and is the location of a former manufactured gas plant (MGP).

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Site Investigations

The report prepared for Manitoba Hydro by UMA Engineering Ltd. (UMA) and dated December 2003 provided a summary of the numerous investigations that have been conducted at the site of the former MGP as well as along the river bank adjacent to Rover Avenue. The following summarizes the investigations in the area of the Disraeli Bridge project site located to the west of the existing Disraeli Bridge.

Disraeli Street was assessed by the City of Winnipeg during a sewer upgrade program. The date of the assessment is unknown. Test drilling was conducted along Disraeli Street prior to the sewer upgrading, and with exception of impacted soils near the gate chamber and outfall structure at the intersection of Disraeli Street and Rover Avenue, no evidence of impact was reported to have been detected within the remaining test holes.

In 2000, an investigation was conducted west of the Disraeli Bridge along the bank of the river. Eight boreholes (TH2K-11 to TH2K-16, TH2K-19 and TH2K-20) and one test pit (TP99-2) were advanced within the immediate area of existing bridge pier 5. Visual impacts of liquid coal tar, staining, and odours were noted in all boreholes at depths between 1.1 m and 4.6 m below grade. Staining at a depth of 0.3 m below grade was noted in borehole TP99-2.

In 2001, an investigation was conducted on the south bank of the Red River, west of the Disraeli Bridge. The assessment included the advancement of a test pit (TP01-01) at the base of the excavation for the construction of the outfall structure and two boreholes (BH01-47 and BH01-48) drilled to the west of the outfall structure. Coal tar related hydrocarbon impacts were detected in soil samples recovered from test pit TP01-01, and from borehole BH01-47. Liquid coal tar was also observed within the excavated test pit.

In 2002, an investigation included the advancement of a borehole MW-29 to the southwest of the outfall structure and completion of the borehole as a nested piezometer. Naphthalene and BTEX impacts were detected in soil samples recovered from the borehole at depths greater than 5 m.

In February 2010, Wardrop completed a limited subsurface investigation at five of the planned substructure units for the new Disraeli Bridge. The investigation was conducted to the west of the existing bridge on the south bank of the Red River. The purpose of the investigation was to characterize the impacts (if any) within the soils that will be excavated during the installation of the piles and substructure footings SU1 to SU5. The investigation included the manual advancement of one borehole to a depth of 2 m below grade in the location of SU5; the mechanical advancement of three boreholes to a depth of 3 m below grade in the location of SU2, SU3, and SU4; and the mechanical advancement of one borehole to a depth of 6 m below grade in the location of SU1.

In February and March 2010, AECOM conducted a sediment sampling program as part of Manitoba Hydro's 2009/2010 Sutherland Environmental Management Plan. The sampling program included the mechanical advancement of a borehole to a depth of 7.3 m below grade at substructure footing SU5.

Site Geology

The native subsurface soils in the general area of the site are highly variable and consist of interbedded layers of low to high plastic clay, low plastic silt, and fine grained sand. Glacial till underlies the lacustrine materials at depths ranging from 8.2 m to 15.6 m below grade, and consists primarily of silt, although some gravel and sand are also present. According to the *Geological Engineering Maps and Report* produced by the former University of Manitoba Department of Geological Engineering in 1983, the carbonate bedrock in the area of the site is of the Selkirk Member and consists of mottled, fossiliferous dolomitic limestone, with abundant chert nodules in the upper limestone layer. Based on previous investigations in the vicinity of the site, bedrock is encountered at approximately 33 m below grade.

Based on the Wardrop investigation in February 2010, the site stratigraphy comprised clay fill from grade to a depth ranging from 0.8 m to 1.8 m below grade, underlain by silt, with varying percentages of clay to the maximum depth of the boreholes (3 m to 6 m below grade) for boreholes advanced in planned substructure locations SU1 to SU4. The remaining borehole was advanced in the planned pier location SU5 at the interface of the river bank and shoreline, which comprised silt with varying amounts of clay from grade to the depth of the borehole at 2 m below grade. An apparent odour and/or petroleum hydrocarbon sheen was noted at 0.8 m and 1.6 m below grade.

Site Hydrogeology

Primarily low permeability tills and glaciolacustrine silt and clay deposits dominate the area with the exception of locations along the floodplains of the river where permeabilities may be greater. Fractures in the glaciolacustrine silts and clays, as well as in the till deposit, can be a source of greater permeabilities.

The major underlying aquifer in the Winnipeg area is the upper 15 m to 30 m fractured zone of the Upper Carbonate Aquifer. The aquifer is somewhat confined by the overburden and underlying lower permeability carbonate bedrock.

Prior to the development of the aqueduct system which supplies the City of Winnipeg with potable water, the Upper Carbonate Aquifer was an important source of water for both municipal and industrial use. The Upper Carbonate Aquifer remains a potable water source in areas bordering the City (east of the Red River) and for some industrial use within Winnipeg. It is known that the Red River supplied process water to the former MGP.

The Lower Carbonate Aquifer occurs in the bottom 7.5 m to 15 m of the Red River formation, along the interface of the upper shale unit of the Winnipeg formation. This aquifer is of limited use for potable water supply. The Winnipeg Formation contains an upper sandstone aquifer which ranges in thickness form 6 m to 12 m and a lower sandstone aquifer approximately 3 m thick. Both sandstone aquifers contain non-potable saline waters.

NATURE AND EXTENT OF IMPACT

Overview of Site Impact

Based on information presented 2003 and 2006 UMA reports, the potential impact in the area of the land-based construction activities can be summarized as follows:

- Maximum historical naphthalene concentration of 8890 mg/kg in test pit TP01-01 at 0.6 m below the base of the excavation for the outfall structure, and a concentration of 1300 mg/kg at 1.2 m below grade in borehole TH2K-14.
- Maximum historical benzo(a)pyrene concentration of 346 mg/kg in test pit TP01-01 at 0.6 m below the base of the excavation for the outfall structure, and a concentration of 628 mg/kg in test pit TP01-01 at 2.0 m below the base of the excavation for the outfall structure.
- Maximum historical ethylbenzene and xylene concentrations of 2.95 mg/kg and 1.55 mg/kg, respectively, in borehole BH01-47 at 1.4 m below grade.
- Maximum historical concentrations of polycyclic aromatic hydrocarbons (PAHs), phenanthrene; pyrene, benzo(a)anthracene; benzo(b)fluoranthene; benzo(k)fluoranthene; indeno(1,2,3-cd)pyrene; and dibenzo(a,h)anthracene of 2250 mg/kg, 1230 mg/kg, 311 mg/kg, 225 mg/kg, 134 mg/kg, 133 mg/kg, and 25.1 mg/kg in borehole TH2K-14 at 1.22 m to 1.52 m below grade, respectively.

The results of the limited site investigation conducted by Wardrop in February 2010 in the area of the land-based construction activities can be summarized as follows:

- The soil sample collected from borehole W3 at 1.5 m below grade exhibited a naphthalene concentration of 0.270 mg/kg and a phenanthrene concentration of 0.278 mg/kg.
- The soil sample collected from borehole W4 at 1.5 m below grade exhibited an indeno(1,2,3-cd)pyrene concentration of 2.61 mg/kg, a benzo(a)pyrene concentration of 2.74 mg/kg, a naphthalene concentration of 0.051 mg/kg, and a phenanthrene concentration of 0.382 mg/kg.
- The soil sample collected from borehole W5 at 0.8 m below grade revealed a benzene concentration of 2.1 mg/kg, a toluene concentration of 1.6 mg/kg, a naphthalene concentration of 4.95 mg/kg, and a phenanthrene concentration of 0.218 mg/kg.
- The soil sample collected from borehole W5 at 1.6 m below grade exhibited a benzene concentration of 6.2 mg/kg, a toluene concentration of 3.6 mg/kg, and PHC fractions F2 and F3 concentrations of 549 mg/kg and 463 mg/kg, respectively. Acenaphthene, benzo(a)pyrene, fluorene, naphthalene and phenanthrene were detected at concentrations of 2.30 mg/kg, 1.23 mg/kg, 1.50 mg/kg, 22.7 mg/kg, and 3.55 mg/kg, respectively, within the soil sample.
- The analytical results are presented on Table 1, attached.

The results of the investigation conducted by AECOM in February 2010 in the area of the substructure pier location SU5 can be summarized as follows:

- The soil sample collected from borehole TH10-01 at 0.10 m to 0.30 m below grade exhibited PAHs including a naphthalene concentration of 1260 mg/kg and a benzo(a)pyrene concentration of 134 mg/kg.
- The sample collected from borehole TH10-01 at 1.8 m to 2.0 m below grade exhibited PAHs including a naphthalene concentration of 4600 mg/kg and a benzo(a)pyrene concentration of 702 mg/kg. This sample was reportedly recovered from a coal tar seam.
- Applicable excerpts from the AECOM analytical tables are presented as Table 2, attached.

REMEDIAL ACTION PLAN

Exposure Pathways

The UMA report prepared for Manitoba Hydro in 2006 and entitled: *Comprehensive Environmental Management Plan for Residuals from Historical Operations at the Sutherland Avenue Former Gas Plant* identified three major human health exposure pathways:

- Direct exposure to PAH-impacted soil (i.e. dermal contact, soil ingestion, and particle inhalation);
- Exposure to volatile components of subsurface coal tar impact in the outdoor environment; and,
- Exposure to volatile components of subsurface coal tar impact via soil vapour intrusion into the indoor environment.

The land-based construction activities for the new Disraeli Bridge will not change the identified exposure pathways. Since the new bridge construction activities will not involve an indoor environment, only the first two exposure pathways are considered applicable for this RAP. Land-based activities related to the new bridge will involve soil excavation at five locations for pile placement and footing construction. Access to the construction area will be restricted to authorized personnel. Authorized personnel will be aware of encountering potentially impacted soil in the excavations. Unnecessary exposure to authorized personnel will be avoided through the use of protective clothing and respirators; and decontamination after working in the excavations exposing potentially impacted soil.

Description of Remedial Action Plan

The purpose of the RAP is to address the potentially impacted soil that may be excavated during the land-based construction activities on the south side of the river adjacent to Disraeli Street and Rover Avenue. The remedial action will consist of the following:

- Excavation of potentially impact soil at five locations to facilitate pile installation and footing construction for the abutment and piers on the south side of the river adjacent to Disraeli Street and Rover Avenue.
- Off-site disposal of potentially impacted soil containing chemicals of concern at concentrations exceeding the applicable Canadian Council of Ministers of the Environment (CCME) guidelines.
- Backfilling around the new substructures with compacted "clean" excavated material, pending confirmatory analytical results indicating that concentrations of chemicals of concern do not exceed the applicable CCME guidelines, and/or imported clean backfill.

Applicable Guidelines/Standards

The UMA (2006) report referenced the CCME (2002) Residential/Parkland soil quality guidelines as applicable for the locations surrounding the MGP site and the riverbank. For the purposes of this RAP, the current CCME *Canadian Environmental Quality Guidelines* (2007), *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil* (2008), and the *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons* (2008) soil quality guidelines have been used for comparison purposes.

Applicable Guidelines/Standards (cont'd)

It is not the intent to remediate, beyond the limits of excavation, any impacted soil that may be encountered during the land-based construction activities. The purpose is only to address impacted soil that may be excavated during the land-based construction activities.

Excavation of Potentially Impacted Soil

Land-based activities related to the new Disraeli Bridge will involve soil excavation at five substructure locations for pile placement and footing construction on the south side of the river adjacent to Disraeli Street and Rover Avenue. Footing excavations will extend to approximately 2 m below grade. Pre-drilling for installation of the 406-mm diameter precast concrete piles at the south abutment SU1 will extend to approximately 4.5 m (vertical pile) or 6 m (battered pile) below the base of the footing excavation. An estimated total of 650 m^3 of soil will be excavated from the five substructure locations. Based on readily available information and the recent analytical results, the 650 m^3 of excavated soil include an estimated 70 m^3 of "clean" soil from substructures SU1 and SU2, and an estimated 580 m^3 of potentially impacted soil from substructures SU3, SU4 and SU5.

During excavation at each of the five locations, soil will be assessed in the field based on visual observations, headspace vapour concentrations measured with GasTECH™ combustible gas indicator, noticeable odours, and available analytical results from previous investigations. Soil assessed in the field to be "clean" (i.e., no visual evidence of impact and no noticeable odour) will be stockpiled on the site for later use as backfill material, pending confirmatory analytical results. The "clean" soil will be stockpiled on polyethylene sheeting adjacent to the excavation from which the soil was removed.

Excavated soil assessed in the field to be impacted (i.e., visual evidence of impact and/or noticeable odours) will be loaded directly onto trucks or into roll-off bins for offsite disposal. In the event that trucks or bins are not immediately available, the soil will be temporarily stockpiled on polyethylene sheeting adjacent to the excavation from which it was removed. The stockpile will also be covered with polyethylene sheeting until it is removed for offsite disposal. Any stockpile will be located within a fenced area accessible only to authorized personnel.

Excavated material assessed in the field to be coal tar or coal tar-saturated (i.e. visual evidence of coal tar) will be loaded directly onto roll-off bins for temporary storage on the site. The bins will be located within a fenced area accessible only to authorized personnel. The bins will remain on the site until a sufficient quantity of the coal tar or coal tar-saturated soil has been collected for offsite disposal.

Site Restoration

The excavated areas will be backfilled with clean compacted fill material to either existing grade or to the design grade set out by the new bridge construction. Any subsequent finish grading and landscaping will be in accordance with the new bridge construction.

Off-Site Disposal

Based on the results of the Wardrop and AECOM 2010 investigations, the excavated potentially impacted soil will be suitable for disposal at MidCanada Environmental Services treatment facility in Ile des Chenes, Manitoba. Disposal of the impacted soil at MidCanada will require approval from the Director of Manitoba Conservation. The approval will be requested by MidCanada.

Coal tar and coal tar-saturated soil will be transported to Clean Harbor's hazardous landfill in Lambton, Ontario.

Confirmatory Sampling

Since it is not the intent to remediate, beyond the limits of excavation, any impacted soil that may encountered during the land-based construction activities, no confirmatory sampling at the limits of the excavations is proposed.

Equipment Decontamination

Excavating and pile drilling equipment that comes in contact with impacted soil will be decontaminated prior to that equipment leaving the site. Loose or visible soil will be scraped or brushed off the equipment. The equipment will then be pressured washed. The wash water will be collected on the site for subsequent disposal pending analytical results. Soil and solids from the decontamination process will be disposed at the MidCanada facility.

Closure Report

Following the completion of the site activities, Wardrop will prepare a closure report summarizing the site activities and including any soil analytical data.

Please contact Andrew Eason at (204) 988-0536 if you have any questions or comments.

Sincerely

WARDROP ENGINEERING INC.

Shauna Zahariuk, B.Env.Sc., CEPIT
Environmental Scientist

Reviewed by

WARDROP ENGINEERING INC.

Andrew Eason, P.Eng.
Senior Environmental Engineer

AE/pp

Attachments
Figure 1
Table 1
Table 2

PROVINCE OF MANITOBA
A. EASON
10/5/6

APEGM
Certificate of Authorization
Wardrop Engineering Inc.
No. 195 Date: April 30, 2011

REFERENCES

AECOM, 2010. Analytical results from 2009/2010 Sutherland Environmental Management Plan, Sediment Sampling Work Plan.

Canadian Council of Ministers of Environment, 2007. *Canadian Environmental Quality Guidelines.*

Canadian Council of Ministers of Environment, 2008. *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil.*

Canadian Council of Ministers of Environment, 2008. *Canadian Soil Quality Guidelines, Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs).*

UMA Engineering Ltd., 2003. *Manitoba Hydro Former Manufactured Gas Plant, 35 Sutherland Avenue, Winnipeg, Manitoba, Supplemental Environmental Site Investigation.*

UMA Engineering Ltd., 2006. *Comprehensive Environmental Management Plan for Residuals From Historic Operations at Sutherland Avenue Former Manufactured Gas Plant.*

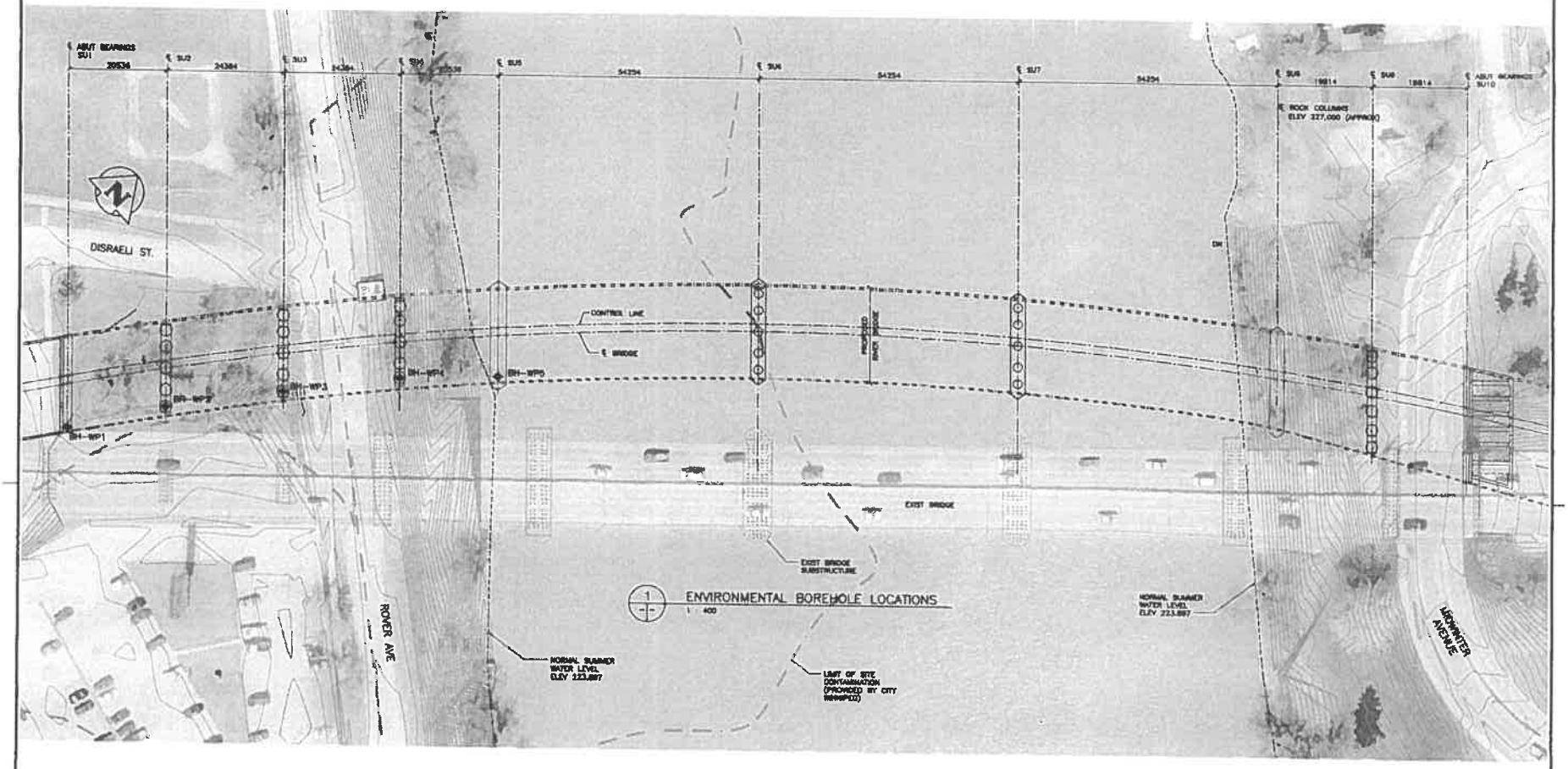
Wardrop Engineering Inc., 2010. *Environmental Investigation, Soil Characterization, South Substructure Units, Disraeli Bridge, Winnipeg, Manitoba.*

LIMITATIONS

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Wardrop makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgement, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which is assumed to be correct. Except as provided, Wardrop has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of boreholes drilled, and the number of water samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based, will consequently change Wardrop's conclusions and recommendations.

DISCLAIMER

This Wardrop Engineering report has been prepared in response to specific requests for services from the client to whom it is addressed. The content of this document is not intended for the use, nor is it intended to be relied upon, by any person, firm, or corporation other than the client of Wardrop Engineering to whom it is addressed. Wardrop denies any liability whatsoever to other parties who may obtain access to this Document by them, without express prior written authority of Wardrop Engineering and its client who has commissioned this Document.



DESIGN TEAM

WARDROP

Stantec

McGOWAN RUSSELL

NO.	REVISIONS	DATE	BY
A	ISSUED FOR INTERIM REPORT	10.02.11	S.Z.

CONSULTANT: WARDROP

DESIGNED BY S.Z. | CHECKED BY
DRAWN BY C.I. | APPROVED BY DATE
HOR. SCALE AS NOTED | AUTHORIZED BY DATE
VERTICAL | ACCEPTED BY DATE
DATE 10.02.10

PRELIMINARY DRAWING
NOT TO BE USED FOR CONSTRUCTION

Plenary Roads | PCL CONSTRUCTION LEADERS

DISRAELI BRIDGES PROJECT
RED RIVER BRIDGE

ENVIRONMENTAL BOREHOLE LOCATIONS

DWG NUMBER | SHEET OF

FIGURE 1

TABLE 1

Soil Sample Laboratory Analytical Results - February 2010
Disraeli Bridge - South River Bank / West of Bridge

Laboratory Analyses	Laboratory Analytical Results (mg/kg)						Environmental Quality Guidelines [1,2,3] (mg/kg)
	W1	W2	W3	W4	W5		
	3.8 m	1.5 m	1.5 m	1.5 m	0.8 m	1.6 m	
BTEX							
Benzene	<0.0050	<0.0050	0.010	0.007	*2.1*	*6.2*	60 / 1.0
Toluene	<0.010	<0.010	0.01	<0.010	*1.6*	*3.6*	110 / 0.10
Ethylbenzene	<0.050	<0.050	<0.050	<0.050	<0.050	0.2	120 / 50
Xylenes	<0.10	<0.10	<0.10	<0.10	0.2	1.7	65 / 37
CCME Fractions							
F1 - BTEX (>nC_6-nC_{10})	<10	<10	<10	<10	<10	<10	210 / 970
F2 (>nC_{10}-nC_{16})	<10	<10	<10	<10	106	*549*	150 / 150
F3 (>nC_{16}-nC_{34})	58	<50	57	250	118	*463*	1300 / 300
F4 (>nC_{34})	<50	<50	<50	122	<50	109	5600 / 2800
Polycyclic Aromatic Hydrocarbons (PAHs)							
Acenaphthene	<0.010	<0.010	<0.010	<0.010	0.051	2.30	0.28
Acenaphthylene	<0.010	<0.010	0.118	0.687	0.036	0.135	320
Acridine	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	NG
Anthracene	<0.010	<0.010	0.100	0.136	0.114	1.22	2.5
Benzo(a)anthracene	<0.010	0.017	0.539	0.757	0.357	1.37	6.2
Benzo(a)pyrene	<0.010	<0.010	0.595	*2.74*	0.331	*1.23*	0.6
Benzo(b)fluoranthene	<0.010	<0.010	0.678	2.18	0.281	1.14	6.2
Benzo(ghi)perylene	<0.010	<0.010	0.344	4.06	0.111	0.661	NG
Benzo(k)fluoranthene	<0.010	<0.010	0.235	0.941	0.141	0.740	6.2
Chrysene	<0.010	<0.010	0.236	0.701	0.194	1.40	6.2
Dibenzo(ah)anthracene	<0.010	<0.010	0.055	0.356	0.020	0.115	1.0
Fluoranthene	<0.010	0.013	0.474	0.782	0.411	3.09	15.4
Fluorene	<0.010	<0.010	<0.010	<0.010	0.052	*1.50*	0.3
Indeno(1,2,3 cd)pyrene	<0.010	<0.010	0.375	*2.61*	0.152	0.940	1.0
1-Methyl Naphthalene	<0.010	<0.010	0.064	<0.010	0.047	2.61	NG
2-Methyl Naphthalene	<0.010	<0.010	0.053	<0.010	0.042	2.47	NG
Naphthalene	<0.010	<0.010	*0.270*	*0.051*	*4.95*	*22.7*	0.013
Phenanthrene	<0.010	<0.010	*0.278*	*0.382*	*0.218*	*3.55*	0.046
Pyrene	<0.010	0.014	0.527	1.08	0.373	2.35	7.7
Quinoline	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	NG
Grain Size							
<75 um	40.0	98.0	84.0	76.0	84.0	84.0	NG
>75 um	60.0	2.0	6.0	24.0	6.0	6.0	NG
Moisture Content (%)	24.2	24.1	17.6	25.4	33.3	39.4	NG

Notes:

[1] CCME, *Canadian Environmental Quality Guidelines* (2007), Residential / Parkland, fine-grained / coarse-grained, eco soil contact and groundwater check (aquatic life).

[2] CCME, *Canada-Wide Standard for Petroleum Hydrocarbons in Soil* (2008), Residential, fine-grained / coarse-grained, eco soil contact and protection of aquatic life.

[3] CCME, *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs)* (2008), Residential / Parkland, soil contact and protection of freshwater life.

NG = No Guideline

Bold Text = Laboratory analytical results in excess of the referenced guidelines

TABLE 2

AECOM Sediment and Soil Sample Laboratory Analytical Results - February 2010
Diersell Bridge - SU5 / South River Bank / West of Bridge

Parameter	Sample Name @ Depth/Date	
	TH10-01 @ 0 - 10 CM	TH10-01 @ 10 - 30 CM [1]
	02/03/2010	02/03/2010
% Sand Content	5	13
% Silt Content	26	25
% Clay Content	69	62
Naphthalene	<0.010	***1260***
2-Methyl Naphthalene	<0.010	***180***
1-Methyl Naphthalene	<0.010	119
Acenaphthylene	<0.010	***46.4***
Acenaphthene	0.011	***195***
Fluorene	<0.010	***141***
Phenanthrene	<0.010	***589***
Anthracene	<0.010	***189***
Fluoranthene	<0.010	***385***
Pyrene	<0.010	***335***
Benzo(a)anthracene	<0.010	***145***
Chrysene	<0.010	***129***
Benzo(b&j)fluoranthene	<0.010	149
Benzo(k)fluoranthene	<0.010	43
Benzo(a)pyrene	<0.010	***134***
Indeno(1,2,3-cd)pyrene	<0.010	97.2
Dibenzo(a,h)anthracene	<0.010	***12.9***
Benzo(g,h,i)perylene	<0.010	55.6
Quinoline	<0.050	<0.25
Acridine	<0.050	<20
Total PAH$_{16}$	0.161	***3886.1***

Notes:
CCME, Interim Sediment Quality Guidelines (PEL) for Freshwater, Update 2007.
-- indicates no criteria
All concentrations in mg/kg
N/A - not applicable
BOLD indicates exceeded guideline value presented by AECOM
[1] - MDL adjusted for required dilution or sample matrix effects

All analytical results provided to Wardrop by AECOM

Parameter	Sample Name @ Depth (m) / Date					
	TH10-01 @ 1.8 - 2.0 [1]	TH10-01 @ 3.4	TH10-01 @ 4.0 - 4.1	TH10-01 @ 4.9 - 5.0	TH10-01 @ 6.4 - 6.7	TH10-01 @ 7.0 - 7.3
	2/24/2010	2/24/2010	2/24/2010	2/24/2010	2/24/2010	2/24/2010
% Sand Content	62	79	44	59	2	44
% Silt Content	20	8	34	22	25	40
% Clay Content	18	13	23	19	73	16
FOC	0.181	0.0047	0.0071	0.0034	0.0125	0.0025
Total Organic Carbon	18.1	0.47	0.71	0.34	1.25	0.25
Benzene	***4.35***	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Toluene	***0.576***	<0.010	<0.010	<0.010	<0.010	<0.010
Ethylbenzene	14.8	0.013	<0.010	<0.010	<0.010	<0.010
Xylenes	9.19	<0.030	<0.030	<0.030	<0.030	<0.030
Naphthalene	***4600***	0.086	0.109	0.079	<0.010	<0.010
2-Methyl Naphthalene	***1160***	0.012	<0.010	0.011	<0.010	<0.010
1-Methyl Naphthalene	1170	0.015	<0.010	0.011	<0.010	<0.010
Acenaphthylene	***155***	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthene	***3360***	0.088	0.012	0.022	<0.010	<0.010
Fluorene	***1250***	0.017	<0.010	<0.010	<0.010	<0.010
Phenanthrene	***4080***	0.173	0.017	0.046	0.018	<0.010
Anthracene	***1390***	0.084	<0.010	0.031	<0.010	<0.010
Fluoranthene	***1790***	0.061	<0.010	0.023	<0.010	<0.010
Pyrene	***2590***	0.089	<0.010	0.033	0.011	<0.010
Benzo(a)anthracene	***673***	0.026	<0.010	0.017	0.012	<0.010
Chrysene	***732***	0.025	<0.010	0.014	<0.010	<0.010
Benzo(b&j)fluoranthene	477	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(k)fluoranthene	160	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(a)pyrene	***702***	0.019	<0.010	<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	378	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenzo(a,h)anthracene	***38.7***	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo(g,h,i)perylene	255	<0.010	<0.010	<0.010	<0.010	<0.010
Quinoline	<25	<0.050	<0.050	<0.050	<0.050	<0.050
Acridine	<20	<0.050	<0.050	<0.050	<0.050	<0.050
Total PAH$_{16}$	***22630.7***	0.728	0.278	0.345	0.171	0.16

Notes:
CCME, Interim Sediment Quality Guidelines (PEL) for Freshwater, Update 2007.
All concentrations in mg/kg
-- indicates no criteria
N/A - not applicable
BOLD indicates exceeded guideline value presented by AECOM
[1] - MDL adjusted for required dilution, Dibenzo(a,h)anthracene, Quinoline and Acridine MDL adjusted for sample matrix effects

All analytical results provided to Wardrop by AECOM

WARDROP
A TETRA TECH COMPANY

December 1, 2010 1000070300-LTR-V0005-00

Mr. Randy Webber
Regional Supervisor
Winnipeg District
Manitoba Conservation
160 – 123 Main Street
Winnipeg, MB R3C 1A5

Dear Mr. Webber

Subject Remedial Action Plan – Site Services and Road Works Adjacent to the Disraeli Bridge – Winnipeg, Manitoba

Wardrop Engineering Inc. (Wardrop) is planning to proceed with the offsite disposal of potentially impacted soil excavated as part of the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The potentially impacted soil will be removed to facilitate the relocation site services and the construction of new road works. The site services are underground utilities on the south side of the river adjacent to Gladstone Street and Rover Avenue. The new underground utilities include a 250 mm diameter watermain, a 300 mm diameter feedermain, and associated appurtenances. Portions of the existing 250 mm diameter watermain and 300 mm diameter land drainage sewer (LDS) will be abandoned in place. The new road works will consist of the relocation of a portion of Gladstone Street to intersect with Rover Avenue on the east side of Disraeli Freeway. A site plan is presented on Sheet 045, attached. Our proposed Remedial Action Plan (RAP) is detailed in the following sections.

PROJECT DESCRIPTION – DISRAELI BRIDGE PROJECT

The Disraeli Bridge project will comprise the construction of a new bridge structure spanning the Red River. The existing roadway will be realigned to the new bridge and exits and entrances will be redesigned. The new four lane bridge structure will be located to the west of the current structure. The current bridge structure will be converted to a pedestrian and cyclist bridge.

SITE BACKGROUND

Site Setting

The site of the underground utilities relocation and new road works is adjacent to the existing Disraeli Bridge and proximate to the existing Gladstone Street and Rover Avenue. The area encompasses a grassed area as well as paved portions of the streets. Surrounding land uses include the Red River to the north; Disraeli Street to the west, across which is a playground; the existing extension of Gladstone Street to the south; and commercial property to the east.

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The commercial property is occupied by Manitoba Hydro and is the location of a former manufactured gas plant (MGP).

Site Investigations

The report prepared for Manitoba Hydro by UMA Engineering Ltd. (UMA) and dated December 2003 provided a summary of the numerous investigations that have been conducted at the site of the former MGP as well as along the river bank adjacent to Rover Avenue.

The site of the underground utilities relocation and new road works is adjacent to the existing Disraeli Bridge and, as such, there has been limited investigation in the area. The nearest investigated areas include borehole MW-22 installed east of the bridge by CH2M Hill Engineering Ltd. in 1993; boreholes TH2K-17 and TH2K-18 installed north of Rover Avenue by AMEC Earth & Environmental limited in 2000; and test pits TP-2 and TP-3 installed west of the bridge by AECOM in 2007.

Site Geology

The native subsurface soils in the general area of the site are highly variable and consist of interbedded layers of low to high plastic clay, low plastic silt, and fine grained sand. Glacial till underlies the lacustrine materials at depths ranging from 8.2 m to 15.6 m below grade, and consists primarily of silt, although some gravel and sand are also present. According to the *Geological Engineering Maps and Report* produced by the former University of Manitoba Department of Geological Engineering in 1983, the carbonate bedrock in the area of the site is of the Selkirk Member and consists of mottled, fossiliferous dolomitic limestone, with abundant chert nodules in the upper limestone layer. Based on previous investigations in the vicinity of the site, bedrock is encountered at approximately 33 m below grade.

Based on a Wardrop investigation in February 2010, the site stratigraphy at the planned substructure to the west of the utility relocation area comprised clay fill from grade to a depth ranging from 0.8 m to 1.8 m below grade, underlain by silt, with varying percentages of clay to the maximum depth of the boreholes (3 m to 6 m below grade).

Site Hydrogeology

Primarily low permeability tills and glaciolacustrine silt and clay deposits dominate the area with the exception of locations along the floodplains of the river where permeabilities may be greater. Fractures in the glaciolacustrine silts and clays, as well as in the till deposit, can be a source of greater permeabilities.

The major underlying aquifer in the Winnipeg area is the upper 15 m to 30 m fractured zone of the Upper Carbonate Aquifer. The aquifer is somewhat confined by the overburden and underlying lower permeability carbonate bedrock.

Prior to the development of the aqueduct system which supplies the City of Winnipeg with potable water, the Upper Carbonate Aquifer was an important source of water for both municipal and industrial use. The Upper Carbonate Aquifer remains a potable water source in areas bordering the City (east of the Red River) and for some industrial use within Winnipeg. It is known that the Red River supplied process water to the former MGP.

The Lower Carbonate Aquifer occurs in the bottom 7.5 m to 15 m of the Red River formation, along the interface of the upper shale unit of the Winnipeg Formation. This aquifer is of limited use for potable water supply. The Winnipeg Formation contains an upper sandstone aquifer which ranges in thickness from 6 m to 12 m and a lower sandstone aquifer approximately 3 m thick. Both sandstone aquifers contain non-potable saline waters.

NATURE AND EXTENT OF IMPACT

Overview of Site Impact

Based on information presented in 1994 CH2M Hill report, the 2000 AMEC Earth & Environmental Ltd. Report and the 2010 AECOM report, 2003 and 2006 UMA reports, the potential impact in the area of the utilities relocation activities can be summarized as follows:

- Maximum historical naphthalene concentration of 0.0156 mg/kg in borehole MW-22 (located east of the site) at 14.32 m to 14.63 m below grade, which is well below the expected 2.5 m depth of the utilities relocation.
- Maximum historical benzo(a)pyrene concentration of 9.86 mg/kg and a maximum historical naphthalene concentration of 154 mg/kg in borehole TH2K-17 (located north of the site) at 6.1 m to 6.4 m below grade, which is below the expected 2.5 m depth of the utilities relocation.
- Maximum historical benzo(a)pyrene concentration of 4.01 mg/kg and a maximum historical naphthalene concentration of 47.1 mg/kg in borehole TH2K-18 (located north of the site) at 4.88 m to 5.18 m below grade, which is below the expected 2.5 m depth of the utilities relocation.
- Maximum historical benzo(a)pyrene concentration of 0.77 mg/kg at 2.4 m below grade and a maximum historical naphthalene concentration of 0.61 mg/kg at 1.8 m in test pit TP-2 (located north of the site).
- Maximum historical benzo(a)pyrene concentration of 0.01 mg/kg at 0.6 m below grade in test pit TP-3 (located west of the site).

The historic analytical results are summarized on Table 1, attached.

REMEDIAL ACTION PLAN

Exposure Pathways

The UMA report prepared for Manitoba Hydro in 2006 and entitled: *Comprehensive Environmental Management Plan for Residuals from Historical Operations at the Sutherland Avenue Former Gas Plant* identified three major human health exposure pathways:

- Direct exposure to PAH-impacted soil (i.e. dermal contact, soil ingestion, and particle inhalation);
- Exposure to volatile components of subsurface coal tar impact in the outdoor environment; and,
- Exposure to volatile components of subsurface coal tar impact via soil vapour intrusion into the indoor environment.

The underground utility relocation activities for the new Disraeli Bridge will not change the identified exposure pathways. Since the new bridge construction activities will not involve an indoor environment, only the first two exposure pathways are considered applicable for this RAP. Land-based activities related to the underground utility relocation will involve soil removal for pipe installation. The road works will involve soil excavation for the relocation of Gladstone Street. Access to the construction area will be restricted to authorized personnel. Authorized personnel will be aware of encountering potentially impacted soil in the excavations. Unnecessary exposure to authorized personnel will be avoided through the use of protective clothing and respirators; and decontamination after working in the excavations exposing potentially impacted soil.

Description of Remedial Action Plan

The purpose of the RAP is to address the potentially impacted soil that may be removed during the underground utilities relocation activities and road works on the south side of the river adjacent to Gladstone Street and Rover Avenue. The remedial action will consist of the following:

- Removal of potentially impacted soil to facilitate installation of a new 250 mm diameter watermain, 300 mm diameter feedermain and associated appurtenances on the south side of the river adjacent to the existing Gladstone Street and Rover Avenue.
- Removal of potentially impacted soil to facilitate the relocation of Gladstone Street to intersect Rover Avenue on the east side of Disraeli Freeway.
- Off-site disposal of potentially impacted soil containing chemicals of concern at concentrations exceeding the applicable Canadian Council of Ministers of the Environment (CCME) guidelines.
- Backfilling around appurtenances with compacted "clean" excavated material, pending confirmatory analytical results indicating that concentrations of chemicals of concern do not exceed the applicable CCME guidelines, and/or imported clean backfill.
- Backfilling the road works excavation with "clean" imported sub-base material and paving.

Applicable Guidelines/Standards

The UMA (2006) report referenced the CCME (2002) Residential/Parkland soil quality guidelines as applicable for the locations surrounding the MGP site and the riverbank. For the purposes of this RAP, the current CCME *Canadian Environmental Quality Guidelines* (2007), *Canada-Wide Standard for Petroleum Hydrocarbons (PHC) in Soil* (2008), and the *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons* (2008) soil quality guidelines have been used for comparison purposes.

It is not the intent to remediate, beyond the limits of the utilities relocation and road works, any impacted soil that may be encountered during the land-based construction activities. The purpose is only to address impacted soil that may be removed during the land-based construction activities.

Excavation of Potentially Impacted Soil

Land-based activities related to the new Disraeli Bridge underground utilities relocation will involve soil removal for the installation the new 250 mm diameter watermain pipe, 300 mm

diameter feedermain pipe, and associated appurtenances. The piping will be installed approximately 2.5 m below grade. An estimated volume of 415 m^3 of soil will be removed for the piping and appurtenances installation. Based on readily available historic information, the estimated 415 m^3 of soil are potentially impacted.

Construction activities related to the relocation of Gladstone Street will involve excavation to a depth of approximately 0.8 m below grade for sub-base preparation and paving. An estimated volume of 550 m^3 of soil will be excavated for the new road works. Based on readily available historic information and the limited depth of excavation, the volume of potentially impacted soil is expected to be minimal.

During soil removal for site services and road works, the soil will be assessed in the field based on visual observations, headspace vapour concentrations measured with GasTECH™ combustible gas indicator, noticeable odours, and available analytical results from previous investigations. Soil assessed in the field to be "clean" (i.e., no visual evidence of impact and no noticeable odour) will be stockpiled on the site for later use as backfill material, pending confirmatory analytical results. The "clean" soil will be stockpiled on polyethylene sheeting adjacent to the excavation from which the soil was removed.

Excavated soil assessed in the field to be impacted (i.e., visual evidence of impact and/or noticeable odours) will be loaded directly onto trucks or into roll-off bins for offsite disposal. In the event that trucks or bins are not immediately available, the soil will be temporarily stockpiled on polyethylene sheeting adjacent to the excavation from which it was removed. The stockpile will also be covered with polyethylene sheeting until it is removed for offsite disposal. Any stockpile will be located within a fenced area accessible only to authorized personnel.

Excavated material assessed in the field to be coal tar or coal tar-saturated (i.e. visual evidence of coal tar) will be loaded directly onto roll-off bins for temporary storage on the site. The bins will be located within a fenced area accessible only to authorized personnel. The bins will remain on the site until a sufficient quantity of the coal tar or coal tar-saturated soil has been collected for offsite disposal.

Abandoned Pipe Decommissioning

Land-based activities related to the new Disraeli Bridge underground utilities relocation will include the decommissioning of portions of a 300 mm diameter LDS and a 250 mm watermain pipe. In accordance with the City of Winnipeg specifications, the abandoned 300 mm diameter LDS will be filled with a cementitious flowable fill and a 1 m thick plug of 20 mpa sulphate resistant concrete will be placed at each limit of the piping.

The abandoned 250 mm diameter watermain will be filled with a cementitious flowable fill and a concrete plug will be placed at each limit of the piping.

Site Restoration

The work areas will be backfilled with clean compacted fill material to either existing grade or to the design grade set out by the new bridge construction. Any subsequent finish grading, landscaping or paving will be in accordance with the new bridge construction.

Off-Site Disposal

Based on the readily available historic analytical results, the potentially impacted soil will be suitable for disposal at MidCanada Environmental Services treatment facility in Ile des Chenes, Manitoba. Disposal of the impacted soil at MidCanada will require approval from the Director of Manitoba Conservation. The approval will be requested by MidCanada.

Coal tar and coal tar-saturated soil will be transported to Clean Harbor's hazardous landfill in Lambton, Ontario.

Confirmatory Sampling

Since it is not the intent to remediate, beyond the limits of the utilities relocation activities, any impacted soil that may be encountered during the land-based construction activities, no confirmatory sampling at the limits of the excavations is proposed.

Equipment Decontamination

Excavating or coring equipment that comes in contact with impacted soil will be decontaminated prior to that equipment leaving the site. Loose or visible soil will be scraped or brushed off the equipment. The equipment will then be pressured washed. The wash water will be collected on the site for subsequent disposal pending analytical results. Soil and solids from the decontamination process will be disposed at the MidCanada facility.

Closure Report

Following the completion of the site activities, Wardrop will prepare a closure report summarizing the site activities and including any soil analytical data.

Please contact Andrew Eason at (204) 954-6843 if you have any questions or comments.

Sincerely

WARDROP ENGINEERING INC.

Andrew Eason, P.Eng.
Senior Environmental Engineer

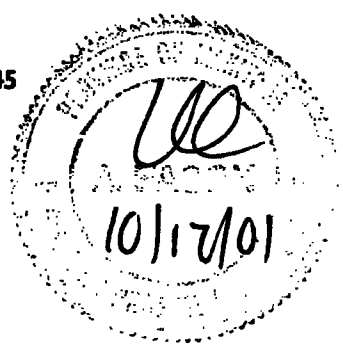
Reviewed by

WARDROP ENGINEERING INC.

for Michel Gregoire, P.Eng., P.Geo.
Senior Environmental Engineer

AE/ew

Attachments: Sheet 045
Table 1



APEGM
Certificate of Authorization
Wardrop Engineering Inc.
No. 195 Date: April 30, 2011

REFERENCES

AECOM, 2010. *Pipe and Ground Seep Supplemental Investigation River Bank Adjacent to the Disraeli Bridge.*

AMEC Earth & Environmental Limited, 2000. *Closure Report, Centra Gas Operations Facility, 35 Sutherland Avenue, Winnipeg, Manitoba.*

Canadian Council of Ministers of Environment, 2007. *Canadian Environmental Quality Guidelines.*

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CH2M Hill Engineering Ltd., 1994. *Environmental Health and Safety Assessment of the Sutherland Avenue Operations Facility in Winnipeg, Manitoba.*

UMA Engineering Ltd., 2003. *Manitoba Hydro Former Manufactured Gas Plant, 35 Sutherland Avenue, Winnipeg, Manitoba, Supplemental Environmental Site Investigation.*

UMA Engineering Ltd., 2006. *Comprehensive Environmental Management Plan for Residuals From Historic Operations at Sutherland Avenue Former Manufactured Gas Plant.*

LIMITATIONS

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Wardrop makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgement, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which is assumed to be correct. Except as provided, Wardrop has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of boreholes drilled, and the number of water samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based, will consequently change Wardrop's conclusions and recommendations.

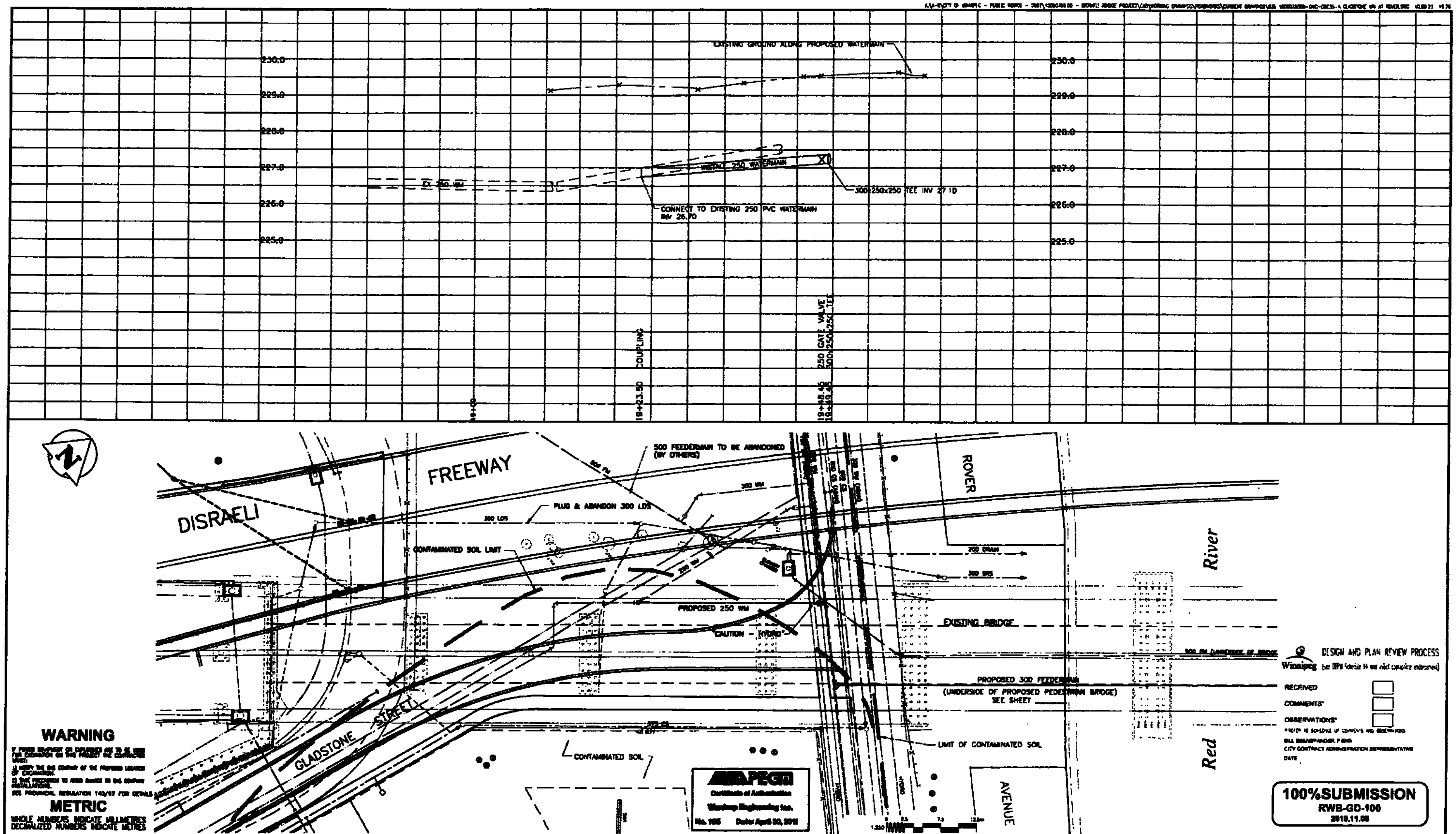
DISCLAIMER

This Wardrop Engineering report has been prepared in response to specific requests for services from the client to whom it is addressed. The content of this document is not intended for the use, nor is it intended to be relied upon, by any person, firm, or corporation other than the client of Wardrop Engineering to whom it is addressed. Wardrop denies any liability whatsoever to other parties who may obtain access to this Document by them, without express prior written authority of Wardrop Engineering and its client who has commissioned this Document.

TABLE 1
Historic Soil Sample Laboratory Analytical Results
Disraeli Bridge - South River Bank near Rover Avenue

Laboratory Analyses	Laboratory Analytical Results (mg/kg)														Environmental Quality Guidelines [1,2,3] (mg/kg)
	BW22	THBH-17		THBH-18	TP2	TP2	TP2	TP2	TP2	TP3	TP3	TP3	TP3	TP3	
	14.32 m - 14.63 m	5.18 m - 5.49 m	6.1 m - 6.4 m	4.88 m - 5.18 m	0.6 m	1.2 m	1.8 m	2.4 m	3	0.6 m	1.2 m	1.8 m	2.4 m	3	
	CNRH Hill 1993	AMEC 2009		AMEC 2009	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	ABCOM 2007	
BTEX															
Benzene	--	--	--	--						<0.005	<0.005	<0.005	<0.005	<0.005	60 / 1.0
Toluene	--	--	--	--						<0.1	<0.1	0.02	<0.1	<0.1	110 / 0.10
Ethylbenzene	--	--	--	--						<0.1	<0.1	<0.1	<0.1	<0.1	120 / 50
Xylenes	--	--	--	--						<0.03	<0.03	<0.03	<0.03	<0.03	65 / 37
CCME Fractions															
F1 - BTEX ($>nC_6$-nC_{10})	--	--	--	--						<5	<5	<5	<5	<5	210 / 970
F2 ($>nC_{10}$-nC_{16})	--	--	--	--						<5	<5	<5	<5	<5	150 / 150
F3 ($>nC_{16}$-nC_{34})	--	--	--	--						9	11	16	11	8	1300 / 300
F4 ($>nC_{34}$)	--	--	--	--						6	<5	6	<5	<5	5600 / 2800
Polycyclic Aromatic Hydrocarbons (PAHs)															
Acenaphthene	0.0142	*1.26*	*5.89*	*2.67*	--	--	--	--	--	--	--	--	--	--	0.36
Acenaphthylene	0.0415	*6.16*	*25.2*	*2.64*	--	--	--	--	--	--	--	--	--	--	320
Acridine	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NG
Anthracene	0.0421	*3.37*	*12.4*	*3.89*	--	--	--	--	--	--	--	--	--	--	2.5
Benzo(a)anthracene	0.0441	*2.86*	*8.85*	*3.29*	1.50	0.16	0.37	0.42	0.23	0.01	0.01	<0.01	<0.01	<0.01	6.2
Benzo(a)pyrene	0.0517	*2.32*	*8.85*	*4.01*	*2.69*	0.44	0.47	*0.77*	0.32	0.01	<0.01	<0.01	<0.01	<0.01	0.6
Benzo(b)fluoranthene	0.0853	*1.42*	*6.37*	*2.70*	*3.80*	0.67	0.97	*1.30*	0.57	0.01	<0.01	<0.01	<0.01	<0.01	6.2
Benzo(g,h,i)perylene	0.0265	0.89	*4.02*	*1.920*	--	--	--	--	--	--	--	--	--	--	NG
Benzo(k)fluoranthene	--	*1.04*	*6.46*	*2.38*	0.99	0.14	0.22	0.28	0.13	0.01	0.01	0.01	0.01	0.01	6.2
Chrysene	0.0445	*1.98*	*8.69*	*3.21*	--	--	--	--	--	--	--	--	--	--	6.2
Dibenzo(a,h)anthracene	0.00296	0.20	0.30	0.40	0.52	0.16	0.21	0.22	0.11	<0.01	<0.01	<0.01	<0.01	<0.01	1.0
Fluoranthene	0.109	5.03	*20.6*	6.30	--	--	--	--	--	--	--	--	--	--	15.4
Fluorene	0.0278	*2.06*	*10.4*	*2.77*	--	--	--	--	--	--	--	--	--	--	0.3
Indeno(1,2,3 cd)pyrene	0.0309	*1.66*	*4.36*	*1.980*	*2.10*	0.74	0.89	0.98	0.39	<0.01	<0.01	<0.01	<0.01	<0.01	1.0
1-Methyl Naphthalene	--	5.97	21.4	5.140	--	--	--	--	--	--	--	--	--	--	NG
2-Methyl Naphthalene	--	8.36	22.7	5.470	--	--	--	--	--	--	--	--	--	--	NG
Naphthalene	*0.0195*	*46.5*	*164*	*47.1*	*6.34*	*0.62*	*0.66*	*0.64*	*0.62*	<0.01	<0.01	<0.01	<0.01	<0.01	0.013
Phenanthrene	*0.166*	*14.3*	*48.6*	*16.2*	*10.00*	*0.66*	*0.27*	*0.29*	*0.16*	<0.01	<0.01	<0.01	<0.01	<0.01	0.046
Pyrene	0.128	*7.79*	*28.6*	*12.3*	*11.00*	0.28	0.53	0.74	0.46	0.01	0.01	<0.01	<0.01	<0.01	7.7
Quinoline	--	--	--	--	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NG
Grain Size															
<75 um	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NG
>75 um	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NG
Moisture Content (%)	--	--	--	--	--	--	--	--	--	--	--	--	--	--	NG

Notes:
[1] CCME, *Canadian Environmental Quality Guidelines* (2007), Residential / Parkland, fine-grained / coarse-grained, eco soil contact and groundwater check (aquatic life).
[2] CCME, *Canada-Wide Standard for Petroleum Hydrocarbons in Soil* (2008), Residential, fine-grained / coarse-grained, eco soil contact and protection of aquatic life.
[3] CCME, *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs)* (2008), Residential / Parkland, soil contact and protection of freshwater life.
NG = No Guideline
-- = not tested / not reported
Bold Text = Laboratory analytical results in excess of the referenced guidelines



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CONSULTANT	WARDROP — A TETRA TECH COMPANY
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DRAWN BY	GMD
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VERTICAL	1 : 50
APPROVED BY / DATE	
AUTHORIZED BY / DATE	
CONSULTANT DRAWING NO	1000070300-DWG-C0035-B

PRELIMINARY DRAWING
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Plenary Roads — PCL CONSTRUCTION LEADERS

DISRAELI BRIDGES PROJECT
ROADWORKS – PART B

NEW WATERMAIN & SEWER ABANDONMENT AT ROVER AVENUE

CITY DRAWING NUMBER	
PACKAGE NO.	RWB-GD
SHEET NO.	045

WARDROP
A TETRA TECH COMPANY

April 5, 2011 1000070300-LTR-V0003-03

Mr. Randy Webber
Manager, Pesticide and Land Use Section
Environmental Assessment and Licencing Branch
Manitoba Conservation
160 - 123 Main Street
Winnipeg, MB R3C 1A5

Dear Mr. Webber

Subject Remedial Action Plan - Revision for Pier SU5
Adjacent to Disraeli Bridge - Winnipeg, Manitoba

Wardrop Engineering Inc. (Wardrop) is planning to proceed with the offsite disposal of potentially impacted soil excavated as part of the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The potentially impacted soil will be excavated to facilitate pile installation and footing construction for the abutment and piers on the west side of the river adjacent to Disraeli Street and Rover Avenue. A remedial action plan (RAP) was submitted to Manitoba Conservation on May 6, 2010 and approval was received on March 1, 2011.

Pier SU5 is located on the west bank of the Red River between the normal summer water level and the winter ice surface level. Originally designed to be supported on driven steel piles, the pier SU5 design has been revised to be supported on five caissons that will extend into the underlying bedrock. The caisson construction methodology will be similar to that of river pier SU6 as presented in the document entitled: Disraeli Bridges Project Environmental Impact Statement (EIS), August 2010.

A construction methodology specific to pier SU5 is presented below. The handling and disposal protocols for potentially impacted soil/sediment and water encountered at pier SU5 will be consistent with those presented the above referenced RAP and EIS documents.

Construction of pier SU5 will begin once a temporary ramp and work pad are installed on the west bank of the Red River to access the work site. The temporary ramp and work pad are parts of the temporary work bridge discussed in the EIS. Pier SU5 will be constructed through potentially contaminated soil/sediment. Therefore, the spoils and water encountered during construction will be treated as contaminated material.

The construction of each of the five caissons for pier SU5 will commence with the setting of a 3 m diameter steel sleeve into the river bank as secondary containment. The sleeve will be positioned from the temporary work pad. The steel sleeve will be advanced through the contaminated soil/sediment to a depth of approximately 6.5 m below grade, where the soil is not expected to exhibit coal tar related hydrocarbon impact. Soil/sediment within the secondary containment will be removed to approximately the bottom of the steel sleeve. The volume of soil/sediment to be removed from within each steel sleeve is estimated to be 45 m3. Water inside the secondary containment will be removed, loaded on tank trucks, and transferred off of the site for disposal. The potentially impacted soil/sediment removed from the secondary containment will be directly loaded onto trucks and transferred to the MidCanada Environmental Services treatment facility in Ile des Chenes, Manitoba for disposal.

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In the event that trucks are not immediately available, the soil/sediment will be temporarily stored in roll-off bins or within a lined containment cell. The bin or containment cell will be covered with polyethylene sheeting until it is removed for offsite disposal. The bin or containment cell will be located within a fenced area accessible only to authorized personnel.

Upon completion of removal of the soil/sediment from within the secondary containment sleeve, a thin bentonite cement mixture with be placed at the bottom of the steel sleeve.

Drilling of the caisson will proceed through the bottom of the secondary containment sleeve. A permanent 1.5 m diameter steel casing will be advanced as primary containment during drilling. The casing will extend to, and be socketed into, the bedrock at approximately 30 m below the river bank.

The solids from the caisson drilling process will be loaded onto trucks and hauled from the site for disposal as fill material.

Groundwater from the bedrock is expected to rise in the casing, but will not discharge directly to into the river. The bedrock groundwater will be contained within the casing. Saline groundwater is not expected to be encountered.

Concrete for the caisson will be placed using the tremie method. Bedrock groundwater in the casing and containment sleeves will be displaced as the concrete is poured. Bedrock groundwater displaced by the tremied concrete in the first caisson will be transferred to the second caisson. The process of transferring bedrock groundwater to next subsequent caisson will continue until the fifth and final caisson. The bedrock groundwater displaced by the tremied concrete in the final caisson will be loaded on tank trucks, and transferred off of the site for disposal.

At the conclusion of the caisson construction, the void between the 3 m diameter steel secondary containment sleeve and the 1.5 m diameter permanent casing will be filled with bentonite cement mixture as the secondary containment sleeve is be removed from the subsurface. Once the containment sleeve is removed from the riverbank, the caisson installation will be complete.

Please contact Andrew Eason at (204) 954-6843 if you have any questions or comments.

Sincerely

WARDROP ENGINEERING INC.

Andrew Eason, P.Eng.
Senior Environmental Engineer

Reviewed by

WARDROP ENGINEERING INC.

Michel Gregoire, P. Eng., P.Geo.
Senior Environmental Engineer

AE/ew

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Certificate of Authorization
Wardrop Engineering Inc.
No. 195 Date: April 30, 2011

LIMITATIONS

The scope of this report is limited to the matters expressly covered and is intended solely for the client to whom it is addressed. Wardrop makes no warranties, expressed or implied, including without limitation, as to the marketability of the site, or fitness for a particular use. The assessment was conducted using standard engineering and scientific judgment, principles and practices, within a practical scope and budget. It is partially based on the observations of the assessor during the site visit, in conjunction with archival information obtained from a number of sources, which is assumed to be correct. Except as provided, Wardrop has made no independent investigations to verify the accuracy or completeness of the information obtained from secondary sources or personal interviews. Generally, the findings, conclusions, and recommendations are based on a limited amount of data (e.g., the number of boreholes drilled, and the number of water samples submitted for laboratory analyses) interpolated between sampling points, and the actual conditions (e.g., the type, level, and extent of impacted media) on the property may vary from that described above. Any findings regarding site conditions different from those described above upon which this report is based, will consequently change Wardrop's conclusions and recommendations.

DISCLAIMER

This Wardrop Engineering report has been prepared in response to specific requests for services from the client to whom it is addressed. The content of this document is not intended for the use, nor is it intended to be relied upon, by any person, firm, or corporation other than the client of Wardrop Engineering to whom it is addressed. Wardrop denies any liability whatsoever to other parties who may obtain access to this Document by them, without express prior written authority of Wardrop Engineering and its client who has commissioned this Document.

Manitoba

Conservation

Environmental Operations
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March 1, 2011

Andrew Eason
Wardrop Engineering Inc.
400 - 161 Portage Avenue
Winnipeg MB R3B 0Y4

Dear Mr. Eason:

Re: Disraeli Bridge Project – Remedial Action Plan – Land-Based Construction, Site Services and Road Works Adjacent to the Disraeli Bridge

---

This will acknowledge receipt of the Remedial Action Plan dated December 1, 2010 regarding limited remediation of potentially impacted soils during the land-based construction activities, site services and road works, for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The Plan was prepared by Wardrop Engineering Inc.

The Disraeli Bridge project will comprise the construction of a new bridge structure spanning the Red River. It is understood that certain land-based construction activities on the south side of the river may encounter potentially impacted soils which are the result of the operation of a former coal gasification plant. This includes the relocation of underground utilities and certain road works as described below.

Land based activities related to the new Disraeli Bridge underground utilities relocation will involve soil removal for the installation of a new 250 mm diameter water main pipe, 300 mm diameter feeder main pipe and associated appurtenances. The piping will be installed approximately 2.5 m below grade. An estimated volume of 415 m^3 of soil will be removed for the piping and appurtenances installation. Based on information provided in the RAP, the estimated 415 m^3 of soil are potentially impacted.

Construction activities related to the relocation of Gladstone Street will involve excavation to a depth of approximately 0.8 m below grade for sub-base preparation and paving. An estimated volume of 550 m^3 of soil will be excavated for the new road works. Based on information provided in the RAP and the limited depth of the excavation, the volume of potentially impacted soil is expected to be minimal.

.../2

During soil removal for site services and road works, the soil will be assessed in the field based on visual observations, headspace vapour concentrations measured with GasTECH™ combustible gas indicator, noticeable odours, and available analytical results from previous investigations. Soil assessed in the field to be "clean" will be stockpiled for later use as backfill material pending confirmatory analytical results. The "clean" soil will be stockpiled on polyethylene sheeting adjacent to the excavation from which the soil is to be removed.

Excavated soil assessed in the field to be impacted will be loaded directly onto trucks or into roll-off binds for offsite disposal. In the event that trucks or bins are not immediately available, the soil will be temporarily stockpiled on polyethylene sheeting adjacent to the excavation from which it will be removed. The stockpile will also be covered with polyethylene sheeting until it is removed for off-site disposal. Any stockpile will be within a fenced area accessible only to authorized personnel.

Excavated material assessed in the field to be coal tar or coal tar saturated will be loaded directly onto roll-off bins for temporary storage on site. The bins will be located within a fenced area accessible only to authorized personnel. The bins will remain on site until a sufficient quantity of the coal tar or coal tar saturated soil has been collected for offsite disposal.

Land based activities related to the underground utilities relocation will include the decommissioning of portions of a 300 mm diameter LDS and a 250 mm water main pipe. In accordance with the City of Winnipeg specifications, the abandoned 300 mm diameter LDS will be filled with a cementitious flowable fill and a 1 m thick plug of 20 mpa sulphate resistant concrete will be placed at each limit of the abandoned piping. The abandoned 250 mm diameter water main will be filled with a cementitious flowable fill and a concrete plug will be placed at each limit of the piping.

The excavated areas will be backfilled with clean compacted fill material to either existing grade or to the design grade of the new bridge construction. Based on the results presented in the RAP, the excavated potentially impacted soil will be suitable for disposal at the MidCanada Environmental Services facility in Ile des Chenes, Manitoba. It should be noted that disposal of the impacted soil at MidCanada will require a separate approval from Manitoba Conservation. The coal tar or coal tar saturated soil will be transported to the Clean Harbours hazardous waste landfill in Lambton, Ontario.

It is the position of Manitoba Conservation that the Remedial Action Plan for the potentially impacted soils during the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg Manitoba be undertaken as proposed.

.../3

It should be noted that the position of Manitoba Conservation as stated in this letter is based on the information provided to this office by Wardrop Engineering Inc. and relates only to the matters within the scope of the investigation conducted by Wardrop Engineering Inc. No additional site monitoring was performed by Manitoba Conservation.

Yours truly,

Don Labossiere
Director

C File: 20861
Bruce Webb (Manitoba Conser

Fax # 945- 5729

Manitoba

Conservation

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March 1, 2011

Andrew Eason
Wardrop Engineering Inc.
400 - 161 Portage Avenue
Winnipeg MB R3B 0Y4

Dear Mr. Eason:

Re: Disraeli Bridge Project – Remedial Action Plan – Land-Based Construction, Pile Installation and Footing Construction Adjacent to the Disraeli Bridge

This will acknowledge receipt of the Remedial Action Plan dated May 6, 2010 regarding limited remediation of potentially impacted soils during the land-based construction activities pile installation and footing construction for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The Plan was prepared by Wardrop Engineering Inc.

The Disraeli Bridge project will comprise of the construction of a new bridge structure spanning the Red River. It is understood that certain land-based construction activities on the south side of the river may encounter potentially impacted soils which are the result of the operation of a former coal gasification plant.

The land-based activities will involve soil excavation at five substructure locations for pile placement and footing construction on the south side of the Red River adjacent to Disraeli Street and Rover Avenue. Footing excavations will extend to approximately 2 m below grade. Pre-drilling for installation of 406 mm diameter precast concrete piles at the south abutment SU1 will extend to approximately 4.5 m (vertical pile) or 6 m (battered pile) below the base of the footing excavation. An estimated total of 650 m^3 of soil will be excavated from the five substructure locations. Based on evidence provided in the RAP the 650 m^3 of excavated soil will include an estimated 70 m^3 of "clean" soil from substructures SU1 and SU2 and an estimated 580 m^3 of potentially impacted soil from substructures SU3, SU4 and SU5.

During excavation at each of the five locations, soil will be assessed in the field based on visual observations, headspace vapour concentrations measured with GasTECH™ combustible gas indicator, noticeable odours, and available analytical results from previous investigations. Soil assessed in the field to be "clean" will be stockpiled for later use as backfill material pending confirmatory analytical results. The "clean" soil will be stockpiled on polyethylene sheeting adjacent to the excavation from which the soil is to be removed.

.../2

Excavated soil assessed in the field to be impacted will be loaded directly onto trucks or into roll-off binds for offsite disposal. In the event that trucks or bins are not immediately available, the soil will be temporarily stockpiled on polyethylene sheeting adjacent to the excavation from which it will be removed. The stockpile will also be covered with polyethylene sheeting until it is removed for off-site disposal. Any stockpile will be within a fenced area accessible only to authorized personnel.

Excavated material assessed in the field to be coal tar or coal tar saturated soil will be loaded directly onto roll-off bins for temporary storage on site. The bins will be located within a fenced area accessible only to authorized personnel. The bins will remain on site until a sufficient quantity of the coal tar or coal tar saturated soil has been collected for offsite disposal.

The excavated areas will be backfilled with clean compacted fill material to either existing grade or to the design grade of the new bridge construction. Based on the results presented in the RAP, the excavated potentially impacted soil will be suitable for disposal at the MidCanada Environmental Services facility in Ile des Chenes, Manitoba. It should be noted that disposal of the impacted soil at MidCanada will require a separate approval from Manitoba Conservation. The coal tar or coal tar saturated soil will be transported to the Clean Harbours hazardous waste landfill in Lambton, Ontario.

It is the position of Manitoba Conservation that the Remedial Action Plan for the potentially impacted soils during the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg Manitoba be undertaken as proposed.

It should be noted that the position of Manitoba Conservation as stated in this letter is based on the information provided to this office by Wardrop Engineering Inc. and relates only to the matters within the scope of the investigation conducted by Wardrop Engineering Inc. No additional site monitoring was performed by Manitoba Conservation.

Yours truly,

Don Labossiere
Director

c File: 20861
Bruce Webb (Manitoba Conservation)

Manitoba

Conservation

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April 14, 2011

Andrew Eason
Wardrop Engineering Inc.
400 - 161 Portage Avenue
Winnipeg MB R3B 0Y4

Dear Mr. Eason:

Re: Disraeli Bridge Project – Remedial Action Plan Amendment – Land-Based Construction, Pier SU5 Construction Adjacent to the Disraeli Bridge

This will acknowledge receipt of the Remedial Action Plan Revision dated April 5, 2011 regarding limited remediation of potentially impacted soils during the land-based construction activities pile installation and footing construction for the new Disraeli Bridge over the Red River in Winnipeg, Manitoba. The Revised Plan for SU5 was prepared by Wardrop Engineering Inc.

The Disraeli Bridge project will comprise the construction of a new bridge structure spanning the Red River. It is understood that certain land-based construction activities on the south side of the river may encounter potentially impacted soils which are the result of the operation of a former coal gasification plant.

Pier SU5 is located on the west bank of the Red River between the normal summer water level and the winter ice surface level. Originally designed to be supported on driven steel piles, the pier SU5 design has been revised to be supported on five caissons that will extend into the underlying bedrock. It is understood the caisson construction methodology will be similar to that of river pier SU6 as presented in the document entitled: Disraeli Bridges Project Environmental Impact Statement, August 2010. The work on SU6 will be undertaken under the authority of Environment Act Licence No. 2943.

It is understood that construction of pier SU5 will begin once a temporary ramp and work pad are installed on the west bank of the Red River to access the work site. The temporary ramp and work pads are parts of the temporary work bridge discussed in the August 2010 EIS. Pier SU5 will be constructed through potentially contaminated soil/sediment. Therefore, the spoils and water encountered during the construction will be treated as contaminated material.

.../2

The construction of each of the five caissons for pier SU5 will commence with the setting of a 3 metre diameter steel sleeve into the river bank as secondary containment. The sleeve will be positioned from the temporary work pad. The steel sleeve will be advanced through the contaminated soil/sediment to a depth of approximately 6.5 metres below grade, where the soil is not expected to exhibit coal tar related hydrocarbon impact. Soil/sediment within the secondary containment will be removed to approximately the bottom of the steel sleeve. The volume of soil/sediment to be removed from each steel sleeve is estimated to be 45 m^3. Water inside the secondary containment will be removed, loaded on tank trucks, and transferred off of the site for disposal. The potentially impacted soil/sediment removed from the secondary containment will be directly loaded onto trucks and transferred to MidCanada Environmental Services treatment facility in Ile des Chenes, Manitoba for disposal.

In the event that trucks are not immediately available, the soil/sediment will be temporarily stored in roll-off bins or within a lined containment cell. The bin or containment cell will be covered with polyethylene sheeting until it is removed for offsite disposal. The bin or containment cell will be located within a fenced area accessible only to authorized personnel.

Upon completion of removal of the soil/sediment from within the secondary containment sleeve, a thing bentonite cement mixture will be placed at the bottom of the steel sleeve.

Drilling of the caisson will proceed through the bottom of the secondary containment sleeve. A permanent 1.5 diameter steel casing will be advanced as primary containment during drilling. The casing will extend to, and be socketed into, the bedrock at approximately 30 metres below the river bank.

The solids from the caisson drilling process will be loaded onto trucks and hauled from the site for disposal as fill material.

Groundwater from the bedrock is expected to rise in the casing, but will not discharge directly into the river. The bedrock groundwater will be contained within the casing. Saline groundwater is not expected to be encountered.

Concrete for the caisson will be placed using the tremie method. Bedrock groundwater in the casing and containment sleeves will be displaced as the concrete is poured. Bedrock groundwater displaced by the tremied concrete in the first caisson will be transferred to the second caisson. The process of transferring bedrock groundwater to the next subsequent caisson will continue until the fifth and final caisson. The bedrock groundwater displaced by the tremied concrete in the final caisson will be loaded onto tank trucks, and transferred off of the site for disposal.

.../3

At the conclusion of the caisson construction, the void between the 3 metre diameter steel secondary containment sleeve and the 1.5 diameter permanent casing will be filled with bentonite cement mixture as the secondary containment sleeve is removed from the subsurface. Once the containment sleeve is removed from the riverbank, the caisson installation will be complete.

It is the position of Manitoba Conservation that the Remedial Action Plan for the potentially impacted soils during the land-based construction activities for the new Disraeli Bridge over the Red River in Winnipeg Manitoba be undertaken as proposed.

It should be noted that the position of Manitoba Conservation as stated in this letter is based on the information provided to this office by Wardrop Engineering Inc. and relates only to the matters within the scope of the investigation conducted by Wardrop Engineering Inc. No additional site monitoring was performed by Manitoba Conservation.

Yours truly,

Don Labossiere
Director

c File: 20861
Bruce Webb (Manitoba Conservation)

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October 17, 2012

Tetra Tech WEI Inc.
400-161 Portage Avenue East
Winnipeg, MB R2K 0C1

Dear Mr. Andrew Eason,

Re: Remedial Action Plan, Pedestrian Bridge adjacent to the new Disraeli Bridge, Winnipeg, Manitoba

This will acknowledge receipt of the Remedial Action Plan for the above noted project, dated October 16, 2012, prepared by Tetra Tech WEI Inc.

The Remedial Action Plan states:

- Approximately 120m^3 of potentially impacted soil will be excavated to facilitate the reconstruction of the existing Pier 5.
- The excavated soil will be managed as outlined in RAP that was submitted to Manitoba Conservation on December 1, 2010 and approved on March 1, 2011 which will include field assessment of the soil during excavation activities followed by off-site disposal.

It is the position of Manitoba Conservation that the remediation of potentially impacted soil surrounding Pier 5 of the pedestrian bridge adjacent to the new Disraeli Bridge be undertaken as described above.

It should be noted that the position of Manitoba Conservation as stated in this letter is based on the information provided to this office by Tetra Tech WEI Inc. and relates only to the matters within the scope of the investigation conducted by Tetra Tech WEI Inc.

Sincerely,

WR

Warren Rospad, B.Sc.
District Supervisor / Environment Officer
Contaminated Sites / Petroleum Storage Programs

File:

Andrew,

Please find attached concurrence to the original RAP approval for potentially impacted soil surrounding Pier 5 during the construction of the pedestrian bridge adjacent to the new Disraeli Bridge.

Please Note my New Phone Number
Warren Rospad, B.Sc.
District Supervisor / Environment Officer
Environmental Compliance and Enforcement
Manitoba Conservation & Water Stewardship
Ste.160-123 Main Street
Winnipeg, MB R3C 1A5
Ph: (204) 330-2685 *
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Manitoba
Conservation

To report an Environmental Emergency please call our
24/7 Emergency Response Line (204)944-4888
Toll Free in Manitoba 1-855-944-4888

From: Eason, Andrew [mailto:Andrew.Eason@tetratech.com]
Sent: October-16-12 11:17 AM
To: Rospad, Warren (CON)
Subject: Remedial Action Plan - Pedestrian Bridge adjacent to the new Disraeli Bridge, Winnipeg, Manitoba

Warren,

Wardrop Engineering Inc. (Wardrop) is planning to proceed with the offsite disposal of potentially impacted soil excavated as part of the land-based construction activities for the new Disraeli Bridge project in Winnipeg, Manitoba. The existing Disraeli Bridge structure will be converted to a pedestrian bridge. The existing Pier 5 will be reconstructed for the pedestrian bridge's south landing proximate to the intersection of Rover Avenue and the realigned Gladstone Street, as shown on the attached highlighted drawing. Potentially impacted soil will be excavated to facilitate the reconstruction of existing Pier 5. We propose to manage the potentially impacted soil in accordance with the Remedial Action Plan (RAP) that was submitted to Manitoba Conservation on December 1, 2010 for the site services and road works proximate to Gladstone Street and Rover Avenue. Approval for the RAP was received from Manitoba Conservation on March 1, 2011. A copy of the RAP is attached for your reference.

An estimated 120 m^3 of potentially impacted soil will be excavated to facilitate the reconstruction of the existing Pier 5. The excavated soil will be managed as outlined in the referenced RAP, including field assessment of the soil during excavation activities followed by offsite disposal. It is not the intent to remediate, beyond the limits of the existing Pier 5 excavation, any impacted soil that may be encountered during the land-based construction

activities. The purpose is only to address impacted soil that may be removed during the land-based construction activities.

The contractor may start the reconstruction activities at existing Pier 5 as soon as this week.

Do not hesitate to call if you have any questions.

Regards,

Andrew Eason, P.Eng |
Direct: 204.954.6843 | Cell: 204.612.5919
Andrew.Eason@tetratech.com

Tetra Tech WEI Inc. |
400-161 Portage Avenue East | Winnipeg, MB, R2K 0C1 | www.tetratech.com

TETRA TECH

APPENDIX B

FIGURE

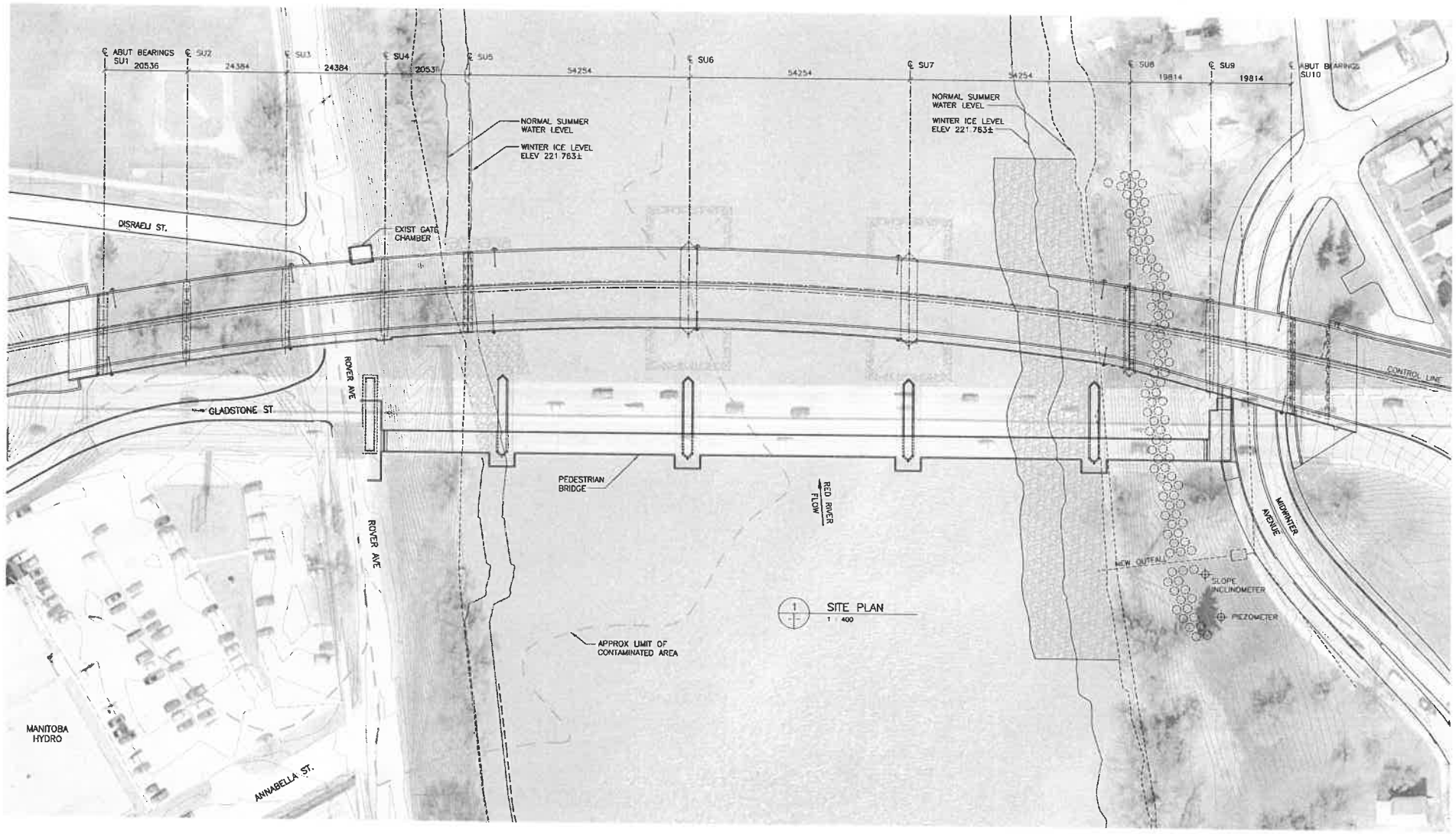
℄ ABUT BEARINGS SU1
℄ SU2
℄ SU3
℄ SU4
℄ SU5
℄ SU6
℄ SU7
℄ SU8
℄ SU9
℄ ABUT BEARINGS SU10
205.36
24384
24384
205.36
54254
54254
54254
19814
19814
NORMAL SUMMER WATER LEVEL
WINTER ICE LEVEL ELEV 221.763±
NORMAL SUMMER WATER LEVEL
WINTER ICE LEVEL ELEV 221.763±
DISRAELI ST.
EXIST GATE CHAMBER
ROVER AVE.
GLADSTONE ST.
ROVER AVE.
PEDESTRIAN BRIDGE
RED RIVER FLOW
CONTROL LINE
MOUNTER AVENUE
NEW OUTFALL
SLOPE INCLINOMETER
PIEZOMETER
1
SITE PLAN
1 : 400
APPROX LIMIT OF CONTAMINATED AREA
MANITOBA HYDRO
ANNABELLA ST.

FIGURE 1

TETRA TECH

APPENDIX C

TABLES

TABLE 1

Soil Petroleum Hydrocarbon and Polycyclic Aromatic Hydrocarbon Laboratory Analytical Results
Diersell Bridge - South River Bank / West of Bridge

Sample Identification	Sampling Date	Field Measurement	Analytical Results																																
			BTEX (mg/kg)				Hydrocarbon Fractions (mg/kg)				Polycyclic Aromatic Hydrocarbons (mg/kg)																									
		Headspace Vapour Concentration (ppm)	Benzene	Toluene	Ethylbenzene	Xylenes	F1 - BTEX (C_6 - C_{10})	F2 (C_{10} - C_{16})	F3 (C_{16} - C_{34})	F4 (C_{34} - C_{50})	Acenaphthene	Acenaphthylene	Acridine	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenz(a,h)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	Quinoline	B(a)P Total Potency Equivalents	IA/IC
Environmental Quality Guidelines [1,2,3]	Fine-Grained	11	110	120	65	210	150	1,300	6,600	0.29	320	N.G.	2.5	0.2	0.8	0.2	N.G.	0.2	0.2	1.8	18.4	0.25	1.8	N.G.	N.G.	0.013	0.046	7.7	N.G.	0.6	N.G.
	Coarse-Grained	1.8	0.10	82	37	210	150	300	2,800																						
SU-1-SP	10-Mar-11	N.M.	< 0.0050	< 0.050	< 0.015	< 0.10	< 10	< 10	< 50	< 50	<0.050	<0.050	<0.50	<0.050	<0.050	<0.020	<0.050	<0.050	<0.020	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.012	<0.030	<0.050	<0.050	<0.15	<0.46
SU-2-SP	11-Mar-11	N.M.	< 0.0050	< 0.050	< 0.015	< 0.10	< 10	< 10	< 50	< 50	<0.050	0.070	<0.50	<0.050	0.223	0.219	0.152	0.167	0.158	0.198	<0.050	0.343	<0.050	0.153	<0.050	<0.050	*0.016*	*0.122*	0.302	<0.050	0.32	3.49
HP-1 SP	14-Jun-11	N.M.	<0.0050	<0.015	<0.050	<0.10	<10	<10	71	123	<0.0050	0.0093	<0.010	0.0363	0.088	0.056	0.060	0.045	0.034	0.071	0.0108	0.110	<0.010	0.046	0.010	0.016	*0.018*	0.040	0.095	<0.010	0.093	1.23
SU-5 SOIL STOCKPILE #2	5-Dec-12	N.M.	–	–	–	–	–	–	–	–	*1.46*	*4.71*	<0.10	*2.50*	*1.66*	*2.01*	*1.48*	*1.14*	0.588	*1.53*	0.134	*4.18*	*1.70*	*1.07*	*6.41*	*8.82*	*49.1*	*8.92*	*5.55*	<0.10	*2.65*	*25.30*
PED BRIDGE WEST ACCESS	10-Jul-13	N.M.	<0.0050	<0.015	<0.050	<0.10	14	57	*3620*	1230	0.16	18.80	0.089	*3.01*	*25.90*	*50.00*	*88.00*	108.00	*30.400*	*40.30*	*8.730*	*9.19*	*0.63*	*96.90*	0.28	0.49	*0.993*	*1.57*	*20.70*	0.03	*84.40*	1070.00
DIS.PED.SU-5 EXC	15-Jul-13	N.M.	<0.0050	<0.015	<0.050	<0.10	<10	<25	<50	<50	0.01	0.27	<0.010	0.12	0.30	0.33	0.45	0.34	0.153	0.28	0.030	0.57	0.03	0.39	0.01	0.02	90.4	0.51	0.55	<0.010	0.499	6.01
DIS.PED.WM.EXC 1	15-Jul-13	N.M.	0.014	1.62	0.605	6.37	31	*3430*	1230	142	*2.66*	*4.93*	0.573	*4.00*	*3.55*	*3.80*	3.05	1.89	1.020	3.06	0.228	6.19	3.81	*2.12*	15.10	17.80	*14200.0*	*11.70*	*8.70*	0.133	*4.75*	48.10
DIS.PED.WM.EXC 2	15-Jul-13	N.M.	0.0084	<0.015	<0.050	<0.10	<10	57	<50	<50	0.08	0.04	<0.010	0.05	<0.010	0.04	0.02	0.04	<0.010	0.02	0.007	0.04	0.09	0.05	0.15	<0.010	1.42	0.27	0.05	<0.010	0.055	0.36
DIS.PED.WM.EXC 3	7-Aug-13	N.M.	0.884	0.091	<0.050	<0.10	<10	<25	<50	<50	<0.0050	0.02	<0.010	0.01	0.02	0.02	0.03	0.04	0.018	0.03	0.006	0.04	<0.010	0.04	<0.010	<0.010	0.05	0.05	0.04	<0.010	0.039	0.50
DIS. BRIDGE GLADSTONE #1	21-Jul-13	N.M.	0.0205	0.285	0.127	4.72	33	*8680*	*17600*	2500	*8.40*	17.10	0.84	*32.70*	*57.80*	*38.10*	*53.50*	35.40	*16.100*	*49.50*	*4.470*	*179.00*	*26.40*	*42.40*	75.20	110.00	*728.0*	*303.00*	*224.00*	0.47	*60.40*	777
DIS. BRIDGE GLADSTONE #2	21-Jul-13	N.M.	0.0112	<0.015	<0.050	<0.10	<10	*345*	*2380*	485	0.51	2.82	0.045	*3.90*	*7.84*	*6.75*	*10.30*	6.81	3.380	7.84	*1.070*	*23.00*	*2.97*	*7.61*	0.37	0.38	*91.2*	*33.60*	*27.20*	0.013	*10.90*	139
DIS. BRIDGE GLADSTONE #3	21-Jul-13	N.M.	0.0574	<0.015	<0.050	<0.10	<10	<25	359	170	0.22	3.65	0.073	1.75	*6.70*	*9.14*	*10.50*	9.86	2.840	*6.30*	*1.340*	10.80	*0.57*	*8.96*	0.68	0.85	*94.0*	*6.75*	*15.30*	0.035	*13.40*	142
DIS. BRIDGE GLADSTONE #4	21-Jul-13	N.M.	0.193	0.041	0.323	0.46	<10	*1580*	*6480*	1080	*2.08*	15.70	0.411	*24.50*	*21.30*	*19.70*	*18.90*	12.70	*6.280*	*18.50*	*2.140*	*46.70*	*14.40*	*15.40*	9.72	13.50	*44.3*	*90.30*	*64.20*	0.099	*26.30*	299
DIS. BRIDGE GLADSTONE #5	21-Jul-13	N.M.	0.0267	<0.015	<0.050	<0.10	<10	66	352	161	0.28	3.67	0.062	1.89	*6.26*	*8.40*	*10.50*	6.01	2.980	5.76	0.883	10.80	*0.89*	*8.70*	2.58	3.93	*20.8*	*10.20*	*15.70*	0.054	*12.10*	136

Notes: Concentrations in excess of referenced environmental quality guidelines are presented in *BOLD* text.

[1] CCME, *Canadian Environmental Quality Guidelines* (2007), Residential / Parkland, fine-grained / coarse-grained, soil ingestion, eco soil contact and groundwater check (aquatic life).

[2] CCME, *Canada-Wide Standard for Petroleum Hydrocarbons in Soil* (2008), Residential, fine-grained / coarse-grained, eco soil contact and protection of aquatic life.

[3] CCME, *Carcinogenic and Other Polycyclic Aromatic Hydrocarbons (PAHs)* (2008), Residential / Parkland, soil contact and protection of freshwater life.

ppm = parts per million

N.M. = not measured

N.G. = no guideline

– = not tested

TABLE 2

Surface Water Petroleum Hydrocarbon and Polycyclic Aromatic Hydrocarbon Laboratory Analytical Results
Diavoli Bridge - South River Bank / West of Bridge

Sample Identification	Sampling Date	Analytical Results																											
		BTEX and Hydrocarbon Fractions (mg/L)						Polycyclic Aromatic Hydrocarbons (ug/L)																					
		Benzene	Toluene	Ethylbenzene	Xylenes	F1 - BTEX (C_6 - C_{10})	F2 (C_{10} - C_{16})	Acenaphthene	Acenaphthylene	Acridine	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(g,h,i)perylene	Benzo(k)fluoranthene	Chrysene	Dibenzo(ah)anthracene	Fluoranthene	Fluorene	Indeno(1,2,3-cd)pyrene	1+2-Methylnaphthalene	1-Methylnaphthalene	2-Methylnaphthalene	Naphthalene	Phenanthrene	Pyrene	Quinoline
Environmental Quality Guidelines [1]		**0.370**	**0.0020**	**0.090**	**N.G.**	**N.G.**	**N.G.**	**5.8**	**N.G.**	**4.4**	**0.012**	**0.018**	**0.015**	**N.G.**	**N.G.**	**N.G.**	**N.G.**	**N.G.**	**0.04**	**3.0**	**N.G.**	**N.G.**	**N.G.**	**N.G.**	**1.1**	**0.4**	**0.025**	**3.4**
SU-2 F-3 WATER	1-Apr-11	< 0.00050	< 0.0010	< 0.00050	< 0.0015	< 0.10	< 0.25	0.032	0.196	<4.0	*0.199*	*0.305*	*0.448*	0.246	0.341	0.240	0.338	0.056	*0.758*	0.021	0.211	0.075	0.075	<0.020	0.031	*0.408*	*0.930*	<0.040

Notes: Concentrations in excess of referenced environmental quality guidelines are presented in *BOLD* text.
[1] CCME, *Canadian Environmental Quality Guidelines* (2007), Freshwater Aquatic Life Pathway
N.G. = no guideline

TABLE 3

Surface Water Sample Analytical Results - Dissolved Metals
Diavik Bridge - South River Bank / West of Bridge

Sample Identification	Sampling Date	Analytical Results Dissolved Metals (mg/L)																																				
		Aluminum (Al)	Antimony (Sb)	Arsenic (As)	Barium (Ba)	Beryllium (Be)	Bismuth (Bi)	Boron (B)	Cadmium (Cd)	Calcium (Ca)	Cesium (Cs)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Iron (Fe)	Lead (Pb)	Lithium (Li)	Magnesium (Mg)	Manganese (Mn)	Molybdenum (Mo)	Nickel (Ni)	Phosphorus (P)	Potassium (K)	Rubidium (Rb)	Selenium (Se)	Silicon (Si)	Silver (Ag)	Sodium (Na)	Strontium (Sr)	Tellurium (Te)	Thallium (Tl)	Thorium (Th)	Tin (Sn)	Titanium (Ti)	Tungsten (W)	Uranium (U)	Vanadium (V)	Zinc (Zn)	Zirconium (Zr)
Environmental Quality Guidelines [1]		**0.005**	**N.G.**	**0.005**	**N.G.**	**N.G.**	**N.G.**	**1.5**	**0.000017**	**N.G.**	**N.G.**	**0.0089**	**N.G.**	**0.002**	**0.3**	**0.001**	**N.G.**	**N.G.**	**N.G.**	**0.073**	**0.025**	**N.G.**	**N.G.**	**N.G.**	**0.001**	**N.G.**	**0.0001**	**N.G.**	**N.G.**	**N.G.**	**0.0008**	**N.G.**	**N.G.**	**N.G.**	**N.G.**	**0.015**	**N.G.**	**0.006**	**N.G.**
SU-2 F-3 WATER	1-Apr-11	*0.0092*	0.00063	*0.0119*	0.132	< 0.00020	< 0.00020	0.415	*0.000163*	360	< 0.00010	0.0045	0.00363	*0.00727*	< 0.10	< 0.000060	0.155	274	1.00	0.0371	0.0178	< 0.10	29.8	0.00243	*0.0021*	6.57	< 0.00010	703	1.14	< 0.00020	< 0.00010	<0.00010	< 0.00020	0.00148	< 0.00020	0.00633	0.0110	*0.104*	< 0.00040

Notes:
Concentrations in excess of referenced environmental quality guidelines are presented in *BOLD* text.
[1] CCME, *Canadian Environmental Quality Guidelines* (2007), Freshwater Aquatic Life Pathway
N.G. = no guideline