Winnipeg

THE CITY OF WINNIPEG

APPENDIX B

Phase II Environmental Site Assessment for 1500 Plessis Road and 849 Ravelston Avenue West, November 2012

BID OPPORTUNITY NO. 874-2016

FORMER FUEL SITES SOIL REMEDIATION AT 849 RAVELSTON AND 1500 PLESSIS

PHASE II ENVIRONMENTAL SITE ASSESSMENT
1500 PLESSIS ROAD AND
849 RAVELSTON AVENUE WEST
CITY OF WINNIPEG
WINNIPEG, MANITOBA

Submitted to:

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AMEC Project No: WX1692301

EXECUTIVE SUMMARY

AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC), was retained by the City of Winnipeg to conduct a Phase II Environmental Site Assessment (ESA) on the property located at 1500 Plessis Road and 849 Ravelston Avenue West in Winnipeg, Manitoba (the "Site").

The objective of the Phase II Environmental Site Assessment (ESA) was to assess the soil conditions at the Site with respect to potential environmental impacts associated with the current and historical operation of the facility. The areas of potential concern are associated with use or storage of petroleum hydrocarbons (PHC), soil salinity, metal parameters, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) which are associated with a 14 areas of the Site.

The AMEC drilling program was conducted between 7 August and 9 August 2012 and consisted of advancing 29 test holes (TH1-12 through TH29-12), with two (2) test holes (TH30-12 and TH31-12) installed with a hand auger. The test holes were drilled to a maximum depth of 3.1 to 6.1 metres below grade level (m bgl) depending on the contaminant of concern and the area of the Site. The test holes were installed with a continuous flight solid stem auger rig, supplied and operated by Maple Leaf Drilling of Winnipeg, Manitoba.

The maximum soil vapour concentration encountered during the test hole drilling program was 100% Lower Explosive Limit (LEL) in soil samples TH28-12@5 and TH29-12@2.53 at a depth of 1.8 m and 0.8 m respectively.

A total of 37 soil samples from 14 areas of the Site were submitted for laboratory analysis of PHC constituents, metal parameters, salinity parameters, PAHs and PCBs. The details of the investigation and recommendations are as follows:

Salt/Sand Outdoor Storage Area

Four (4) test holes were installed in the road salt/sand outdoor storage area and were submitted for laboratory analysis of salinity parameters. The location of the test holes was based on the results of the EM Survey completed in conjunction with the subsurface investigation. The test holes were placed such that the road salt impacts could be confirmed and delineated. In addition to the samples that were selected from the test holes advanced within the salt/sand plume, the sample that was submitted for laboratory analysis from an adjacent area of was analyzed for salinity parameters to help delineate potential road salt impacts.

Each sample that was analyzed for salinity parameters had at least one (1) parameter that exceeded the comparison criteria. The sample collected from the area of the greatest impacts, as identified by the EM survey, had a Sodium Adsorption Ratio (SAR) of 606 which is approximately 121 times higher than the guideline value of 5. This sample also had a conductivity value of 133 dS/m which is approximately 66 times higher than the guideline value of 2 dS/m. In addition to SAR and conductivity there are a number of other parameters

(including potassium, sodium, chloride and sulphate) that do not have comparison guidelines but have concentrations that are significantly higher than typical soil conditions for Winnipeg. The remaining samples collected from this area had SAR values that ranged between 7.5 and 59.6 times higher than the guideline; conductivity values that ranged between 2.5 and 29 times higher that the guidelines; and elevated concentrations of several other parameters (including sodium, chloride, and sulphate) were measured.

There appears to be correlation between the laboratory results and the EM survey result. As a result, the horizontal extent of the road salt impacts appears to be delineated. However, since the impacts originate at the surface, the EM survey equipment cannot accurately measure the depth of impacts. It should also be noted that the EM survey indicated that the road salt impacts appear to have migrated off property north of the Site. To confirm the vertical extent of the road salt impacts and to confirm the impacts have migrated off property, additional soil samples are recommended from this area of the Site. The additional sampling program can be completed for a cost of approximately $15,000 to $20,000.

Based on the information discovered during this investigation, a conservative estimate of the area with road salt impacts is approximately 65,000 m^3. The Class D cost estimate for the remediation road salt impacts is approximately $6,3500,000.

Former Pump Island and USTs Located Between Building H and Building G

Four (4) test holes were installed around the former pump island and associated USTs and the selected soil samples were analyzed for PHC parameters. Three (3) of the samples had PHC concentration that exceeded the guidelines. The impacts were horizontally delineated to the southeast and vertical delineation was achieved in test holes TH28-12.

Since the PHC impacts have not been fully delineated vertically or horizontally, further investigation is recommended to gain a better understanding of the size of impacts located at the Site. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 2,400 m^3 covering an aerial extent of 520 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with the pump island is $450,000.

Hydraulic System and Floor Drains in Building A

Two (2) test holes were installed with a hand auger near the hydraulic hoists located in the northern portion of Building A. The selected soil samples were submitted for laboratory analysis PHC and PCBs. Both of the samples had PHC concentrations that exceeded the guidelines. Both of the soil samples submitted for analysis had PCB concentrations that were below the

laboratories reportable detection limits and comparison guideline. As a result, PCB is not required for any future analysis.

The horizontal extent of the impacts appears to be limited to the building footprint since the test holes that were installed around the building do not show any signs of hydrocarbon impacts. The vertical extent of the PHC impacts could not be determined at the time of the field investigation. As a result, an addition investigation of this area of the Site is recommended to determine the horizontal and vertical extent of the PHC impacts. However, it is AMEC's understanding that the building will be removed from the Site in the near future. As a result the subsequent investigation is recommended to be coordinated with the building removal so concrete coring will not be required. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000 (if conducted after the building removal).

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 1,400 m^3. The Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with Building A is approximately $220,000.

Sodium Chloride ASTs

Two (2) soil samples were submitted for laboratory analysis of salinity parameters from test holes that were installed to delineate PHC impacts around the former pump island and associated USTs. The results indicated exceedances of the SAR and conductivity values as well as elevated concentration of sodium, chloride and sulphate.

The impacts associated with the sodium chloride are relatively moderate compared to the road salt/sand storage area of the Site and the EM survey indicates a similar result. The horizontal extent of the impacts appears to be reasonably defined by the EM Survey. However, the eastern and southern extent of the impact could not be fully delineated with the EM survey since there is a concrete apron around the building that contains metal rebar. Additionally, the vertical extent of the salt impacts could not be determined with EM survey equipment. As a result, a soil investigation is recommended in this area to fully determine the vertical and horizontal extent of the sodium chloride impacts. The additional sampling program can be completed for a cost of approximately $4,000 to $6,000. This cost estimate assumes that it would be completed in conjunction with the additional PHC investigation associated with the former pump island and associated USTs.

Based on the information discovered during this investigation, a conservative estimate of sodium chloride impacted soil is 2,400 m^3. The Class D cost estimate for the remediation of the sodium chloride impacted soil associated with the sodium chloride ASTs is approximately $50,000. The estimate for the remedial activities assumes it will be completed in conjunction with the remediation of the PHC impacted soil associated with the former pump island and associated USTs. If remediation of this area is conducted independently the cost estimate would need to be re-evaluated.

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Current Pump Island

Three (3) test holes were installed around the pump island and the selected soil sample were submitted for laboratory analysis of PHC. All of the samples complied with the comparison guideline. However, one (1) of the samples had measurable concentrations of hydrocarbons, indicating PHC impacts over guideline values were likely present in the vicinity. AMEC has conservatively assumed that impacts are present unless determined otherwise.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 470 m^3. The Class D cost estimate for the remediation of the potential PHC soil associated with the pump island is approximately $90,000.

Abandoned USTs Located North of the Current Pump Island

Four (4) test holes were installed around the abandoned USTs located north of the current pump island. The samples selected for laboratory analysis of PHC had concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines indicating that no PHC impacts appear to be present. However, it is AMEC's understands that the tanks are scheduled to be decommissioned in the near future. During the decommissioning of the tanks, soil samples must be collected from the material located between the tanks and from the limits of the excavation (as per Manitoba Conservation guidelines) to confirm no impacts are present. As part of the tank decommissioning program, provisions should also be made for the excavation and disposal of a limited quantity of PHC soil. Since the test hole located around the tank did not indicate any signs of PHC impacts, any potential PHC impacts are likely limited to the material adjacent to the tank, which could cost effectively be remediated during the tank decommissioning program.

Abandoned Waste Oil UST North of Building C

Two (2) test holes were installed around the waste oil UST north of Building C and the selected soil samples were submitted for laboratory analysis of PHC. Both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected from the limits of the excavation for field and laboratory analysis.

Abandoned Waste Oil UST Northeast of Building A

Two (2) test holes were installed around the waste oil UST northeast of Building A and the selected soil samples were submitted for laboratory analysis of PHC. Both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be

properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected the limits of the excavation for field and laboratory analysis.

Hazardous Materials/Waste Storage Area

Two (2) test holes were installed around the hazardous materials/waste storage area and the selected soil samples were submitted for laboratory analysis of PHC and metals parameters. Both of the samples had PHC concentrations below the comparison guidelines. Most of the metal parameters in the two samples had a measurable concentration however, aside from the sodium concentration in one (1) sample, the parameters appear to have concentrations typical to the Winnipeg area and were not above guidelines. Since the hazardous materials/waste storage area is located near the road salt/sand storage area, the elevated sodium concentrations are likely a result of the road salt/sand storage area. No further investigation is recommended for this area.

It is recommended that the storage of the hazardous materials/waste should be relocated to a secure facility located within one of the Site buildings to reduce the potential for accidental release of the materials stored in this area to the environment.

Former Hazardous Materials/Waste Storage Area

One (1) test holes was installed near the former hazardous materials/waste storage area and the selected soil sample was submitted for laboratory analysis of PHC and metals parameters. The soil sample had PHC concentrations below the comparison guidelines. Most of the metal parameters had a measurable concentration; however the parameters appeared to have concentrations typical to the Winnipeg area and were not above guidelines. No further investigation is recommended for this area.

Refuse Storage Area

Two (2) test holes were installed around the refuse stockpile and the selected soil samples were submitted for laboratory analysis of PHC, metal parameters, and PAHs. Both of the soil samples had PHC concentrations below the laboratory's reportable detection limits which are below the comparison guidelines. Most of the metal parameters had a measurable concentration; however the parameters appeared to have concentrations typical to the Winnipeg area and were not above guidelines. Both samples had concentrations of PAHs that were below the reportable detection limits and did not exceed the comparison guidelines. No further investigation is recommended for this area.

It is recommended that storage of refuse at the Site be within the appropriate containers (garbage bins) to minimize the potential impacts of the waste to soil and groundwater at the Site.

Stockpile/Storage and Street Sweeping Stockpiles

Three (3) test holes were installed within the area used to store the material collected from the street sweeping program. The selected soil samples were submitted for the laboratory analysis of PHC, metal parameters, and salinity parameters. All of the samples had PHC concentrations below the comparison guidelines, and most of the metal parameters had measurable concentrations below the guidelines. The parameters appear to have concentrations that are typical of soils in the Winnipeg area.

One (1) of the samples had a conductivity value that exceeded the guidelines and another sample had a pH value that exceeded the guidelines. The sulphate concentration in one (1) of the samples was elevated above what would be typically expected in the Winnipeg area. However, considering the EM survey indicated that the area had background concentrations (i.e. no impacts appear to be present) and the elevated sulphate concentration does not pose a risk to human health or the environment (no available guideline), no further work is recommended for this area.

Rail Tie (Creosol Treated Timbers) Storage Area

One (1) test holes was installed near the area where creosol treated timbers are stored in the bridge departments material storage area of the Site. The selected soil sample was submitted for laboratory analysis of salinity parameters and PAHs. The salinity results were discussed as part of salt/sand outdoor storage area. The PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of PHC and PAHs. It should be noted that the presence of the timbers limited the area available for investigation.

Former Rail Line

One (1) test holes was installed along the former rail spur line located in the western corner of the Site in one (1) of the bridge department material storage areas. The selected soil sample was submitted for laboratory analysis of metal parameters and PAHs. Most of the metal parameters had a measurable concentration but were typical for soils in the Winnipeg area. The PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of metal parameters and PAHs.

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1.0 INTRODUCTION

AMEC Environment & Infrastructure, a division of AMEC Americas Limited (AMEC), was retained by Mr. Greg Kucel of the City of Winnipeg's Planning, Property & Development (the City) to conduct a Phase II Environmental Site Assessment (ESA) of the property located at 1500 Plessis Road and 849 Ravelston Avenue West (the Site) in Winnipeg, Manitoba.

The objective of the Phase II Environmental Site Assessment (ESA) is to assess the soil conditions at the Site with respect to potential environmental impacts associated with the current and historical operation of the facility. The areas of potential concern are associated with the use or storage of petroleum hydrocarbons (PHC), soil salinity, metal parameters, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) which are associated with a number of different areas of the Site.

A Site Location Plan and a Site and Surrounding Land Use Plan are presented as Figures 1 and 2, respectively (Appendix A).

2.0 BACKGROUND

The City of Winnipeg authorized AMEC to conduct a Phase I of the property with the municipal address of 1500 Plessis Road and 849 Ravelston Avenue West in Winnipeg, Manitoba. The purpose of the Phase I ESA was to identify actual or potential environmental concerns at the Site. A Phase I ESA may assist in reducing the uncertainty about potential environmental liabilities and may be a basis for further investigation of the property. Site observations were of a visual, walk-through type and did not include sampling or testing, a process consistent with the industry standard.

The Phase I ESA identified several area of potential environmental concern where further investigation was recommended. These areas included:

- Four (4) 22 975 L USTs that were reported to be located north of the current Fuelling Station;
- The former fuel underground storage tanks (UST) located north of Building F and south of Building G;
- The used oil UST located north of Building C;
- The used oil UST located northeast of Building A;
- Hazardous waste storage area (loading dock) located north of Building G;
- Former hazardous waste storage area located west of oil storage room in Building A;
- The area surrounding the Rock Salt and Topsoil Storage Building that was used for mixing of salt and sand, as well as the storage of sand and salt-mixed sand.
- The refuse storage area located west of the current fuelling station;
- The north-western area of the Site which has been used for material storage of fill stockpiles and spring street sweeping stockpiles.
- The railway tie storage area located south of Building H.
- A rail spur was formerly located in the north-western corner of the Site parallel to the southern Site.
- The former hydraulic hoists located in Building A.

Additional areas of potential concern that were not identified in the Phase I ESA include:

- The current pump island as a result of potential underground piping that historically may have been present at the Site.
- The calcium chlorate aboveground storage tanks (ASTs).

3.0 SCOPE OF WORK

The following scope of work was completed at the Site based on the information discovered during the Phase I ESA, the information that was provided by the City of Winnipeg and the Site conditions encountered during the investigation:

- Ensure ground disturbance/utility locates at the Site have been completed.
- Conduct a Phase II ESA consisting of the following:
    - Drill up to 31 test holes in 14 areas of the Site to 3.1 to 6.1 m below grade level (bgl), depending on the contaminant of concern. The 14 areas are identified as the following:
        - Current pump island
        - Abandoned Underground Storage Tank (UST) located north of the current pump island
        - Former pump island and UST located between Building H and Building G
        - Abandoned waste oil UST north of Building C
        - Abandoned waste oil UST northeast of Building A
        - Hazardous materials/waste storage area
        - Former hazardous materials/waste storage area
        - Salt/Sand outdoor storage area
        - Sodium Chloride Aboveground Storage Area (AST)
        - Refuse storage area
        - Stockpile storage and street sweeping stockpiles
        - Rail tie (creosol treated timbers) storage area
        - Former rail spur
        - Hydraulic system and floor drains in Building A
    - Recover soils samples separated at approximately 0.8 m depth intervals to maximum depth of 6.1 m.
    - Submit one (1) soil sample from each test hole for laboratory analysis. The laboratory analysis was based on the contaminant of concern for each area and included:
        - Benzene, Toluene, Ethylbenzene, Xylene (BTEX) parameters and petroleum hydrocarbons (PHC) fractions F1 – F4;
        - Polychlorinated biphenyls (PCBs);
        - Polycyclic Aromatic Hydrocarbons (PAHs);
        - Metals
        - Detailed salinity scan

- Complete laboratory analysis with a regular turn-around time of five (5) to seven (7) business days.
- Relay any potential Site issues or concerns verbally to the City immediately as they become known.
- Complete an Electromagnetic Survey of the Site.
- Prepare a report summarizing results of field and laboratory analysis, as well as any relevant conclusions and recommendations.

4.0 INVESTIGATIVE METHODOLOGY

4.1 HAZARD ASSESSMENT AND SERVICE LOCATIONS

Prior to the start of the intrusive investigation, AMEC completed a site specific health and safety checklist to identify such items as project health and safety requirements, hazard identification, work site classification and personnel protective equipment requirements.

4.2 SURROUNDING LAND USE

A survey of surrounding land uses was conducted as part of AMEC's Site visit. The purpose of the survey was to identify specific land uses (i.e. agricultural, residential, commercial or industrial) adjacent to the Site to establish the applicable comparison criteria.

4.3 DRILLING AND SAMPLING PROGRAM

The AMEC drilling program was conducted from 7 to 9 of August 2012. The drilling program consisted of advancing 29 test holes (TH1-12 through TH29-12) in 14 areas of the Site. The test holes were advanced to a maximum depth of either 3.1 m or 6.1 m below the ground level (m bgl) depending on the source and type of environmental concern. The test holes were advanced with a truck mounted continuous flight solid stem auger rig, supplied and operated by Paddock Drilling Ltd. of Brandon, Manitoba. Two (2) additional test holes (TH30-12 and TH31-12) were advance with a hand auger by AMEC's field personnel on 9 August 2012. The hand auger samples were advanced to a maximum depth of 2.3 m bgl.

The test hole locations are shown on Figures 3 through 14 (Appendix A).

Soil samples were recovered from the continuous flight solid stem augers at approximately 0.8 m depth intervals to the maximum depth of the test holes. Disturbed soil was trimmed from the outside of the samples to minimize potential cross contamination. Soil samples were also obtained in zones of visual impacts and/or at each stratigraphy change.

Soil samples were classified according to the Modified Unified Soil Classification System and observed for visual evidence of impacts. Soils samples collected for potential PHC and PAHs analysis were collected and split into two (2) portions. One (1) portion was placed in a laboratory prepared glass jar (for possible laboratory analyses) and the other portion was placed in a plastic bag (for field screening of combustible vapours). Soil samples were field screened

for volatile PHC vapours using ambient temperature headspace (ATH) techniques and an RKI Eagle combustible vapour analyzer set in the no methane response mode. The ATH method involves partially filling and sealing a plastic bag with soil and allowing the vapours to accumulate at ambient temperatures prior to analyzing the headspace. Accumulated vapours were measured in parts per million total combustible vapours (ppm_v). Vapours in excess of 1,000 ppm_v were measured in percent lower explosive limit (% LEL). Soil samples were stored in an insulated cooler with ice while on Site and during transport to the laboratory. The field protocols and QA/QC procedures utilized by AMEC were in accordance with standard industry protocols.

4.4 LABORATORY ANALYSIS

In total 37 soil samples were submitted for laboratory analysis at AMEC's laboratory in Edmonton, Alberta.

The Canadian Association Laboratory Accreditation Inc. (CALA) has accredited AMEC's laboratory for testing including PHC parameters, metal parameters, PAHs, PCBs and soil salinity parameters in accordance with the International Standard ISO/IEC 17025. The laboratory QA/QC is provided in Appendix C along with the certificates of analysis.

5.0 ASSESSMENT CRITERIA

5.1 GENERAL

Environmental assessment in Manitoba is based on the assessment guidelines as produced by CCME. The following documents produced by CCME were selected as being applicable to the Site based on the contaminants of concern.

- CCME 1999 (updates to 2012). Canadian Environmental Quality Guidelines (EQGs).
- CCME 2001 (revised 2008). Canada-Wide Standards (CWS) for Petroleum Hydrocarbons in Soil.

Based on the above current CCME documents (and their precursors), AMEC conducted an evaluation of the applicable exposure pathways, land uses, key receptors and a visual evaluation of the predominant soil texture at the Site. The sensitivity assessment was conducted in accordance with current CCME guidelines and did not include the modification or recalculation of the formulas used to derive the guideline values.

5.2 LAND USE

The CCME EQGs and CWS have been developed for four (4) generic land uses that have been adopted within these guidelines. A generic land use scenario is envisioned for each category based on the normal activities on these lands. The four (4) land uses as defined by CCME are:

Agricultural lands: where the primary land use is growing crops or tending livestock. This also includes agricultural lands that provide habitat for resident and transitory wildlife and native flora. The portion of a farm that houses people is considered a residential land use.

Residential/Parkland: where the primary activity is residential or recreational activity. The ecologically-based approach assumes parkland is used as a buffer between areas of residency, but this does not include wild lands such as national or provincial parks.

Commercial: where the primary activity is commercial (*e.g.*, shopping mall) and there is free access to all members of the public, including children. The use may include, for example, commercial day-care centres. It does not include operations where food is grown.

Industrial: where the primary activity involves the production, manufacture or construction of goods. Public access is restricted and children are not permitted continuous access or occupancy.

The Site is currently used by the City of Winnipeg for it road maintenance department, bridges department, parks department and Winnipeg Police service. However, as indicated by the City of Winnipeg, property may be redeveloped for retail or residential purposes. As a result, AMEC has selected the residential land use guidelines for comparison so future development of the Site will not be limited.

Please note that at the request of the City of Winnipeg, the commercial land use guideline have been included in the summary tables. These values have been included for the City of Winnipeg's internal discussion only and will not be discussed in this report.

5.3 GRAIN SIZE DESIGNATION

The CCME guidelines are prescribed for coarse-grained and fine-grained soils for PHC assessments. Fine-grained soils are defined as having a median grain size of less than or equal to 75 µm; coarse-grained soils have a median grain size of greater than 75 µm. Where both fine and coarse grained strata are present, the dominant soil particle size is determined by the stratum governing horizontal and vertical migration to a receptor.

Grain size analysis was conducted on two (2) soil samples as part of the Phase II ESA. The first soil sample (TH7-12@12.5) consisted of a grab sample collected from a layer of native clay located approximately 3.8 m below ground level (bgl) and the second sample (TH28-12@6) consisted of a grab sample collected from a layer of granular fill material located approximately

1.8 m bgl. The first sample had 98% passing through the 75 µm sieve indicating fine grained soil and the second sample had 21.6% passing through the 75 µm sieve indicating coarse grained soil. The soil conditions that were encountered at the Site are generally represented by the fine grain soil sample. As a result, the soil conditions at the Site are considered to be fine grained and the fine grained guidelines will be used for comparison.

5.4 APPLICABLE EXPOSURE PATHWAYS

CCME recognizes two (2) soil horizons; surface soil (≤ 1.5 m depth) and subsoil (>1.5 m depth) for PHC assessment. Exposure pathways for PHCs are assessed individually for both horizons.

5.4.1 Human Exposure Pathways

Potential human exposure pathways include the soil ingestion, soil dermal contact, vapour inhalation, and protection of groundwater for potable use. The applicability of each of these potential exposure pathways are discussed in the following sections.

5.4.1.1 *Soil Ingestion and Dermal Contact Pathway*

The soil ingestion and dermal contact pathway would be considered applicable to the surface soil horizon and the subsoil horizon for the protection of the construction workers during the proposed redevelopment of the Site.

5.4.1.2 *Vapour Inhalation Pathway*

The vapour inhalation (slab on grade) pathway is applicable to both the surface and subsoil horizons since the current site building have a slab on grade construction. The vapour inhalation (indoor, basement) pathway is also considered applicable to both the surface and subsoil horizons the since the proposed future use of the Site includes residential property and the majority of residential buildings within the City include basements.

5.4.1.3 *Protection of Potable Groundwater*

5.4.1.3.1 Manitoba Well Search

Considering the present and potential future land use of the Site and surrounding properties, and that potable water is supplied by the City of Winnipeg, it is unlikely that there would be usage of groundwater for potable purposes and therefore a well records search was not conducted.

5.4.1.3.2 Potable Groundwater Pathway

Manitoba Conservation recognizes the division between contaminated soil and groundwater that is not hydraulically connected to an underlying aquifer. A 5 m thickness of massive unfractured saturated fine-grained material is considered sufficient to ensure isolation of groundwater aquifers.

Based on available geological maps, the subsurface stratigraphy in this area of Winnipeg normally consists of topsoil and fill materials underlain by glacio-lacustrine silt and clay to a depth of about 12 to 15 metres from grade. A deposit of silty till, typically a few metres or more in thickness, occurs between the clay and the underlying bedrock. The bedrock in this area is of the Lower Fort Garry Member and consists of aphanitic Dolomite. Bedrock is estimated to occur at about 15 to 18 metres below grade. Fractured zones in the bedrock comprise the major aquifer in the area. There are no aquifers above the bedrock. The substantial clay thickness overlying the aquifer is considered sufficient to provide a confining layer for protection of the underlying groundwater aquifer. As such, the potable groundwater pathway is not considered to be applicable for the Site.

5.4.2 Ecological Exposure Pathways

Potential ecological exposure pathways include the ecological soil contact and freshwater aquatic life pathways. The applicability of each of these potential exposure pathways are discussed in the following sections.

5.4.2.1 *Ecological Soil Contact Pathway*

The ecological soil contact pathway would be considered applicable as ecological receptor exposure, from terrestrial and subterranean organisms and plant root systems, to soils in the surface soil horizon is feasible at the Site. Ecological receptor exposure to soils in the subsoil horizon is not considered realistic.

5.4.2.2 *Freshwater Aquatic Life Pathway*

CCME states that the freshwater aquatic life pathway may be excluded in cases where there is no surface water body within 10 m of a site classified as fine grained for the contaminants of concern. The closest surface water body is a creak located between Grassie Blvd and Bluecher Ave which is located approximately 2.2 km north of the Site. The closes major surface water body is the Red River located approximately 5.7 km west of the Site. As a result, the freshwater aquatic life pathway is not applicable to the Site.

5.4.3 Miscellaneous Criteria

As residential land use criteria are applicable to the Site, soil management limits as produced by CCME for PHCs are applicable to the assessment.

5.4.3.1 *Management Limit*

The management limits for PHCs applies for soils in the surface soil and subsoil horizon.

5.5 SUMMARY

Given the future potential residential land use of the Site, current surrounding land use, the fine grained nature of the soil and the applicable exposure pathways as outlined in the previous sections, AMEC determined assessment guidelines for each contaminant of concern. The most stringent of the applicable exposure pathway guideline values as produced by CCME was used for each contaminant for both the surface soil and subsoil horizons.

AMEC has chosen the following applicable risk guidelines for the Site:

Soil:

Above 1.5 m below grade:

- Residential values for fine grained surface soil in a non-potable situation as limited by the:
  - Inhalation of Indoor Air Check (basement, slab on grade) for Benzene; and
  - Eco Soil Contact exposure for Toluene, Ethylbenzene, Xylene, and PHC fractions F1 – F4.

Below 1.5 m below grade:

- Residential values for fine grained subsurface soil in a non-potable situation as limited by the:
  - Inhalation of Indoor Air Check (basement) for Benzene, Toluene, Ethylbenzene, and Xylene
  - Inhalation of Indoor Air Check (slab on grade) PHC fraction F1; and
  - Management Limits for PHC fractions F2 – F4.

The CCME Soil Quality Guideline for benzene provides for both a 10^{-6} (1 in 1,000,000) and 10^{-5} (1 in 100,000) incremental risk. As Manitoba Conservation generally adopted the 10^{-5} incremental risk value, the results obtained in this soil investigation will be compared to the 10^{-5} incremental risk guideline. The applicable assessment guidelines are shown in Table 2 (Appendix B).

6.0 ASSESSMENT RESULTS

6.1 SITE AND AREA DESCRIPTION

The Site consisted of two (2) addresses 1500 Plessis Road and 849 Ravelston Avenue West. These addresses consist of a triangle shaped property that is bordered by Plessis Road on the east, Ravelston Avenue West to the south and Canadian National (CN) rail line to the north, and covers an area of approximately 29 ha. The Site is occupied by several City of Winnipeg departments including the Road Maintenance Department, the Bridges Department, the Parks and Recreation Department, and the Winnipeg Police Services.

The surrounding properties include: active transportation pathways, a CN rail line and residential property located north of the Site, Plessis Road and residential property located east of the Site, Ravelston Avenue West, and a mixture of vacant and commercial properties to the south, and a mixture of vacant and commercial properties to the west. The surrounding land uses are outlined in Table 1 (Appendix B).

6.2 SERVICE LOCATIONS

Manitoba Hydro, MTS, City of Winnipeg sewer and water, Videon as well as a private locater where used to determine the location of utilities. Most of the services are located along the southern and eastern property boundaries. The on-site services are concentrated around the

buildings. One exception is an overhead power line that runs in a north/south direction and is located in the approximate center of the Site.

6.3 SOIL CONDITIONS

6.3.1 Regional and Local Geology

Based on available geological maps, the subsurface stratigraphy in this area of Winnipeg normally consists of topsoil and fill materials underlain by glacio-lacustrine silt and clay to a depth of about 12 to 15 metres from grade. A deposit of silty till, typically a few metres or more in thickness, occurs between the clay and the underlying bedrock. The bedrock in this area is of the Lower Fort Garry Member and consists of aphanitic Dolomite. Bedrock is estimated to occur at about 15 to 18 metres below grade.

6.3.2 Stratigraphy

The soil profile encountered at the test hole locations generally consisted of:

- Generally there is a surface cover consisting of granular fill, asphalt, or concrete that is approximately 0.1 to 0.6 m thick;
- clay fill approximately 0.3 to 1.5 m thick;
- Followed by native clay that extends to the termination depth of test holes.

The variation to the general stratigraphy encountered included a silty layer ranging from 0.2 to 2.0 m thick that was encountered below the clay fill layer in six (6) of the test holes, and another two (2) of the test holes had the clay fill layer extend to the test hole completion depth. The detailed individual soil profiles for each test hole location is shown on the test hole logs included in Appendix D.

6.3.3 Field Observations

Soil vapour concentrations and field observations made during the field investigations from 7 August to 9 August 2012 are summarized in Table 3 (Appendix B) and detailed on the test hole logs (Appendix D). The maximum soil vapour concentration encountered for each area of the Site is as follows:

- Current pump island – maximum field vapour concentration was 120 ppm_v at TH20-12 at 1.5 m bgl and TH21-12 at 2.3 m bgl.
- Abandoned USTs located north of the current pump island – maximum field vapour concentration was 15 ppm_v at TH6-12 at 1.5 m bgl.
- Former pump island and UST located between Building H and Building G – maximum field vapour concentration was 100% LEL at TH28-12 at 1.8 m bgl and TH29-12 at 0.8 m bgl.
- Abandoned waste oil UST north of Building C – maximum field vapour concentration was 40 ppm_v at TH14-12 at 5.3 m bgl.

- Abandoned waste oil UST northeast of Building A – maximum field vapour concentration was 110 ppm_v at TH18-12 at 2.3 m bgl.
- Hazardous materials/waste storage area – maximum field vapour concentration was 120 ppm_v at TH15-12 at 2.3 m bgl.
- Former hazardous materials/waste storage area – maximum field vapour concentration was 70 ppm_v at TH19-12 at 2.3 m bgl.
- Salt/Sand outdoor storage area –field vapour concentration were not measured in this area of the Site.
- Sodium Chloride Aboveground Storage Area (AST) – Field vapour concentrations were only measured from this area since it overlaps with former pump island and associated USTs. As a result, the maximum vapour concentration has been incorporated into the former pump island and associated USTs area of the Site.
- Refuse storage area – maximum field vapour concentration was 5 ppm_v at TH1-12 at 2.3 m bgl.
- Stockpile storage and street sweeping stockpiles – maximum field vapour concentration was 150 ppm_v at TH11-12 at 1.5 m bgl.
- Rail tie (creosol treated timbers) storage area – maximum field vapour concentration was 5 ppm_v at TH4-12 at 3.0 m bgl
- Former rail line – maximum field vapour concentration was 5 ppm_v at TH3-12 at 0.8 m and 1.5 m bgl.
- Hydraulic system and floor drains in Building A – maximum field vapour concentration was 15 ppm_v at TH31-12 between 0.5 and 0.8 m bgl.

6.3.4 Electromagnetic (EM) Survey

On 7 August 2012, Penserv Corp. completed and electromagnetic (EM) survey of the Site to identify the extent of the road salt/sand at the Site, as well as identify any additional anomalies associated with the current and historic Site activities. The results of the EM survey are displayed on Figures 8 and 9. A copy of the full report is included in Appendix E.

6.3.5 Soil Laboratory Results

A total of 37 soil samples were submitted for laboratory analysis as described below. The laboratory results have been summarized in Table 4 to 8 and copies of the detailed analytical reports is included in Appendix C.

6.3.5.1 *Current Pump Island*

Three (3) soil samples (TH20-12@5, TH21-12@7.5, and TH22-12@12.5) were submitted for analysis of BTEX parameters and PHC fractions F1 – F4. As indicated in Table 4, the sample collected from test hole TH21-12 had measurable concentrations of hydrocarbons that did not exceed the comparison guidelines. The remaining two (2) samples had hydrocarbon concentrations that were below the reportable detection limits, and did not exceed the guidelines.

6.3.5.2 *Abandoned USTs Located North of the Current Pump Island*

Four (4) soil samples (TH5-12@5, TH6-12@7.5, TH7-12@12.5, TH8-12@7.5) and one (1) duplicate (DUP 3) were submitted for analysis of BTEX parameters and PHC fractions F1 – F4. As indicated in Table 4; the samples had hydrocarbon concentrations that were near or below the reportable detection limits and did not exceed the comparison guidelines.

The sample that was collected from test hole TH5-12 was also analyzed for salinity parameters. As indicated in Table 6 sample TH5-12@5 had concentrations of pH, conductivity and the Sodium Adsorption Ratio (SAR) that exceeded the guideline values. Other parameters had measureable concentrations that did not exceed the guidelines or there were no guidelines for comparison.

6.3.5.3 *Former pump island and UST located between Building H and Building G*

Five (5) soil samples (TH16-12@5, TH27-12@10, TH28-12@6, TH28-12@10, and TH29-12@2.5) and one (1) duplicate sample (DUP 18) were submitted for analysis of BTEX parameters and PHC fractions F1 – F4. As indicated in Table 4, the sample collected from test hole TH16-12 had concentrations of PHC fractions F1 to F3 that exceeded the guidelines. Samples TH28-12@6 and TH29-12@25 both had concentrations of xylene and PHC fraction F1 and F2 that exceeded the guidelines. TH28-12@6 also had benzene concentration that also exceeded the comparison guidelines. Sample TH28-12@10 had measureable concentration of hydrocarbons that did not exceed the comparison guidelines, and sample TH27-12@10 had hydrocarbon concentrations that were below the reportable detection limits which did not exceed the comparison guidelines. A graphical representation of the laboratory results are displayed on Figure 14.

Two (2) of the samples (TH16-12@5 and TH28@10) were also analyzed for salinity parameters since this area is located near the sodium chloride ASTs. The analytical results will be discussed is section 6.3.5.9.

6.3.5.4 *Abandoned Waste Oil UST North of Building C*

Two (2) soil samples (TH13-12@10 and TH14-12@17.5) were submitted for analysis of BTEX parameters and PHC fractions F1 – F4. As indicated in Table 4, all of the samples had hydrocarbon concentrations that were below the reportable detection limits which did not exceed the comparison guidelines.

6.3.5.5 *Abandoned Waste Oil UST Northeast of Building A*

Two (2) soil samples (TH17-12@12.5 and TH18-12@7.5) were submitted for analysis of BTEX parameters and PHC fractions F1 – F4. As indicated in Table 4, the samples had hydrocarbon concentrations that were below the reportable detection limits and consequently did not exceed the comparison guidelines.

6.3.5.6 *Hazardous Materials/Waste Storage Area*

Two (2) soil samples (TH12-12@2.5 and TH15-12@7.5) were submitted for analysis of BTEX parameters, PHC fractions F1 – F4 and metal parameters. As indicated in Table 4, the samples had hydrocarbon concentrations that were below the reportable detection limits which did not exceed the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration, but the concentrations did not exceed the relevant guidelines.

6.3.5.7 *Former Hazardous Materials/Waste Storage Area*

One (1) soil samples (TH19-12@7.5) were submitted for analysis of BTEX parameters, PHC fractions F1 – F4 and metal parameters. As indicated in Table 4, the samples had hydrocarbon concentrations that were below the reportable detection limits and consequently did not exceed the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration, but the concentrations did not exceed the relevant guidelines or there were no guidelines for comparison.

6.3.5.8 *Salt/Sand Outdoor Storage Area*

Five (5) soil samples (TH23-12@2.5, TH24-12@2.5, TH25-12@2.5, TH25-12@7.5, and TH26-12@5) and one (1) duplicate sample (DUP B) were submitted for analysis of salinity parameters. Sample TH4-12@2.5 collected from the rail tie storage area was also analyzed for salinity parameters since it is located near the Salt/Sand storage area.

As indicated in Table 6, the samples had conductivity concentrations that exceeded the guidelines. The samples collected from test holes TH4-12, TH23-12, and TH25-12 also had concentration of the SAR that exceeded the guideline values, and the sample collected from TH4-12 also had a pH value that exceeded the guideline values. Other parameters had measurable concentration that did not exceed the guideline values or there were no guidelines for comparison. A graphical representation of the laboratory results and the EM survey results are displayed on Figure 15.

6.3.5.9 *Sodium Chloride ASTs*

As indicated in section 6.3.5.3, two (2) soil samples (TH16-12@5 and TH28@10) were submitted for analysis of salinity parameters. As indicated in Table 6, both of the samples had conductivity concentrations that exceeded the guidelines, and TH16-12@5 also had a concentration of the SAR that exceeded the guidelines. Other parameters had measurable concentrations that did not exceed the guideline values or there were no guidelines for comparison.

6.3.5.10 *Refuse Storage Area*

Two (2) soil samples (TH1-12@2.5 and TH2-12@5) were submitted for analysis of BTEX parameters, PHC fractions F1 – F4, metal parameters, and Polycyclic Aromatic Hydrocarbons

(PAHs). As indicated in Table 4, the samples had hydrocarbon concentrations that were below the reportable detection limits and did not exceed the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration, but the concentrations did not exceed the relevant guidelines. Both samples had concentrations of PAHs that were below the reportable detection limits and did not exceed the comparison guidelines. The PAHs laboratory results have been summarized in Table 7.

6.3.5.11 ***Stockpile/Storage and Street Sweeping Stockpiles***

Three (3) soil samples (TH9-12@7.5, TH10-12@2.5 and TH11-12@5) were submitted for analysis of BTEX parameters, PHC fractions F1 – F4, metal parameters, and salinity parameters. As indicated in Table 4, the samples had hydrocarbon concentrations that were below the reportable detection limits and did not exceed the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration, but the concentrations did not exceed the relevant guidelines. As indicated in Table 6, the samples collected from test hole TH9-12 had a conductivity concentration that exceeded the guideline and TH10-12 had a pH value that exceeded the guideline range. Other parameters had measurable concentrations that did not exceed the guideline values or there were no guidelines for comparison.

6.3.5.12 ***Rail Tie (Creosol Treated Timbers) Storage Area***

One (1) soil samples (TH4-12@2.5) was submitted for analysis of salinity parameters and PAHs. As indicated in section 6.3.5.8 the sample collected from TH4-12 had concentration of pH, conductivity, and SAR that exceeded the guidelines, and there were measurable concentration of the remaining salinity parameters. As indicated in Table 7, the PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present.

6.3.5.13 ***Former Rail Line***

One (1) soil samples (TH3-12@2.5) was submitted for analysis of metal parameters and PAHs. As indicated in Table 5 most of the metal parameters had measurable concentrations that did not exceed the guidelines. As indicated in Table 7, the PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present.

6.3.5.14 ***Hydraulic System and Floor Drains in Building A***

Two (2) soil samples (TH30-12@2.5-4 and TH31-12@1.5-2.5) were submitted for analysis of BTEX parameters, PHC fractions F1 – F4 and Polychlorinated biphenyls (PCBs). As indicated in Table 4, the sample collected from test hole TH30-12 had concentrations of PHC fraction F3 that exceeded the guidelines and the sample collected from test hole TH31-12 had concentration of PHC fractions F2 and F3 that exceeded the guidelines. As indicated in Table 8, both of the samples had PCB concentrations that were below the reportable detection limit

and did not exceed the comparison guidelines. A graphical representation of the laboratory results are displayed on Figure 16.

6.4 QUALITY ASSURANCE

6.4.1 Accreditation

The analytical laboratory employed to perform the laboratory analyses (AMEC located in Edmonton, Alberta) is certified with the Canadian Association for Laboratory Accreditation Inc. (CALA).

6.4.2 Data Validation

Laboratory QA/QC

The laboratory incorporates various QA/QC procedures to ensure the accuracy of the laboratory results and assess the possibility of false positives attributed to analytical equipment contributions and laboratory control samples. The laboratory QA/QC includes the completion of laboratory blanks, blank spikes and blank spike recovery. A summary of laboratory QA/QC findings is present below:

- All samples/sample extracts were analyzed within their applicable hold times using approved analytical methods;
- The reported detection limits were met for all tested parameters;
- Agreement between the corresponding datasets for the reference material samples, where applicable, and recoveries reported for spiked samples/blanks, where applicable, were within acceptable range;
- Surrogate recoveries were within acceptable ranges in all cases for all samples;
- Agreement between the corresponding datasets for the laboratory replicate samples is considered acceptable.

Field QA/QC

Four (4) blind duplicate soil sample were submitted as part of the Phase II ESA analytical program; two (2) were submitted as PHC duplicated, one (1) was submitted as a metals duplicated, and one (1) was submitted as a salinity duplicate.

The relative percent difference (RPD) approach can be used as a means of assessing the accuracy of the duplicate analytical results. The RPD is calculated for specific parameters using the following equation:

$$\text{Field Duplicate RPD (\%)} = \frac{|(C1-C2)|}{(C1+C2)/2} \times 100\%$$

where: RPD = relative percent difference
C1= larger of two observed values from the field duplicate analysis
C2 = smaller of two observed values from the field duplicate analysis

One (1) of the two (2) duplicate sample collected for BTEX and PHC parameters had concentrations that were greater than five (5) time the reportable detection limit allowing a RPD to be calculated; the second sample had concentrations that were below the reportable detection limit and a RPD could not be calculated. The RPDs that were calculated had one (1) parameter (benzene) that was outside of the acceptable RPD range of (0 -100%). The remaining parameters had RPD values that were within the acceptable range and the average was also with the acceptable range. Most of the metal parameters had concentrations that were greater than five (5) times the reportable detection limit allowing a RPD to be calculated, and all were within the acceptable RPD range (0-100%) where valid RPD values were calculable. All of the salinity parameters had concentrations that were greater than five (5) times the reportable detection limit allowing a RPD to be calculated, and all were within the acceptable RPD range (0–100%).

As indicated by the RPD calculation and the laboratories QA/QC reporting the sample collection, sample storage, sample bottles and transportation of the samples to the laboratory, had no material effect on the quality of the data collected as part of this assessment. The laboratory results for soil samples obtained during AMEC's investigation are considered to be valid. The results of the laboratory's QA/QC analyses are detailed on the laboratory Certificates of Analyses presented in Appendix C.

7.0 DISCUSSION

7.1 CURRENT PUMP ISLAND

Three (3) test holes (TH20-12, TH21-12, and TH22-12) were installed around the pump island and the selected soil sample were submitted for laboratory analysis of PHC. As indicated in Table 4, the samples complied with the comparison guideline. However, one (1) of the samples (TH21-12@7.5) had measurable concentrations of hydrocarbons, indicating PHC impacts are present.

Since the test hole placement was limited to the perimeter of the pump island due to the presence of the active ASTs and underground utilities associated with the pump island, the subsurface investigation in this area may have missed more significant impacts. Typically, further investigation would be recommended for this location after it is no longer in service, but considering the location of the underground utilities, the placement of additional test holes may be limited. As a result, the investigation is recommended to be completed in conjunction with the removal of the pump island infrastructure.

At this point, PHC impacts should be assumed to be present within the area defined by test holes TH20-12, TH21-12, and TH22-12 until laboratory results refute this assumption. Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 470 m^3 covering an aerial extent of 150 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with the pump island is approximately $90,000. This estimate includes the

excavation and removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees.

7.2 ABANDONED USTs LOCATED NORTH OF THE CURRENT PUMP ISLAND

Four (4) test holes (TH5-12, TH6-12, TH7-12, and TH8-12) were installed around the abandoned USTs located north of the current pump island. As indicated in Table 4, all of the samples selected for laboratory analysis of PHC had concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As a result no PHC impacts appear to be present. However, the test holes were limited to the perimeter of the tank nest impacts could be present with the fill material adjacent to the tanks. It is AMEC's understanding that the tanks are scheduled to be decommissioned in the near future. During the decommissioning of the tanks, soil sample must be collected from the material located between the tanks and from the limits of the excavation to confirm no impacts are present under Manitoba Conservation guideline requirements. As part of the tank decommissioning program, provisions should also be made for the excavation and disposal of a limited quantity of PHC soil. Since the test hole located around the tank did not indicate any signs of PHC impacts, any potential PHC impacts are likely limited to the material adjacent to the tank, which could cost effectively be remediated during the tank decommissioning program.

7.3 FORMER PUMP ISLAND AND UST LOCATED BETWEEN BUILDING H AND BUILDING G

Five (5) soil samples (TH16-12@5, TH27-12@10, TH28-12@6, TH28-12@10, and TH29-12@2.5) were selected for laboratory analysis of PHC parameters from four (4) test holes advanced around the former pump island and associated USTs. Three (3) of the samples (TH16-12@5, TH28-12@6, and TH29-12@2.5) had PHC concentration that exceeded the guidelines. Vertical delineation in test hole TH28 was confirmed since the measurable concentration of PHC in TH28-12@10 complied with the guidelines. The area of impact was also delineated to the east with test hole TH27-12.

Since the PHC impacts have not been fully delineated vertically or horizontally in this area, further investigation is recommended to gain a better understanding of the size of impacts located at the Site. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000 and would include all engineering fees, laboratory cost, and disbursements.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 2,400 m^3 covering an aerial extent of 520 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with the pump island is approximately $450,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees.

7.4 ABANDONED WASTE OIL UST NORTH OF BUILDING C

Two (2) test holes (TH13-12 and TH14-12) were installed around the waste oil UST and the selected soil samples were submitted for laboratory analysis of PHC. As indicated in Table 4, the samples had PHC concentrations below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected the limits of the excavation for field and laboratory analysis

7.5 ABANDONED WASTE OIL UST NORTHEAST OF BUILDING A

Two (2) test holes (TH17-12 and TH18-12) were installed around the waste oil UST and the selected soil samples were submitted for laboratory analysis of PHC. As indicated in Table 4, the samples had PHC concentrations below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected from the limits of the excavation for field and laboratory analysis.

7.6 HAZARDOUS MATERIALS/WASTE STORAGE AREA

Two (2) test holes (TH12-12 and TH15-12) were installed around the hazardous material/waste storage area and the selected soil samples were submitted for laboratory analysis of PHC and metals parameters. As indicated in Table 4, the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As indicated in Table 5, most of the metal parameters had measurable concentrations, however, aside from the sodium concentration in sample TH12-12@2.5, the remaining parameters appear to have concentrations typical to Winnipeg and were not above guidelines. Since the hazardous materials/waste storage area is located near the road salt/sand storage area, the elevated sodium concentrations are likely a result of the road salt/sand storage area. No further investigation is recommended for this area.

It is recommended that the storage of the hazardous materials/waste should be relocated to a secure facility located within one of the Site buildings to reduce the potential for accidental release of the materials stored in this area to the environment.

7.7 FORMER HAZARDOUS MATERIALS/WASTE STORAGE AREA

One (1) test holes (TH19-12) was installed near the former hazardous materials/waste storage area and the selected soil sample was submitted for laboratory analysis of PHC and metals parameters. As indicated in Table 4, the soil sample had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration. However,

the parameters appeared to have concentrations typical to the Winnipeg area and were not above guidelines. No further investigation is recommended for this area.

7.8 SALT/SAND OUTDOOR STORAGE AREA

Five (5) soil samples (TH23-12@2.5, TH24-12@2.5, TH25-12@2.5, TH25-12@7.5, and TH26-12@5) were collected from four (4) test holes located within the area historical used to store/mix road salt and sand. The location of the four (4) test holes was based on the results of the EM Survey completed in conjunction with the subsurface investigation. The test holes were placed such that the impacts as a result of the road salt/sand could be confirmed and delineated. In addition to the five (5) samples selected from the test holes within the salt/sand plume, the sample collected from test hole TH4-12 was also submitted for analysis of salinity parameters since the test hole was located along the edge of the salt/sand plume.

As indicated in Table 6, the samples had at least one (1) parameter that exceeded the comparison criteria. More specifically, the samples collected from the area of the greatest impacts as identified by the EM survey (TH25-12@2.5) had a SAR of 606 which is approximately 121 times higher than the guideline value of 5, and a conductivity value of 133 dS/m which is approximately 66 times higher than the guideline value of 2 dS/m. In addition to SAR and conductivity there are a number of other parameters (including potassium, sodium, chloride and sulphate) that do not have comparison guidelines but have concentrations that are significantly higher than typical soil conditions for Winnipeg. The second soil sample collected from this test hole (TH25-12@7.5) had a SAR of 54.7 which is more than an order of magnitude higher than the guideline; a conductivity concentration of 59.6 dS/m which is more than 29 times higher than the guideline; and also had elevated concentrations of potassium, sodium, chloride and sulphate. Sample TH23-12@2.5 also has a SAR that were approximately 7.5 times greater than the guideline, a conductivity concentration that was 23 times greater than the guideline, and elevated concentrations of sodium and chloride. The samples that were collected from the edges of the salt/sand plume (TH24-12@2.5 and TH26-12@5) had conductivity concentrations that were approximately 2.5 and 5 time higher than the guideline respectively, SAR that complied with the guidelines, and sodium and chloride concentration that were significantly lower than TH25-12, although they are still higher that what would typically be expected for Winnipeg soils.

For the samples that were collected from the road salt/sand area of the Site, there appears to be a correlation between the laboratory results and the EM survey result. As a result, the horizontal extent of the road salt impacts appears to be delineated. However, since the impacts originate at the surface, the EM survey equipment cannot accurately measure the depth of impacts. It should also be noted that the EM survey indicated that the road salt impacts appear to have migrated off property north of the Site. To confirm the vertical extent of the road salt impacts and to confirm the impacts have migrated off property, additional soil samples should be collected from this area of the Site. The additional sampling program can be completed for a cost of approximately $15,000 to $20,000 and will include all engineering fees, laboratory costs and disbursements.

Based on the information discovered during this investigation, a conservative estimate of the area with road salt impacts is approximately 65,000 m^3 covering an aerial extent of 28,000 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the road salt impacts is approximately $6,350,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, and all engineering fees. AMEC has assumed that the road salt impacted soil can be sent to the Brady Road landfill for disposal as daily cover at no cost to this project.

7.9 SODIUM CHLORIDE ASTs

As indicated in section 6.3.5.3, two (2) soil samples (TH16-12@5 and TH28@10) were submitted for laboratory analysis of salinity parameters since they were located near the sodium chloride ASTs. As indicated in Table 6, TH16-12@5 had conductivity value of 13.7 dS/m which is approximately 6.8 times the guideline value, and a SAR of 17 which is more than three (3) times the guideline value. The sample identified as TH28-12@10 had a conductivity value of 8.14 dS/m which is approximately four (4) times the guideline value. The remaining parameters did not exceed the relevant guideline or there were no guidelines for comparison. However, these samples have elevated sodium, chloride and sulphate concentration that are higher than are typical to the Winnipeg area

As indicated in section 7.1.1.8 there appears to be a correlation between the laboratory results and the EM survey result. The impacts associated with the sodium chloride are relatively moderate compared to the road salt/sand storage of the Site and the EM survey indicates a similar result. The horizontal extent of the impacts appears to be reasonably defined by the EM Survey. However, the eastern and southern extent of the impact could not be fully delineated with the EM survey since there is a concrete apron around the building that contains metal rebar. The EM survey equipment gravitates to the presence of metal and the salt impacts cannot be determined. Additionally, the vertical extent of the salt impacts could not be determined with EM survey equipment. As a result, a soil investigation is recommended in this area to fully determine the vertical and horizontal extent of the sodium chloride impacts. Since section 7.1.1.3 has recommended further investigation in this area due to PHC impacts, the two investigations could be completed in conjunction. As a result, the additional sampling program can be completed for a cost of approximately $4,000 to $6,000 and would include all engineering fees, laboratory cost, and disbursements. This cost estimate assumes that the remediation will be completed in conjunction with the additional PHC investigation.

Based on the information discovered during this investigation, a conservative estimate of sodium chloride impacted soil is 2,400 m^3 covering an aerial extent of 520 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the sodium chloride impacted soil associated with the sodium chloride ASTS is approximately $50,000. The estimate for the remedial activities includes the excavation and removal of sodium chloride impacted soil, supply and install of back fill material, disposal of the impacted material, and all engineering fees, and assumes the remedial activities will be completed in conjunction with the

remediation of the PHC impacted soil identified in section 7.1.1.3. If remediation of this area is conducted independently the cost estimate would need to be re-evaluated.

7.10 REFUSE STORAGE AREA

Two (2) test holes (TH1-12 and TH-12) were installed around the refuse stockpile and the selected soil samples were submitted for laboratory analysis of PHC, metal parameters, and PAHs. As indicated in Table 4, both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As indicated in Table 5, most of the metal parameters had a measurable concentration; however the parameters appear to have concentrations typical to the Winnipeg area and were not above guidelines. Both samples had concentrations of PAHs that were below the reportable detection limits and did not exceed the comparison guidelines. No further investigation is recommended for this area.

It should be recommended that any storage of refuse at the Site should be within the appropriate containers (garbage bins) to minimize the potential impacts of the waste to soil and groundwater at the Site.

7.11 STOCKPILE/STORAGE AND STREET SWEEPING STOCKPILES

Three (3) test holes (TH9-12, TH10-12, and Th11-12) were installed within the area used to store the material collected from the street sweeping program. The selected soil samples were submitted for the laboratory analysis of PHC, metal parameters, and salinity parameters. As indicated in Table 4, all of the samples had PHC concentrations below the comparison guidelines. As indicated in Table 5, most of the metal parameters had measurable concentrations below the guidelines. The parameters appear to have concentrations that are typical of soils in the Winnipeg area.

As indicated in Table 6, the samples collected from test holes TH9-12 had a conductivity concentration that exceeded the guideline and TH10-12, had a pH value that exceeded the guideline values. The sulphate concentration in sample TH9-12@7.5 was elevated above what would be typically expected in the Winnipeg area. However, considering the EM survey indicated that the area had background concentrations (i.e. no impacts appear to be present) and the elevated sulphate concentration does not pose a risk to human health or the environment (no available guideline), no further work is recommended for this area.

7.12 RAIL TIE (CREOSOL TREATED TIMBERS) STORAGE AREA

One (1) test holes (TH4-12) was installed near the area where creosol treated timbers are stored in the bridge departments material storage area of the Site. The selected soil sample was submitted for laboratory analysis of salinity parameters and PAHs. The salinity results were discussed as part of section 7.1.1.8. As indicated in Table 7, the PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if

staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of PHC and PAHs. It should be noted that the presence of the timbers limited the area available for investigation.

7.13 FORMER RAIL LINE

One (1) test holes (TH3-12) was installed along the former rail spur line located in the western corner of the Site in one (1) of the bridge department material storage areas. The selected soil sample was submitted for laboratory analysis of metal parameters and PAHs. As indicated in Table 5, most of the metal parameters had a measurable concentration but were typical for soils in the Winnipeg area. As indicated in Table 7, the PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of metal parameters and PAHs.

7.14 HYDRAULIC SYSTEM AND FLOOR DRAINS IN BUILDING A

Two (2) test holes (TH30-12 and TH31-12) were installed with a hand auger near the hydraulic hoists located in the northern portion of Building A. The selected soil samples were submitted for laboratory analysis PHC and PCBs. As indicated in Table 4, the sample collected from test hole TH30-12 had concentrations of PHC fraction F3 that exceeded the guidelines and the sample collected from test hole TH31-12 had concentration of PHC fractions F2 and F3 that exceeded the guidelines. Both of the soil samples submitted for analysis had PCB concentrations that were below the laboratories reportable detection limits and comparison guideline. As a result, PCB is not required for any future analysis.

The horizontal extent of the impacts appears to be limited to the building footprint since the test holes that were installed around the building do not show any signs of hydrocarbon impacts. The vertical extent of the PHC impacts could not be determined at the time of the field investigation. As a result, an addition investigation of this area of the Site is recommended to determine the horizontal and vertical extent of the PHC impacts. However, it is AMEC's understanding that the building will the removed from the Site in the near future. As a result the subsequent investigation is recommended to be coordinated with the building removal so concrete coring will not be required. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000 (if conducted after the building removal) and would include all engineering fees, laboratory cost, and disbursements.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 1,400 m^3 covering an aerial extent of 600 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with Building A is approximately $220,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees. The cost for to removal of the concrete floor or removal of the building has not been included with this estimate.

7.15 ADDITIONAL ITEMS

During the Site investigation, a relatively large area of the Site was covered by a soil stockpile that the City reported was a result of material excavated from water main renewals, road repairs, etc. Due to the limitation of this investigation, the soil stockpiles were not included in the Site investigation, however, to reduce some of the remedial cost associated with PHC impacted area, this material can be utilized as backfill material, provided composite samples submitted for laboratory analysis indicates no impacts are present. If no laboratory analysis is completed on the stockpile, the material should be transported to an appropriate facility for disposal.

8.0 SUMMARY AND CONCLUSION

The objective of the Phase II Environmental Site Assessment (ESA) was to assess the soil conditions at the Site with respect to potential environmental impacts associated with the current and historical operation of the facility. The areas of potential concern are associated with use or storage of petroleum hydrocarbons (PHC), soil salinity, metal parameters, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) which are associated with a 14 areas of the Site.

The AMEC drilling program was conducted between 7 August to 9 August 2012 and consisted of advancing 29 test holes (TH1-12 through TH29-12), with two (2) test holes (TH30-12 and TH31-12) installed with a hand auger. The test holes were drilled to a maximum depth of 3.1 to 6.1 metres below grade level (m bgl) depending on the contaminant of concern and the area of the Site. The test holes were installed with a continuous flight solid stem auger rig, supplied and operated by Maple Leaf Drilling of Winnipeg, Manitoba.

The soil profile encountered at the test hole locations generally consisted of granular fill, concrete or asphalt to approximately 0.1 to 0.6 m bgl, followed by a clay fill layer ranging in thickness from approximately 0.3 to 1.5 m. The remainder of the test hole typically consisted of native clay that extended to the completion depth of the test holes. Some variation to the general stratigraphy encountered included a silty layer ranging from 0.2 to 2.0 m thick was encountered below the clay fill layer in six (6) of the test holes, and another two (2) of the test holes had the clay fill layer extend to the test hole completion depth.

The maximum soil vapour concentration encountered during the test hole drilling program was 100% Lower Explosive Limit (LEL) in soil samples TH28-12@5 and TH29-12@2.53 at a depth of 1.8 m and 0.8 m respectively.

A total of 37 soil samples from 14 areas of the Site were submitted for laboratory analysis of PHC constituents, metal parameters, salinity parameters, PAHs and PCBs. The details of the investigation and recommendations are as follows:

Current Pump Island

Three (3) test holes were installed around the pump island and the selected soil sample were submitted for laboratory analysis of PHC. All of the samples complied with the comparison guideline. However, one (1) of the samples had measurable concentrations of hydrocarbons, indicating PHC impacts over guideline values were likely present in the vicinity. AMEC has conservatively assumed that impacts are present unless determined otherwise.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 470 m^3. The Class D cost estimate for the remediation of the potential PHC soil associated with the pump island is approximately $90,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees.

Abandoned USTs Located North of the Current Pump Island

Four (4) test holes were installed around the abandoned USTs located north of the current pump island. The samples selected for laboratory analysis of PHC had concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines indicating that no PHC impacts appear to be present. However, it is AMEC's understands that the tanks are scheduled to be decommissioned in the near future. During the decommissioning of the tanks, soil sample must be collected from the material located between the tanks and from the limits of the excavation (as per Manitoba Conservation guidelines) to confirm no impacts are present. As part of the tank decommissioning program, provisions should also be made for the excavation and disposal of a limited quantity of PHC soil. Since the test hole located around the tank did not indicate any signs of PHC impacts, any potential PHC impacts are likely limited to the material adjacent to the tank, which could cost effectively be remediated during the tank decommissioning program.

Former Pump Island and USTs located between Building H and Building G

Four (4) test holes were installed around the former pump island and associated USTs and the selected soil samples were analyzed for PHC parameters. Three (3) of the samples had PHC concentration that exceeded the guidelines. The impacts were horizontally delineated to the southeast and vertical delineation was achieved in test holes TH28-12.

Since the PHC impacts have not been fully delineated vertically or horizontally, further investigation is recommended to gain a better understanding of the size of impacts located at the Site. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000 and would include all engineering fees, laboratory cost, and disbursements.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 2,400 m^3 covering an aerial extent of 520 m^2. As requested by the City of Winnipeg, the Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with the pump island is $450,000. This estimate includes the excavation and

removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees.

Abandoned Waste Oil UST North of Building C

Two (2) test holes were installed around the waste oil UST north of Building C and the selected soil samples were submitted for laboratory analysis of PHC. Both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected from the limits of the excavation for field and laboratory analysis.

Abandoned Waste Oil UST Northeast of Building A

Two (2) test holes were installed around the waste oil UST northeast of Building A and the selected soil samples were submitted for laboratory analysis of PHC. Both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. As a result, no further investigation is recommended for this area. However, current Manitoba regulation stipulates that hydrocarbon storage tanks need to be properly decommissioned if they are no longer required at the Site. As part of any UST decommissioning program (Manitoba Conservation guidelines), soil samples have to be collected from the limits of the excavation for field and laboratory analysis.

Hazardous Materials/Waste Storage Area

Two (2) test holes were installed around the hazardous material/waste storage area and the selected soil samples were submitted for laboratory analysis of PHC and metals parameters. Both of the samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. Most of the metal parameters in the two samples had measurable concentrations; however, aside from the sodium concentration in one (1) sample, the parameters appear to have concentrations typical to Winnipeg and were not above guidelines. Since the hazardous materials/waste storage area is located near the road salt/sand storage area, the elevated sodium concentrations are likely a result of the road salt/sand storage area. No further investigation is recommended for this area.

It is recommended that the storage of the hazardous materials/waste should be relocated to a secure facility located within one of the Site buildings to reduce the potential for accidental release of the materials stored in this area to the environment.

Former Hazardous Materials/Waste Storage Area

One (1) test holes was installed near the former hazardous materials/waste storage area and the selected soil sample was submitted for laboratory analysis of PHC and metals parameters. The soil sample had PHC concentrations below the laboratory's reportable detection limits

which were also below the comparison guidelines. Most of the metal parameters had a measurable concentration; however the parameters appeared to have concentrations typical to soils in the Winnipeg area and were not above guidelines. No further investigation is recommended for this area.

Salt/Sand Outdoor Storage Area

Four (4) test holes were installed in the road salt/sand outdoor storage area and were submitted for laboratory analysis of salinity parameters. The location of the test holes was based on the results of the EM Survey completed in conjunction with the subsurface investigation. The test holes were placed such that the road salt impacts could be confirmed and delineated. In addition to the samples that were selected from the test holes advanced within the salt/sand plume, the sample that was submitted for laboratory analysis from an adjacent area of was analyzed for salinity parameter to help delineate potential road salt impacts.

Each sample that was analyzed for salinity parameters had at least one (1) parameter that exceeded the comparison criteria. The sample collected from the area of the greatest impacts as identified by the EM survey had a Sodium Adsorption Ratio (SAR) of 606 which is approximately 121 times higher than the guideline value of 5. This sample also had a conductivity value of 133 dS/m which is approximately 66 times higher than the guideline value of 2 dS/m. In addition to SAR and conductivity there are a number of other parameters (including potassium, sodium, chloride and sulphate) that do not have comparison guidelines but have concentrations that are significantly higher than typical soil conditions for Winnipeg. The remaining samples collected from this area had SAR values that ranged between 7.5 and 59.6 times higher than the guideline; conductivity values that ranged between 2.5 and 29 times higher that the guidelines; and elevated concentrations of several other parameters (including sodium, chloride, and sulphate) were measured.

There appears to be correlating between the laboratory results and the EM survey result. As a result, the horizontal extent of the road salt impacts appears to be delineated. However, since the impacts originate at the surface, the EM survey equipment cannot accurately measure the depth of impacts. It should also be noted that the EM survey indicated that the road salt impacts appear to have migrated off property north of the Site. To confirm the vertical extent of the road salt impacts and to confirm the impacts have migrated off property, additional soil samples are recommended from this area of the Site. The additional sampling program can be completed for a cost of approximately $15,000 to $20,000 and will include all engineering fees, laboratory costs and disbursements.

Based on the information discovered during this investigation, a conservative estimate of the area with road salt impacts is approximately 65,000 m^3. The Class D cost estimate for the remediation road salt impacts is approximately $6,350,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, and all engineering fees. AMEC has assumed that the road salt impacted soil can be sent to the Brady Road landfill for disposal as daily cover at no cost to this project.

Sodium Chloride ASTs

Two (2) soil samples were submitted for laboratory analysis of salinity parameters form test holes that were installed to delineate PHC impacts around the former pump island and associated USTs. The results indicated exceedances of the SAR and conductivity values as well as elevated concentration of sodium, chloride and sulphate.

The impacts associated with the sodium chloride are relatively moderate compared to the road salt/sand storage of the Site and the EM survey indicates a similar result. The horizontal extent of the impacts appears to be reasonably defined by the EM Survey. However, the eastern and southern extent of the impact could not be fully delineated with the EM survey since there is a concrete apron around the building that contains metal rebar. Additionally, the vertical extent of the salt impacts could not be determined with EM survey equipment. As a result, a soil investigation is recommended in this area to fully determine the vertical and horizontal extent of the sodium chloride impacts. The additional sampling program can be completed for a cost of approximately $4,000 to $6,000 and would include all engineering fees, laboratory cost, and disbursements. This cost estimate assumes that it would be completed in conjunction with the additional PHC investigation associated with the former pump island and associated USTs.

Based on the information discovered during this investigation, a conservative estimate of sodium chloride impacted soil is 2,400 m^3. The Class D cost estimate for the remediation of the sodium chloride impacted soil associated with the sodium chloride ASTs is approximately $50,000. The estimate for the remediation of the sodium chloride impacted soil includes the excavation and removal of impacted soil, supply and install of back fill material, disposal of the impacted material, and all engineering fees, and assumes the remedial activities will be completed in conjunction with the remediation of the PHC impacted soil associated with the former pump island and associated USTs. If remediation of this area is conducted independently the cost estimate would need to be re-evaluated.

Refuse Storage Area

Two (2) test holes were installed around the refuse stockpile and the selected soil samples were submitted for laboratory analysis of PHC, metal parameters, and PAHs. Both of the soil samples had PHC concentrations below the laboratory's reportable detection limits which were also below the comparison guidelines. Most of the metal parameters had a measurable concentration; however the parameters appear to have concentrations typical to the Winnipeg area and were not above guidelines. Both samples had concentrations of PAHs that were below the reportable detection limits and did not exceed the comparison guidelines. No further investigation is recommended for this area.

It should be recommended that any storage of refuse at the Site should be within the appropriate containers (garbage bins) to minimize the potential impacts of the waste to soil and groundwater at the Site.

Stockpile/Storage and Street Sweeping Stockpiles

Three (3) test holes were installed within the area used to store the material collected from the street sweeping program. The selected soil samples were submitted for the laboratory analysis of PHC, metal parameters, and salinity parameters. All of the samples had PHC concentrations below the comparison guidelines, and most of the metal parameters had measurable concentrations below the guidelines. The parameters appear to have concentrations that are typical of soils in the Winnipeg area.

One (1) of the samples had a conductivity value that exceeded the guidelines and another sample had a pH value that exceeded the guidelines. The sulphate concentration in one (1) of the samples was elevated above what would be typically expected in the Winnipeg area. However, considering the EM survey indicated that the area had background concentrations (i.e. no impacts appear to be present) and the elevated sulphate concentration does not pose a risk to human health or the environment (no available guideline), no further work is recommended for this area.

Rail Tie (Creosol Treated Timbers) Storage Area

One (1) test holes was installed near the area where creosol treated timbers are stored in the bridge departments material storage area of the Site. The selected soil sample was submitted for laboratory analysis of salinity parameters and PAHs. The salinity results were discussed as part of salt/sand outdoor storage area. The PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of PHC and PAHs. It should be noted that the presence of the timbers limited the area available for investigation.

Former Rail Line

One (1) test holes was installed along the former rail spur line located in the western corner of the Site in one (1) of the bridge department material storage areas. The selected soil sample was submitted for laboratory analysis of metal parameters and PAHs. Most of the metal parameters had a measurable concentration but were typical for soils in the Winnipeg area. The PAHs parameters had concentrations that were below the reportable detection limits, and no exceedances of the guidelines were present. No further investigation is recommended for this area. However, if staining or odours are encountered during future excavation in this area of the Site, soil samples should be collected for laboratory analysis of metal parameters and PAHs.

Hydraulic System and Floor Drains in Building A

Two (2) test holes were installed with a hand auger near the hydraulic hoists located in the northern portion of Building A. The selected soil samples were submitted for laboratory analysis PHC and PCBs. Both of the samples had PHC concentrations that exceeded the guidelines. Both of the soil samples submitted for analysis had PCB concentrations that were below the laboratories reportable detection limits and comparison guideline. As a result, PCB is not required for any future analysis.

The horizontal extent of the impacts appears to be limited to the building footprint since the test holes that were installed around the building do not show any signs of hydrocarbon impacts. The vertical extent of the PHC impacts could not be determined at the time of the field investigation. As a result, an addition investigation of this area of the Site is recommended to determine the horizontal and vertical extent of the PHC impacts. However, it is AMEC's understanding that the building will the removed from the Site in the near future. As a result the subsequent investigation is recommended to be coordinated with the building removal so concrete coring will not be required. The additional sampling program can be completed for a cost of approximately $10,000 to $15,000 (if conducted after the building removal) and would include all engineering fees, laboratory cost, and disbursements.

Based on the information discovered during this investigation, a conservative estimate of PHC impacted soil is 1,400 m^3. The Class D cost estimate for the remediation of the potential hydrocarbon impacted soil associated with Building A is approximately $220,000. This estimate includes the excavation and removal of PHC impacted soil, supply and install of back fill material, disposal of the PHC impacted material, and all engineering fees. The cost for to removal of the concrete floor or removal of the building has not been included with this estimate.

Additional Items

During the Site investigation, a relatively large area of the Site was covered by a soil stockpile that the City reported was a result of material excavated from water main renewals, road repairs, etc. Due to the limitation of this investigation, the soil stockpiles were not included in the Site investigation, however, to reduce some of the remedial cost associated with PHC impacted area, this material can be utilized as backfill material, provided composite samples submitted for laboratory analysis indicates no impacts are present. If no laboratory analysis is completed on the stockpile, the material should be transported to an appropriate facility for disposal.

9.0 CLOSURE

The American Society for Testing and Materials Standard of Practice notes that no environmental site assessment can wholly eliminate uncertainty regarding the potential for recognized environmental conditions in the connection with a property. Performance of a standardized environmental site assessment protocol is intended to reduce, but not eliminate, uncertainty regarding the potential for recognized environmental conditions in connection with the property, given reasonable limits of time and costs. The findings of this investigation are based on the interpretation of data from a limited number of boreholes and analytical results pertaining to specific samples. The evaluation and interpretations do not preclude the existence of chemical substances other than those identified herein, or the possibility that contamination levels can vary between the areas of the investigation.

This report has been prepared for the exclusive use of the City of Winnipeg and their agent for specific application to the property identified in this report. The environmental assessment was conducted in accordance with generally accepted assessment practices. No other warranty, expressed or implied, is made.

We trust that this report meets your present requirements. Please contact our office if you have any questions or if we can be of further assistance.

This Report is also subject to the further General Conditions contained in Appendix F.

Respectively submitted,

AMEC Environment & Infrastructure,
a division of AMEC Americas Limited

PROVINCE OF MANITOBA
C.M.J.
BLAIR
Member
22448
REGISTERED PROFESSIONAL ENGINEER

Craig Blair P. Eng
Environmental Engineer

Reviewed by:

Allyson Desgroseilliers, P.Eng., B.Sc. (Bio), EP
Senior Environmental Engineer
Unit Manager Winnipeg Operations

10.0 REFERENCES

AMEC Environmental & Infrastructure. "Phase I Environmental Site Assessment, 1500 Plessis Road & 849 Ravelston Avenue West, Winnipeg, Manitoba." 16 July 2012.

Canadian Council of Ministers of the Environment (CCME). Canadian Environmental Quality Guidelines (EQG).

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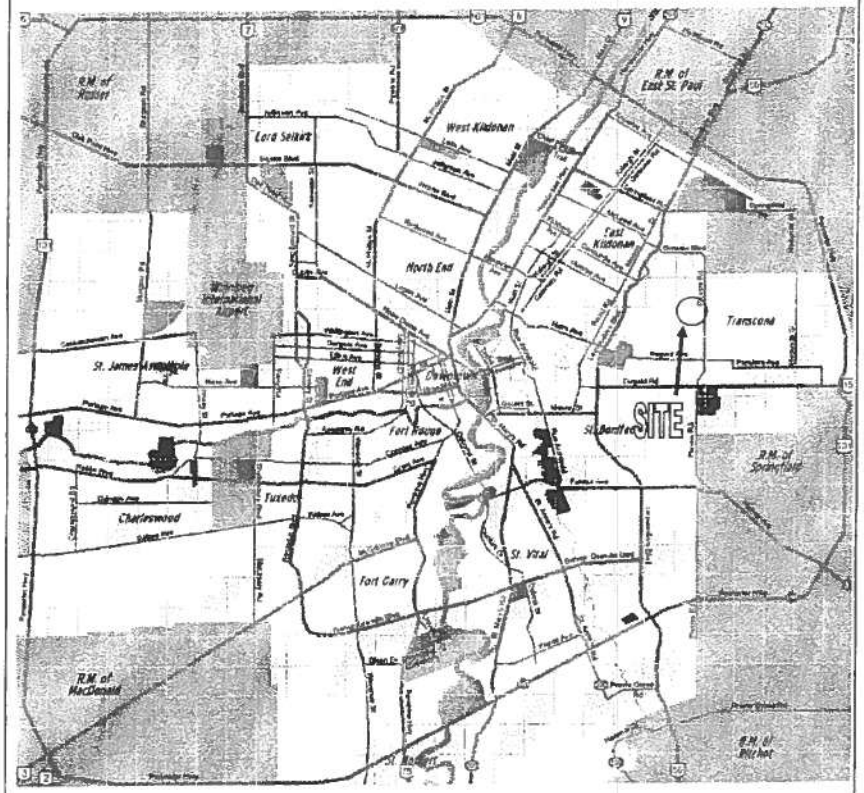
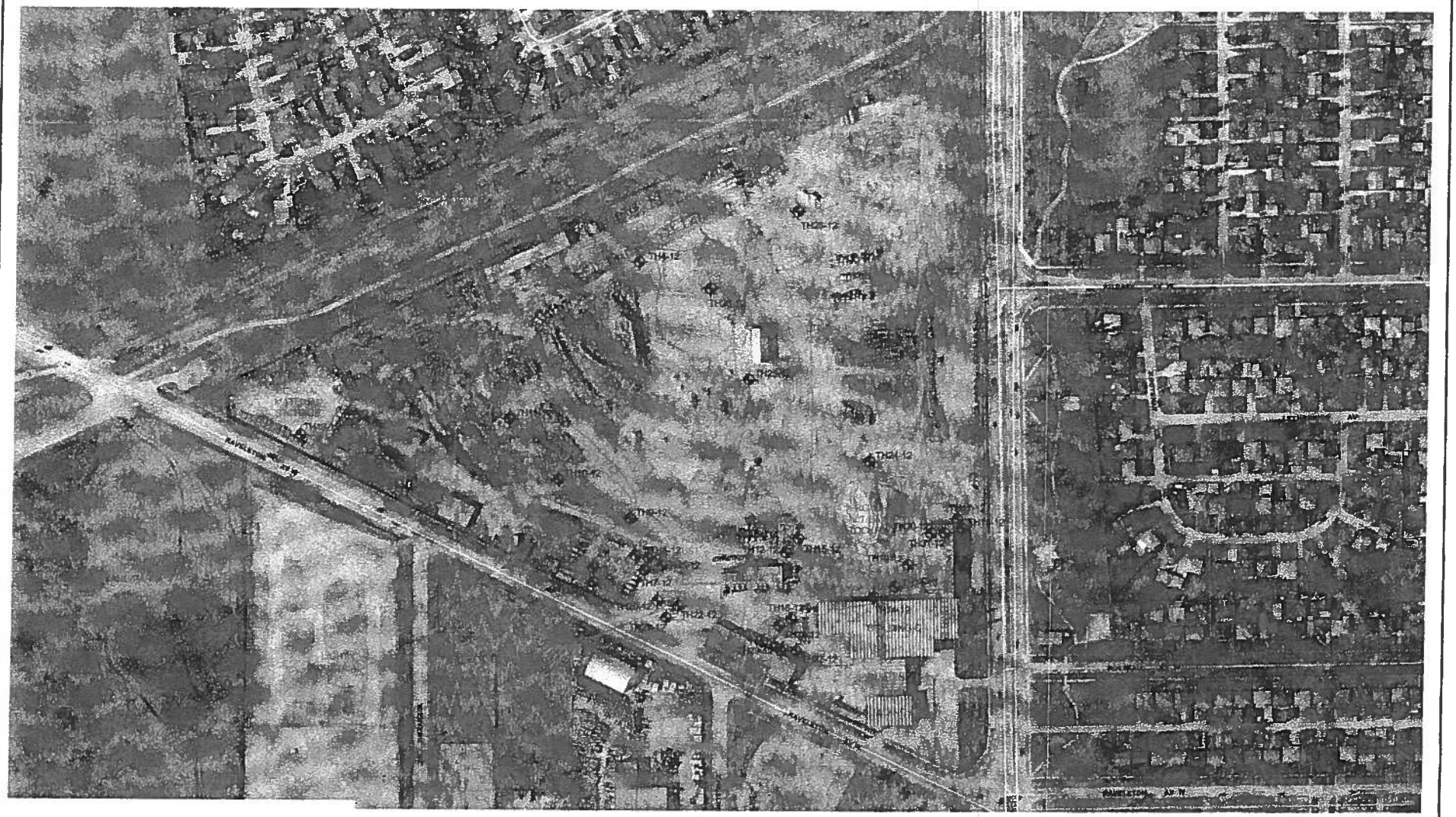
APPENDIX A

FIGURES



CITY OF WINNIPEG

amec Environment & Infrastructure City of Winnipeg Planning, Property & Development		SITE LOCATION PLAN PHASE II ENVIRONMENTAL SITE ASSESSMENT 1500 PLESSIS ROAD & 849 RAVELSTON AVENUE WEST WINNIPEG, MANITOBA		
Drawn: N/A	Scale: ~1:150 000	Date: Nov 2012	Project No.: WX1692301	Figure: 1



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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1500 PLESSIS ROAD

TITLE: SITE AND SURROUNDING USE PLAN

DATE	JOB No.	CAD FILE	FIGURE No.	REV.
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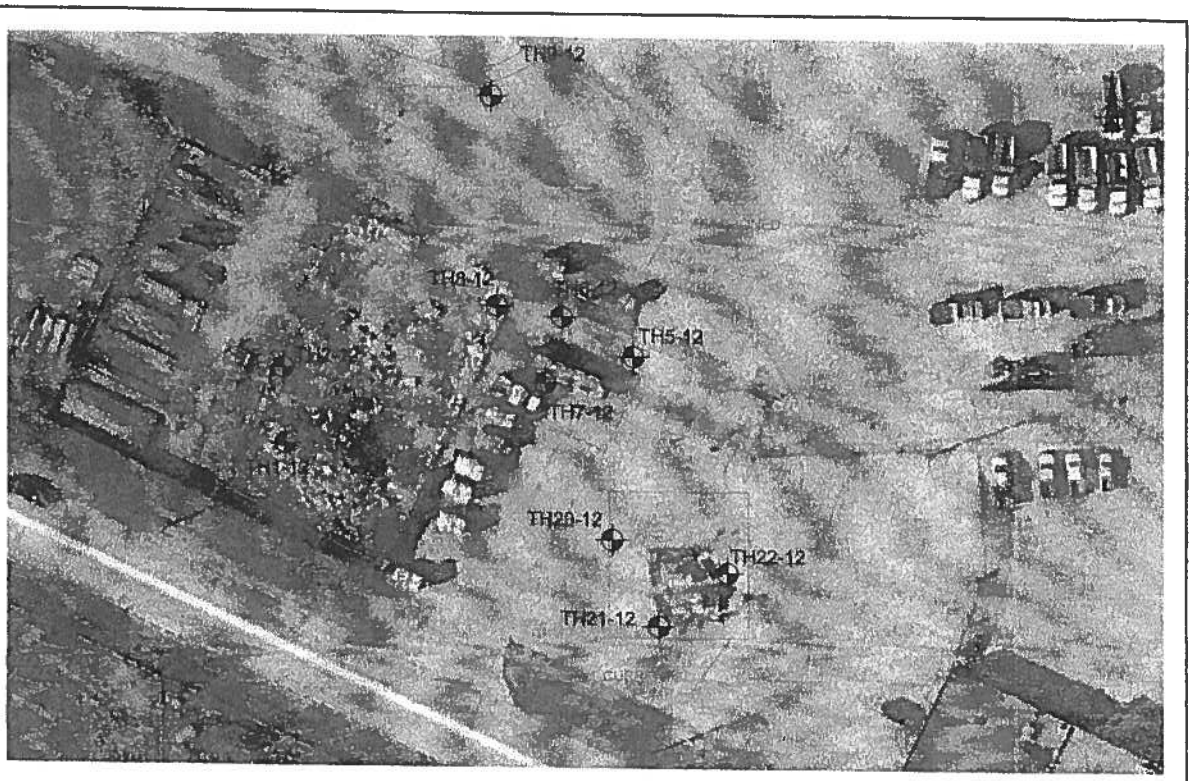

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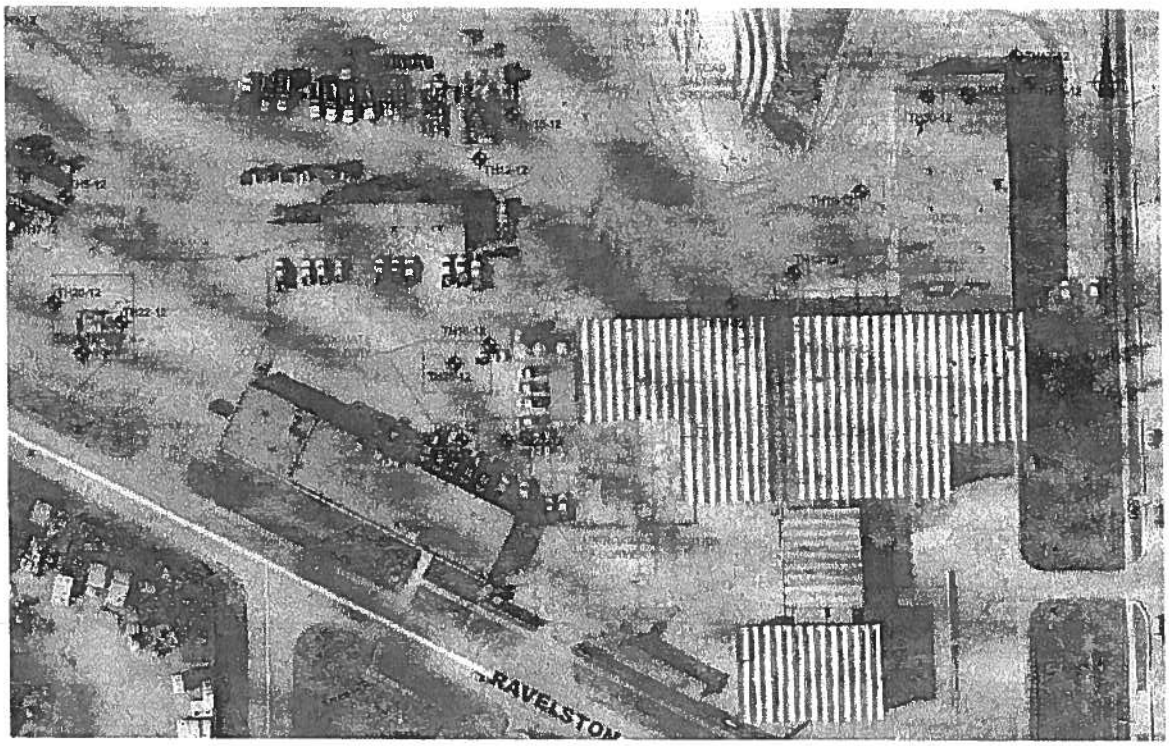
amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: CURRENT PUMP ISLAND AND ABANDON USTs NORTH OF PUMP ISLAND

DATE	JOB No.	CAD FILE	FIGURE No.	REV.
AUGUST 2012	WX1692301	1692301N01-2012 08 10	FIGURE 3	A



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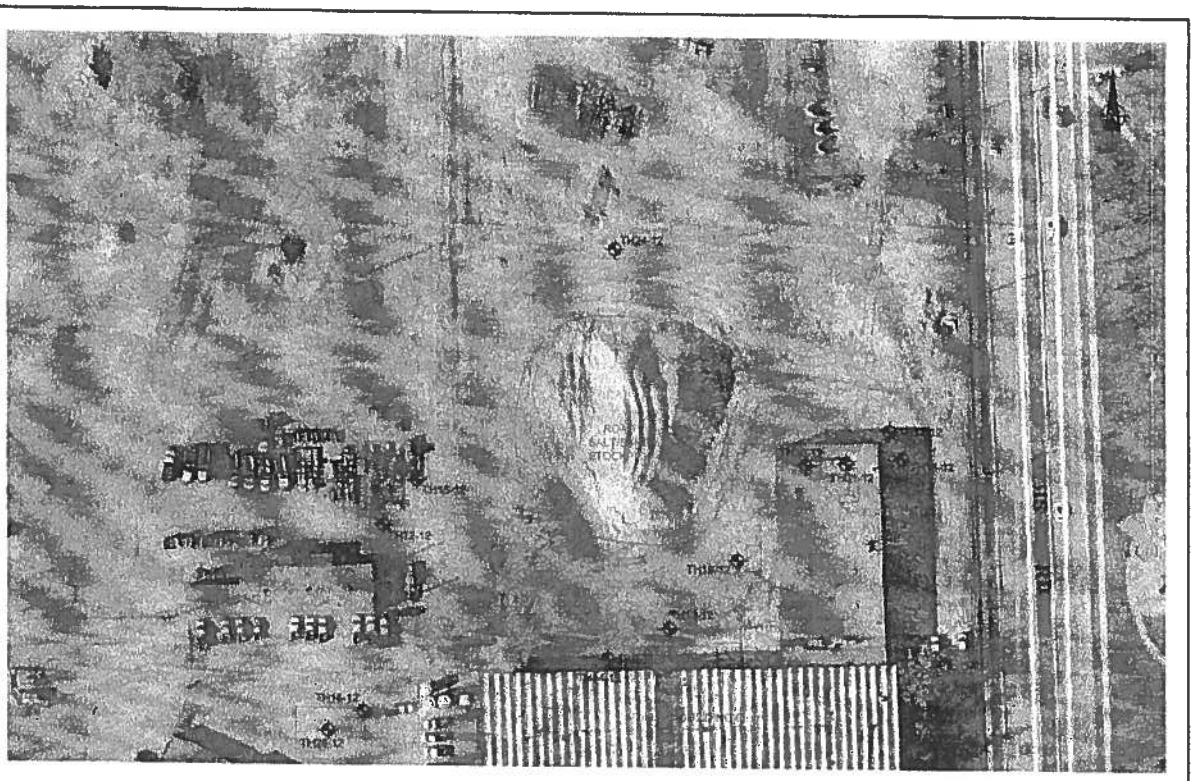
amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1500 PLESSIS ROAD

TITLE: FORMER PUMP ISLAND AND ASSOCIATED USTs

DATE	AMEC No.	CAD FILE	FIGURE No.	REV.
AUGUST 2012	WX1692301	1692301ND1-2012 08 10	FIGURE 4	A



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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: ABANDON USTs AND HYDRAULIC SYSTEM ASSOCIATED WITH BUILDINGS

DATE	JOB No	CAD FILE	FIGURE No	REV
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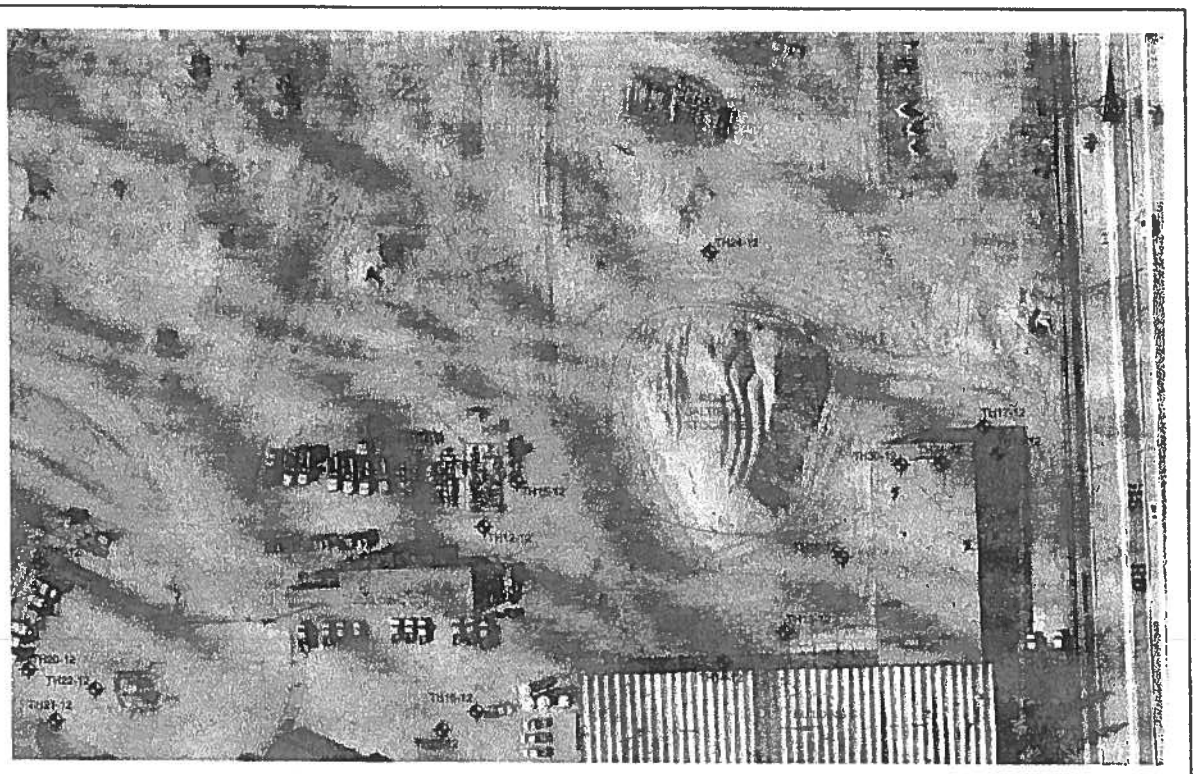

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CLIENT
CITY OF WINNIPEG

PROJECT
PHASE II ESA - 1500 PLESSIS ROAD

TITLE
HAZARDOUS MATERIAL STORAGE AREA

DATE	JOB No	CAD FILE	FIGURE No	REV
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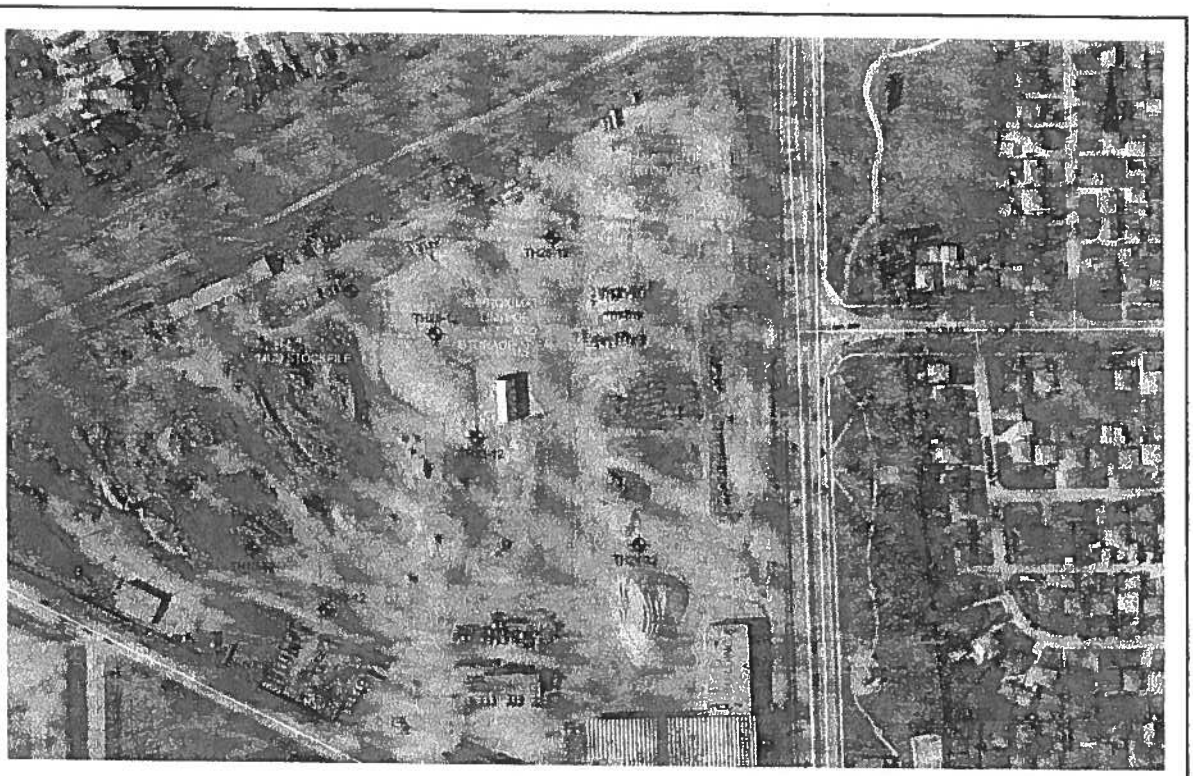

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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1500 PLESSIS ROAD

TITLE: SALT AND OUTDOOR STORAGE AREA

DATE	JOB No	CAD FILE	FIGURE No	REV.
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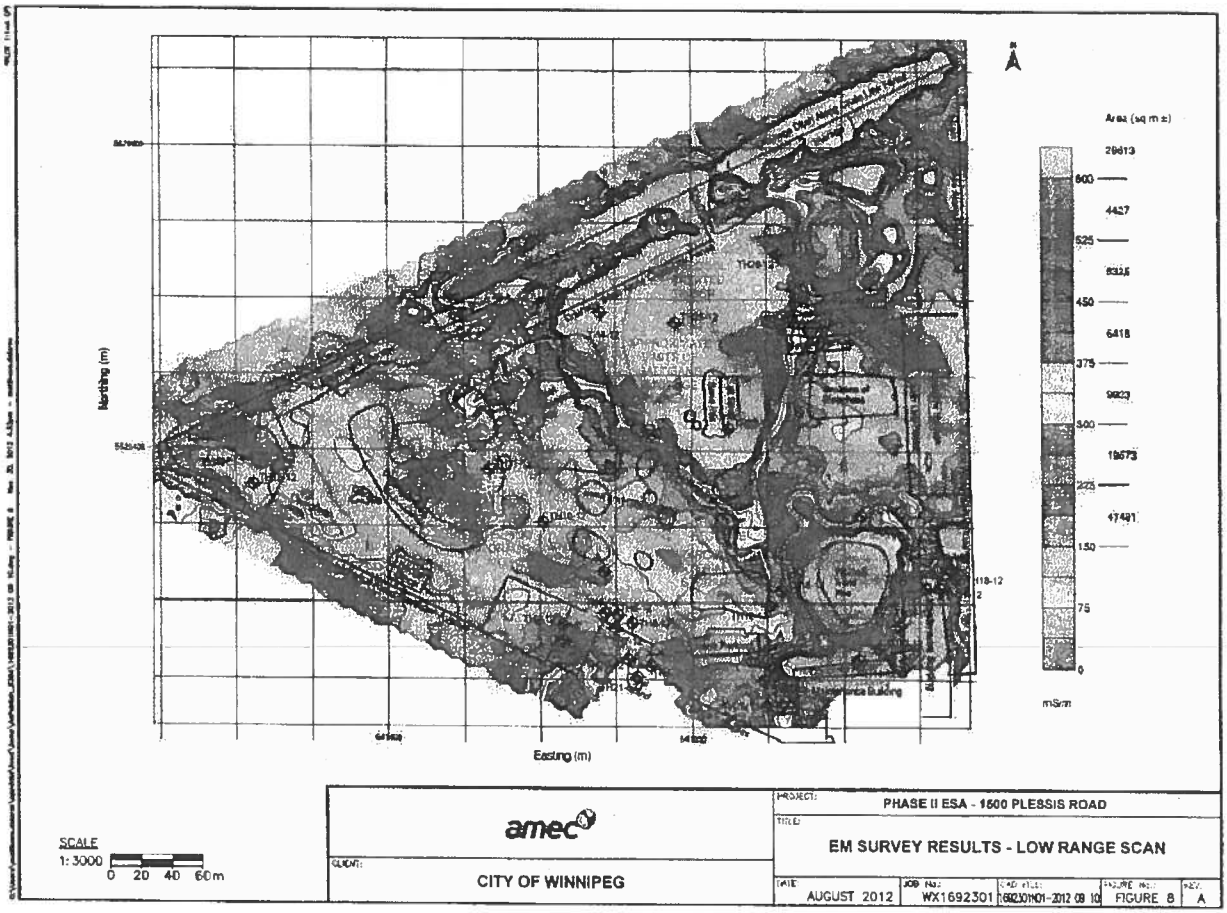
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mS/m
Northing (m)
Easting (m)
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amec
CLIENT:
CITY OF WINNIPEG
PROJECT:
PHASE II ESA - 1600 PLESSIS ROAD
TITLE:
EM SURVEY RESULTS - LOW RANGE SCAN
DATE
AUGUST 2012
JOB NO:
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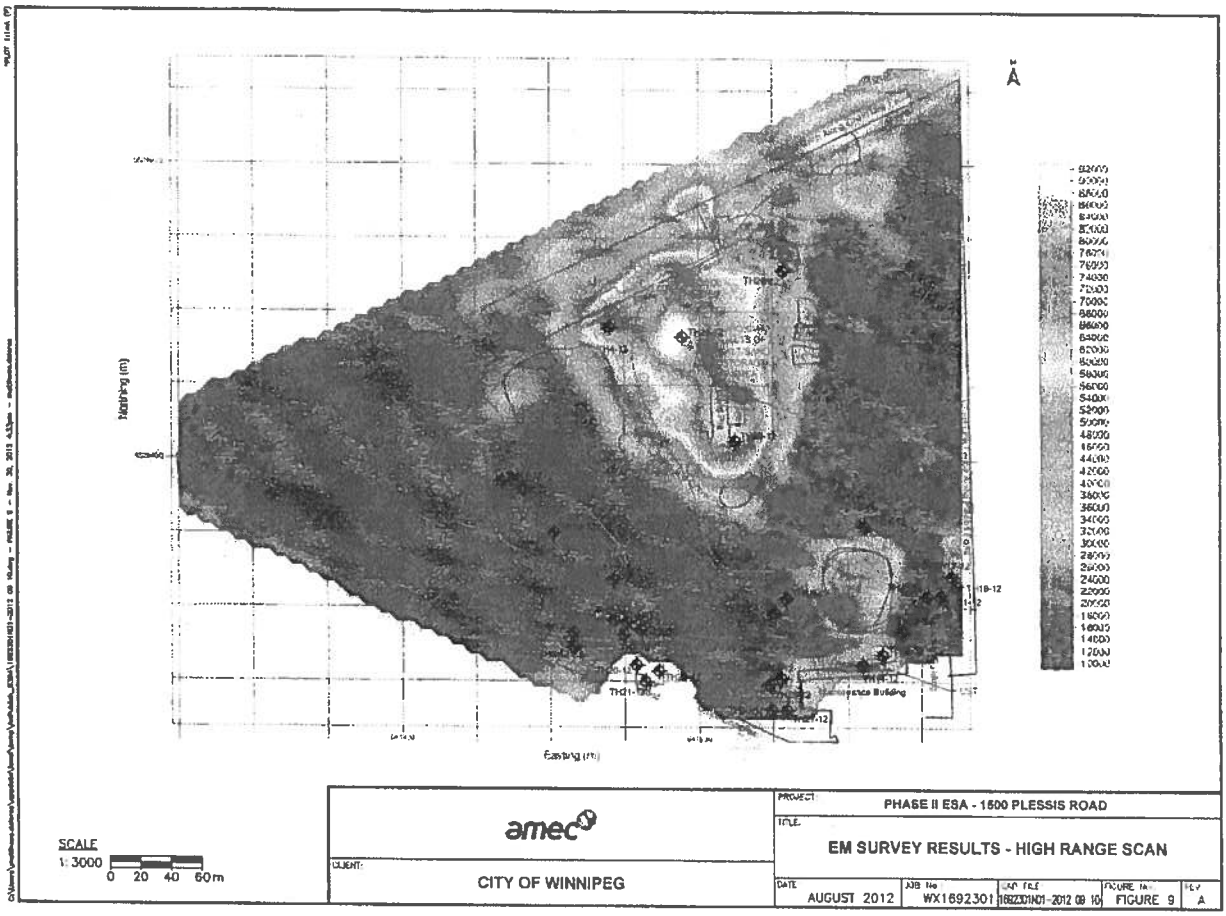
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CITY OF WINNIPEG
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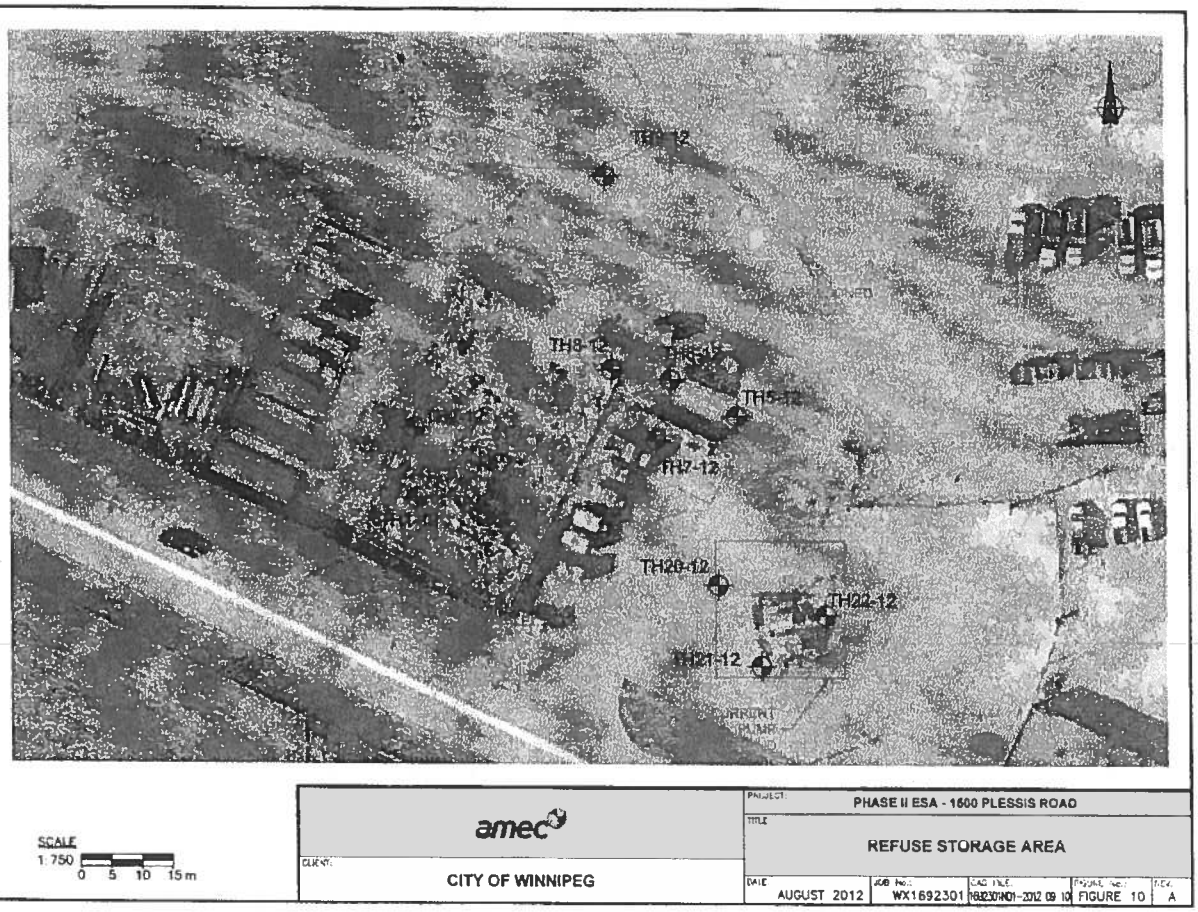

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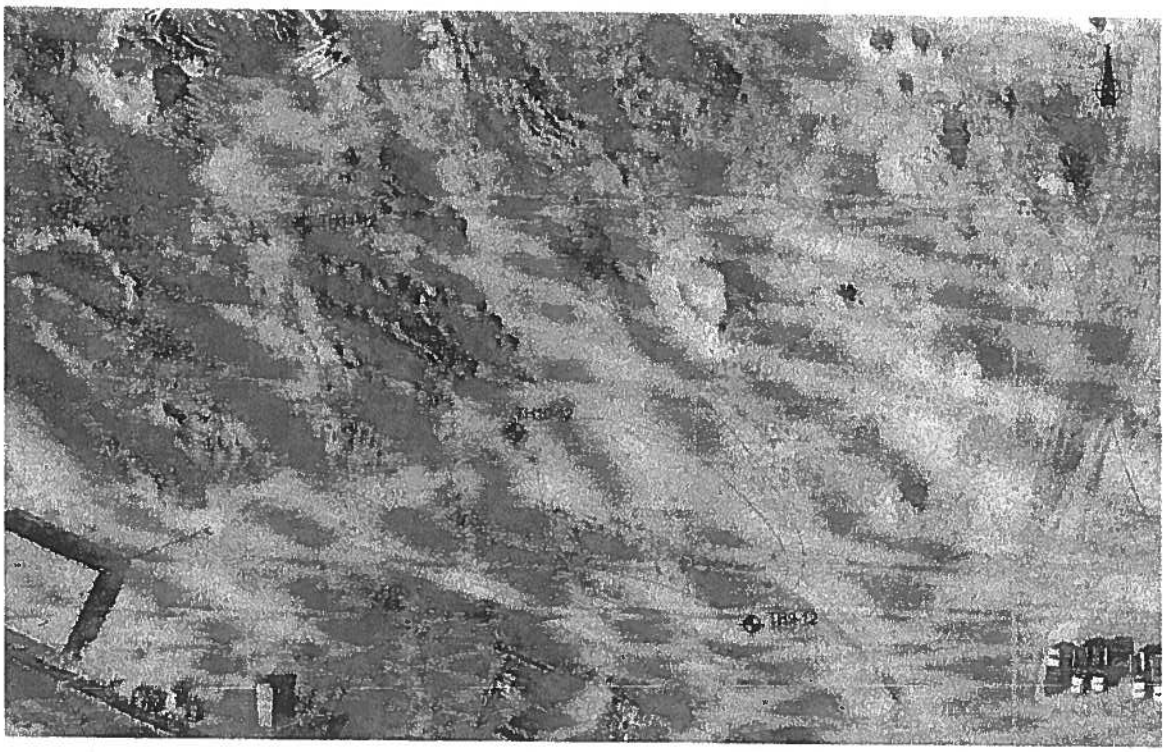
CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: REFUSE STORAGE AREA

DATE	JOB No.	CAD FILE	FIGURE No.	REV.
AUGUST 2012	WX1692301	1692301N01-2012 09 10	FIGURE 10	A



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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: STREET SWEEPING STOCKPILE/STORAGE AREA

DATE	JOB No.	CAD FILE	FIGURE No.	REV.
AUGUST 2012	WX16923O1	16923O1H01-2012 09 10	FIGURE 11	A

SCALE
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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: TREATED TIMBER STORAGE AREA

DATE	JOB No.	CAD FILE:	FIGURE No.	REV.
AUGUST 2012	WX16923O1	16923O1M01-2012 09 10	FIGURE 12	A

SCALE
1:1000
0 10 20m

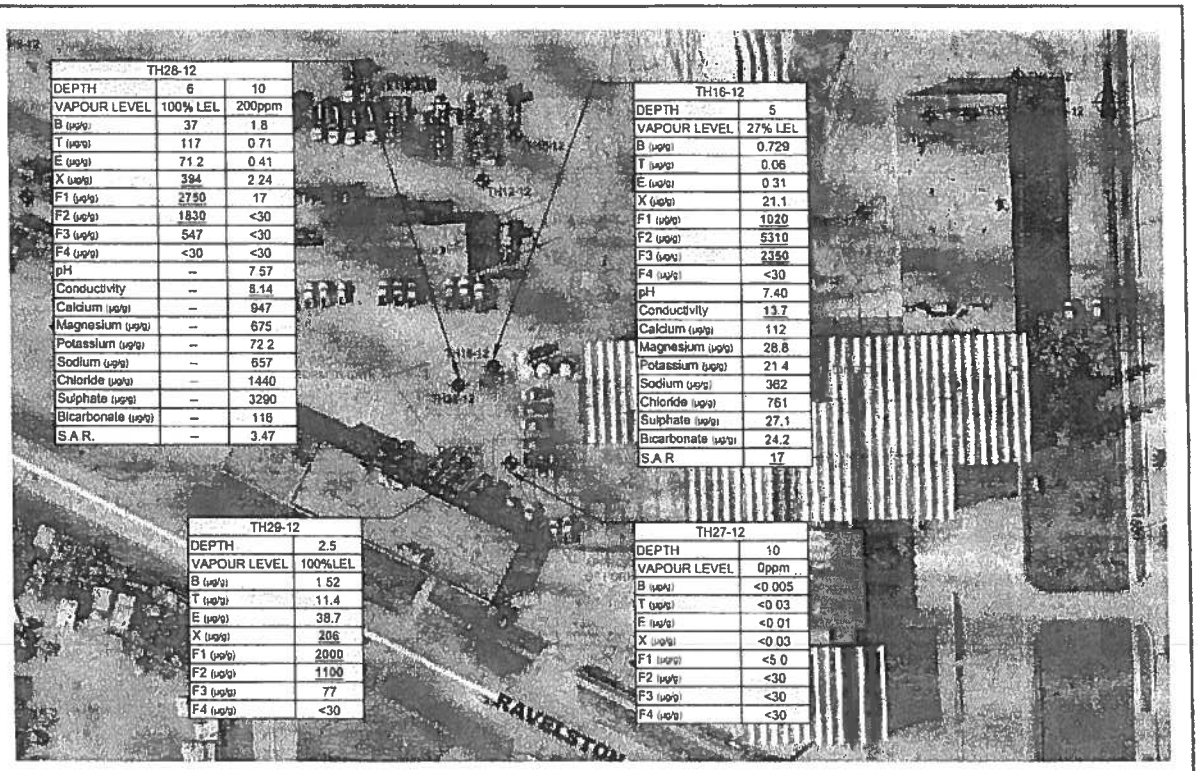
amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1500 PLESSIS ROAD

TITLE: FORMER RAIL LINE

DATE	AMEC No	CAD FILE	FIGURE NO	REV
AUGUST 2012	WX1692301	1692301N01-2012 09 10	FIGURE 13	A



SCALE
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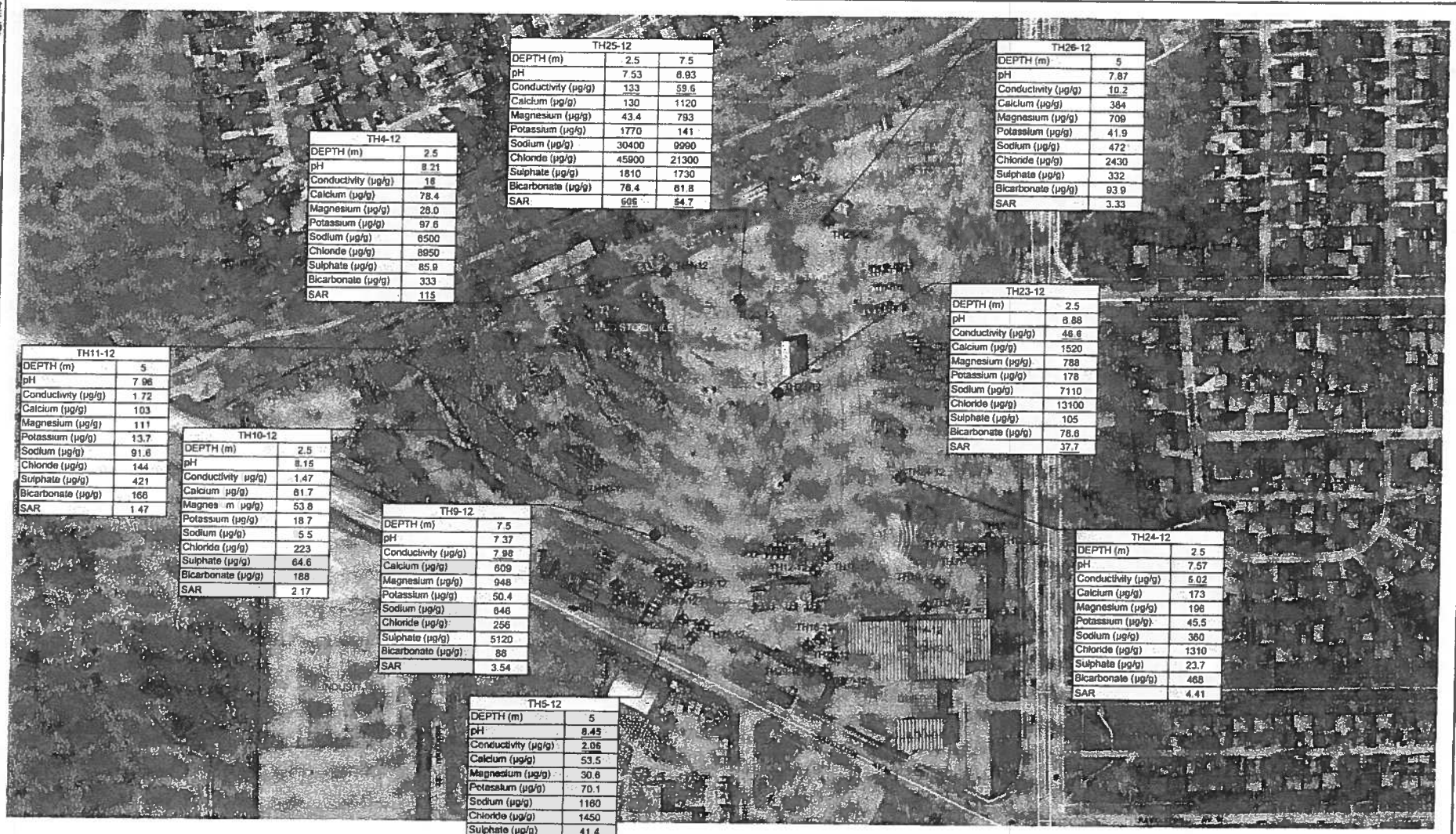
amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: IMPACTS ASSOCIATED WITH THE FORMER PUMP ISLAND AND USTs

DATE	JOB No.	CAD FILE	DRAWING No.	REV.
AUGUST 2012	WX1692301	1692301N01-2012 09 10	FIGURE 14	A



TH25-12		
DEPTH (m)	2.5	7.5
pH	7.53	8.93
Conductivity (µg/g)	133	59.6
Calcium (µg/g)	130	1120
Magnesium (µg/g)	43.4	793
Potassium (µg/g)	1770	141
Sodium (µg/g)	30400	9990
Chloride (µg/g)	45900	21300
Sulphate (µg/g)	1810	1730
Bicarbonate (µg/g)	76.4	61.8
SAR	606	64.7

TH26-12	
DEPTH (m)	5
pH	7.87
Conductivity (µg/g)	10.2
Calcium (µg/g)	384
Magnesium (µg/g)	709
Potassium (µg/g)	41.9
Sodium (µg/g)	472
Chloride (µg/g)	2430
Sulphate (µg/g)	332
Bicarbonate (µg/g)	93.9
SAR	3.33

TH4-12	
DEPTH (m)	2.5
pH	8.21
Conductivity (µg/g)	18
Calcium (µg/g)	78.4
Magnesium (µg/g)	28.0
Potassium (µg/g)	97.6
Sodium (µg/g)	6500
Chloride (µg/g)	8950
Sulphate (µg/g)	85.9
Bicarbonate (µg/g)	333
SAR	115

TH23-12	
DEPTH (m)	2.5
pH	8.88
Conductivity (µg/g)	46.6
Calcium (µg/g)	1520
Magnesium (µg/g)	788
Potassium (µg/g)	178
Sodium (µg/g)	7110
Chloride (µg/g)	13100
Sulphate (µg/g)	105
Bicarbonate (µg/g)	78.6
SAR	37.7

TH11-12	
DEPTH (m)	5
pH	7.96
Conductivity (µg/g)	1.72
Calcium (µg/g)	103
Magnesium (µg/g)	111
Potassium (µg/g)	13.7
Sodium (µg/g)	91.6
Chloride (µg/g)	144
Sulphate (µg/g)	421
Bicarbonate (µg/g)	166
SAR	1.47

TH10-12	
DEPTH (m)	2.5
pH	8.15
Conductivity (µg/g)	1.47
Calcium (µg/g)	81.7
Magnesium (µg/g)	53.8
Potassium (µg/g)	18.7
Sodium (µg/g)	5.5
Chloride (µg/g)	223
Sulphate (µg/g)	64.6
Bicarbonate (µg/g)	188
SAR	2.17

TH9-12	
DEPTH (m)	7.5
pH	7.37
Conductivity (µg/g)	7.98
Calcium (µg/g)	609
Magnesium (µg/g)	948
Potassium (µg/g)	50.4
Sodium (µg/g)	846
Chloride (µg/g)	256
Sulphate (µg/g)	5120
Bicarbonate (µg/g)	88
SAR	3.54

TH24-12	
DEPTH (m)	2.5
pH	7.57
Conductivity (µg/g)	5.02
Calcium (µg/g)	173
Magnesium (µg/g)	196
Potassium (µg/g)	45.5
Sodium (µg/g)	360
Chloride (µg/g)	1310
Sulphate (µg/g)	23.7
Bicarbonate (µg/g)	468
SAR	4.41

TH5-12	
DEPTH (m)	5
pH	8.45
Conductivity (µg/g)	2.06
Calcium (µg/g)	53.5
Magnesium (µg/g)	30.6
Potassium (µg/g)	70.1
Sodium (µg/g)	1160
Chloride (µg/g)	1450
Sulphate (µg/g)	41.4
Bicarbonate (µg/g)	533
SAR	17

SCALE
1: 2500
0 10 20 30 40 50 m

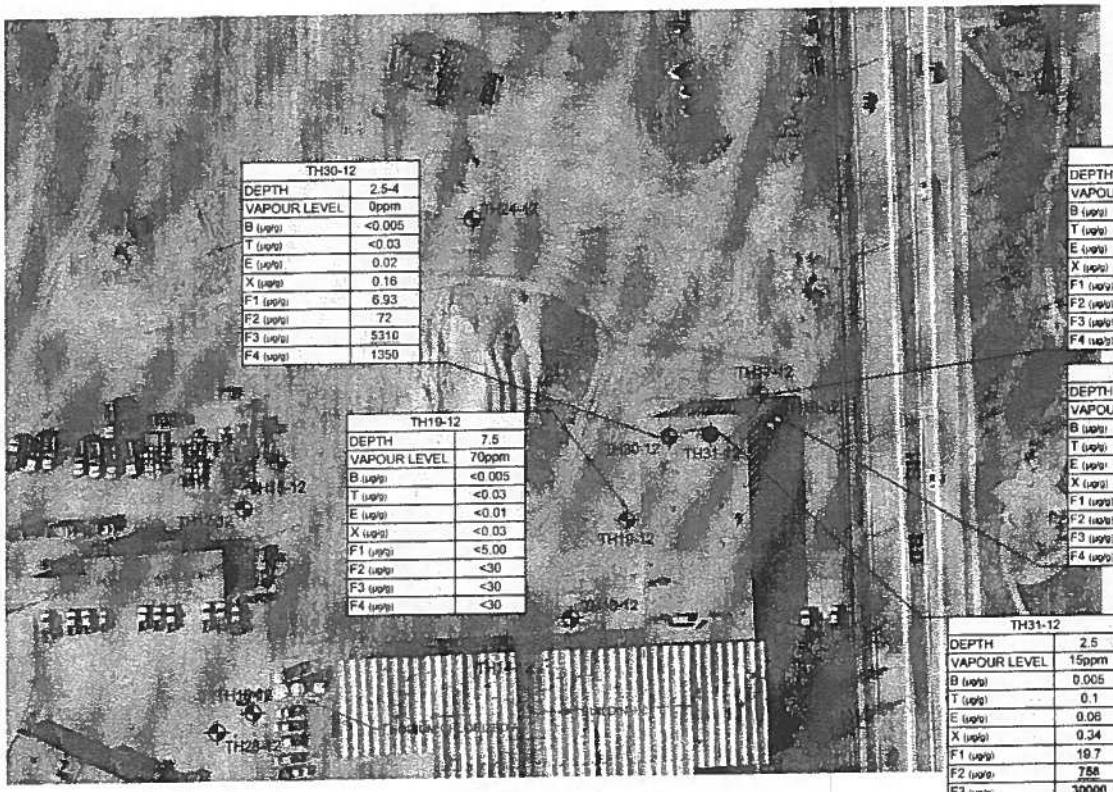
amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1500 PLESSIS ROAD

TITLE: IMPACTS ASSOCIATED WITH THE SALT/SAND OUTDOOR STORAGE AREA

DATE	JOB No.	CAD FILE	FIGURE No.	REV.
AUGUST 2012	WX16923O1	16923O1M01-2012 09 10	FIGURE 15	A



SCALE
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amec

CLIENT: CITY OF WINNIPEG

PROJECT: PHASE II ESA - 1600 PLESSIS ROAD

TITLE: IMPACTS ASSOCIATED WITH HYDRAULIC SYSTEM IN BUILDING A

DATE	JOB NO.	CAD FILE	FIGURE NO.	REV.
AUGUST 2012	WX1692301	1692301N01-2012 09 10	FIGURE 16	A