



**September 2015**

## **REPORT ON**

# **Landfill Status Report for Closed Landfills Winnipeg, Manitoba**

**Submitted to:**  
City of Winnipeg

**REPORT**



**Report Number: 1522283/1000**

**Distribution:**

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### GLOSSARY

Unit	Definition
µg/L	micrograms per litre
4H:1V	4 horizontal to 1 vertical
BTEX	benzene, toluene, ethylbenzene, and xylenes
C&D	Construction and demolition
CCME	Canadian Council of Ministers of the Environment
CFB	Canadian Forces Base
City	City of Winnipeg
CNR	Canadian National Railway
CP	Canadian Pacific
CWS	Manitoba Conservation and Water Stewardship
ha	hectares
KGS	KGS Group
LEL	lower explosive limit
m	metres
masl	metres above sea level
mg/L	milligrams per litre
MOE	Ministry of the Environment
PCB	polychlorinated biphenyl
TDS	total dissolved solids
TKN	total kjeldahl nitrogen



### 1.0 INTRODUCTION

Golder Associates Ltd. (Golder Associates) was retained by the City of Winnipeg (City), to provide professional consulting services relating to the City's Water and Waste Department closed landfills, as outlined under RFP No. 1199-2014. The study being completed, known as the Landfill Disposition Study, includes 33 landfill/dump sites generally located within the City of Winnipeg, Manitoba (see Figure 1) and will be completed in a phased approach, consisting of the completion of a series of reports for each site, including:

- Phase 1 – Landfill Status Report;
- Phase 2 – Landfill Environmental Risk Report;
- Phase 3 – Landfill Rehabilitation and Cost Estimate Report;
- Phase 4 – Landfill Land Use Potential Report; and,
- Phase 5 – Legal Risk and Responsibility Report.

The 33 landfills were operated from as early as 1875 to as late as 1998. Investigations undertaken by others in the area of the landfills have identified waste, and in some cases soil, groundwater, surface water, and landfill gas impacts, potentially associated with waste materials.

The potential impact that can occur from waste sites is influenced by factors such as the type and age of material deposited, depth of waste, cover material, and the local geology, hydrogeology and surface water bodies. As a result, investigations of areas where waste is known to have been deposited must assess and/or consider these factors in order to determine the potential for impact. Older waste fill areas containing little putrescible material and pre-dating use of industrial organics may be relatively innocuous, whereas those containing large amounts of organic material or liquid waste can continue to generate landfill gas or seepage even when a significant amount of time (like twenty-five years) has passed since closure of these sites.

This report fulfils Phase 1, the Landfill Status Report. The Landfill Status Report presents the current physical status of each of the 33 sites (cover, drainage, etc.) and its associated impacts on the environment in terms of leachate and landfill gas effects based on the most recent data electronically available coupled with a site visit of each location. No new intrusive investigation programs or sampling was completed as part of the Landfill Status Report.



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## WINNIPEG LANDFILL STATUS REPORT

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The Landfill Status Report is organized into the following sections:

- Background and Methodology – outlines the background of the landfill sites and at a high level the studies/work undertaken to date;
- Status Factors – describes the factors that influence the status and/or impacts associated with each site;
- Potential Impacts – describes the impacts, how they can occur and what regulatory requirements prevail;
- Status of the Closed Landfills – provides a status of each site; and,
- Closing – provides concluding statements for the Landfill Status Report.



### 2.0 BACKGROUND AND METHODOLOGY

Historically there was very little knowledge about the potential environmental impacts associated with waste disposal. As such, there was very little thought given to the establishment of a disposal site, let alone the subsurface conditions or the need for constructed protective containment and/or control measures. Similarly there was little to no thought given to the types of materials that were disposed in those sites. Sites were selected because they were available or offered, often were natural or man-made low lying areas that could be filled in, and at the time may have been separated by a reasonable distance from the developed municipal area. It was not until the 1970's and 1980's that there was a much better understanding of the long term potential impacts of landfills and their contents in terms of groundwater, surface water and landfill gas, and a much greater emphasis on environmental protection by the regulatory authorities. In the past two decades, there has been much heightened awareness and concern expressed by the general public, and even more so by owners of properties adjacent to old closed disposal sites and active sites.

In Winnipeg, there are 33 closed landfill sites. Each of the landfills has a unique setting, were operated during different time periods with different waste being deposited. Based on recommendations from programs previously undertaken by the City, there is a control zone around most of these landfills, in which there are limitations on development and land use. In 1993 the City retained KGS Group to complete a Landfill Site Disposition Study (KGS Group, 1993), hereafter referred to as the 1993 Disposition Study.

The City undertakes environmental monitoring programs once or twice per year at most sites. The monitoring is mostly landfill gas monitoring, but leachate, groundwater and surface water monitoring are also included at some sites.

Site visits of the 33 landfills were completed between June 15 and 18, 2015. The site visits were conducted by Ms. Megan Farnel (Golder Associates), who was accompanied by solid waste staff from the City of Winnipeg, Environmental Branch. The site visits were completed to become familiar with the setting of the sites and surrounding area, assess and document the current physical condition of the landfill, and view the monitoring locations/installations to assist in subsequent data interpretation. No drilling, sampling, measurements and/or chemical analyses were completed as part of this Landfill Status Report.

The primary reference sources that were consulted for this Landfill Status Report were: the 1993 Disposition Study; electronic results of surface water, groundwater, leachate and landfill gas monitoring programs carried out by the City at its disposal sites since that time; other reports electronically available about various sites provided by the City of Winnipeg; observations from the site visits; and City ownership, utility and topographical information supplied by the City of Winnipeg. In addition, the City has many historical hard copy files for the landfills. These were not reviewed extensively although when there were obvious gaps in information, these files were referenced.



### 3.0 STATUS FACTORS

The status of the site was reviewed and considered based on a series of factors. The following section describes each of the factors considered.

#### 3.1 Geological and Hydrogeological Setting

The regional surficial geology in the Winnipeg area is characterized by glaciolacustrine sediments of silt and clay. The upper 1 m to 3 m of this glaciolacustrine clay is referred to as a “complex zone” that has stratified silty clay and silt. High plastic glacial Lake Agassiz clay typically extends from near ground surface to depths ranging from 6 metres (m) to 18 m below grade. The upper silts and clays are underlain by approximately 3 m of silt till. The depth to bedrock is typically between 10 m and 20 m below ground surface, except in the northwest corner of the City near Sites 16 (Barry Avenue Dump Site), 17 (Harcourt Street Landfill Site) and 18 (Summit Road Landfill Site) where the bedrock is closer the ground surface. The underlying bedrock is Ordovician carbonate rocks. (University of Manitoba's Geological Engineering Maps and Report for Urban Development Winnipeg, 1983).

Within the upper clay soils, groundwater is present within silt and fine sand lenses and layers in the upper 3 to 5 m of the soil profile. Groundwater is also within fractures present in the clay mass. Regionally, the silt till at the base of the overburden soil profile is typically of sufficiently low hydraulic conductivity to limit the flow of significant volumes of groundwater, except when it has been fractured due to groundwater pressure from the bedrock aquifers underneath. The exception to this general observation is when higher hydraulic conductivity sand and gravel lenses are present within the till. These sand and gravel lenses are typically small but, where present, can form a significant pathway for the flow of water from the bedrock aquifer to the excavations aided by the removal of the restraining weight of the clay overburden. Notable occurrences of this in the southeast portion of the City include the excavations at the Floodway Inlet Structure and at the South End Pollution Control Centre (Baracos and Render, 1982).

There are three significant bedrock aquifers beneath the City. The largest is known as the Upper Carbonate Aquifer which is generally found within the upper few metres to as many as 30 metres of the carbonate bedrock profile. This aquifer is contained in an extensive network of fractures and karstic solution cavities formed by the dissolution of the upper carbonate rocks. Other aquifers include the Lower Carbonate Aquifer at the base of the carbonate bedrock profile and the underlying Winnipeg Formation sandstones. A Middle Carbonate Aquifer has also been encountered locally.

Prior to the start of development of the Upper Carbonate Aquifer in the late 1800's, the potentiometric surface was estimated to be approximately 3 to 6 m below ground surface in the central Winnipeg area. Extensive consumptive use of this groundwater resulted in a decline in the potentiometric surface to a depth of 21 to 24 m below ground surface. Consumptive use has declined since the early 1970's and since that time the potentiometric surface has been rising. Currently in the downtown area, the potentiometric surface is approximately 7 m below grade. Therefore, there is generally a downward hydraulic gradient from the upper clay soils to the bedrock.

The regional groundwater flow within the Upper Carbonate Aquifer is generally towards the Red River (the major discharge point for this aquifer), and in particular towards the St. Boniface Industrial Park on the east side of the river where consumptive groundwater use occurs.





### 3.2 Ground Cover

Typically, a final cover is placed over waste when a landfill is closed. The final cover can vary from fill material to compacted clay, or even a geomembrane cover. The type of cover material and the thickness will affect the rate of infiltration of precipitation that can then generate leachate, and the release of landfill gas to the atmosphere. If the cover has not been placed in a thick enough layer, or if erosion processes have occurred then waste can be exposed over time.

The final cover of a landfill is either seeded or allowed to naturally re-vegetate. Areas of stressed vegetation or low- to no-growth can be indicative of leachate impacts or landfill gas release. If an area is not properly vegetated then the cover will be prone to erosion and potential waste exposure.

Some of the closed landfills in Winnipeg have been developed and in these cases the landfill is covered with pavement for a parking lot or with a portion of a building.

### 3.3 Topography

The topography of a landfill and the surrounding area can contribute to potential impacts to the environment or may be evidence of settlement of the waste. The top of a landfill can either be at ground level (typically from a trench or pit method of waste disposal) or can be raised in a mound above the surrounding area. A modern landfill will have steeper side slopes and a gentler slope on the top to maximize air space of the landfill. If the side slopes are too steep there is the potential for slope failure or erosion due to surface water running down the slope. A very shallow top slope does not promote runoff and can result in either ponding and/or increased leachate production due to the increased infiltration of precipitation.

If the topography of a landfill is uneven or irregular, this may be indicative of waste settlement. As waste decomposes and compresses the top elevation of the landfill may start to settle. This often will happen in pockets and not evenly across the site. Settlement may result in ponding and/or increased leachate production due to the increased infiltration of precipitation.

### 3.4 Structures

Some closed landfills have no structures but others do, including buildings, light standards or play structures, for example. Review of the presence of the structures on or near a landfill can help in understanding potential risks or contaminant pathways. Landfill gas can accumulate in closed structures and cause an explosive hazard. Buried utilities to support structures could be a preferential pathway for landfill gas or leachate as the utility trench is typically constructed out of a permeable material like gravel.

### 3.5 Ownership

While the majority of the landfills are owned by the City, there are some that are privately owned. Further, the control zone is often not owned by the City. It is in the City's best interest to understand which sites are owned by the City and which are not. This information is readily available to the City and they should use this information in establishing priorities for site investigations as per this disposition study.



## 4.0 POTENTIAL IMPACTS

### 4.1 Landfill Gas

The natural biodegradation of construction and demolition (C&D) and putrescible waste in a landfill is expected to produce gas. The generated gases vary depending upon the stage of decomposition and the characteristics of the waste. The major constituents of landfill gas produced from putrescible waste are methane ( $\text{CH}_4$ ) and carbon dioxide ( $\text{CO}_2$ ), with small amounts of compounds such as hydrogen sulphide ( $\text{H}_2\text{S}$ ), mercaptans and non-methane organic compounds. The landfill gas is emitted to the atmosphere through the landfill cover or after it migrates some distance laterally through the subsurface.

The methane component of gas can pose an explosion hazard if trapped in an enclosed space at concentrations between the lower explosive limit of 5 percent methane gas by volume in air to the upper explosive limit of 15 percent methane gas by volume in air. Concentrations of methane in the vicinity of the waste area are monitored to ensure that methane is not migrating laterally and measures can be taken to control the landfill gas. These measures customarily take the form of vents constructed in the waste. The methane rising within the wells can be flared, or in cases of high methane production, collected for other uses such as energy generation or alternative fuel.

Since landfill gas is lighter than air, it will preferentially travel upwards. If the upward pathway is restricted by a low permeability material on the landfill or within the landfill then the landfill gas will begin to migrate laterally in the subsurface. The lateral migration of the landfill gas will take the path of least resistance, which includes more permeable material such as till, granular material for roadways or buried utility bedding, and fractures within clay. At some of the closed landfill sites in Winnipeg, landfill gas migration barriers, which take this preferential migration into consideration, have been installed to limit the lateral migration of landfill gas. Migration barriers then essentially force the landfill gas to vent vertically to atmosphere.

In Winnipeg, the primary focus of monitoring at the closed landfill sites has been landfill gas monitoring. Monitoring probes that have been installed in the waste would be expected to have the highest measurements of methane gas, while monitoring probes outside of the waste will have readings above 0 percent methane gas if the landfill gas is migrating or if there is another natural source, such as peat, that is producing the methane. An important consideration, especially given the high water table at many sites in the City is that probes used for assessing landfill gas migration have been installed such that the screen is at least partially located in the unsaturated soil horizon. Methane is also monitored within on-site buildings or buildings that are within the control zone surrounding the landfill. Measurements from buildings are typically taken from cracks in the floor, drains, or sometimes probes installed within the building.

For reference, under Ontario Regulation 232/98 (MOE, 1998) that applies to new or expanding landfills but is sometimes loosely applied to existing landfills, specifies methane concentration limits as follows:

- Less than 1.0 percent methane gas by volume in air in an on-site building, or its foundation;
- Less than 2.5 percent methane gas by volume in air in the subsurface at the property boundary; and,
- Less than 0.05 percent methane gas by volume in air in a building, or its foundation, that is located off-site.



The Standards and Guidelines for the Mitigation of Methane Gas at Buildings and Utilities and Guidelines for Construction on Landfill Sites (City, 2006) indicate the following levels:

- 1) Take Action Level – when a concentration of 1% methane gas is encountered consistently at any point source within a building; and,
- 2) Alarm Level – the detection in mid-air of a concentration of methane gas at or greater than 0.25% methane in air by volume.

### 4.2 Leachate

Leachate is a combination of precipitation that infiltrates through the cover into the waste as well as liquid from the waste itself as it decomposes. The leachate contains dissolved, suspended and/or microbial contaminants. The composition of the leachate depends on the composition of the waste. The quantity of leachate produced by a landfill is directly related to the climatological data of a given area (precipitation, humidity, temperatures, etc.) and the characteristics of the cover material (the less permeable a cover is, the less precipitation will infiltrate and therefore, less leachate is produced). A high groundwater table can also influence leachate quality and quantity.

As the leachate is produced within a landfill the leachate will move towards the groundwater table, if there is no barrier. If the base of the landfill is comprised of a low permeability material, such as clay, then the leachate will start to mound within the landfill since the rate of movement of the leachate out of the base of the landfill does not exceed the rate at which leachate is produced. If the mound becomes high enough within the landfill it may find a pathway out of the landfill through the cover on the side. These are called seeps. The mounded leachate also creates a hydraulic head, which will cause leachate to migrate into the groundwater (as discussed in the following section).

Leachate can be collected with the implementation of a leachate collection system. A leachate collection system can be installed prior to waste placement and would typically be comprised of a granular bedding material and perforated piping, graded in such a way as to collect leachate that can then be pumped out of the landfill to be sent for treatment. If a leachate collection system is implemented after waste placement (often times to correct leachate seeps), a perimeter leachate collection system can be used. A perimeter leachate collection system may consist of granular “finger drains” built into the side of the landfill and a granular trench with perforated piping surrounding the landfill. The leachate collected from the perimeter leachate collection system can then be pumped out to be sent for treatment.

The closed landfills in Winnipeg have varying depths below ground surface, heights, slopes, covers and leachate collection systems (or no leachate collection systems). For those landfills that have a leachate collection system the City has monitored the quality and quantity of the leachate that is collected.

### 4.3 Groundwater

As discussed previously, leachate mounded within a landfill can potentially impact the surrounding groundwater. The contaminants in the leachate can impact groundwater in a number of ways. The contaminant transport processes of groundwater from leachate include molecular diffusion, mechanical dispersion and advection. Other processes slow or attenuate the process of contaminant transport of groundwater from leachate and include adsorption onto soil solids and bio-chemical decay in the landfill and underlying soil layers. Typically,



low permeability soils, such as clay are often chosen as preferred sites on which to locate a landfill. The clay will slow advection and dispersion and increase the contaminant adsorption onto soil solids.

The direction of groundwater flow in an area of a landfill is important in understanding the areas that could potentially be at risk. Leachate impacted groundwater could impact the hydraulically downgradient users. In Winnipeg, the potential migration of leachate impacted groundwater is generally confined to the upper fractured zones of the clay, and/or via man-made conduits (such as utility trenches), or at locations where the underlying more permeable till comes close to surface.

Some of the closed landfill sites have groundwater monitoring wells from which groundwater is sampled on a regular basis. Historically, groundwater from a number of residential wells near the landfills was also sampled. As outlined in the Manitoba Conservation and Water Stewardship's (CWS's) Guideline "Environmental Site Assessments in Manitoba", the concentrations of parameters in groundwater samples are compared to Canadian Council of Ministers of the Environment (CCME) Canadian Environmental Quality Guidelines (CCME 1999) and the Health Canada Guidelines for Canadian Drinking Water Quality – Summary Table (Health Canada, 2012). If a standard does not exist in these guidelines for the parameter of concern then the Ontario Ministry of the Environment, Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act (MOE, 2011) is used. If a standard is still not found then the Government of Alberta, Alberta Tier 1 Soil and Groundwater Remediation Guidelines (Government of Alberta, 2010) is used.

### 4.4 Surface Water

Many of the closed landfills in Winnipeg do not have natural bodies of water nearby (such as rivers, lakes or streams), but many have nearby stormwater ditches and agricultural ditches. Surface water can become impacted by landfill leachate either by overland runoff that has come in contact with waste from the landfill or from impacted groundwater/leachate discharging to the surface water.

Precipitation that falls on a landfill either infiltrates through the cover and waste, thus contributing to leachate production, or runs off the side of the landfill to collect in nearby water bodies. If the surface water runoff comes in contact with waste it may become impacted with contaminants. If the surface water passes over bare ground it could carry sediment into the nearby body of water.

The other method by which surface water can become impacted is if leachate or leachate impacted groundwater discharges to the nearby body of water. If leachate is seeping from the sides of the landfill, it can flow into nearby bodies of water. Depending on the configuration of the landfill, the depth of the groundwater table below ground surface and the elevation of the nearby body of water, leachate impacted groundwater also has the potential to discharge to the body of water. Either method could potentially impact the surface water.

The City currently monitors surface water quality from surface water stations at some of the closed landfill sites. Surface water quality is compared to the CCME guidelines.



### 5.0 STATUS OF CLOSED LANDFILLS

Each of the status factors and potential impacts noted in the previous sections were considered for all sites. A summary of the status of each landfill is provided in Appendices A through FF. The appendices include the following sections:

- History – outlines the background of the landfill sites and the studies/work undertaken to date;
- Status – describes the observations and notes from the recent (June 2015) site visit;
- Monitoring – describes the groundwater, surface water, leachate and landfill gas monitoring programs that have been completed at each site, as applicable; and,
- Potential Impact – provides an interpretation of the status of each site as it relates to monitoring completed and the applicable regulatory requirements.



### 6.0 LIMITATIONS

This report was prepared for the exclusive use of the City of Winnipeg. The report, which specifically includes all tables, figures and attachments, is based on information provided by the City and is based solely on historical information and data obtained by Golder Associates during site visits. The City provided available electronic information for each site. Hard copies of additional historical documents for all of the landfill sites are stored at the City offices. Due to the quantity of these files, the review of these documents was out of the scope of this project, although they have been referenced on a limited basis. It has been assumed that the City has provided the relevant information required to complete this report. Reporting of results from the historical information provided does not allow for evaluation of the adequacy of the work completed.

Although comprehensive in nature, the data contained in this report should not be used in lieu of a more complete Phase I Environmental Site Assessment where such an assessment is required, for example, for a property transaction.

The information provided by the City has not been verified by any physical or intrusive methods other than visual inspection conducted during a visit of the sites. Consequently actual geographic limits of the footprint may extend beyond the boundaries shown on figures and the base of the waste may be different than what is reported.

The services performed, as described in this report, were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services.

Any use which a third party makes of this report, or any reliance on, or decisions to be made based on it, are the responsibilities of such third parties. Golder Associates accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The findings and conclusions of this report are valid only as of the date of this report. If new information is discovered in future work, including excavations, borings, or other studies, Golder Associates should be requested to re-evaluate the conclusions of this report, and to provide amendments as required.



### 7.0 CLOSURE

There are 33 closed landfills generally within the City of Winnipeg. The landfills vary in cover material, waste type, height, depth, controls, on-site uses and adjacent uses. The status of each landfill was summarized in the attached appendices. The findings of this report will be used in writing the Landfill Environmental Risk Report.

We trust this report meets your current needs. If you have any further questions regarding this report, please contact the undersigned.

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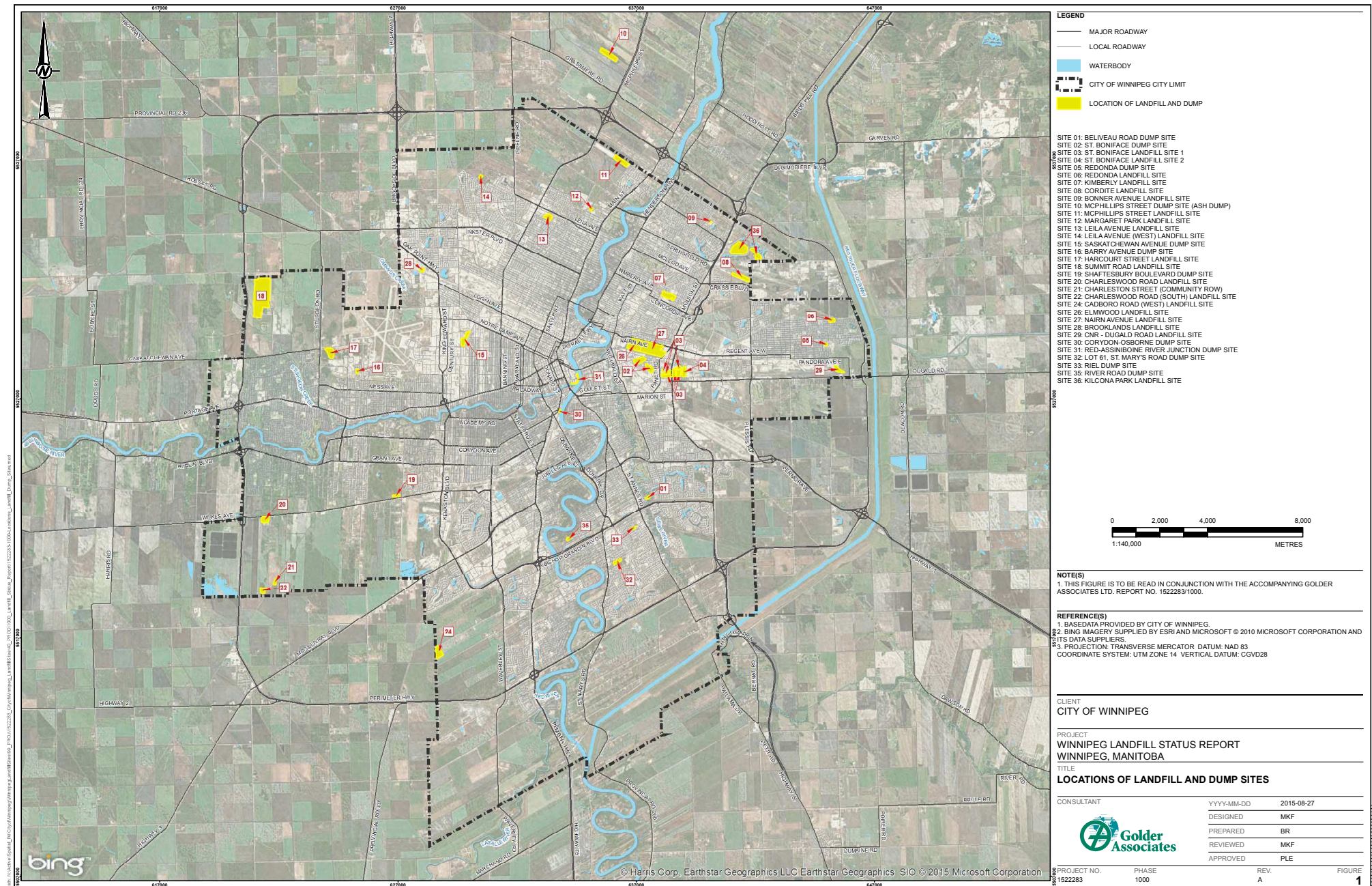
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# **APPENDIX A**

## **1. Beliveau Road Dump Site**





## APPENDIX A

### 1. Beliveau Road Dump Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Beliveau Road Dump Site (Site 1), located at 65 Marlene Street in Winnipeg, Manitoba, as illustrated on Figure A1. The Beliveau Road Dump Site covers an area of approximately 1.8 hectares (ha) and was operated by the Municipality of St. Vital from the 1950s until it closed in 1968. The landfill was used by private contractors with no extensive public use and the waste reportedly includes arsenic used for rat bait and ash from partially burned refuse.

In 1980, a drilling program was conducted at the Beliveau Road Dump Site, which included the drilling of 22 boreholes to depths ranging from 1.5 metres (m) to 8.5 m. The stratigraphy encountered at the Site reportedly included fill (gravelly, sandy clay) and/or topsoil to a depth of 2 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 22 boreholes drilled at the Site, 15 contained waste/refuse, including ash, glass, wire, cinders, ceramics, tin, metal, and/or wood. At another three locations, the surficial fill contained ash, glass, and/or cinders in the absence of buried waste/refuse. The average depth of waste, where present, was 2.4 to 3 m below ground surface, however, extended to a maximum depth of 6 m below grade at one borehole location described as being located in the southeast area of the Site, close to the bank of the Seine River.

Monitoring wells and/or landfill gas probes were installed in five of the boreholes and labelled as follows:

- P6E, drilled to a depth of 7.0 m below grade, located 23.8 m south of the corner post of the frost fence. Depth to water at this location ranged from 2.96 m below grade (March 2, 1982) to 6.46 m below grade (November 4, 1980);
- P7L, drilled to a depth of 7.0 m below grade, located 14.9 m south of P6E. Depth to water at this location ranged from 3.38 m below grade (February 17, 1981 and March 2, 1982) to 3.81 m below grade (November 1, 1983);
- P14E, drilled to a depth of 7.0 m below grade, located on the west side of the Site approximately 50 m east of the centre line of Marlene Street extended. Depth to water at this location ranged from 1.49 m below grade (June 3, 1985) to 6.80 m below grade (November 4, 1980). As of September 10, 2007, the leachate level was reportedly 2.18 m below grade;
- P17L, drilled to a depth of 7.0 m below grade, located approximately 25.9 m south of the centre line of Beliveau Road extended, 52.7 m south of the fence, and 19.2 m south of the hydro pole line (34.1 m from P14E). Depth to water at this location ranged from 3.22 m below grade (September 9, 1981) to 6.38 m below grade (November 4, 1980); and,
- L19, drilled to a depth of 8.5 m below grade, located in the southeast area of the Site, close to the bank of the Seine River. Depth to water at this location ranged from 3.54 m below grade (August 11, 1993) to 4.27 m below grade (November 1, 1983). As of September 10, 2007, the leachate level was reportedly 2.18 m below grade 3.85 m below grade.

Ground surface is at an elevation of 232 m above sea level (masl). The Seine River is at an elevation of 224 to 227 masl. The water level within the waste is reportedly at 228 masl.



## APPENDIX A

### 1. Beliveau Road Dump Site – Winnipeg Landfill Status Report

In May 1985, an additional borehole (labelled P23E) was drilled to a depth of 5.5 m and instrumented with a landfill gas probe. The probe was reportedly located at the north boundary, 1.4 m south of the extended property. The stratigraphy encountered at this location was described as topsoil overlying clay fill to a depth of 0.6 m below grade, underlain by silty clay. Water levels between 1990 and 2007 ranged from 2.12 m below measuring pipe to 2.67 m below measuring pipe. The elevation of the measuring pipe has not been recorded to date.

The cover material is undocumented; however, reportedly may have consisted of fill to up to 0.6 m in thickness. In 1992, the Site was being used as a snow dump. A 15 m landfill gas control zone was allotted for the Site in 1998 as shown on Figures A1 to A3.

The Site is located within a residential area and is used for informal recreation purposes. Constraints previously reported for the Site include insufficient cover, bank stability concerns, and soil salinity. High impact recreation which could cause surface erosion was discouraged.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Beliveau Road Dump Site. Findings from the most recent Site visit, completed on August 19, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, a residential development was noted to the north of the Site;
- The Site was mainly grass covered and treed in the buffer zones;
- The grass was well maintained at the Site; although the vegetation surrounding three existing landfill gas probes had not been trimmed;
- Some minor dumping of household waste was noted;
- No drainage or leachate issues were identified during the Site visit; and,
- Most probes on Site have been damaged and terminated.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from of Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat at the top of the landfill and sloped downward to the Seine River, which surrounds the Site on the north, east, and south sides. A residential development was noted to the west of the Site. The Site was mainly grass covered and treed in the buffer zones. Very little exposed debris was noted, although some debris could be seen at the southwest corner of the landfill as it slopes towards the river if the grass was removed. Previously exposed concrete debris noted along the slope to the Seine River was not readily evident.



## APPENDIX A

### 1. Beliveau Road Dump Site – Winnipeg Landfill Status Report

The waste boundary was fairly well defined and the Site was being used as a park and walking trail. Hydro lines were evident to the south. No groundwater monitoring wells, leachate collection systems or landfill gas migration barriers were noted. One landfill gas probe was present on-Site. Bollards had been placed at the entrance to the Site.

See attached Table A1 and Figures A1 through A3 for Site specific details. Site photographs are provided in Figures A4 through A6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Weekly landfill gas measurements were obtained from P6E, P7L, P14E, P17L, and L19 between October 21, 1980 and December 4, 1981. Monthly sampling was conducted at the same locations between January 1982 and May 1982, followed by quarterly sampling in 1993, semi-annual sampling between 1984 and 1989, and annual sampling between 1990 and 1994. In 1985, P6E, P7L, and P17L were replaced by P23E. Results were as follows:

- P6E – No methane was detected, with the exception of one occasion - April 13, 1981 0.05% methane by volume was measured. No readings were obtained after April 17, 1985;
- P7L – Methane fluctuated from non-detect to 0.15% by volume, measured on May 10, 1982. No readings were obtained after April 17, 1985;
- P14E – No methane was detected, with the exception of two occasions – January 8 and 14, 1981 0.025% methane by volume was measured;
- P17L – Methane fluctuated from non-detect to 0.10% by volume, measured on June 16, 1983. No readings were obtained after April 17, 1985;
- L19 – No methane was detected; and,
- P23E – No methane was detected during the sampling events occurring between 1985 and 1994.

Sporadic landfill gas sampling has been completed at P14E, L19, and P23E since 1994, including July 27, 1998, June 12, 2000, July 2, 2001, August 27, 2002, and September 10, 2007. The results were as follows:

- P14E – No landfill gas was detected during these sampling events;
- L19 – Landfill gas was detected at 0.04% by volume on June 12, 2000 and at 2% by volume on August 27, 2002. No landfill gas was detected during the remaining sampling events; and,
- P23E – No landfill gas was detected during these sampling events.



## APPENDIX A

### 1. Beliveau Road Dump Site – Winnipeg Landfill Status Report

During a Site visit completed on July 5, 2011, P14E and L19 could no longer be located; however, a landfill gas reading was obtained from P23E. The methane concentration was 1% of the lower explosive limit of methane and the hydrogen sulfide (H<sub>2</sub>S) reading was 0 parts per million. The casing was broken and the cap was stuck. The remaining landfill gas probes and leachate well could not be located.

By July 18, 2013, the methane concentration at P23E was below the detection limit of the measuring device and the hydrogen sulfide (H<sub>2</sub>S) reading was 0 parts per million. The casing remained broken and the cap was stuck. Two other gas probes were located (P14E and L19); however, were too damaged to collect a landfill gas reading. Three previously installed landfill gas probes could not be located (i.e. P17L, P6E, and P7L).

## 3.2 Groundwater

### 3.2.1 Leachate

One leachate probe was located on the Site for groundwater monitoring (L19); however, this leachate probe can no longer be located and there is no current or ongoing groundwater monitoring program conducted at the Site. Details of the screen installation in this probe are unknown, although it is known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in this probe and that the probe is representative of leachate quality.

Groundwater sampling was conducted five times at the Site between May 6, 1981 and July 24, 1989 and annually (i.e. four additional times) between 1992 and 1995, although the 1995 results were not available for review. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Results were compared to both the CCME water quality guidelines for the protection of aquatic life as the Seine River is in close proximity to the Site and groundwater will likely discharge to surface water and to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 as the area in the vicinity of the Site has the potential for uses as a potable water supply.

## 3.3 Surface Water

A semi-annual (Spring and Fall) surface water monitoring program is carried out at the Site at upstream and downstream locations.

Ten sets of upstream and downstream surface water samples have been collected at the Site between April 2008 and April 2015. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total coliform, fecal coliform, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, turbidity, conductivity, calcium, magnesium, manganese, iron, sodium, arsenic, potassium, cadmium, chromium, copper, nickel, lead, and zinc.



## APPENDIX A

### 1. Beliveau Road Dump Site – Winnipeg Landfill Status Report

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1985 to 1992 – two wells were installed outside the waste fill area and one was installed within the waste fill area (also used for leachate sampling). No detectable landfill gas was reported;
- 1998 – A 15 m control zone was implemented at the Site (with the exception of an area along the Seine River on the northern portion of the Site. The River would act as a natural barrier to migration of landfill gas at this location; and,
- 2013 – Only one remaining gas probe in 2013 (P23E). No detectable landfill gas was reported.

To date there is no indication of landfill gas migration. Based on the type of waste reported at this location (i.e., ash, glass, wire, cinders, ceramics, tin, metal, and/or wood), the potential for landfill gas generation (with the exception of the presence of a small amount of wood waste) is limited. As the Seine River provides a natural barrier to migration of landfill gas, migration to the north, south, and east is limited. The depths to water at the Site are also quite shallow (2.65 m below grade) at P23E, which extends to a total depth of 5.8 m below grade. The non-detectable methane concentrations at this location may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen.

### 4.2 Groundwater

#### 4.2.1 Elevations

The depth to water measured in 1989 and 1990 in the leachate well installed within the waste fill area was 4 m below grade, while the water level outside the waste fill area was 2.07 m below grade in 1990. There is no ongoing monitoring program.

#### 4.2.2 Leachate

Based on analytical results from L19, collected between 1981 and 1994, chloride and several metals, including cadmium, copper, nickel, lead, and/or zinc were elevated above the CCME Water Quality Guidelines for the protection of aquatic life during the five groundwater sampling events. When compared to the Health Canada Drinking Water Quality Guidelines, cadmium and chromium exceeded their respective maximum allowable concentrations. The remainder of the exceedances were of aesthetic guidelines only.

It appears that the groundwater has been impacted by the presence of buried waste although no current data or background water quality data is available for review.



## **APPENDIX A**

### **1. Beliveau Road Dump Site – Winnipeg Landfill Status Report**

#### **4.3 Surface Water**

The concentration of iron exceeds the CCME Water Quality Guideline of 0.3 mg/L in both the upstream and downstream locations during all sampling events. Unionized ammonia exceeded the CCME Water Quality Guideline of 0.019 mg/L in both the upstream and downstream locations on one occasion (September 2008) and copper exceeded the CCME Water Quality Guideline on one occasion (May 2014). The remainder of the analysed surface water samples were less than their respective CCME Water Quality guidelines.

Based on the available results, concentrations of analysed parameters are either consistent or generally lower in the downstream sample than in the upstream sample indicating that there is little impact from buried waste to the surface water in the vicinity of the Site.



**TABLE A1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 1  
**Site Name** Beliveau Road Dump Site

**Landfill Operation**

<b>Waste type</b>	Used by private contractors, no extensive public use, includes arsenic used for rat bait, ash
<b>Start date</b>	1950s
<b>End date</b>	1968
<b>Operated by</b>	Municipality of St. Vital
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.8		
Depth of waste below ground surface (metres)	Average 2.4 to 3, maximum 6		
Height above ground surface (metres)	0		
Slope %	--	Cover thickness (metres)	0 - 0.6
Cover material	Potentially Fill (undocumented)		
Comment on slopes	Historical stability concerns		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg, with the exception fo the southern 15 m control zone, north of the Seine River
<b>Current</b>	Informal recreation. Raised planting bed and pathway installed on the surface in 2014
<b>North</b>	Seine River
<b>East</b>	Seine River
<b>South</b>	Seine River
<b>West</b>	Residential
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	232	<b>Groundwater flow direction</b>	North/Northwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Seine River		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	228.6	<b>Max</b>	229.8
<b>Minimum clay thickness below base grades (metres)</b>		12.5		
<b>Minimum depth to till (metres)</b>		18.6		
<b>Minimum depth to bedrock (metres)</b>		18.6		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	228.0	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	1 leachate probe	<b>Current</b>	None
<b>Current surface water</b>	Yes			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Historical stability concerns
<b>Erosion</b>	Yes
<b>Seeps</b>	No
<b>Other</b>	None



BELIVEAU RDE

SEINE RIVER


## SEINE RIVER


15 m



15 m

**LEGEND**

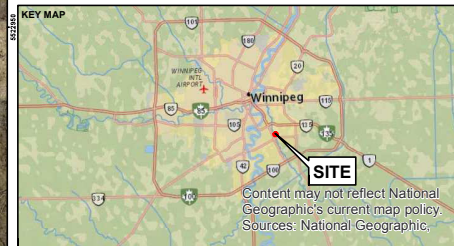
 LANDFILL FOOTPRINT

 CONTROL ZONE AREA

 ROAD

 LANDFILL FOOTPRINT CONTROL ZONE AREA

ROAD



0 10 20  
1:1,000 METRE

1:1,000 METRE

**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

CLIENT  
CITY OF WINNIPEG

PROJECT  
WINNIPEG LANDFILL STATUS REPORT  
SITE 1: BELIVEAU ROAD DUMP SITE, WINNIPEG, MANITOBA

## SITE PLAN

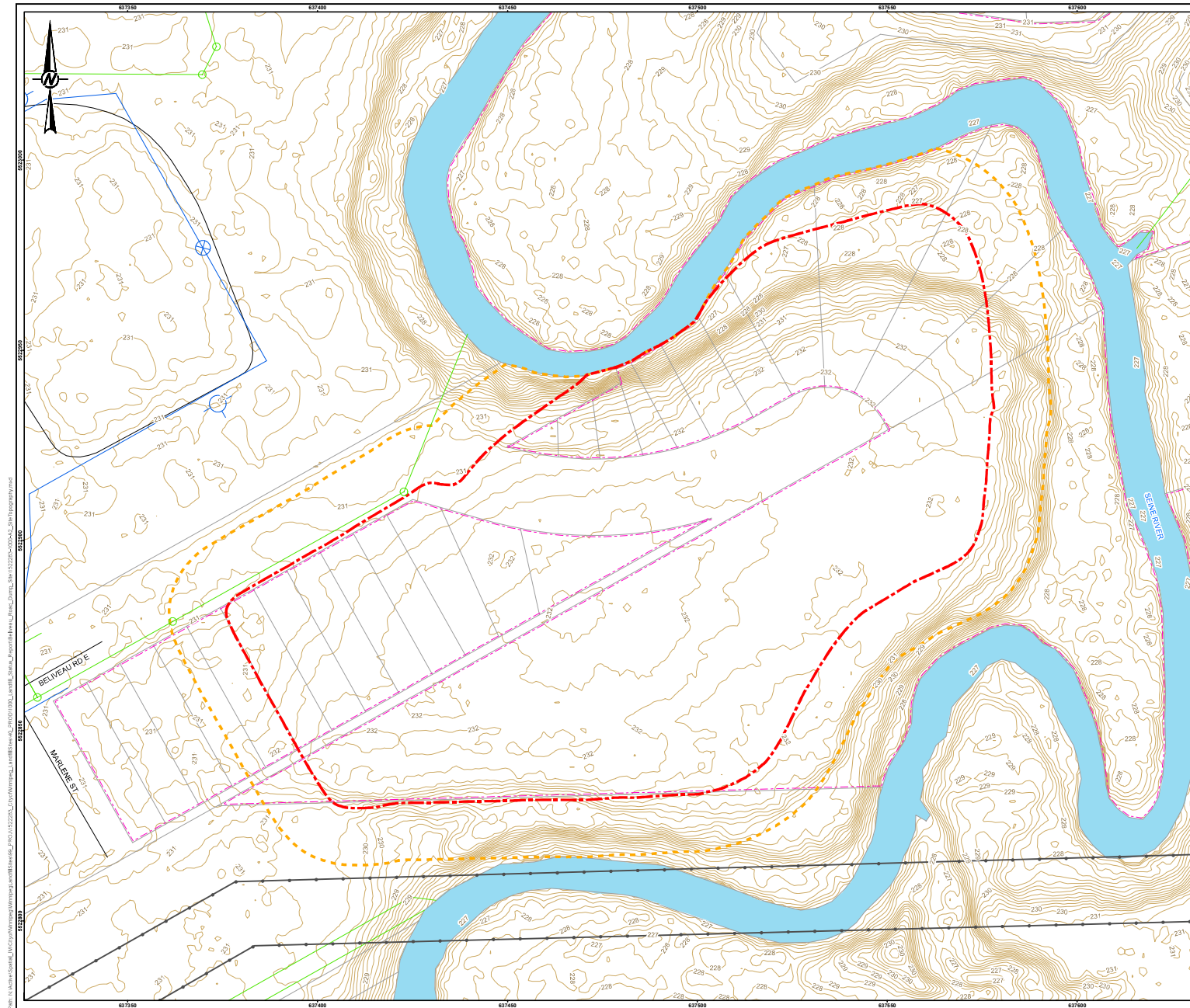
622303  <b>Golder Associates</b>	CONSULTANT	YYYY-MM-DD	2015-06-29
		DESIGNED	MKF
		PREPARED	BR
		REVIEWED	MKF
		APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	A1

PHASE  
1000RE  
A

FIGURE  
A1





- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL
  - RIVER
  - ROAD
  - TOPOGRAPHIC CONTOUR, metres
  - UTILITIES
    - SANITARY SEWER
    - WATER MAIN
    - POWER TRANSMISSION LINE (OVERHEAD)




**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 1: BELIVEAU ROAD DUMP SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

	CONSULTANT	YYYY-MM-DD	2015-06-29
	DESIGNED	MKF	
	PREPARED	BR	
	REVIEWED	MKF	
	APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE **A2**

\\golder\projects\1522283\1522283\_01\_Site Topography.dwg, 2015-06-29, 1522283\_01\_Site Topography.dwg

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM

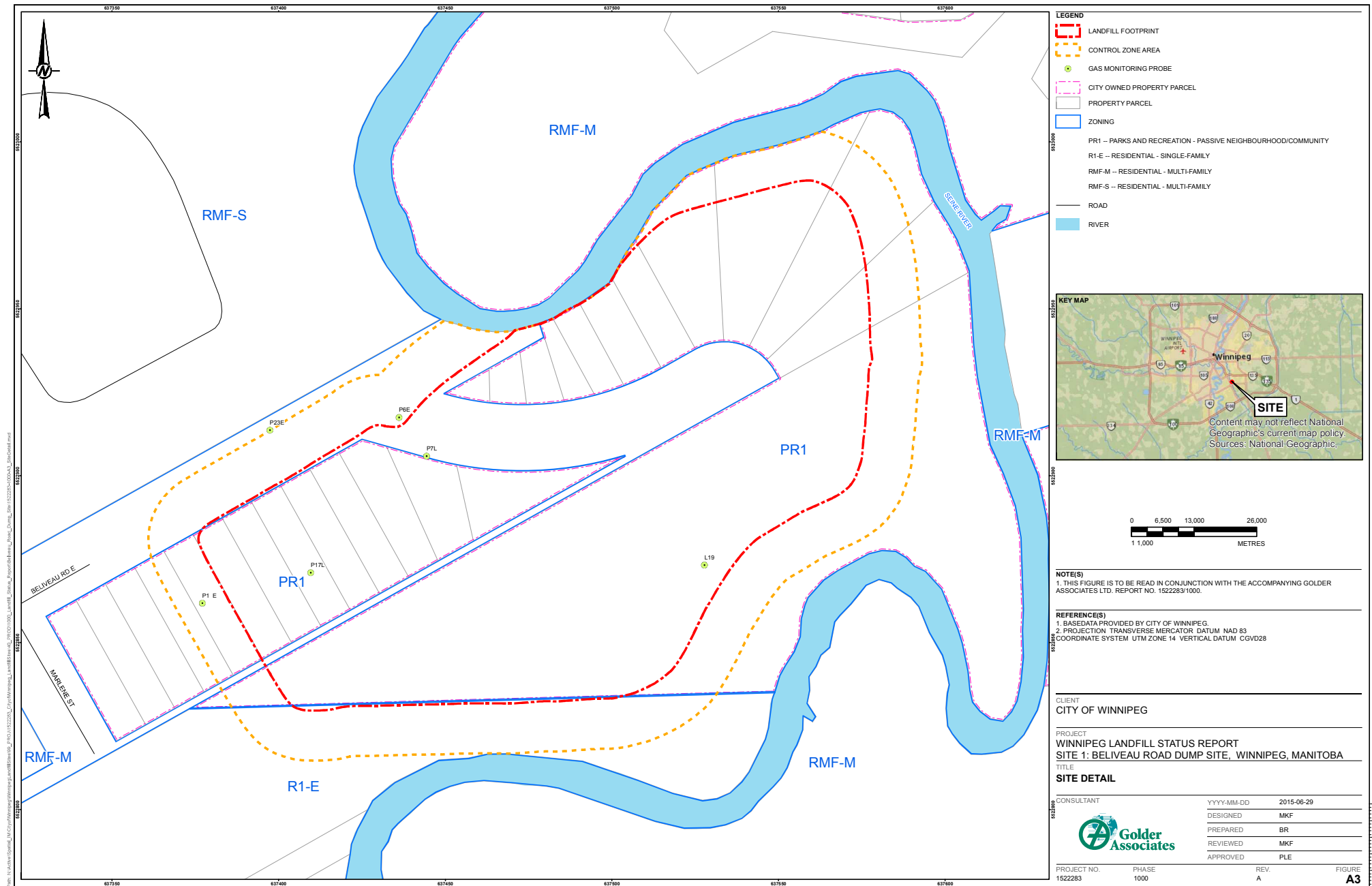







Photo A1  
Entrance to Dump Site off Marlene Street  
looking northeast



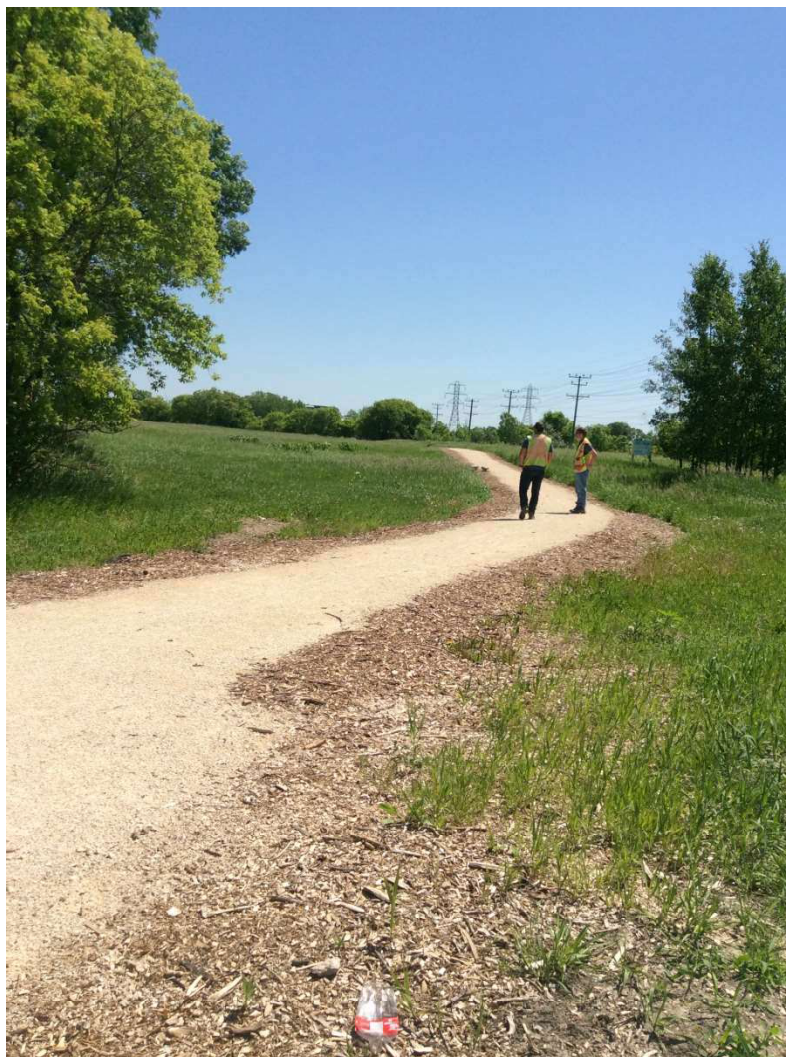
Photo A2  
East slope of landfill looking east across the  
Seine River

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 1: BELIVEAU ROAD DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MPF Sept 2015		
				REVIEW	PLE Sept 2015		
				FIGURE A4			






**Photo A3**  
Southern portion of Dump Site looking east



**Photo A4**  
Northern portion of the Dump Site  
looking north

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 1: BELIVEAU ROAD DUMP SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLF Sept 2015			
		FIGURE A5			






**Photo A5**  
**North side of Dump site looking east along  
the Seine River**



**Photo A6**  
**North slope of landfill to Seine River looking  
south up the bank**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 1: BELIVEAU ROAD DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF	Sept 2015	
				REVIEW	PLE	Sept 2015	
				<b>FIGURE A6</b>			



# **APPENDIX B**

## **2. St. Boniface Dump Site**





## APPENDIX B

### 2. St. Boniface Dump Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the St. Boniface Dump Site (Site 2), located at 212 Panet Road in Winnipeg, Manitoba, as illustrated on Figure B1. The St. Boniface Dump Site covers an area of approximately 11 hectares (ha) and was operated by the City of Winnipeg from the 1900s until 1954. Waste was disposed of using both the surface method in the older area and the trench method in the newer area. There are two landfills (one more to the south and one more to the north). It is unknown which area was used first for waste disposal.

A subsurface investigation was undertaken at some point after the closure of the landfill and consisted of at least 80 boreholes. Borehole logs or details of the investigation were not available for review. Landfill gas probes were installed in nine of the boreholes and labelled as follows: P3E, P10L, P27E, P34E, P37E, P39E, P46E, P47E and, P48E. It is noted that P27E, P34E and P3E are labelled as external to the landfill but review of Figure B3 indicates that these probes are within the waste footprint. Refuse may not have been encountered at these locations during drilling.

Ground surface is at an elevation of 232 m above sea level (masl). The water level within the waste is reportedly at 231 masl. The cover material consists of fill 0.6 m to 1.8 m in thickness. The north portions of the Site have been previously used as a biofarm to treat contaminated soil ex-situ. A 45 m landfill gas control zone was allotted for the northern landfill portion of the Site in 1988 as shown on Figures B1 to B3. The Site is located within an industrial area and is used and owned by Shell Canada (Shell). The Site is used as a petroleum product terminal.

### 1.1 Previous Site Visits

The City does not regularly visit the Site and no inspection reports were available for review.

## 2.0 LANDFILL STATUS

A Site visit was conducted on June 18, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch and by staff from Shell. Due to safety concerns, electronic devices such as cameras were not permitted. Also, due to safety concerns, the Site was observed from within a vehicle.

At the time of the Site visit, the Site was generally flat. The area surrounding the Site is all industrial. The Site is owned by Shell and is used as a petroleum product terminal. A large tank farm is present over the southern landfill. It was assumed that the foundations for the tanks were fairly deep below ground surface. The buildings in the area of the landfill are open air buildings or are elevated on piles that extend approximately 10.7 m below ground surface. The building construction is a deterrent to methane accumulation within a building. The tank farm area did not have any vegetation because it is discouraged by the owners since it is a fire hazard. Pieces of wood were observed pushing up out of the ground. This is reportedly a regular occurrence.

The northern landfill was mostly unused. A portion of the northern landfill was reportedly formerly used as a biofarm to treat contaminated soil ex-situ. The western land of the northern landfill is leased to a concrete company. The ground cover on the northern landfill was either grass, gravel roadways, or grass that was in the process of growing. Pieces of coloured glass are reportedly found periodically in this area.



## **APPENDIX B**

### **2. St. Boniface Dump Site – Winnipeg Landfill Status Report**

No leachate collection systems or landfill gas migration barriers were noted. Some landfill gas probes were present on-Site. Shell hires a consultant to do regular groundwater and methane monitoring as part of their operations. The results of this monitoring are not provided to the City and were not available for review.

See attached Table B1 and Figures B1 through B3 for Site specific details. Photographs were not permitted during the Site visit.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No drill logs or information regarding screen elevations was provided.

Landfill gas measurements were obtained from the landfill gas probes from 1982 until 1992. The measurements started bi-monthly at P3E, P10L, P27E, P34E, P37E, P39E and P45E. The location of P45E is unknown. The measurements reduced over time until 1985 when the monitoring was conducted annually. In 1986 three additional gas probes on the boulevard (assumed to be on Plinquet Street) were added to the monitoring program. Those three additional probes are not named, it is assumed that they are P46E, P47E and, P48E. Results were as follows:

- P10L (located within the waste footprint) – methane was detected at greater than 10% of the lower explosive limit (LEL) until 1987 when future monitoring events were non detect;
- P3E, P27E and P34E – methane was detected at less than 20% LEL in 1982;
- P3E (located reportedly outside of the waste footprint, but based on Figure B1, is located within the waste footprint) – methane was detected at greater than 20% LEL in 1983 and 1984; and,
- From 1985 until 1992 methane was not detected in any of the probes other than P10L.

### **3.2 Groundwater**

There is no evidence of historical groundwater monitoring at this Site.

### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.



## APPENDIX B

### 2. St. Boniface Dump Site – Winnipeg Landfill Status Report

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1982 to 1992 – ten landfill gas probes were monitored over time. No detectable methane was reported in landfill gas probes located outside of the waste footprint from 1985 onwards and no detectable methane was reported from the landfill gas probe located in the waste footprint from 1987 onwards; and,
- 1988 – A 45 m control zone was implemented for the northern landfill.

To date there is no indication of landfill gas migration and the landfill gas production of the waste has decreased. Based on the presence of wood there is the potential for landfill gas to continue to be generated. Sanitary sewers and water mains are located to the north of the Site and could potentially act as a preferential pathway for landfill gas migration. The depths to water at the Site are also quite shallow (approximately 1 m below grade). The non-detectable methane concentrations may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen.

### 4.2 Groundwater

There are no current, or historical, monitoring results for groundwater available for review.

### 4.3 Surface Water

There are no current, or historical, monitoring results for surface water available for review.

**TABLE B1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 2  
**Site Name** St. Boniface Dump Site

**Landfill Operation**

<b>Waste type</b>	Undocumented, southern portion includes construction and demolition waste (wood) and the northern portion is unknown waste but includes glass
<b>Start date</b>	1900
<b>End date</b>	1950, moved 1954
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Surface (old), trench (new)
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	11		
Depth of waste below ground surface (metres)	5.8		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	0.6 - 1.8
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	--		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	Elevated buildings
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	Private - Shell Canada
<b>Current</b>	Shell terminal (tank farm) and biofarm
<b>North</b>	Industrial
<b>East</b>	Industrial
<b>South</b>	Industrial
<b>West</b>	Industrial
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	232	<b>Groundwater flow direction</b>	South/Southwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Ditches throughout Site		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	230.4	<b>Max</b>	232.0
<b>Minimum clay thickness below base grades (metres)</b>	7.9			
<b>Minimum depth to till (metres)</b>	13.7			
<b>Minimum depth to bedrock (metres)</b>	15.2			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.0	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	Yes - by others
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes - by others			

**Notable 2015 Site Visit Observations**

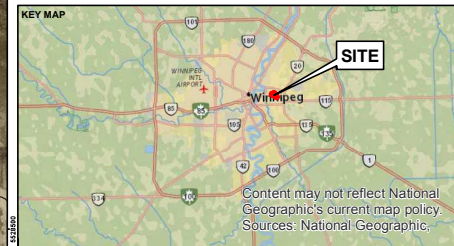
<b>Settlement/slopes</b>	--
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Pieces of wood and coloured glass are found pushing out of the ground periodically.





LEGEND

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD



NOTE(S)  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

REFERENCE(S)  
1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

CLIENT  
CITY OF WINNIPEG

PROJECT  
WINNIPEG LANDFILL STATUS REPORT  
SITE 2: ST. BONIFACE DUMP SITE, WINNIPEG, MANITOBA

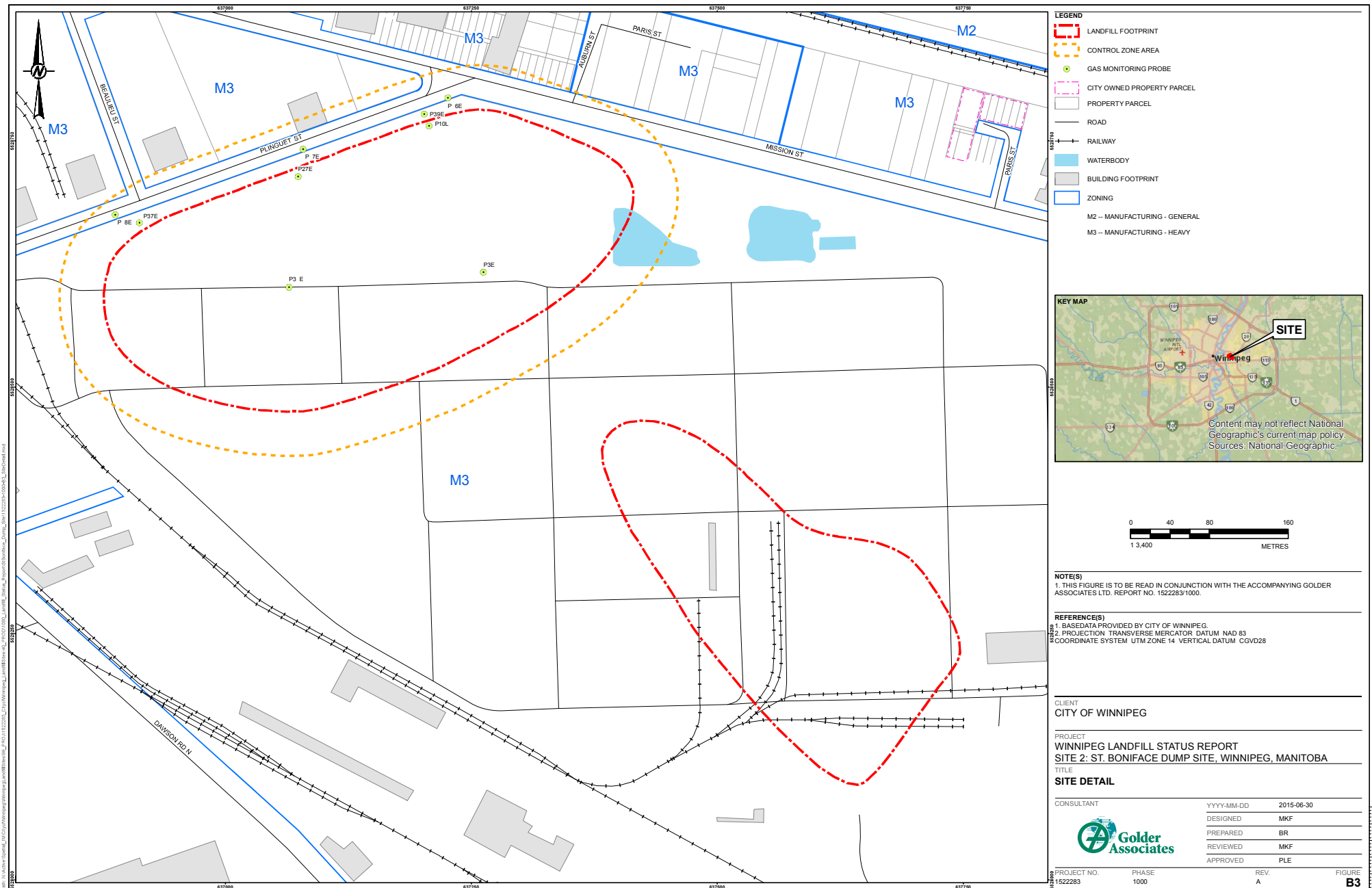
TITLE  
SITE PLAN

CONSULTANT	YYYY-MM-DD	2015-07-15
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE B1









# **APPENDIX C**

## **3. St. Boniface Landfill Site 1**





## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the St. Boniface Landfill Site 1 (Site 3), located at multiple locations on either side of Lagimodiere Boulevard near Warman Road in Winnipeg, Manitoba, as illustrated on Figure C1. The St. Boniface Landfill Site 1 covers an area of approximately 18.7 hectares (ha) and was operated from the early 1950s until the late 1960s. The landfill was used primarily for disposal of rendering waste. The portion of the landfill north of Warman Road is the old Warman Dump.

During the 1970s, legal action associated with methane production for this landfill prompted the start of the environmental investigation and monitoring program for closed landfills in the City of Winnipeg.

In 1980 and 1981, a drilling program was conducted at the St. Boniface Landfill Site 1, which included the drilling of 88 boreholes to depths ranging from 1.2 metres (m) to 8.2 m. The stratigraphy encountered at the Site reportedly included fill (gravelly, sandy clay), topsoil or road bed material to a depth of 0.3 m to 3.3 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 88 boreholes drilled at the Site, 50 contained waste/refuse, including hair, animal horns, black clay, fibrous material, straw, wood shavings, manure, paper, fibres, metal and rags. The depth of waste was greater than 4 m below grade at some locations. Monitoring wells and/or landfill gas probes were installed in at least 26 of the boreholes.

In 1987 nine additional boreholes (H-133 to H-141) were completed at the Site as part of the report titled, "Review of Landfill Gas and Leachate Conditions at the St. Boniface and Cordite Landfills", submitted by Keil & Associates Ltd. and dated May, 1987. The boreholes ranged in depth from 5.5 to 7.6 m below ground surface. Eight of the nine boreholes contained refuse.

In 1988 the 4N153, 4N154 and 4N155 nests of groundwater monitoring wells were installed, with the shallowest well at each location labelled as A (completed within the upper clay) and the deepest well at each location labelled as D (completed at borehole refusal).

In 1989, groundwater monitoring wells W1 and W2 were completed in bedrock.

In 1990, eight test pits and seven boreholes were completed at the Site in the area of a proposed transfer station (TS-1 through TS-15). Refusal (likely bedrock) was noted at a depth of 14.3 m below ground surface.

The City has been approached numerous times to develop portions of the Site lands. Investigations have been undertaken by consultants for potential purchasers. The following investigations were noted:

- In 2007 an investigation was undertaken by [REDACTED] that included boreholes drilled at seven locations at 221 Panet Road (west end of Site). Fill material was noted from 0.8 m to 6.4 m thick and refuse was found at depths ranging from 2.3 m to 5 m below ground surface;
- In 2008 a subsurface investigation was undertaken by [REDACTED] towards the east end of the Site. An average of 1 m of waste was observed with the deepest waste being 4 m; and,



## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

- In 2014 a subsurface investigation (including drilling, soil sampling and groundwater sampling) was undertaken by [REDACTED] and covered the majority of the Site. Seven test pits were advanced to an average depth of 3.66 m below ground surface and twelve boreholes were advanced from 4.6 to 18 m below ground surface. Fill varied from 0 to 4 m below ground surface and refuse varied from 2 to 6.5 m below ground surface. Till was noted at depths greater than 13.5 m below ground surface. The investigation is outlined in a draft report titled, “Environmental Site Investigation – Former St. Boniface Landfill, Winnipeg, Manitoba” dated June 2014. The report has a comprehensive table in the executive summary outlining the waste characteristics, soil impacts and groundwater impacts for different parcels across the Site. The report indicates petroleum hydrocarbon impacts in groundwater, and benzene, toluene, ethylbenzene and xylene (BTEX) and metal impacts to on-Site soil. The report also includes detailed cross-sections of the landfill.

Ground surface is at an elevation of 233 to 234 m above sea level (masl). The water level within the waste is reportedly at 230 to 232 masl. The cover material is undocumented; however, reportedly may have consisted of fill of an unknown thickness. Waste is expected to be approximately 6 m below the surrounding ground surface. A 45 m landfill gas control zone was allotted for the Site as shown on Figures C1 to C3.

The Site is located within an industrial area and is comprised of vacant land, an asphalt plant and a storage building (all west of Lagimodiere Boulevard). Constraints previously reported for the Site include high landfill gas production and potential for leachate breakouts.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the St. Boniface Landfill Site 1. Findings from the most recent recorded Site visit, completed on July 9, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- Three buildings are located on the Kildonan Concrete Site;
- The Site has overgrown grass, thistles and trees throughout the landfill;
- There are some signs of stressed vegetation;
- Some minor dumping was noted with a large dirt pile observed near probe 2 and concrete near P23E;
- No drainage, erosion, slope stability or leachate issues were identified during the Site visit;
- There are two unlisted probes west of P10L; and,
- Twenty-six landfill gas probes were located and could be monitored.



## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was situated within an industrial area. The Site extends across many different properties and the uses include vacant land, storage building (southeast of the intersection of Warman Road and Lagimodiere Boulevard), an asphalt plant (at the south end, west of Lagimodiere Boulevard), soil blending (at the east end) and storage yards. The Site is predominantly owned by the City and the City owned land is leased to the different users. Each section of the Site is separated by roadways.

The Site is fairly flat and the ground cover varies from grass, shrubs, and dirt to paved parking lot. No stressed vegetation was observed. A building was formerly located south of Warman Road between Fournier Street and Lagimodiere Boulevard. The building was removed due to issues with settlement and landfill gas. Some rebar was noted on the ground in this area from the building. Some dumping of waste was noted at Warman Road east of Lagimodiere Boulevard.

A stormwater pond is located north of the east end of the Site and roadside ditches are located throughout the Site. A natural gas pipeline runs along the south end of the Site. The pipeline is not shown on Figure C2 as it is not City owned. Railroad tracks are located to the east.

The storage building (southeast of the intersection of Warman Road and Lagimodiere Boulevard) on-Site has been made into an open air building to protect against methane accumulation. Within the control zone is a tire store (at the southwest corner of Warman Road and Lagimodiere Boulevard). The building for the tire store has passive air venting as a measure to protect against methane accumulation.

No leachate collection systems or landfill gas migration barriers were noted. Probes were noted around the Site. It was noted that some of the probes have been installed and monitored by other consultants for clients interested in developing the land. A transfer station had previously been considered for the Site in the area of MH1 and MH2. This area is now used by an asphalt plant.

See attached Table C1 and Figures C1 through C3 for Site specific details. Site photographs are provided in Figures C4 through C7.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Landfill gas measurements were obtained from 16 to 26 landfill gas probes between 1980 and 1992. The measurements started off as weekly and reduced to annually by 1986. Methane was being measured at 60 to 80% methane by volume in air at the majority of locations completed within the landfill and greater than 20% lower explosive limit (LEL) at the majority of locations outside of the waste footprint during 1980 until 1982 at which point the methane concentrations were decreasing both within the landfill (30 to 70% methane by volume in air) and in the probes completed outside of the waste footprint for which more monitoring sessions did not detect methane. In 1986 the concentrations within the landfill ranged from 0.6% methane to 55% methane by



## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

volume in air. By 1992, of the seven probes monitored within the waste footprint, five had methane at concentrations greater than 100% LEL and two did not detect methane. Of the nine probes monitored outside of the waste footprint, six did not detect methane, one detected methane at less than 20% LEL and two detected methane at concentrations greater than 20% LEL.

Handwritten field notes for methane monitoring at P77E were available from 1992 until 2010. During that time methane concentrations varied from not detected in 2007 to 24% in 2008 (it is unknown if this is LEL or methane by volume in air).

Landfill gas monitoring occurred at the following landfill gas probes during 2011, 2013 and 2014: P55L (2011 only), W1, P61E, P103E, P102E, P101E, P100E, P104E, P9L, P88E (2011 and 2013), P77E, W2, P23E, L147, L145, 4N155A, 4N155B, 4N155C, 4N154A, 4N154B, 4N154C, 4N154D. Methane was not detected during the recent monitoring events since 2011 with the following exceptions:

- Less than or equal to 2% methane by volume in air at P101E, P104E and P9L (2013 and 2014);
- L147 – 14% methane by volume in air (2013 and 2014);
- Less than 5% LEL at P104E, P88E, P23E in 2011;
- Between 5 and 15% methane by volume in air (i.e. the explosive range) at P10L and P9L in 2011; and,
- Less than 20% LEL at P8L, 4N155B and L147 in 2011.

Monitoring within commercial buildings is undertaken annually at two locations near the Site (1025 Dugald Road is south of the Site and 140 Warman Road is the tire store north of the Site). There are five floor probes (P1, P1A, P2, FP-1 and FP-2) at the Dugald Road property. Methane from floor joints, cracks and vent stack are monitored at the Warman Road property. Methane was not detected at these properties in 2013 or in 2014 (only Dugald Road property was monitored in 2014).

## 3.2 Groundwater

### 3.2.1 Leachate

Groundwater sampling was conducted annually in 1986, 1988 through 1993 and 2008 at three to sixteen locations each year. Leachate sample locations include P8L, P9L, P12L, P21L, P48L, P53L, L147, L151, L152, MH1 and a “break-out” and from the proposed transfer station site. Samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate + nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, total coliform, fecal coliform, fecal streptococcus, standard plate count, conductivity, chemical oxygen demand, turbidity, volatile fatty acids, ammonia, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

### 3.2.2 Groundwater

Groundwater sampling was conducted annually in 1989 through 1993, 1995 and 2008 at three to sixteen locations each year. Sample locations include P100E, 4N153A, 4N153B, 4N153C, 4N153D, 4N154A, 4N154B, 4N154C, 4N154D, 4N155A, 4N155B and 4N155. Groundwater sampling was conducted at on-Site bedrock monitoring wells W1 and W2 once or twice per year during varying years between 1989 and 2014, and from water



## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

wells located farther south of the Site at Burns Meat Ltd (at the corner of Lagimodiere and Marion Street) and J.M. Schneider Inc. at 663 Marion Street once or twice per year during varying years between 1989 and 1992. Samples were submitted for laboratory analysis of one or more of the same parameter list as for leachate.

### 3.3 Surface Water

It was recorded that a water sample was collected from a pond under a power line in 1986, but results of this analysis were not provided.

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1980 to 1992 – Landfill gas was generated within the waste footprint but reduced over time. Landfill gas was also detected outside of the waste footprint;
- 1988 – A 45 m control zone was implemented at the Site; and,
- 2011, 2013 and 2014 – Landfill gas continues to generate within the landfill and methane is detected outside of the waste footprint in trace amounts.

This Site has been generating landfill gas and there is evidence of migration beyond the waste footprint. The type of waste (renderings) increases the potential for landfill gas generation. Water mains, sanitary sewers and roadways go directly through the waste footprints (Fournier Street, Lagimodiere Boulevard, Softley Road and Warman Road). In addition, a natural gas pipeline runs along the south of the Site. The granular material in the water mains, sanitary sewers and roadways can act as a preferential pathway for the landfill gas migration.

### 4.2 Groundwater

#### 4.2.1 Elevations

The depth to water measured in 2011, 2012 and 2013 in the landfill gas probes monitored during those years within the waste fill area ranged from 1.4 to 2.3 m below the top of pipe, while the water level outside the waste fill area ranged from 1.1 to 6.1 m below the top of pipe. Some wells recorded depths to water of 8 to 10.7 m below the top of pipe and these are assumed to be completed within a lower geological unit. There is no ongoing monitoring program.

#### 4.2.2 Leachate

Based on analytical results collected between 1985 and 1995 at probes completed within the waste footprint (P8L, P9L, P12L, P21L, P48L, P53L, L147, L151, L152, MH1) the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- Total dissolved solids, turbidity, iron and lead at all locations for most sampling sessions;
- Occasional exceedances of arsenic, cadmium, chromium, copper, sulphate and zinc at some locations; and,
- The highest chloride concentrations were noted at P21L and P48L.



## APPENDIX C

### 3. St. Boniface Landfill Site 1 – Winnipeg Landfill Status Report

#### 4.2.3 Groundwater

Based on analytical results collected between 1985 and 1995 at probes completed outside of the waste footprint (P100E, 4N153A, 4N153B, 4N153C, 4N153D, 4N154A, 4N154B, 4N154C, 4N154D, 4N155A, 4N155B, 4N155) the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- Total dissolved solids (TDS), turbidity, manganese, iron, cadmium and lead during the one sampling session at P100E;
- Turbidity, lead and iron at all locations at 4N153 and 4N154;
- Sulphate consistently in the two upper wells at 4N153 and 4N154 and occasionally in the deeper wells at both locations;
- Manganese and lead consistently at the 4N153 and 4N154 series of wells except for the deepest well at 4N153;
- Sodium at all wells at 4N154 and the shallowest well at 4N153; and,
- Occasional exceedances of nitrate + nitrite at the two deeper wells at 4N154.

Based on analytical results collected from on-Site bedrock groundwater monitoring wells W1 and W2 between 1985 and present the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- TDS and turbidity consistently exceeded at both W1 and W2;
- At W1 – Occasional exceedances of chloride, iron and one exceedance of arsenic, cadmium, chromium and copper (2001 or 2004); and,
- At W2 – one exceedance of iron, arsenic, cadmium, chromium, copper and zinc (2001, 2004 or 2006).

Based on analytical results collected from off-Site locations between 1985 and 1992 the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- Burns Meat Ltd – TDS; and,
- 663 Marion – TDS, chloride and sodium.

The concentrations of ammonia, TKN, chloride and metals such as cadmium, chromium, copper, nickel and lead are higher in the groundwater below the waste footprint compared to the groundwater outside of the waste footprint, indicating potential landfill leachate impact to the shallow groundwater. Due to the exceedances of some metals in the on-Site bedrock monitoring wells but not in the off-Site bedrock monitoring wells, the bedrock groundwater below the Site may be potentially impacted.

#### 4.3 Surface Water

Results of one surface water sampling session in 1986 were not available for review.

\\golder gds\gallottawa\active\2015\3 proj\1522283 city of winnipeg landfill study\04\_reporting\landfill status report\3 st. boniface site 1\appendix c - st boniface site 1 final\_sept14 docx

**TABLE C1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 3  
**Site Name** St. Boniface Landfill Site 1

**Landfill Operation**

<b>Waste type</b>	Animal renderings
<b>Start date</b>	early 1950s
<b>End date</b>	late 1960s
<b>Operated by</b>	City of Winnipeg and Private Owners
<b>Disposal method</b>	Unknown
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	18.7		
Depth of waste below ground surface (metres)	~6		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	0.6 to 3.3
Cover material	Potentially Fill (undocumented)		
Comment on slopes	Historic settlement		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	Passive venting in building
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	The landfill and control zone is mostly City owned with some private ownership
<b>Current</b>	Vacant field, asphalt plant, storage yards, soil blending, storage building
<b>North</b>	Industrial and a stormwater pond
<b>East</b>	Railway track, St. Boniface Landfill Site 2
<b>South</b>	Industrial
<b>West</b>	Industrial
<b>Comment</b>	Land is leased

**Physical Site Setting**

Ground elevation (mASL)		233	Groundwater flow direction	South
Potable water? Yes/No		Yes	Water Taking Unit	--
Nearby Water Bodies	Roadside ditches			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	--	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>		6.1		
<b>Minimum depth to till (metres)</b>		13.7		
<b>Minimum depth to bedrock (metres)</b>		17.7		
<b>Bedrock</b>		Red River (Fort Garry - lower pt. (E), Selkirk		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	230.4	<b>Max</b>	232.3

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

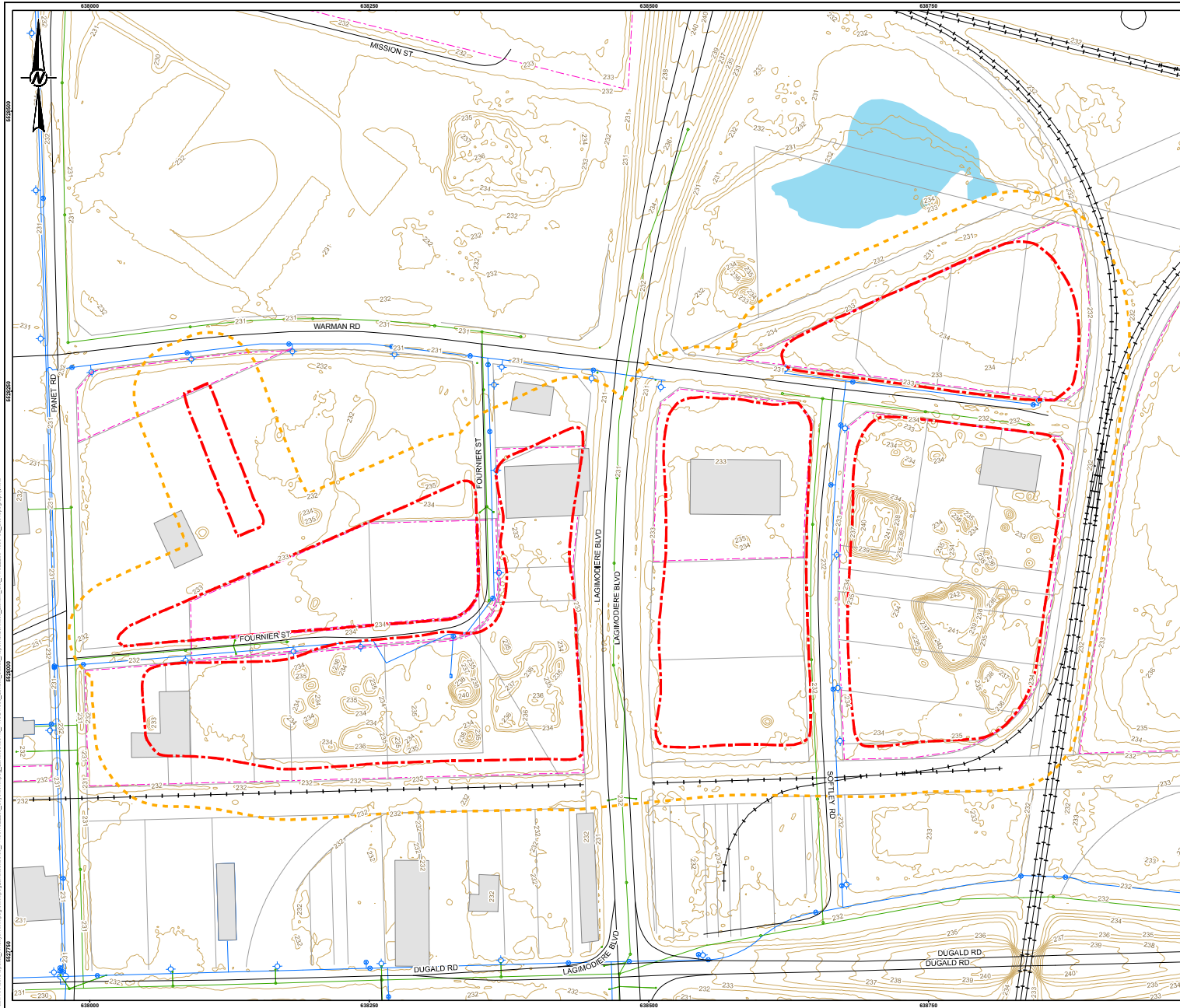
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Historic settlement
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Leachate breakouts reported









**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- ROAD
- RAILWAY
- TOPOGRAPHIC CONTOUR, metres
- UTILITY
  - SANITARY SEWER
  - WATER MAIN
  - WATERBODY
  - BUILDING FOOTPRINT

**KEY MAP**

Content may not reflect National Geographic's current map policy. Sources: National Geographic.

0 40 80 160  
1:3,400 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION: TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 3: ST. BONIFACE LANDFILL SITE 1, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-06-30
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>C2</b>
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WINNIPEG LANDFILL STATUS REPORT - SITE 3: ST. BONIFACE LANDFILL SITE 1, WINNIPEG, MANITOBA








**Photo C1**  
**Looking east across Lagimodiere Boulevard**  
**towards storage building**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT



**Photo C2**  
**Manhole MH2 located within**  
**asphalt plant yard**

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 3: ST. BONIFACE LANDFILL SITE 1 PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS					
		CHECK	MKF Sept 2015				
		REVIEW	PLF Sept 2015				
				FIGURE C4			




**Photo C3**  
**Asphalt plant at southwest portion of Site**



**Photo C4**  
**Storage building east of  
 Lagimodiere Boulevard**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 3: ST. BONIFACE LANDFILL SITE 1 PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS					
		CHECK	MKF Sept 2015				
		REVIEW	PLF Sept 2015				
				FIGURE C5			






**Photo C5**  
Looking west across northernmost  
portion of the Site



**Photo C6**  
At Warman Road and Lagimodiere  
Boulevard looking southwest towards Site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT


PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 3: ST. BONIFACE LANDFILL SITE 1 PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLF Sept 2015			
		FIGURE C6			



**Photo C7**  
**Looking south across landfill just**  
**west of Fournier Street**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
 REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 3: ST. BONIFACE LANDFILL SITE 1 PHOTOGRAPHS				
		PROJECT No. 1522283		PHASE No. 1000
		DESIGN	July 2015	SCALE AS SHOWN
		GIS	—	REV.0
		CHECK	MKF Sept 2015	FIGURE C7
		REVIEW	PLE Sept 2015	



# **APPENDIX D**

## **4. St. Boniface Landfill Site 2**





## APPENDIX D

### 4. St. Boniface Landfill Site 2 – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the St. Boniface Landfill Site 2 (Site 4), located north of Dugald Road, east of the railway and west of the Terracon Place in Winnipeg, Manitoba, as illustrated on Figure D1. The St. Boniface Landfill Site 2 covers an area of approximately 7.8 hectares (ha) and was operated from approximately 1970 until its closure in 1974. The landfill was used for disposal of industrial, bulk and domestic waste.

In 1980 and 1981, a drilling program was conducted at the St. Boniface Landfill Site 2, which included the drilling of 43 boreholes to depths ranging from 1.5 metres (m) to 7.9 m. The stratigraphy encountered at the Site reportedly included fill (clay with granular material and occasionally refuse) to a depth of 0.6 m to 2.4 m below grade, overlying refuse (if present), underlain by clay to the maximum depth of investigation.

Of the 43 boreholes drilled at the Site, 15 contained waste/refuse, including domestic waste. The bottom of waste ranged from 2.1 m to 2.7 m below ground surface. Monitoring wells and/or landfill gas probes were installed in at least 26 of the boreholes based on the names of the logs. The locations of ten probes are shown on Figure D3 as follows: P16E, P17L, P1L, P43, P24E, P50E, P40E, P51E, P18L and P27E. Note that P16E is labelled as an external probe to the landfill but it is within the waste limits as shown on Figure D3.

Two gas probes GP1 and GP2 exist on the Site but details of their construction were not available for review.

Ground surface is at an elevation of 233 m above sea level (masl). The water level within the waste is reportedly at 230 masl. The cover material is fill, potentially containing construction debris, glass and ash. The cover thickness is 0.6 m to 3.7 m. Waste is expected to be approximately 7.6 m below the surrounding ground surface which is greater than the depths observed in the borehole logs from 1980 and 1981. A 45 m landfill gas control zone was allotted for the Site as shown on Figures D1 to D3.

Constraints previously reported for the Site include minimal cap, restricted foundation construction, poor surface drainage and soil salinity. Active recreation that could cause surface erosion was discouraged.

## 1.1 Previous Site Visits

The City performs regular Site visits to the St. Boniface Landfill Site 2. Findings from the most recent recorded Site visit, completed on July 14, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] old waste staff from the City of Winnipeg Environmental Branch;
- The Site has overgrown grass, thistles and bushes throughout the landfill;
- There are dead areas of vegetation throughout the landfill that may be due to gravel and rocky soil or related to methane;
- Construction waste, tires, and piles of dirt were noted throughout the Site buried in the tall vegetation;
- Ground level is very uneven;
- Rebar was noted to be protruding in some areas;



## APPENDIX D

### 4. St. Boniface Landfill Site 2 – Winnipeg Landfill Status Report

- No drainage, erosion, slope stability or leachate issues were identified during the Site visit; and,
- Three landfill gas probes were located and could be monitored (P18L, P1L and P53E). Probe P18L was noted to have a bent top.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was a vacant field situated within an industrial area. The Site is owned by the City but land within the control zones is privately owned. It was noted by City staff that this area was formerly used as a snow dump. North of the Site are railway lines and vacant land. West of the Site is a railway line and St. Boniface Landfill Site 1. To the south is privately owned land being used to store fill. To the east is an industrial subdivision.

The Site rises slightly above the surrounding land and is poorly graded at the top. The ground cover is natural grasses and shrubs. Fill material has been placed in piles throughout the Site and dead areas of vegetation may be attributed to the placement of fill instead of methane gas generation. Rubble and wood have been dumped at the Site.

The waste limits are well defined with stormwater ditches surrounding the whole Site. A natural gas pipeline runs along the south end of the Site. The pipeline is not shown on Figure D2 as it is not City owned. Railroad tracks are located to the west and a hydro corridor was noted to the east. No buildings are located on the Site. No leachate collection systems or landfill gas migration barriers were noted.

See attached Table D1 and Figures D1 through D3 for Site specific details. Site photographs are provided in Figures D4 and D5.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Landfill gas measurements were obtained from six to eleven landfill gas probes between 1980 and 1991. The measurements started off as weekly and reduced to annually by 1985. The following observations were made about the landfill gas monitoring results:

- Methane was being generated at 10 to 70% methane by volume in air in 1981 at the majority of locations completed within the waste footprint, with lower methane concentrations at P16E;
- By 1986 methane concentrations reduced from trace to 30% methane by volume in air at the locations completed within the waste footprint;



## APPENDIX D

### 4. St. Boniface Landfill Site 2 – Winnipeg Landfill Status Report

- Methane continued to be measured at greater than 100% LEL at the locations completed within the waste footprint until 1991; and,
- Methane was not detected in the probes completed outside of the waste footprint with the exception of trace readings (<20% LEL) and some readings greater than 20% LEL at probes P24E, P27E and P40E in 1981 and 1982, and trace readings (<20% LEL) at no more than one location per year from 1983 to 1991.

Landfill gas monitoring occurred at the following landfill gas probes during 2011, 2013 and 2014: P18L, P1L and P53E. Methane was not detected during the recent monitoring events since 2011.

## 3.2 Groundwater

### 3.2.1 Leachate

Groundwater sampling was conducted annually from 1988 to 1991 at probes P1L and P18L located within the waste footprint. Details of the screen installation in these probes are unknown. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality.

Samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate + nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, conductivity, chemical oxygen demand, turbidity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

## 3.3 Surface Water

There is no evidence of historical surface water monitoring at this Site.

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1980 to 1991 – Landfill gas was generated within the waste footprint but reduced over time. Landfill gas was also detected at low concentrations directly outside of the waste footprint;
- 1988 – A 45 m control zone was implemented at the Site; and,
- 2011, 2013 and 2014 – Methane was not detected within the waste footprint or outside of the waste footprint.

This Site generated landfill gas in the 1980s and 1990s with evidence of minor migration beyond the waste footprint at that time. Methane has not been detected in recent years of monitoring. The waste footprint is surrounded by a stormwater ditch that would act as a barrier and allow for some venting of landfill gas to the atmosphere. In addition, a natural gas pipeline runs along the south of the Site.



## APPENDIX D

### 4. St. Boniface Landfill Site 2 – Winnipeg Landfill Status Report

## 4.2 Groundwater

### 4.2.1 Elevations

The depth to water measured 2011, 2012 and 2013 in the landfill gas probes monitored during those years within the waste fill area ranged from 1.0 to 2.5 m below the top of pipe, while the water level outside the waste fill area ranged from 1.6 to 2.0 m below the top of pipe.

### 4.2.2 Leachate

Based on analytical results collected between 1988 and 1991 at probes P1L and P18L the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- P1L (eastern side at centre) – exceedances of total dissolved solids, chloride, manganese, iron, sodium and lead during the majority of sampling sessions;
- P18L (northeast corner) – consistent exceedances of total dissolved solids and iron, with some exceedances of sulfate, chloride, chromium and copper; and,
- P1L had higher concentrations in general than P18L.

It appears that the groundwater in the location of P1L has been impacted by the presence of buried waste, with less impact noted at the north end of the waste footprint near P18L. No current data or comparable background water quality data is available for review.

### 4.2.3 Groundwater

There is no ongoing monitoring program.

## 4.3 Surface Water

There are no current, or historical, monitoring results for surface water available for review.



**TABLE D1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 4  
**Site Name** St. Boniface Landfill Site 2

**Landfill Operation**

<b>Waste type</b>	All wastes, industrial, bulk, domestic waste
<b>Start date</b>	~1970
<b>End date</b>	mid 1974
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	7.8		
Depth of waste below ground surface (metres)	~7.6		
Height above ground surface (metres)	0.3		
Slope %	Fair	Cover thickness (metres)	0.6 - 3.7
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	Poorly graded		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	Landfill - City of Winnipeg, Control Zone - private industrial uses
<b>Current</b>	Vacant field
<b>North</b>	Railway and vacant land
<b>East</b>	Industrial Park
<b>South</b>	Privately owned land used to stockpile fill
<b>West</b>	Railway, St. Boniface Landfill Site 1
<b>Comment</b>	Formerly used as a snow dump

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	232.9	<b>Groundwater flow direction</b>	South/Southwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Stormwater ditches surround landfill		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.5	<b>Max</b>	230.4
<b>Minimum clay thickness below base grades (metres)</b>	6.1			
<b>Minimum depth to till (metres)</b>	13.7			
<b>Minimum depth to bedrock (metres)</b>	17.7			
<b>Bedrock</b>	Red River (Fort Garry - lower pt., Selkirk (NE))			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	229.5	<b>Max</b>	233.5

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Poorly graded
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Construction debris and fill placed at Site














**Photo D1**  
**Looking north across the Site**  
**at the eastern edge**



**Photo D2**  
**Looking west across the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 4: ST. BONIFACE LANDFILL SITE 2 PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF	Sept 2015	
				REVIEW	PLE	Sept 2015	
				FIGURE D4			




**Photo D3**  
Looking south across the Site  
at the eastern edge

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
REPORT



**Photo D4**  
Stressed vegetation and/or presence of fill

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 4: ST. BONIFACE LANDFILL SITE 2 PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MLF	Sept 2015		
	REVIEW	PLF	Sept 2015		
					FIGURE D5



# **APPENDIX E**

## **5. Redonda Dump Site**





## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Redonda Dump Site (Site 5), located at 255 Redonda Street in Winnipeg, Manitoba, as illustrated on Figure E1. The Redonda Dump Site covers an area of approximately 1.4 hectares (ha) and was operated by the City of Winnipeg from 1935 until it closed in 1955 and serviced the Town of Transcona Area. The landfill Site is located in the central portion of Victoria Jason Park (a City-owned recreational park), which includes soccer pitches, baseball diamonds, and a skate park. The landfill reportedly included a small incinerator and had a rubble berm surrounding the Site. The waste reportedly includes ash from partially burned refuse.

In 1980, a drilling program was conducted at the Redonda Dump Site, which included the drilling of 8 boreholes to depths ranging from 2.4 metres (m) to 5.8 m. The stratigraphy encountered at the Site reportedly included fill (clayey, gravelly, till-like) and/or topsoil to a depth of up to 4 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the eight boreholes drilled at the Site, three contained waste/refuse, including ash, bricks, glass, cinders, and/or wood. At another three locations, the surficial fill contained cinders in the absence of buried waste/refuse. The depth of waste, where present, ranged from 1.2 to 1.5 m below ground surface (mostly drilled along the slopes of the landfill Site).

Monitoring wells and/or landfill gas probes were installed in four of the boreholes and labelled as follows:

- P3E, drilled to a depth of 5.5 m below grade, located at the baseball diamond fence. The depth to water was 4.2 m below grade on November 3, 1980, although it has been as high as 1.24 m below grade (September 2, 1994);
- P5L, drilled to a depth of 5.5 m below grade, located at the base of the slope on the west side of the Site. The well was dry on November 3, 1980, although the depth to water has been as high as 0.46 m below grade (May 2, 1989);
- P7L, drilled to a depth of 5.2 m below grade, located approximately 15 m northwest of P5L. The depth to water was 4.3 m below grade on November 3, 1980, although it has been as high as 2.6 m below grade (September 29, 1982); and,
- P8L, drilled to a depth of 5.5 m below grade, located on the east side of the Site at the top of the slope. The depth to water was 4.8 m below grade on November 3, 1980 and has remained relatively stable at this depth.

Ground surface is at an elevation of 235 m above sea level (masl). There is reportedly a minimum silt and clay layer thickness of 6.7 m below the landfill Site.

The cover material is undocumented; however, reportedly may have consisted of fill to up to 1.2 m thick. Waste reportedly ranges from 4.6 m above grade to 0.9 m below grade. In 1992, the Site contained a light and play structure. A 15 m landfill gas control zone was allotted for the Site in 1998. The Site was technically owned by the Province until 2015.





## APPENDIX E

### 5. Redonda Dump – Winnipeg Landfill Status Report

The Site is located within a mixed residential/institutional area and is used for recreational purposes. Constraints previously reported for the Site include restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

The nearest industrial well is less than 500 m south of the Site. There are two supply wells and one return well used for cooling purposes. Depths are reportedly 67.1 m below grade.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Redonda Dump Site. Findings from the most recent Site visit, completed on July 8, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was mainly grass covered with trees along the perimeter and well maintained with no signs of stressed vegetation;
- No illegal dumping and no drainage, erosion, slope stability, or leachate issues were identified during the Site visit;
- Two baseball diamonds and a skate park were noted on the Site (although these are in fact adjacent to the Site and/or within the control zone);
- No other issues were identified; and,
- No remaining probes were present on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat at the top of the landfill and sloped downward to the recreational area, which surrounds the Site on all sides. A residential development was noted to the west and south of the recreational areas. Murdoch MacKay Collegiate and College Pierre-Elliott-Trudeau were present to the east of Redonda Street. To the north, along Kildare Avenue, a personal care home was present along with additional residential housing. The Site was mainly grass covered and well maintained. No exposed debris was noted.

The waste boundary was fairly well defined and the Site was being used as open space. City staff indicated that a sewer system was potentially present beneath the path running to the south from the Site. Note that the sewer system does not show up on utilities mapping provided by the City of Winnipeg for this study. No groundwater monitoring wells, leachate collection systems, methane probes or landfill migration barriers were noted.

See attached Table E1 and Figures E1 to E3 for Site specific details. Site photographs are provided in Figures E4 through E7.



### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Weekly landfill gas measurements were obtained from P3E, P5L, P7L, and P8L between October 21, 1980 and December 4, 1981. Monthly sampling was conducted at the same locations between January 1982 and May 1982, followed by quarterly sampling in 1993, semi-annual sampling between 1984 and 1989, and annual sampling between 1990 and 1994. Results were as follows:

- P3E – No methane was detected. No readings were obtained after June 14, 1995;
- P5L – Methane fluctuated from non-detect to 1% by volume, measured on four occasions in 1981. No detectable methane readings were reported after April 28, 1981. No readings were obtained after May 2, 1989;
- P7L – Methane fluctuated from non-detect to 1.6% by volume, measured on November 13, 1980. No detectable methane readings were reported after April 28, 1981. No readings were obtained after February 7, 1983; and,
- P8L – No methane was detected. No readings were obtained after May 2, 1989.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site. No leachate probes remain at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

Landfill gas concentrations were identified at two locations (P5L and P7L) in the early 1980s, however were not detected subsequently. These wells were located on the western slope of the landfill and to the west side of the landfill Site.

The elevated landfill gas to the west of the landfill may indicate some migration in this direction. Based on the type of waste reported at this location (i.e., ash, bricks, glass, cinders, and/or wood), the potential for landfill gas generation (with the exception of the presence of a small amount of wood waste) appears to be limited. The presence of higher methane may indicate the presence of more organic waste than previously reported, specifically in the western portion of the Site. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited although the presence of utilities to the east and south west of the Site may act as a conduit for landfill gas migration. The utilities are more than 40 m from the Site.



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## **APPENDIX E**

### **5. Redonda Dump – Winnipeg Landfill Status Report**

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As depths to water at the Site have historically been quite shallow (as high as 0.46 m below grade), the non-detectable methane concentrations reported more recently may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE E1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 5  
**Site Name** Redonda Dump Site

**Landfill Operation**

<b>Waste type</b>	Small incenerator, rubble berm around site, ash
<b>Start date</b>	1935
<b>End date</b>	1955
<b>Operated by</b>	Town of Transcona
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.4		
Depth of waste below ground surface (metres)	0.9		
Height above ground surface (metres)	4.6		
Slope %	0	Cover thickness (metres)	1.2 (top)
Cover material	Potentially Fill (undocumented)		
Comment on slopes	Steep slope to recreational areas from top of landfill site		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Pathways, light standards, trees, baseball diamond outfield, northeast corner of one soccer field and
<b>North</b>	Recreational with Institutional land use beyond ( personal care home, residential)
<b>East</b>	Recreational with institutional land use beyond ( Murdoch MacKay Collegiate and College Pierre-Elliott-
<b>South</b>	Recreational, with residential land use beyond
<b>West</b>	Recreational and community (Kinsmen Club), with residential land use beyond
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	235	<b>Groundwater flow direction</b>	West
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	233.0	<b>Max</b>	234.1
<b>Minimum clay thickness below base grades (metres)</b>		6.7		
<b>Minimum depth to till (metres)</b>		8.8		
<b>Minimum depth to bedrock (metres)</b>		14.0		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	232.0	<b>Max</b>	234.0

**Monitoring**

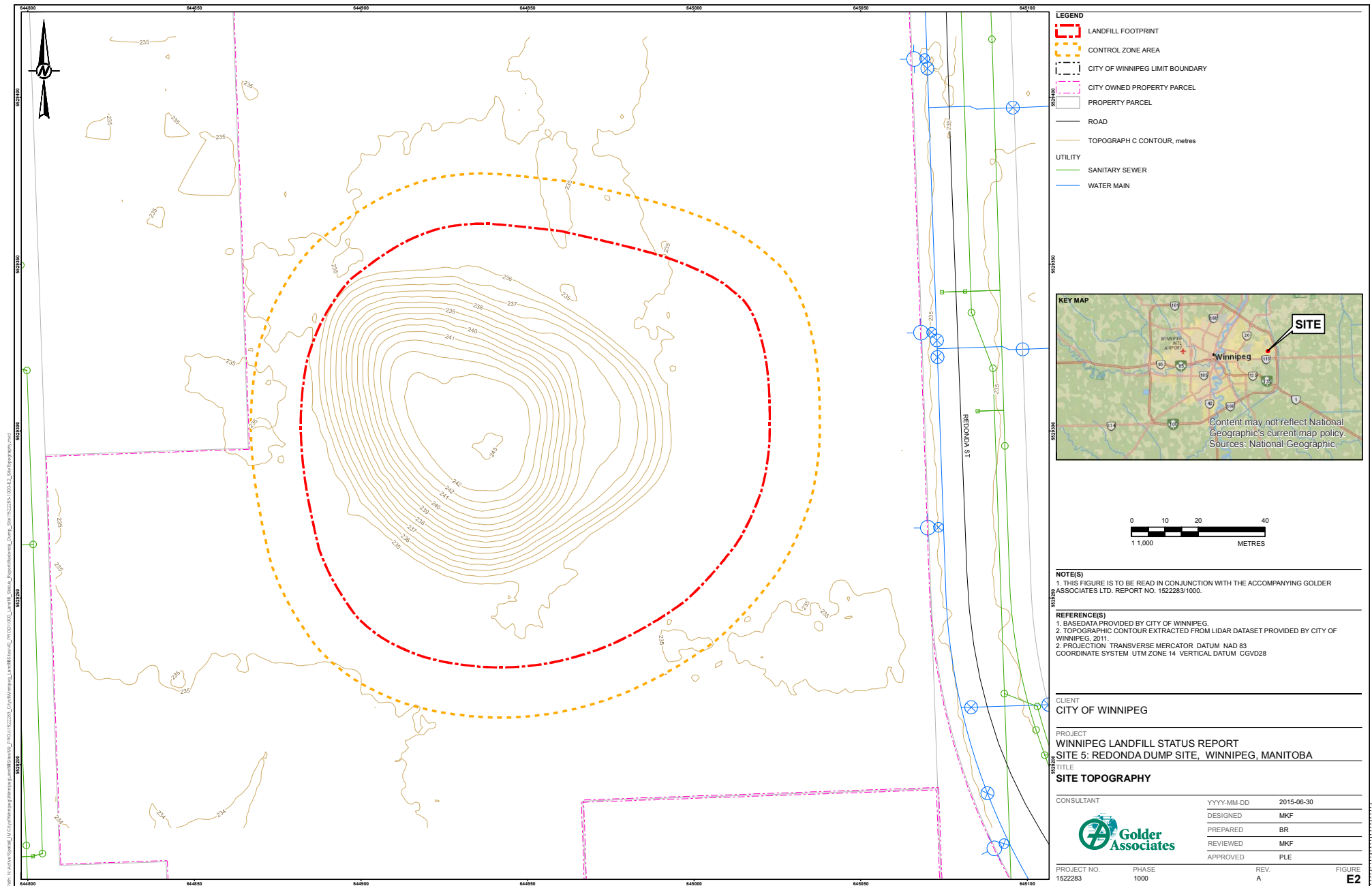
<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		No		

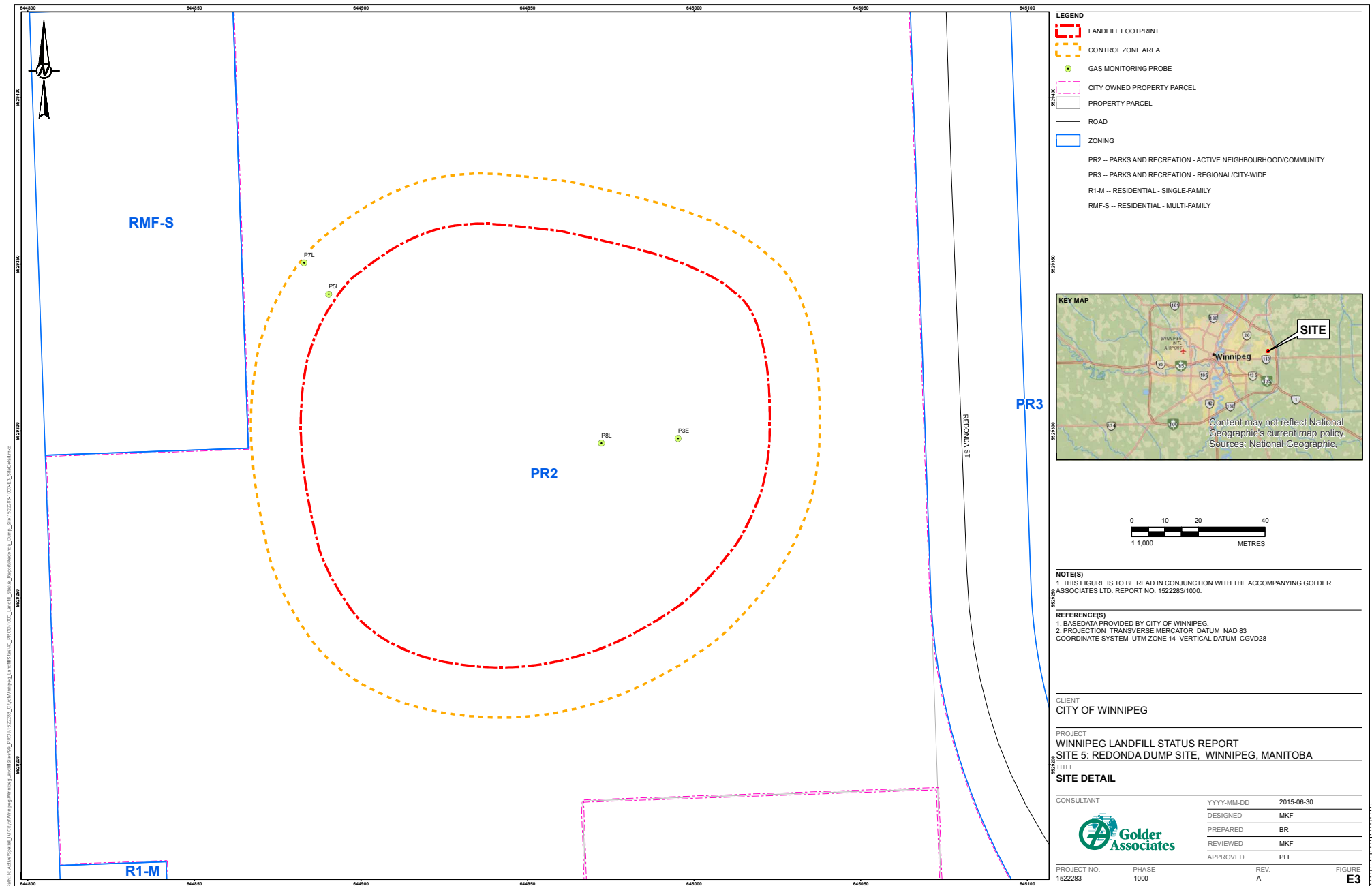
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Steep slope to recreational areas from top of landfill site
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None














**Photo E1**  
**Redonda Dump Site, looking west**



**Photo E2**  
**Top of Redonda Dump, looking northwest**  
**Note: light standard at center of Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 5: REDONDA DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF Sept 2015		
				REVIEW	PIE Sept 2015		
				<b>FIGURE E4</b>			






**Photo E3**  
**Soccer pitch to the south, looking south**



**Photo E4**  
**Baseball diamond to the east, looking east**  
**Note: School beyond Redonda Street**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 5: REDONDA DUMP SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MLF Sept 2015			
	REVIEW	PLF Sept 2015			
		FIGURE E5			



**Photo E5**

**Soccer pitch to the north, looking north**

**Note: Institutional and residential land use beyond**




**Photo E6**

**Skate park to the southeast, looking southeast**

**Note: school across Redonda Street**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 5: REDONDA DUMP SITE PHOTOGRAPHS	
	PROJECT No. 1522283		PHASE No. 1000
	DESIGN	July 2015	SCALE AS SHOWN
	GIS	—	REV.0
	CHECK	MKF Sept 2015	
	REVIEW	PLF Sept 2015	
		FIGURE E6	






**Photo E7**  
**Kinsmen Club to the northwest, looking northwest**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 5: REDONDA DUMP SITE PHOTOGRAPHS				
	PROJECT No. 1522283			PHASE No. 1000
	DESIGN	—	July 2015	SCALE AS SHOWN
	GIS	—	—	REV.0
	CHECK	MKF	Sept 2015	FIGURE E7
	REVIEW	PLE	Sept 2015	



# **APPENDIX F**

## **6. Redonda Landfill Site**





## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Redonda Landfill (Site 6), located at 500 Redonda Street in Winnipeg, Manitoba, as illustrated on Figure F1. The Redonda Landfill covers an area of approximately 3.7 hectares (ha) and was operated by the City of Winnipeg from the late 1950s until it closed in 1970 and serviced the Town of Transcona. The landfill is located on the Harold Hatcher School property owned by the City of Winnipeg. A small portion in the southwest corner is privately owned and several private properties and City owned property are located within the control zone. The waste fill area is located partially beneath the school building and extends to the east and is surrounded by play structures and sporting fields including baseball diamonds and soccer pitches. The waste reportedly includes ash from partially burned domestic refuse and was placed in trenches.

In 1979/1980, a drilling program was conducted at the Redonda Landfill, which included the drilling of 95 boreholes to depths ranging from 1.2 metres (m) to 5.8 m. The stratigraphy encountered at the Site reportedly included fill (clayey, gravelly) and/or topsoil to a depths ranging from 0.6 m below grade to 2.1 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 95 boreholes drilled at the Site, 26 contained waste/refuse, including black wet organics, glass, wood, wire, paper, and/or tires. Odours were noted at numerous locations containing refuse and were described in one location (i.e. H-55) as a petroleum odour. The depth of waste, where present, extended to 3 m below ground surface and to 1.5 m above grade.

Monitoring wells and/or landfill gas probes were installed in select boreholes as outlined below. The following information was provided:

### **Drilled and Installed in December 1979**

- P1L, drilled to a depth of 5.5 m below grade, located on Redonda Street at the southeast corner of the Site. This well can no longer be located on-Site;
- P2E, drilled to a depth of 5.3 m below grade, located on Redonda Street 10 m south of the property line in the southeast corner of the Site. This well can no longer be located on-Site;
- P15L, drilled to a depth of 2.7 m below grade, located on the east side of the waste mound, east of the school building. This well can no longer be located on-Site;
- P16E, drilled to a depth of 3.0 m below grade, located on the east side of the waste mound, east of the school building. This well can no longer be located on-Site;
- P36L, drilled to a depth of 3.4 m below grade, located on the north side of the waste mound, east of the school building. This well can no longer be located on-Site;
- P37E, drilled to a depth of 3.4 m below grade, located 6.1 m north of P36L. This well can no longer be located on-Site;
- P42E, drilled to a depth of 3.0 m below grade, located at the eastern limit of the waste fill area. This well can no longer be located on-Site;



## APPENDIX F

### 6. Redonda Landfill – Winnipeg Landfill Status Report

- P43L, drilled to a depth of 3.0 m below grade, located at the eastern limit of the waste fill area. This well can no longer be located on-Site;
- P50E, drilled to a depth of 2.7 m below grade, located in the southern limit of the landfill in the eastern portion of the fill area. This well can no longer be located on-Site; and,
- P51L, drilled to a depth of 3.0 m below grade, located in the southern limit of the landfill in the eastern portion of the fill area. This well can no longer be located on-Site.

#### Drilled and Installed in June/July 1980

- P79E, drilled to a depth of 5.8 m below grade, located at the eastern extent of the control zone, on the west side of Fairview Drive. This well can no longer be located on-Site;
- P87L, drilled to a depth of 4.0 m below grade, located near the southeast corner of the fill area. This well can no longer be located on-Site; and,
- P88E, drilled to a depth of 4.0 m below grade, located near the southeast corner of the fill area. This well can no longer be located on-Site.

#### Drilled and Installed in December 1980

- P96L, drilled to a depth of 4.3 m below grade, located in the southern limit of the landfill in the eastern portion of the fill area. This well replaced P51L. This well can no longer be located on-Site;
- P97E, drilled to a depth of 2.7 m below grade, located in the southern limit of the landfill in the eastern portion of the fill area. This well can no longer be located on-Site; and,
- According to the available drawings, P98E, P99E, P100E, P101E, P102E, P103E, P104E, and P105E were installed to the west, south, and east of the waste fill area, although no drill logs were available for review. In July 2011 P102E and P105E were present on-Site. In July 2013, P102E and P103E were present on-Site. By July 2014, no wells were present on-Site with no records of decommissioning.

Ground surface is at an elevation of 234 to 235 m above sea level (masl). The water level is reportedly 1.8 m below grade in the waste fill area and there is a 5.8 m thick clay layer below the landfill.

The Harold Hatcher Primary School is partially constructed on refuse. There is a crawl space at grade, under the structural slab divided into three zones by grade beams. A compacted clay liner provides the primary protection against methane gas migration, with continuous forced air crawlspace ventilation as secondary protection. A 24 point gas monitoring system will trigger an alarm if methane levels in the crawlspace exceed concentrations of 20% of the lower explosive limit (LEL; 1% methane by volume). The alarm triggers an increase of approximately five fold in the ventilation rate. System maintenance is performed bimonthly and air sampling is done biannually. Over the life of the school, test results have shown no measurable methane levels in the crawlspace air, but the levels below the clay liner exceed LEL levels. It is important to maintain the ventilation system and the integrity of the clay liner.

The cover material is fill extending from 0.3 to 1.5 m in thickness. Waste reportedly extends to 3.0 m below grade. In 1992, the Site was owned and maintained similarly to today. A 45 m landfill gas control zone was allotted for the Site in 1984.



## APPENDIX F

### 6. Redonda Landfill – Winnipeg Landfill Status Report

The Site is located within a mixed residential/institutional area and is used as a school and for recreational purposes. Constraints previously reported for the Site included a minimal cap. High impact recreation which could cause surface erosion was discouraged.

The nearest industrial well is less than 500 m south of the Site. There are two supply wells and one return well used for cooling purposes. Depths are reportedly 67.1 m below grade.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Redonda landfill. Findings from the most recent Site visit, completed on July 8, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the on-Site vegetation consisted mainly of grass with trees having been planted on the edges of the property;
- No illegal dumping and no drainage, erosion, slope stability, or leachate issues were identified during the Site visit;
- Harold Hatcher School (in good repair), a baseball diamond (well maintained), and a playground (located at the top of the hill at the southwest corner of the school (in good condition) were noted on the Site;
- No other issues were identified; and,
- No remaining probes were present on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel, from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was generally flat with a mounded area to the east of the building. The western portion of the waste fill area is covered by Harold Hatcher School. The eastern portion of the waste fill area is utilized for parking areas, lights, and as a recreational area with play structures, baseball diamonds, soccer pitches. The holes dug for the foundation posts for the play structure were backfilled with bentonite. Residential developments are present to the west, south, and east. A hydro line and agricultural fields are present to the north. The recreational areas of the Site were mainly grass covered and well maintained. Asphalt parking areas surrounded the school building. No exposed debris was noted.

The waste boundary was not totally defined at the Site, although the drawings are reported to provide a reasonably accurate location of waste. The school has a passive and active (with continuous forced air ventilation in the crawl space) venting system and a landfill gas monitoring program is performed inside the building on an annual basis. No groundwater monitoring wells, landfill gas probes, or leachate collection systems were noted. There is no surface water near the Site.

See attached Table F1 and Figures F1 to F3 for Site specific details. Site photographs are provided in Figures F4 through F7.



### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Based on available reports, the landfill gas data summary for results collected pre-1985 indicated outside probes had landfill gas concentrations of less than 20% LEL, but had detectable trace concentrations.

Between 1985 and 1992, annual landfill gas sampling was completed at nine outside landfill gas probe locations. Trace concentrations were reported in 1986. No detectable landfill gas was detected during the remaining sampling events.

In 1992, 131 indoor air samples were also collected from within the school building. 39 probes were installed beneath the floor slab, 45 samples were collected at the point sources (floor cracks, etc.), and 47 samples were collected mid-air. The results were as follows:

- Of the 39 samples collected beneath the floor slab, five were less than 0.05% methane by volume, one was between 0.01% and 1% by volume, two were 1.5% by volume, and 31 were greater than 5% by volume (the lower explosive limit of methane);
- The 45 samples collected at the point sources were less than 0.01% by volume; and,
- The 47 samples collected mid-air were less than 0.01% by volume.

Currently, the school building has passive and active venting systems and a landfill gas monitoring program is performed inside the building on an annual basis. During the most recent sampling event, conducted on August 14, 2014, no methane was detected from the methane probe, mid-air or near the two floor drains located inside the building.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site. No leachate probes remain at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.





## **APPENDIX F**

### **6. Redonda Landfill – Winnipeg Landfill Status Report**

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Relatively high landfill gas concentrations have historically been identified beneath the floor slab of the school building. The ventilation system is still present in the building and a monitoring program is conducted annually. No issues within the Site building have been identified to date.

The exterior landfill gas probes previously had trace concentrations of methane although remained less than 1% methane by volume. The presence of landfill gas indicates that the buried waste continues to produce methane, although migration does not appear significant based on the historical exterior gas probe readings. A water main runs westerly from the school to Redonda Street through the waste fill area. This buried utility could act as a conduit for landfill gas migration.

Based on the type of waste reported at this location (i.e., domestic waste), the potential for landfill gas generation is relatively high. As there are no natural gas barriers (i.e. surface water outlets), any landfill gas generated at the Site would likely escape through the surficial fill or buried utility corridors to the west and migration would be expected to be limited. The building ventilation system should continue to be utilized to prevent methane build-up within the Site building.

### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE F1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 6  
**Site Name** Redonda Landfill Site

**Landfill Operation**

<b>Waste type</b>	Primarily domestic waste burning, ash
<b>Start date</b>	Late 1950s
<b>End date</b>	1970
<b>Operated by</b>	Town of Transcona
<b>Disposal method</b>	Trench
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	3.7		
Depth of waste below ground surface (metres)	3		
Height above ground surface (metres)	0.5		
Slope %	--	Cover thickness (metres)	0.3 - 1.5
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	Minimal slope		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	Harold Hatcher School built on refuse. Ventilation crawlspace, forced air, compacted clay liner, monitoring
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	City of Winnipeg, with the exception of the southwest corner of the Site. Several private properties and city owned roadways and properties are present within the control zone
<b>Current</b>	Playground/park, Harold Hatcher School. Playground installed in 2013. Existing tennis courts, baseball diamonds, trees, soccer fields and asphalt path within landfill.
<b>North</b>	hydro lines, agricultural fields
<b>East</b>	Recreational with residential land use beyond
<b>South</b>	Residential
<b>West</b>	Redonda Street with residential land use beyond
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	234 to 235	<b>Groundwater flow direction</b>	West/Southwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Cordite Drain		

**Site Geology and Hydrogeology**

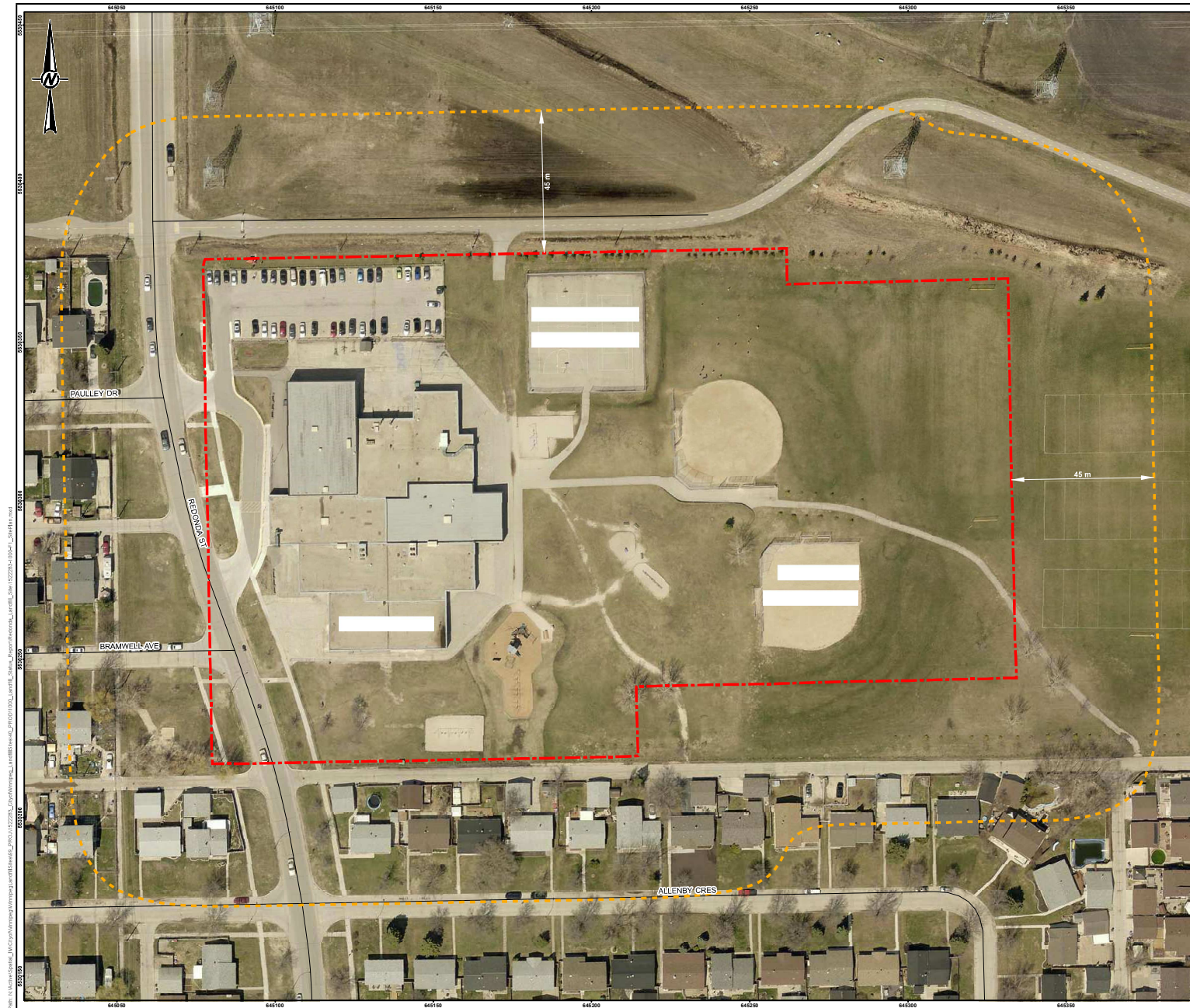
<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	232.3	<b>Max</b>	233.3
<b>Minimum clay thickness below base grades (metres)</b>	5.8			
<b>Minimum depth to till (metres)</b>	8.8			
<b>Minimum depth to bedrock (metres)</b>	14.0			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	233.0	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Minimal slope
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None



**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

Content may not reflect National Geographic's current map policy.  
Sources: National Geographic.

0 10 20 40  
1:1,200 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 6: REDONDA LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE PLAN

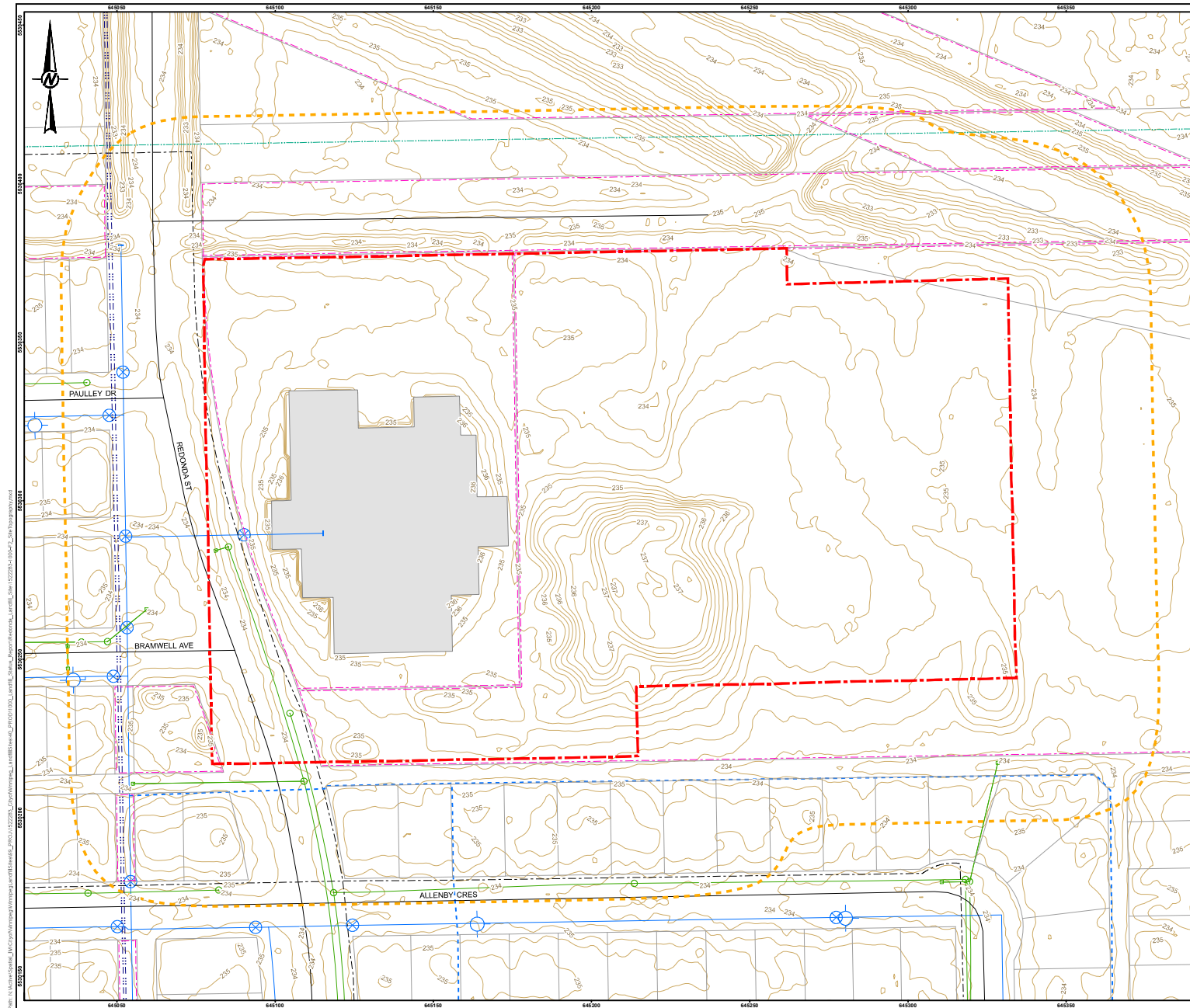
CONSULTANT	YYYY-MM-DD	2015-06-30
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>F1</b>
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\\golder\golder\_mn\proj\winipeg\landfill\status\_report\winipeg\_landfill\_status\_report\_f1.mxd, Date: 15/06/2015, User: golder\jple

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 28mm





- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL
  - ROAD
  - WATERBODY
  - BUILDING FOOTPRINT
  - UTILITY
    - FIBER OPTIC CABLE
    - GAS LINE
    - HYDRO CABLE
    - MTS CABLE
    - SANITARY SEWER
    - WATER MAIN
  - TOPOGRAPHIC CONTOUR, metres



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION: TRANSVERSE MERCATOR; DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

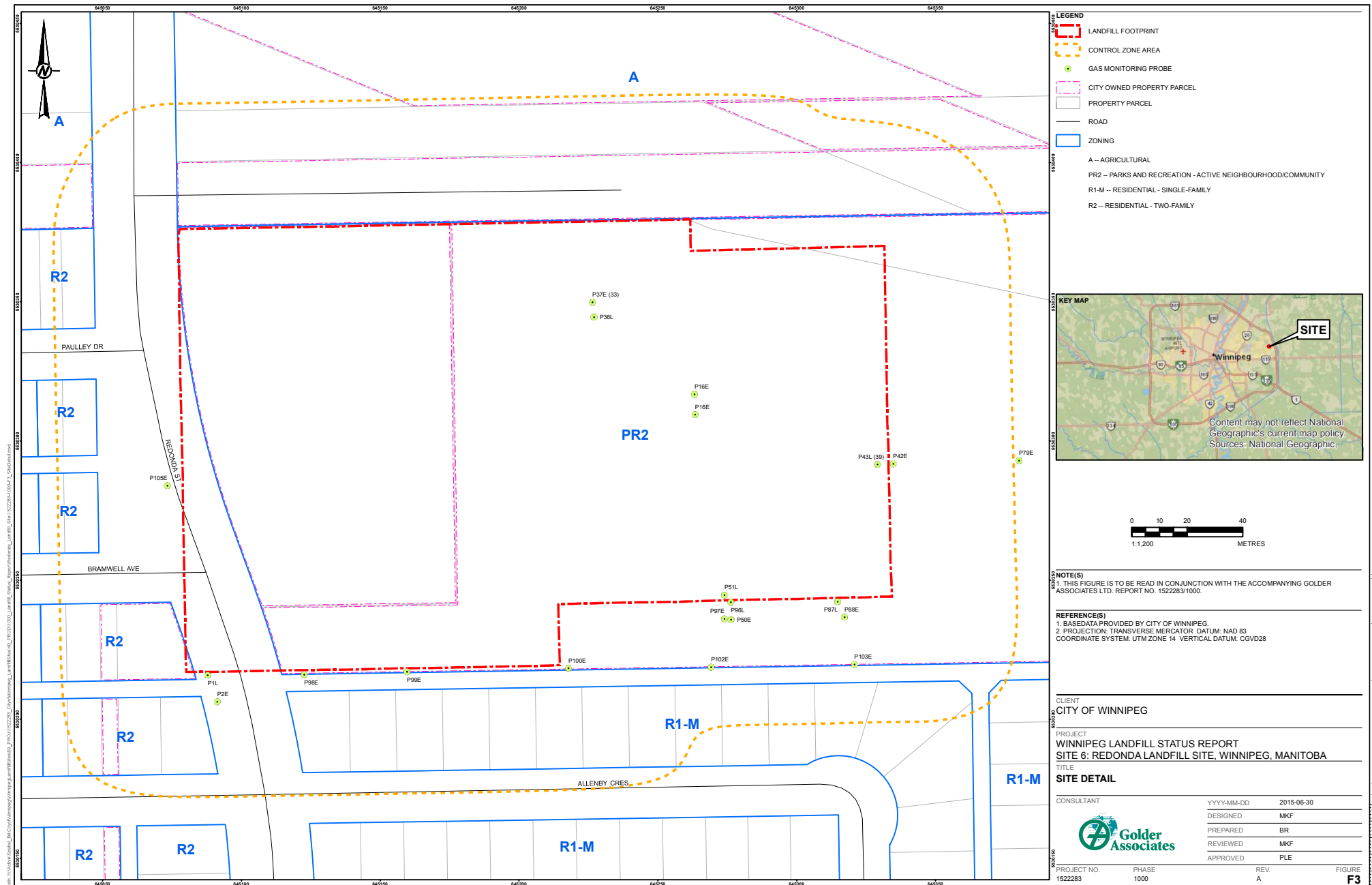
**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 6: REDONDA LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

	CONSULTANT	YYYY-MM-DD	2015-07-29
	DESIGNED	MKF	
	PREPARED	BR	
	REVIEWED	MKF	
PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE F2







**Photo F1**  
**Redonda Landfill, looking northeast from the  
 southeast corner of the school**



**Photo F2**  
**Top of waste mound at Redonda Landfill,  
 east of the school looking northwest**  
**Note: Hydro lines in the background**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 6: REDONDA LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		PHASE No. 1000	SCALE AS SHOWN
		REV.0	REV.0
		FIGURE F4	





Photo F3

Baseball diamond and soccer pitch to the east,  
looking east




Photo F4

Southeast corner of school, looking northeast

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 6: REDONDA LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	Julv 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLF Sept 2015			
		FIGURE F5			




**Photo F5**  
**North side of building between parking area and  
 school looking east**



**Photo F6**  
**West side of school looking south**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 6: REDONDA LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PLE	Sept 2015		
					FIGURE F6






**Photo F7**  
**West side of school looking east from the**  
**west side of Redonda Street**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 6: REDONDA LANDFILL PHOTOGRAPHS				
	PROJECT No. 1522283			PHASE No. 1000
	DESIGN	—	July 2015	SCALE AS SHOWN
	GIS	—	—	REV.0
	CHECK	MKF	Sept 2015	FIGURE F7
	REVIEW	PLE	Sept 2015	



# **APPENDIX G**

## **7. Kimberly Landfill Site**



## APPENDIX G

### 7. Kimberly Landfill Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Kimberly Landfill Site (Site 7), located at Kimberly Avenue between London Street and Gibson Street in Winnipeg, Manitoba, as illustrated on Figure G1. For the purposes of this report Kimberly Street is being described as running east-west. The Kimberly Landfill Site covers an area of approximately 12 hectares (ha) and was operated from the 1958 until it closed in 1971. The landfill was used as an incinerator site with the incinerator located in the space currently occupied by the Terry Sawchuk Arena. The ash and partially burned waste and general domestic waste was deposited in pits, on the surface and in trenches (to a lesser extent).

In 1979 and 1980, a drilling program was conducted at the Kimberly Landfill Site, which included the drilling of 71 boreholes to depths ranging from 0.8 metres (m) to 10.4 m. The stratigraphy encountered at the Site reportedly included fill (clay and gravel) to a depth of 0.3 m to 1 m below grade (up to 2.7 metres at the northeast corner), overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation. A silt layer of approximately 1 m thickness was present at some locations approximately 2 m to 3 m below grade.

Of the 71 boreholes drilled at the Site, 41 contained waste/refuse, including domestic waste, paper, wire, glass, grass, manure, metal, concrete, tires, rags, and/or wood. The maximum depth of waste observed was 8.5 m below grade at one borehole location believed to be at the south east end of the Site.

Monitoring wells and/or landfill gas probes were installed in 26 of the boreholes and labelled as follows: P9L, P14L, P15E, P16E, P18E, P19L, P20L, P21E, P24L, P25E, P26L, P27E, P32L, P41E, P47E, P50E, P51E, P52E, P55E, P59E, P60E, P61E, P65E, P66E, P70E and P71E.

In 1981 a landfill gas barrier was constructed around the majority of the perimeter of the waste footprint as shown on Figure G3. The barrier consists of a cut-off trench, a chlorinated polyethylene barrier membrane and a granular gas collector system with a perforated horizontal gas collector pipe. The trench was installed to a depth of approximately 3.6 metres below ground surface, which is below the water table. Landfill gas probes/vents were installed along the length of the barrier.

Additional landfill gas probes were installed in the 1980s. Drilling of additional boreholes was also completed in 2008. Details of the boreholes were not available for review.

Ground surface is at an elevation of 232 m above sea level (masl). The top of the waste mound is at 244 masl. The water level within the waste is reportedly as 228.6 masl.

The cover material is undocumented; however, reportedly may have consisted of fill to up to 1.2 m in thickness. A 45 m landfill gas control zone was allotted for the Site in 1988 as shown on Figures G1 to G3. In 2008 the methane ventilation and detection system at the Terry Sawchuk Arena was updated. An alarm system is in place.

Constraints previously reported for the Site included minimal cap and restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.



## APPENDIX G

### 7. Kimberly Landfill Site – Winnipeg Landfill Status Report

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Kimberly Landfill Site. Findings from the most recent Site visit, completed on July 4, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- Grass is well maintained and the vegetation did not appear stressed;
- The soil was noted to be saturated with water due to recent precipitation;
- No illegal dumping, slope stability, drainage or leachate issues were identified during the Site visit; and,
- Nine landfill gas probes could be located and were monitored (PV14, PV13, P51E, P55E, P101E, P117E, P118E, P119E and P47E).

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was used primarily as a park with sports fields. An elevated waste mound is located on the west end of the Site with two distinct peaks. The slopes of the elevated waste mound were fairly steep in some areas. The peaks of the waste mound were covered with gravel type material and vegetation was not growing in these areas. A light standard exists on the top of the waste mound.

The Site is located in a residential area. The Terry Sawchuk Arena is located in the central part of the Site, but not within the waste footprint. The Terry Sawchuk Arena was placed on the same area on which the incinerator was located. It is understood that it was previously assumed that little to no waste exists under the arena because the incinerator was in that location. A residential development was noted to the east of the Site. To the west is an undeveloped portion of land followed by a residential area. To the north is a residential area and schools. To the south are sports fields, a pool and a school.

The Site was mainly grass covered and the grass was well maintained. Stressed vegetation was noted at the top of the waste mounds. No exposed waste was observed but the City staff noted that occasionally buried waste breaks the ground surface. No debris or dumping was noted. The Site was formerly used as a leaf and yard waste depot but signs have been installed advising people they are not to leave this type of waste at the Site anymore.

The waste boundary was fairly well defined for the waste mound, but the flat areas contain ash and the waste boundary in the flat areas is not well defined. Fill is brought in regularly to fill in depressions. A landfill gas barrier exists at the presumed extent of waste placement at the Site, however, there have been concerns that some waste may exist beyond or below the barriers.

No groundwater monitoring wells or leachate collection systems are present. Landfill gas probes are located at the Site. The arena has a landfill gas detection system; however, the City cannot access the system to monitor it. The City monitors inside the arena as well as in residential homes to the east that are within the control zone.





## APPENDIX G

### 7. Kimberly Landfill Site – Winnipeg Landfill Status Report

See attached Table G1 and Figures G1 through G3 for Site specific details. It should be noted that all landfill gas probes and wells are shown on Figure G3, but some of these may be lost or destroyed and therefore not included in the current monitoring program. Site photographs are provided in Figures G4 and G5.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site. Vents and landfill gas probes are also constructed along the landfill gas barrier trench.

Landfill gas measurements were obtained from 24 to 33 landfill gas probes between 1980 and 1992. The measurements started off as weekly and reduced to annually by 1985. Methane was being generated at 20 to 60% methane by volume in air at the majority of locations completed within the landfill and greater than 20% lower explosive limit (LEL) at many locations outside of the waste footprint during 1980. By 1985 the methane decreased both within the landfill (20 to 45% methane by volume in air) and no detection of methane in the majority of probes completed outside of the waste footprint with the exception of some detections on the east and west side of trace to 7.8% methane by volume in air. By 1992 methane was not detected within the waste footprint or outside of the waste footprint with the exception of 1 location that had methane at a concentration of greater than 100% LEL within the waste footprint.

Landfill gas measurements were obtained from 33 landfill gas barrier probes from 1983 to 1986, 1990 and 1992. In 1992, half of the barrier probes had methane concentrations greater than 20% LEL. Landfill gas measurements were obtained from 12 landfill gas barrier vents in 1990 and 1992. In 1992, the concentration of methane in the vents varied from not detected to greater than 100% LEL.

In recent years, landfill gas monitoring occurred at one or more of the following landfill gas probes during 2005, 2007, 2008, 2011, 2013 and 2014: V7, V12, PV14, PV13, P47E, P51E, P55E, P60E, P101E, P117E, P118E, P119E, L123, P124E, P125E, P91B and P96B. Methane was not detected during these recent monitoring events with the following exceptions:

- An increase from 0% LEL in 2008 to up to 8% LEL during the summer of 2011 at PV13, P47E, P51E, P55E, P60E, P101E, P117E, P118E and P119E, which then reduced to 0% LEL over the next one or two years; and,
- 16% LEL at PV4, 4.5% LEL at P96B and 0.1 % methane by volume in air at PV13 in 2008.

Methane monitoring within buildings adjacent to the Site has been conducted on a regular basis by the City. In 1992 the Terry Sawchuk Arena and eight residential homes were monitored and there were no detections of methane. In 2013, the arena was locked so monitoring was undertaken from pole vents and nearby probes. No detections of methane were observed with the exception of 5% LEL in P101E.

Monitoring within residential buildings is scheduled to be undertaken annually at locations near the Site. In 2013, nine of the nineteen residents scheduled to be monitored were home, and none had detections of methane gas. In 2014, five of the fourteen residents scheduled to be monitored were home, and none had detections of methane gas.



## APPENDIX G

### 7. Kimberly Landfill Site – Winnipeg Landfill Status Report

## 3.2 Groundwater

### 3.2.1 Leachate

Groundwater samples have been collected from P19L (within the east edge of the landfill), L122 (leachate probe on the west end of the landfill) and L123 in the past (leachate probe on the west end of the landfill). Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality.

Groundwater sampling was conducted five times at the Site in 1986 (P19L only), 1988, 1989, 1992, 1993 and 1995 (L123 only). The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc. Groundwater quality results for P19L were only available for 1993.

### 3.2.2 Groundwater

There is no current or ongoing groundwater monitoring program conducted at the Site.

## 3.3 Surface Water

There is no evidence of historical surface water monitoring at this Site.

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1980 to 1992 – An extensive monitoring program was undertaken including landfill gas probes (inside and outside the waste footprint), barrier probes, vents and residential buildings;
- 1981 – Installation of landfill gas migration barrier;
- 1988 – A 45 m control zone was implemented at the Site; and,
- 2005 to 2014 – Monitoring continues at nine to seventeen probes, within Terry Sawchuk Arena and in residential homes in the control zone. Detection of methane still occurs periodically at some locations, but none within buildings.

This Site has been generating landfill gas in the past and continues to generate some landfill gas. There is evidence of minor migration beyond the waste footprint, even with the presence of a landfill gas barrier system. Water mains, sanitary sewers and roadways are located to the west, south and east of the Site. The granular material in the water mains, sanitary sewers and roadways can act as a preferential pathway for the landfill gas.



## APPENDIX G

### 7. Kimberly Landfill Site – Winnipeg Landfill Status Report

## 4.2 Groundwater

### 4.2.1 Elevations

The depth to water measured from 2008 to 2014 during the landfill gas monitoring from probes or wells installed outside of the waste fill area ranged from 2.1 to more than 4.6 m below the top of pipe.

### 4.2.2 Leachate

Based on analytical results collected between 1986 and 1995 the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- Groundwater from leachate probes L122 and L123 exceeded for total dissolved solids, chloride, manganese, iron, sodium and lead during the majority of the sampling sessions; and,
- Groundwater from P19L was analyzed for a smaller list of parameters in 1993 (the only year for which results are available) and exceeded for chloride, manganese, iron and lead.

It appears that the groundwater beneath the waste footprint has been impacted by the presence of buried waste although no current data or comparable background water quality data is available for review.

### 4.2.3 Groundwater

There is no ongoing analytical groundwater monitoring program.

## 4.3 Surface Water

There are no current, or historical, monitoring results for surface water available for review.

**TABLE G1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 7  
**Site Name** Kimberly Landfill Site

**Landfill Operation**

<b>Waste type</b>	Ash, partially burned refuse and general refuse
<b>Start date</b>	1958
<b>End date</b>	1971
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit, Surface, (minor trench use)
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	12		
Depth of waste below ground surface (metres)	Average 7.6		
Height above ground surface (metres)	15.8		
Slope %	Steep in some areas	Cover thickness (metres)	0 - 1.2
Cover material	Potentially fill (undocumented)		
Comment on slopes	Fill has been brought to the Site in the past due to settlement		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Membrane barrier (waste is potentially beyond barrier and deeper than barrier)
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	City of Winnipeg (Site), City of Winnipeg and private (control zone)
<b>Current</b>	Park with sportsfields
<b>North</b>	School and residential
<b>East</b>	Residential
<b>South</b>	Terry Sawchuk Arena, school, sportsfields
<b>West</b>	Vacant, residential
<b>Comment</b>	Incinerator located at present arena site

**Physical Site Setting**

<b>Ground elevation (mASL)</b>		231.6	<b>Groundwater flow direction</b>	South/Southwest
<b>Potable water? Yes/No</b>		Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	None			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	228.6	<b>Max</b>	230.4
<b>Minimum clay thickness below base grades (metres)</b>		4.6		
<b>Minimum depth to till (metres)</b>		12.2		
<b>Minimum depth to bedrock (metres)</b>		18.9		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	228.9	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Fill has been brought to the Site in the past due to settlement
<b>Erosion</b>	Top of landfill has exposed gravel material
<b>Seeps</b>	No
<b>Other</b>	--





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

Content may not reflect National Geographic's current map policy.  
Sources: National Geographic.

0 25 50 100  
1:2,500 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 7: KIMBERLY LANDFILL, WINNIPEG, MANITOBA

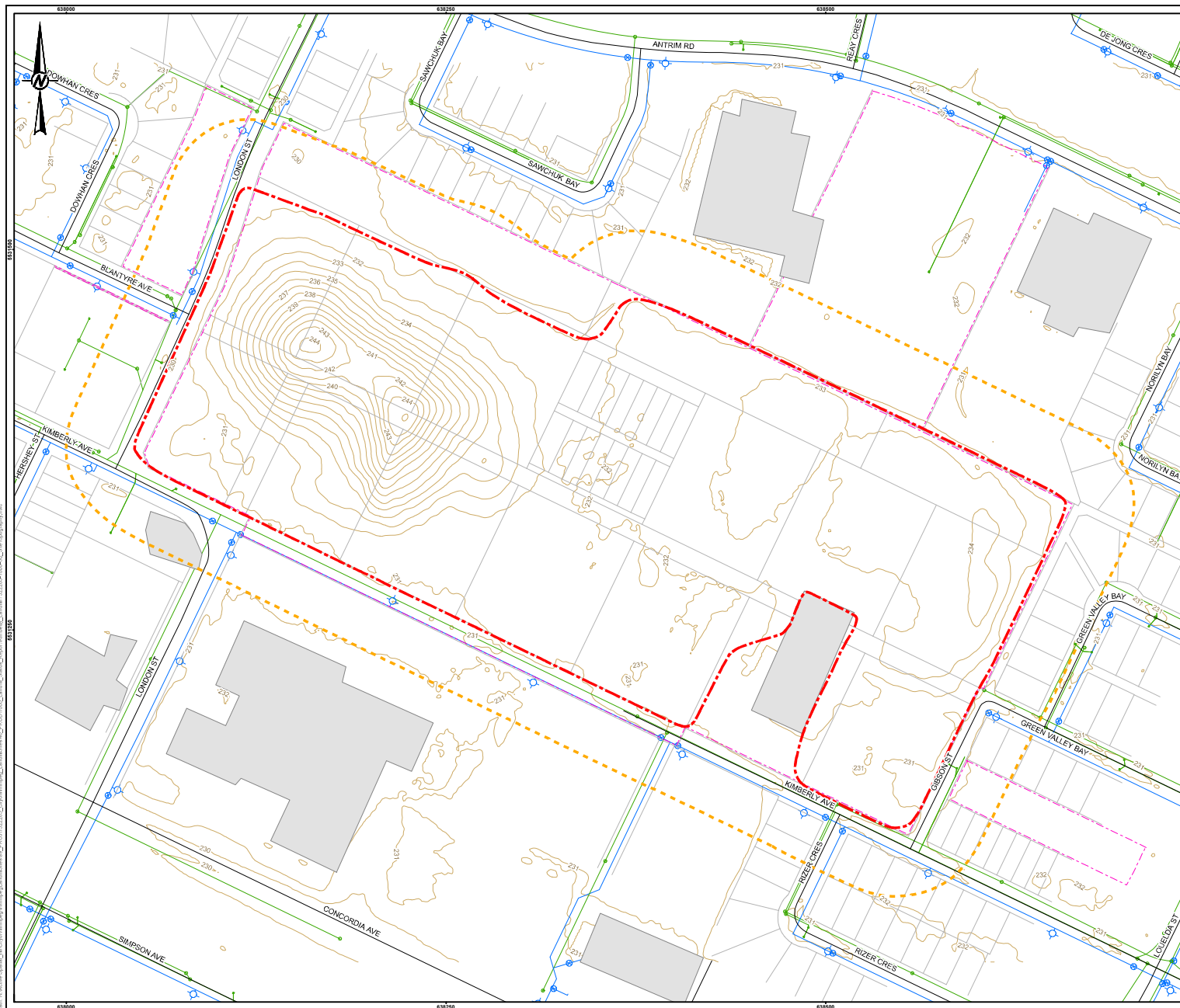
**TITLE**  
SITE PLAN

CONSULTANT	YYYY-MM-DD	2015-06-30
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE











PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>G1</b>
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 28mm

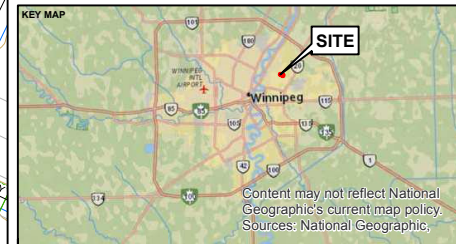




**LEGEND**

-  LANDFILL FOOTPRINT  
 CONTROL ZONE AREA  
 CITY OWNED PROPERTY PARCEL  
 PROPERTY PARCEL  
 BUILDING FOOTPRINT  
 ROAD  
 UTILITY  
 SANITARY SEWER  
 WATER MAIN  
 TOPOGRAPHIC CONTOUR, metres

**KEY MAP**



**NOTE(S)**

- NOTE(S)  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

## REFERENCE(S)

- REFERENCE(S)  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

CLIENT

CLIENT  
CITY OF WINNIPEG

## PROJECT

WINNIPEG LANDFILL STATUS REPORT  
SITE 7: KIMBERLY LANDFILL, WINNIPEG, MANITOBA

## SITE TOPOGRAPHY

CONSULTANT

YYYY-MM-DD 2015-06-30

DESIGNED	MKF
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PREPARED	BR
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REVIEWED
MKF

APPROVED	PLE
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PROJECT NO.

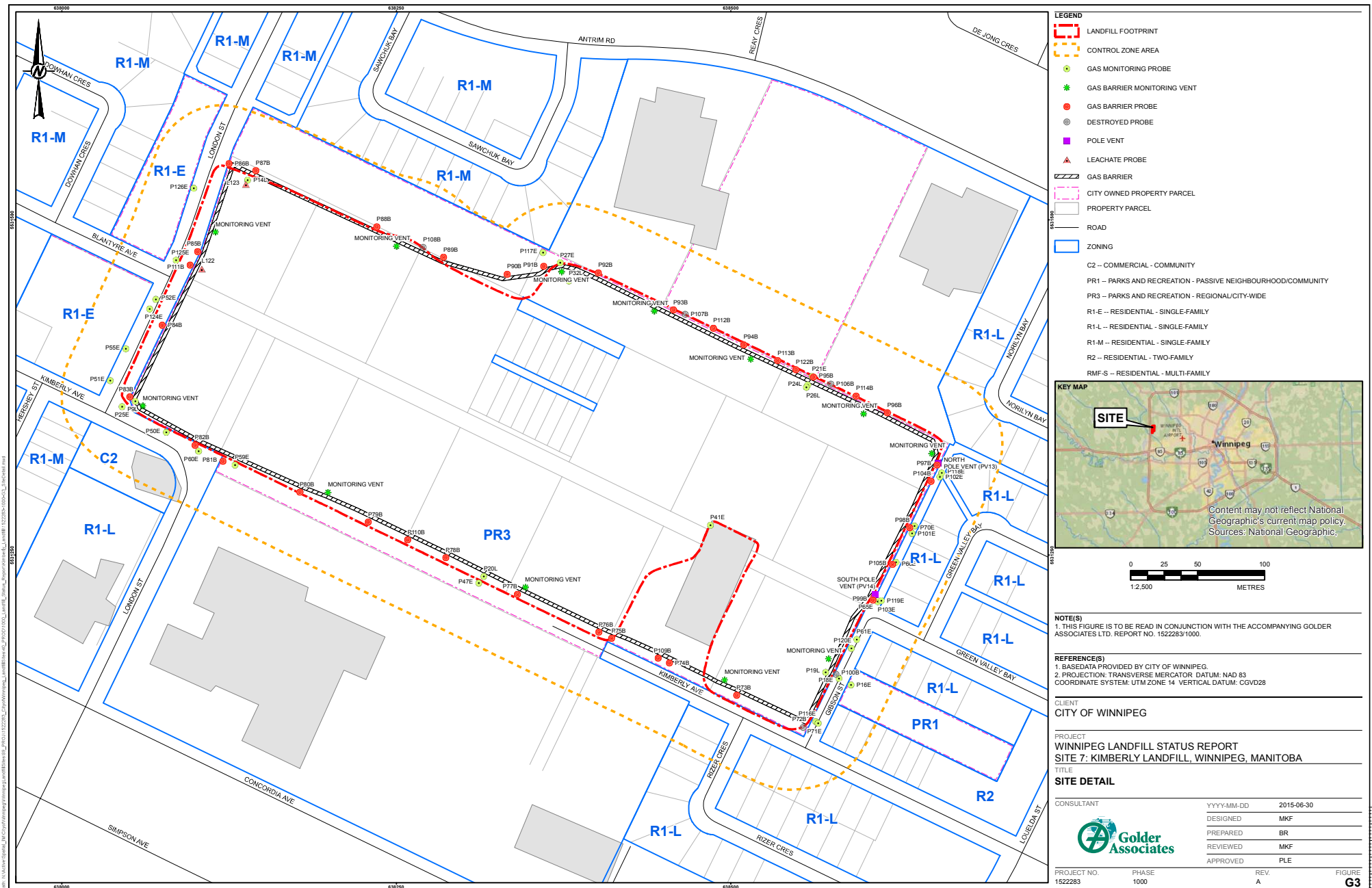
PHASE

REV.

A

FIGURE  
**G2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:







**Photo G1**

**Facing west across Site from parking lot at arena**




**Photo G2**

**Top of eastern waste mound facing west.  
Stressed vegetation visible in foreground**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 7: KIMBERLY LANDFILL SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF Sept 2015		
				REVIEW	PIE Sept 2015		
				<b>FIGURE G4</b>			






**Photo G3**  
**View of Site from waste mound facing east.**  
**Arena visible**



**Photo G4**  
**View from east end of the Site looking west**  
**towards arena**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 7: KIMBERLY LANDFILL SITE PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE G5	



# **APPENDIX H**

## **8. Cordite Landfill Site**



## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Cordite Road Landfill (Site 8), located on the northwest corner of the intersection of Plessis Road and Cordite Road in Winnipeg, Manitoba, as illustrated on Figure H1. The Cordite Road Landfill covers an area of approximately 9.8 hectares (ha) and was operated by the City of Winnipeg between 1957 until it closed in approximately 1975. The Site has not been developed since it closed and is an open field although fencing was erected to prevent public use. The waste reportedly includes unburned domestic and construction waste. The Site reportedly has a compacted clay liner ranging in thickness from 0.6 to 1.2 m. Erosion and settling have occurred at the Site. Large areas; however, remain undocumented. Concentrations of total dissolved solids, sulphate, and chloride in the bedrock are the lowest of the landfills monitored in this study. Groundwater in the vicinity of the Site is used for domestic purposes and a 90 m landfill gas control zone has been established for the Site although there are no barriers in place. The Site is located within a mixed residential/industrial area.

In 1980/1981, a drilling program was conducted at the Cordite Road Landfill, which included the drilling of 28 boreholes to depths ranging from 1.1 metres (m) to 6.1 m. The stratigraphy encountered at the Site reportedly included fill (clayey, gravelly) and/or topsoil to depths ranging from 0.6 m below grade to 1.8 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 28 boreholes drilled at the Site, 9 contained waste/refuse, including black domestic waste, paper, rags, wire, and cables. The depth of waste, where present, extended to a maximum depth of at least 5.5 m below ground surface and reportedly to a maximum depth of 7.6 m below grade. At seven locations, the surficial fill contained metal, wire, wood, organics, concrete rubble, and/or bricks.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in October 1980

- P4L, drilled to a depth of 5.5 m below grade, located on the west slope of the landfill;
- P7E, drilled to a depth of 5.5 m below grade, located on the edge of the swampy ditch on the west side of the Site;
- P8L, drilled to a depth of 5.5 m below grade, located in the south-central portion of the waste Site. This well can no longer be located on-Site;
- P13E, drilled to a depth of 6.1 m below grade, located on the edge of Cordite Road, just south of P8L. This well can no longer be located on-Site;
- P18E, drilled to a depth of 5.8 m below grade, located on the east side of the Site. This well can no longer be located on-Site; and,
- P19L, drilled to a depth of 5.8 m below grade, located on the east side of the Site, just west of P18E. This well can no longer be located on-Site.



## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

#### Drilled and Installed in March 1981

- P22E, drilled to a depth of 5.5 m below grade, located on the west side of the Site;
- P23E, drilled to a depth of 5.8 m below grade, located on the west side of the Site. This well can no longer be located on-Site;
- P25E, drilled to a depth of 4.0 m below grade, located in the southwest corner of the Site;
- P26E, drilled to a depth of 5.8 m below grade, located south of the central portion of the landfill in the southern portion of the road. This well can no longer be located on-Site;
- P27E, drilled to a depth of 4.0 m below grade, located at the southeast corner of the landfill;
- According to the available drawings, ten additional boreholes were drilled (numbered 29 to 38) and P32E, P36E, P37E, and P38E were installed within their respective boreholes to the east and south of the waste fill area, although no drill logs were available for review. P36E can no longer be located on-Site; and,
- According to the available drawings, ten additional boreholes/leachate wells were drilled (numbered L39 to L48) were installed within at the top of the waste fill area, although no drill logs were available for review. L39, L40, L42, L43, L44, and L45 can either no longer be located on-Site or are destroyed. Leachate wells L46 and L48 are likely shown as LD46 and LD48 on Figure H3.

#### Drilled and Installed in January 2008

- In 2008, an additional drilling program was conducted at the Cordite Road Landfill, which included the drilling of LD-49, drilled to a depth of 6.6 m below grade and screened from 1.5 m to 6.1 m below grade. Clay fill was present from ground surface to 1.4 m below grade, underlain by waste to a depth of 6.2 m below grade, underlain by clay. The probe was dry following installation. LD-50 was reportedly also drilled at the Site although no drill log was available for review. Both wells remain on-Site although are not shown on Figure H3.

Landfill gas has historically been a concern at the Site. High landfill gas concentrations (greater than 10% methane by volume) have been identified within the waste fill area. The edge of the waste on the east, north, and west sides of the landfill is at the property boundary. Two probes were installed on Cordite Drain (south of the landfill). No landfill gas was detected and the Drain was relied upon as a barrier to gas migration. To the west, landfill gas monitoring was undertaken at commercial/industrial properties. Natural methane (i.e. associated with the decomposition of natural organic matter and not refuse) was reported beneath the buildings. A railway is present to the north and the property to the south is an open field.

#### Slope Stabilization Work

KGS Group prepared a remedial works letter to address slope stability issues on the north slope that were implemented in 2010.

Ground surface is at an elevation of 232 m above sea level (masl). The water level is reportedly 2.1 m below grade in the waste fill area and there is an 8.5 m thick clay layer below the maximum landfill depth.

The cover material is fill extending from 0.6 to 1.2 m below existing grade. Waste reportedly extends from 7.6 m below grade to 12.2 m above grade. In 1992, the Site was owned and maintained similarly to today (i.e. as a





## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

vacant field). Constraints previously reported for the Site included a minimal cap and restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

The nearest industrial well is greater than 1.5 km northwest of the Site. Smaller private residential or commercial wells are located closer and are monitored by the City.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Cordite Road landfill. Findings from the most recent Site visit, completed on July 2, 2014 were as follows:

- The Site inspection was conducted by solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was overgrown with grass and thistles;
- Stressed vegetation/bare spots were noted in various areas throughout the landfill and were either related to gravelly soil or to the presence of methane. Areas of stressed or no vegetation were noted at the base of the slope along the east side of the landfill near the southeastern gate;
- Dumping of household waste (such as chairs, sofas, and wooden pallets) and construction waste were also noted throughout the landfill, which made walking and driving on-Site difficult;
- Hydrogen sulphide could be detected by scent prior to opening probe casings at P32E, LD-49, and LD-50;
- No drainage or leachate issues were identified during the Site visit;
- Evidence of erosion channels from surface water run-off were noted on the southwestern side of the landfill;
- Major sloughing was noted on the eastern slopes of the landfill; and,
- No buildings were present on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site contained slopes with settling evident at the top of the waste fill area. The slopes were not smooth and erosion was noted, specifically on the north and east sides. Generally no exposed debris was noted. A chair was noted. The Site has been fenced due to unauthorized recreational off-road use by the public. A hydrogen sulphide odour was noted near the leachate drain, which consists of vertical drains, installed to reduce mounding and installed at the southwest limit of the landfill. No buildings or landfill gas migration barriers were present on-Site. Stressed vegetation and bare areas were noted in the southern and eastern portions of the landfill. A ditch surrounds the landfill and a wetland area is present to the north.

Previously installed leachate and landfill gas probes were still present on-Site.

See attached Table H1 and Figures H1 to H3 for Site specific details. Site photographs are provided in Figures H4 through H8.



## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Based on available reports, the landfill gas data summary for results collected between 1980 and 1984, fifteen probes existed (12 outside the waste, 3 inside the waste fill area). The results indicated that probes located outside the waste fill area (P7E, P13E, P18E, P19E, P22E, P25E, P26E, P27E, P32E, P36E, P37E, P38E) had landfill gas concentrations of greater than 20% of the lower explosive limit (LEL) of methane, or 1% methane by volume, on at least one occasion. These probes are located on the west, south and eastern limits of the landfill. Probes located inside the waste fill area had landfill gas concentrations of greater than 100% LEL (10% methane by volume, at P4L, P8L and P19L) on at least one occasion. These probes are located on the west, south and eastern limits of the landfill, respectively.

Between 1985 and 1992, annual landfill gas sampling was completed at the following locations:

- 1985 – 10 outside waste, 3 inside waste (two outside probes [south of the drain] were inaccessible). One outside probe (west side) had trace methane gas concentrations (less than 20% LEL) and two inside probes had concentrations greater than 100% LEL. The remaining probes were non-detect;
- 1986 – 12 outside waste, 3 inside waste. 4 outside probes had trace concentrations, 1 outside probe had a methane concentration greater than 20% LEL and two inside probes had concentrations greater than 100% LEL. The remaining probes were non-detect;
- 1987 – 12 outside waste, 3 inside waste. One inside probe had a concentration greater than 100% LEL. The remaining probes were non-detect. Vinyl chloride analysed within the landfill gas was reported to be 2.6 parts per million;
- 1988/1989 (90 m control zone established for the Site) – 11 outside waste, 3 inside waste. Two inside probes had concentrations greater than 100% LEL. The remaining probes were non-detect.
- 1990 – 10 outside waste, 3 inside waste, 2 leachate wells. Two inside probes and two leachate wells had concentrations greater than 100% LEL. The remaining probes were non-detect;
- 1991 – 10 outside waste, 3 inside waste, 2 leachate wells. Two inside probes and two leachate wells had concentrations greater than 100% LEL. The remaining probes were non-detect; and,
- 1992 – 9 outside waste (P22E could not be located), 3 inside waste, 2 leachate wells. One outside probe (P13E located south of the landfill) had a concentration of 5% methane. Two leachate wells had concentrations greater than 100% LEL. The remaining probes were non-detect.



## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

In 1992, six landfill gas samples were also collected from within the building located at 165 Cordite Road (approximately 45 m west of the landfill). Two probes were installed beneath the floor slab and four samples were collected mid-air. The results were as follows:

- Of the 2 samples collected beneath the floor slab, one was between 0.01% and 1% by volume and one was greater than 5% by volume; and,
- Of the 4 samples collected mid-air, three were less than 0.01% by volume and one was between 0.01% and 1% by volume.

Currently, a landfill gas monitoring program is performed inside the building located at 165 Cordite Road on an annual basis. Based on the results provided, the maximum concentration of methane beneath the floor slab was 40% by volume, while the maximum concentration of methane at a floor crack inside the building was 12% by volume. During the most recent sampling event, conducted on August 14, 2014, no methane was reportedly detected from the floor drain or the manhole at this property. The location of the manhole was not provided

Since 1992, sporadic landfill gas sampling has been conducted at the Site at several locations, including P4L, P7E, P22E, P25E, P27E, P32E, P37E, P38E, L41, L45, LD-46, L47, LE-48, LD-49, and LD-50. During the most recent sampling event at each location, methane was detected at 5% LEL at P4L (2013), 13% LEL at P40 (2008), 15% LEL at LD-46 (2013), 48% LEL at LD-48 (2013), 71% LEL at LD-49 (2013), and 65% LEL at LD-50 (2013). No detectable landfill gas was detected at the remaining locations.

## 3.2 Groundwater

Groundwater sampling events were previously conducted at the Site between 1986 and 1992 at leachate wells P4L, P19L, and L39. No current groundwater monitoring program has been implemented at the Site.

Groundwater sampling was conducted five times at each leachate well between December 11, 1985 and May 6, 1992. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Groundwater sampling has also previously been completed at 12 wells located on surrounding residential and commercial/industrial properties. These wells were labelled GWQ-2 through GWQ-13 and were sampled a minimum of 4 times between March 8, 1982 and April 11, 1992, with the exception of GWQ-10, which was only sampled once in 1982.

Results were compared to both the CCME water quality guidelines for the protection of aquatic life (wetland to the north) and the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 (the area in the vicinity of the Site is used as a potable water supply).

## 3.3 Surface Water

There is no surface water present at the Site and therefore no historical or current surface water sampling program.



## APPENDIX H

### 8. Cordite Road Landfill – Winnipeg Landfill Status Report

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

As of July 2014, there were seven landfill gas probes and eight leachate wells present at the Site.

High landfill gas concentrations (greater than 10% methane by volume) have been identified within the waste fill area. Concentrations of landfill gas beneath the floor slab of the building located at 165 Cordite Road were also high with the maximum concentration recorded to date of 40% methane by volume. Concentrations within the building have been recorded as high as 12% methane by volume. However, results from the most recent monitoring event indicated non-detectable levels of methane in the probes located outside the waste fill area and beneath and within the building. Since there were explosive conditions previously recorded, the monitoring programs should be continued.

Migration currently does not appear significant, based on the most recent gas probe readings. Based on the type of waste reported at this location (i.e., domestic waste), the potential for landfill gas generation remains. A wetland area is noted to the north and would act as a natural barrier to landfill gas migration in this direction. Any landfill gas generated at the west, east, and south portions of the Site would likely escape through the surficial fill and migration would be expected to be limited. There is currently a ditch surrounding the landfill that could also act as a venting system.

### 4.2 Groundwater

The depth to water measured in 2014 at the Site ranged from 0.9 m below grade at P32E (located east of the landfill) to 11.2 m below grade at L41 (located on the west side of the waste fill area). There is no ongoing monitoring program. Several gas probes were dry in 2014.

Based on analytical results collected between 1982 and 1992, several metals, including cadmium, copper, nickel, lead, and/or zinc were elevated above the CCME Water Quality Guidelines for the protection of aquatic life during the five groundwater sampling events. Chloride is relatively low (i.e. generally half of the CCME water quality guideline of 640 mg/L). Ammonia is generally less than 6 mg/L. When compared to the Health Canada Drinking Water Quality Guidelines, no exceedances of the maximum allowable concentrations were noted. Any exceedances noted were of aesthetic guidelines only.

Based on the results of the wells on surrounding properties, no exceedances of the Canadian Drinking Water Standards were noted.

It appears that the groundwater has been only slightly impacted by the presence of buried waste although does not appear to be impacting nearby receptors. No current data or background water quality is available for review.

### 4.3 Surface Water

No surface water is present at the Site.



**TABLE H1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 8  
**Site Name** Cordite Road Landfill Site

**Landfill Operation**

<b>Waste type</b>	Unburned domestic and construction refuse
<b>Start date</b>	1957-1968, 1971
<b>End date</b>	~1975
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	9.8		
Depth of waste below ground surface (metres)	7.6		
Height above ground surface (metres)	12.2		
Slope %	--	Cover thickness (metres)	0.6 - 1.2
Cover material	compacted clay (0.6 to 1.2 metres), large areas undocumented		
Comment on slopes	Steep, with settlement and erosion		

**Environmental Controls**

<b>Description of leachate collection system</b>	Vertical drains located in the southwest corner of the landfill
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	City of Winnipeg. Several private owners and CP Rail own properties within the control zone
<b>Current</b>	Vacant, fenced
<b>North</b>	CP Rail line and vacant field with a rail yard and industrial land use beyond
<b>East</b>	Plessis Road with a vacant field beyond. A large industrial chimney stack is located 180 m east of the Site
<b>South</b>	Vacant field with a walking trail with agricultural land use beyond
<b>West</b>	Industrial (Speciallaser Tech Inc. and Perfanick Enterprises)
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	232	<b>Groundwater flow direction</b>	Southwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	Cordite Drain		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.8	<b>Max</b>	230.4
<b>Minimum clay thickness below base grades (metres)</b>	8.5			
<b>Minimum depth to till (metres)</b>	16.2			
<b>Minimum depth to bedrock (metres)</b>	18.9			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	229.2	<b>Max</b>	231.3

**Monitoring**

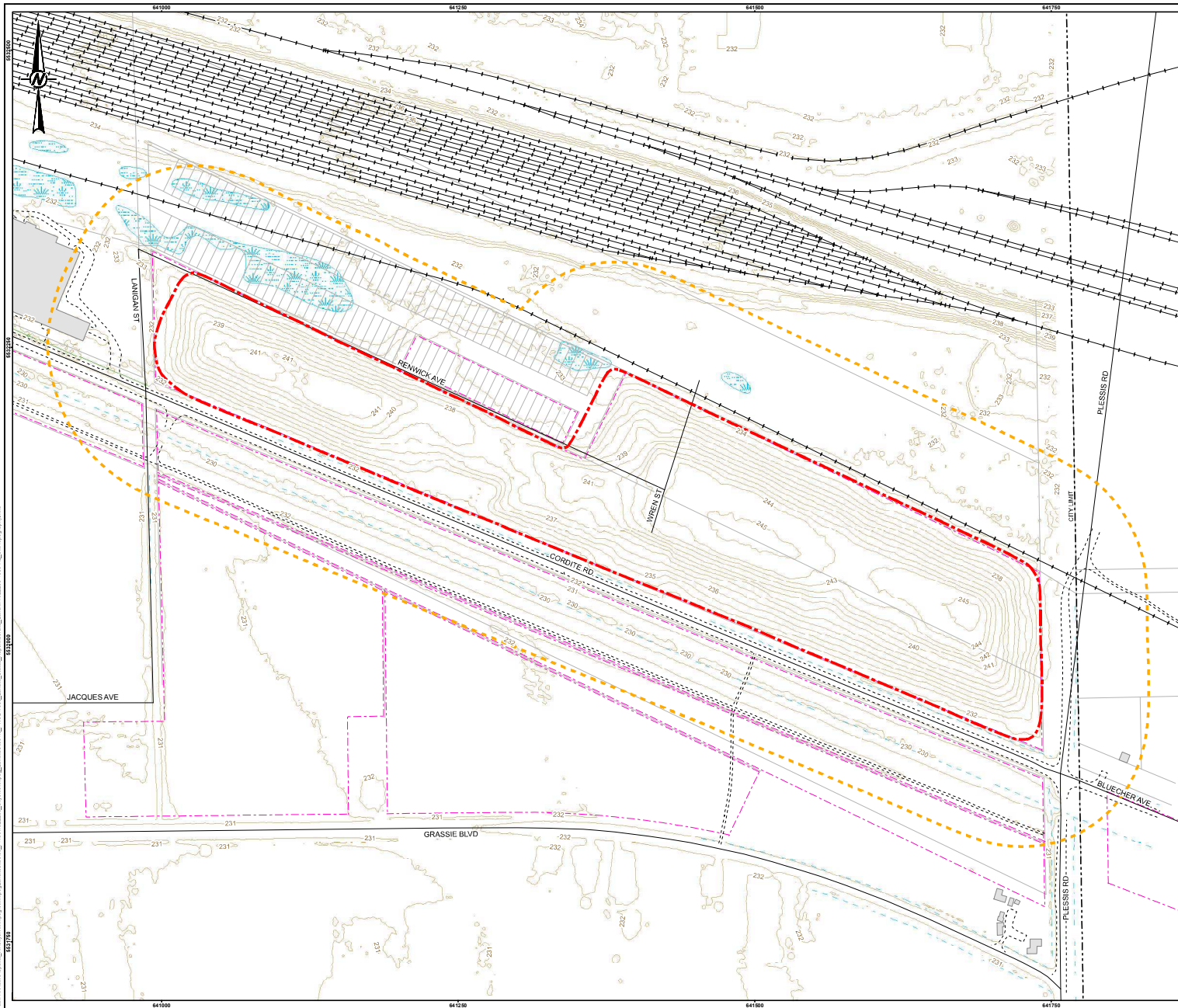
<b>Groundwater</b>	<b>Historical</b>	yes, includes domestic wells, 2 leachate probes, and 12 water supply wells	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Steep, with settlement and erosion
<b>Erosion</b>	Yes, along steep slopes
<b>Seeps</b>	No
<b>Other</b>	Settlement throughout the landfill, hydrogen sulphide odour noted







**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- BUILDING FOOTPRINT
- CITY OF WINNIPEG LIMIT BOUNDARY
- SWAMP
- ROAD
- GRAVEL ROAD
- RAILWAY
- DITCH
- TOPOGRAPHIC CONTOUR, metres
- UTILITY
- SANITARY SEWER

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic

0 30 60 120  
1:3,200 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 8: CORDITE LANDFILL, WINNIPEG, MANITOBA

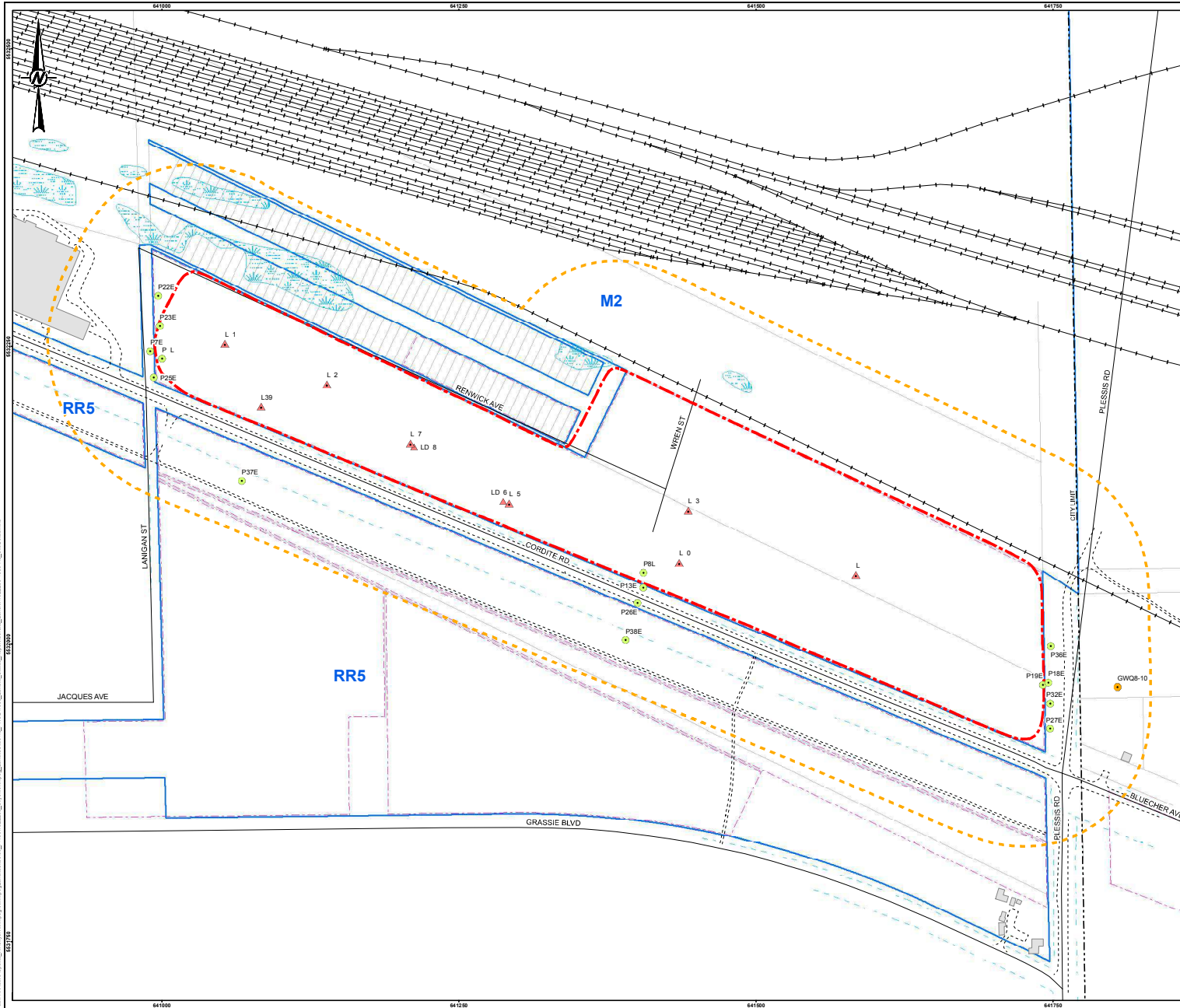
**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-02
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	H2

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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 24mm



**LEGEND**

- GAS MONITORING PROBE
- MONITORING WELL
- LEACHATE PROBE
- LEACHATE DRAIN
- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- ROAD
- GRAVEL ROAD
- BUILDING FOOTPRINT
- CITY OF WINNIPEG LIMIT BOUNDARY
- SWAMP
- DITCH
- RAILWAY
- ZONING
- M2 – MANUFACTURING - GENERAL
- RR5 – RURAL RESIDENTIAL - 5

**KEY MAP**

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 8: CORDITE LANDFILL, WINNIPEG, MANITOBA

**TITLE**  
SITE DETAIL

CONSULTANT	YYYY-MM-DD	2015-07-02
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	H3

FILE: C:\Users\jgould\Documents\Projects\1522283\_01\Winipeg\_Landfill\Site\_8\1522283\_01\_Site\_8\_Map.mxd, 2015-07-02 10:00:00, 1522283\_01\_Site\_8\_Map.mxd, 1522283\_01\_Site\_8\_Map.mxd, 1522283\_01\_Site\_8\_Map.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 25mm





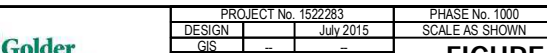
**Photo H1**  
**Neighbouring property to the north looking north**  
**from the top of the landfill**



**Photo H2**  
**Top of Cordite Road Landfill, looking west along**  
**the top of the waste fill area**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 8: CORDITE ROAD LANDFILL PHOTOGRAPHS			
 <b>Golder Associates</b>	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015	 <b>FIGURE H4</b>	
	REVIEW	PLF	Sept 2015		



**Photo H3**

**View looking southeast from the east slope of the landfill Note: Chimney stack**




**Photo H4**

**View looking south from the south slope of the landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 8: CORDITE ROAD LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE H5	





**Photo H5**

**View looking west from the west slope of the landfill**  
**Note: Industrial property (165 Cordite Road)**




**Photo H6**

**View looking north from on top of landfill**  
**Note: Wetland with a rail line beyond**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT			
WINNIPEG LANDFILL STATUS REPORT			
TITLE			
SITE 8: CORDITE ROAD LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000
	DESIGN	July 2015	SCALE AS SHOWN
	GIS		REV.0
	CHECK	MKF Sept 2015	FIGURE H6
	REVIEW	PLE Sept 2015	






**Photo H7**  
**Stressed/bare vegetation along the south slope of the landfill looking west**



**Photo H8**  
**Landfill gas probes located on the south slope of the landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 8: CORDITE ROAD LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PIE Sept 2015
		PHASE No. 1000	SCALE AS SHOWN
			REV.0
		<b>FIGURE H7</b>	





**Photo H9**  
**Vertical drains located in the southwest corner**  
**of the landfill looking east**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 8: CORDITE ROAD LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	Julv 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLT Sept 2015			
		FIGURE H8			



# **APPENDIX I**

## **9. Bonner Avenue Landfill Site**



## APPENDIX I

### 9. Bonner Avenue Dump Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Bonner Avenue Dump Site (Site 9), located at 1717 Gateway Road (near Bonner Avenue) in Winnipeg, Manitoba, as illustrated on Figure I1. The Bonner Avenue Dump Site covers an area of approximately 0.6 hectares (ha) and was operated by the City of East Kildonan from prior to 1948 until it closed in approximately 1960. The landfill is located on the Gateway Community Centre property (owned by the City of Winnipeg). The waste fill area is located partially beneath the community centre building and extends to the west under the parking area and to the east under a playground and ball diamond. The waste reportedly includes ash from partially burned domestic refuse with some bulk and industrial waste and was placed at surface.

In 1980, a drilling program was conducted at the Bonner Avenue Dump Site, which included the drilling of 83 boreholes to depths ranging from 0.6 metres (m) to 3.8 m. The stratigraphy encountered at the Site reportedly included fill (clayey, gravelly) and/or topsoil to depths ranging from 0.15 m below grade to 2.4 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 83 boreholes drilled at the Site, 22 contained waste/refuse, including fibrous organic material, ash, black organics, glass, wood, wire, metal, paper, rags, concrete, bottles, and/or straw. Odours were noted at numerous locations containing refuse. The depth of waste extended to 2.4 m below ground surface.

Monitoring wells and/or landfill gas probes were installed at select boreholes as outlined below. No wells currently remain at the Site. The following information was provided:

### Drilled and Installed in January 1980

- P12E, drilled to a depth of 3.8 m below grade, located southeast of the waste fill area (within the control zone);
- P13L, drilled to a depth of 3.8 m below grade, located within the eastern portion of the waste fill area;
- P23E, drilled to a depth of 3.7 m below grade, located northeast of the waste fill area (within the control zone);
- P24E, drilled to a depth of 3.7 m below grade, located south of the waste fill area, in the southeast portion of the current community centre building footprint;
- P25E, drilled to a depth of 3.8 m below grade, located southwest of the waste fill area;
- P38E, drilled to a depth of 3.8 m below grade, located west of the waste fill area (within the control zone);
- P39L, drilled to a depth of 3.8 m below grade, located within the western portion of the waste fill area;
- P46E, drilled to a depth of 3.8 m below grade, located southwest of the waste fill area (within the control zone), north of P25E; and,
- P47L, drilled to a depth of 3.7 m below grade, located within the southern portion of the waste fill area.



## APPENDIX I

### 9. Bonner Avenue Dump Site – Winnipeg Landfill Status Report

#### Drilled and Installed in July 1980

- P74L, drilled to a depth of 3.7 m below grade, within the northern portion of the waste fill area;
- P76L, drilled to a depth of 3.7 m below grade, located within the central portion of the waste fill area; and,
- According to the available drawings, P98E was installed to the northwest of the waste fill area and control zone, although no drill logs were available for review.

Ground surface is at an elevation of 231 m above sea level (masl). The water level is reportedly 0.5 m below grade in the waste fill area and there is a minimum thickness of 9.8 m of clay below the landfill.

The Gateway Community Centre building is partially constructed on refuse. The building was elevated with a passively vented service crawl space in the back half of the building. Air sampling is done annually (although was not completed in 2014) under the floor slab in the crawl space (accessible from the floor hatch in the maintenance room), at the furnace room floor cracks and in the enclosed storage spaces under spectator stands of the indoor soccer arena.

The cover material is fill extending from 0.6 to 1.6 m in thickness. In 1992, the Site was owned and maintained similarly to today. A 15 m landfill gas control zone was allotted for the Site in 1984.

The Site is located within a mixed residential/recreational area and is used as a community centre and for recreational purposes. Constraints previously reported for the Site included a minimal cap with a high surface contact hazard, and restricted foundation construction. Active recreation which could cause surface erosion was discouraged.

The nearest industrial well is greater than 500 m south of the Site, at Sun Valley School, where there is one supply well and one return well operated in the summer only. Depths are reportedly 79 m and 88 m below grade, respectively.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Bonner Avenue Dump Site. Findings from the most recent Site visit, completed on July 8, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the on-Site vegetation consisted mainly of grass and trees;
- No illegal dumping and no drainage, stressed vegetation, erosion, slope stability, or leachate issues were identified during the Site visit;
- Recreation Centre (well maintained and recently updated), a new playground (well maintained and installed on the western side of the recreation centre), and a shed/maintenance building located on the northern side of the Site (well maintained) were noted on the Site;
- No other issues were identified; and,
- No remaining probes were present on-Site.





## **APPENDIX I**

### **9. Bonner Avenue Dump Site – Winnipeg Landfill Status Report**

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat. The western portion of the waste fill area is a paved parking area and the central portion is covered by Gateway Community Centre and an outdoor rink. The eastern portion of the waste fill area is utilized as a recreational area with play structures and a baseball diamond. Residential developments are present to the north, west (across Gateway Road and Raleigh Street), south, and east of the recreation complex. A large surface water retention pond is located to the east of the Site. The recreational areas of the Site were mainly grass covered and well maintained. Asphalt parking areas surrounded the community centre building. No exposed debris was noted.

The Site is flat so the waste boundaries are not able to be seen, although the drawings are reported to provide a reasonably accurate location of waste. A landfill gas monitoring program is performed inside the building on an annual basis. No groundwater monitoring wells, landfill gas probes, or leachate collection systems were noted. There is no surface water near the Site. One on-Site water well is present in the northern portion of the Site and is used to flood the outdoor rink.

See attached Table I1 and Figures I1 to I3 for Site specific details. Site photographs are provided in Figures I4 through I7.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

In 1985, no detectable methane was noted in five probes located outside the waste fill area nor in three probes located inside the waste fill area. Ten on-Site landfill gas probes were decommissioned, leaving two on-Site probes located outside the waste fill area. A recommendation for a probe to the south of the building was made.

In 1986 and 1997, no detectable methane was noted in the two remaining probes. An additional probe was reportedly installed in 1988 and no detectable methane was noted in the three on-Site probes in 1988, 1989, or 1990. In 1991, two probes remained, and in 1992, only one remained. No detectable methane was reported in the existing probes.

In 1992, an air sample was taken from the crawl space in the community centre building. No detectable methane was noted.

The building was constructed above grade and has a passive vented crawl space in the back half of the building. A landfill gas monitoring program is performed inside this building in the crawl space, furnace room and within the storage/maintenance room of the indoor soccer field on an annual basis. The most recent sampling event, conducted on September 5, 2013 indicated no detectable methane concentrations under the stands, in the furnace room (drain, cracks, and mid-air), nor in the crawl space.



## **APPENDIX I**

### **9. Bonner Avenue Dump Site – Winnipeg Landfill Status Report**

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#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site. No leachate probes remain at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

No landfill gas has been reported at the Site to date. No probes remain at the Site.

Any landfill gas generated at the Site would likely escape through the surficial fill and through the space between the building and ground surface. Migration would be expected to be limited.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE I1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 9  
**Site Name** Bonner Avenue Landfill Site

**Landfill Operation**

<b>Waste type</b>	Ash from partial burned domestic waste, some bulk and industrial
<b>Start date</b>	before 1948
<b>End date</b>	~1960
<b>Operated by</b>	City of East Kildonan
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	0.6		
Depth of waste below ground surface (metres)	2.4		
Height above ground surface (metres)	0		
Slope %	0	Cover thickness (metres)	0.6 - 1.5
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	No slope. Site is flat		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Gateway community centre - elevated construction
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Gateway Community Center and Sporting Fields
<b>North</b>	Bonner Street with recreational and residential beyond
<b>East</b>	recreational, with storm water retention pond and residential beyond
<b>South</b>	recreational, residential beyond
<b>West</b>	Gateway Road and Raleigh Street, with residential beyond
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	231	<b>Groundwater flow direction</b>	South
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None. Storm water retention pond to the east		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.2	<b>Max</b>	230.7
<b>Minimum clay thickness below base grades (metres)</b>	9.8			
<b>Minimum depth to till (metres)</b>	12.2			
<b>Minimum depth to bedrock (metres)</b>	18.3			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	228.6	<b>Max</b>	230.7

**Monitoring**

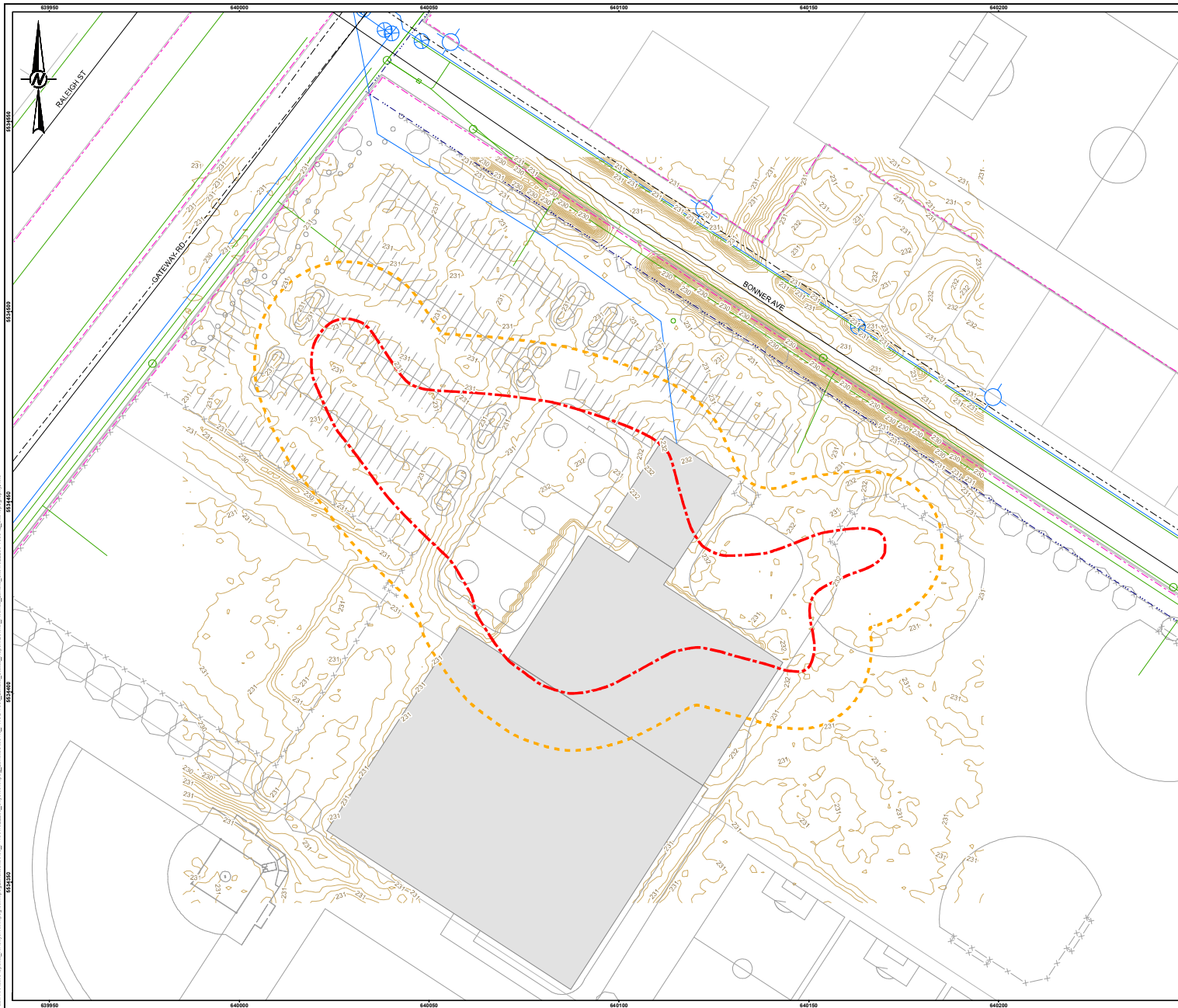
<b>Groundwater</b>	<b>Historical</b>	None	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	No slope. Site is flat
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None







- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - BUILDING FOOTPRINT
  - ROAD
  - UTILITY
    - SANITARY SEWER
    - WATER MAIN
    - MTS CABLE
    - GAS LINE
  - TOPOGRAPH C CONTOUR, metres



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

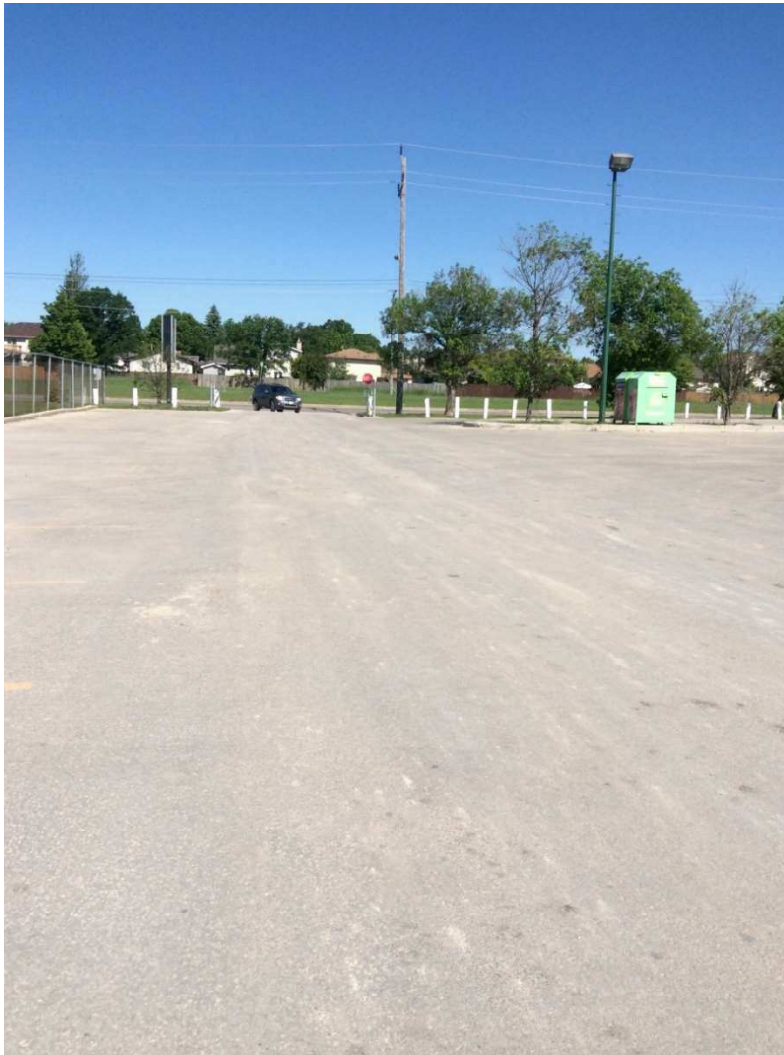
CLIENT		
CITY OF WINNIPEG		
PROJECT		
WINNIPEG LANDFILL STATUS REPORT		
SITE 9: BONNER AVENUE LANDFILL, WINNIPEG, MANITOBA		
TITLE		
SITE TOPOGRAPHY		
	CONSULTANT	YYYY-MM-DD 2015-07-28
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	12

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25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 0





**Photo I1**

**Paved parking area to the west of the community centre building, looking west from south side of the outdoor rink**


**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT



**Photo I2**

**Paved parking area to the west of the community centre building, looking north from west side of the outdoor rink**

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 9: BONNER AVENUE DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015		
		<b>FIGURE I4</b>			





**Photo I3**

**Gateway Community Centre building looking east**  
**Note: outdoor rink in the foreground**




**Photo I4**

**Playground, looking south from the parking lot,**  
**west of the outdoor rink**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 9: BONNER AVENUE DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000		FIGURE I5	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0		
		GIS	—	—	—		
		CHECK	MKF Sept 2015	—	—		
		REVIEW	PLF Sept 2015				






**Photo I5**  
**West side of community centre building,**  
**looking north**



**Photo I6**  
**Northeast corner of community centre building,**  
**looking north**  
**Note: baseball diamond in the background**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT


PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 9: BONNER AVENUE DUMP PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PIE	Sept 2015		
			FIGURE I6		



**Photo I7**  
**On-Site well used for outdoor rink**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 9: BONNER AVENUE DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS					
		CHECK	MKF Sept 2015				
		REVIEW	PLT Sept 2015	FIGURE I7			



# **APPENDIX J**

## **10. McPhillips Street Dump Site (Ash Dump)**



## APPENDIX J

### 10. McPhillips Street Dump Site (Ash Dump) – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the McPhillips Street Dump Site (Ash Dump) (Site 10), located on the west side of McPhillips Street, approximately 1.1 kilometres (km) north of Grassmere Road, in the Rural Municipality of West St. Paul, Manitoba, as illustrated on Figure J1. The McPhillips Street Ash Dump covers an area of approximately 13.1 hectares (ha) and was operated by the Town of West St. Paul and Civic Properties as a City incinerator between 1958 until it closed in 1974. The Site was reportedly used as a City incinerator and capped in 1979. The Site has not been developed since it closed and is an open field. The waste reportedly includes ash from a City incinerator, industrial and domestic, non-combustibles, and septic tank pumpings. The cover material is largely undocumented and in some areas, it has been reported that no cover material is present. Groundwater in the vicinity of the Site is used for domestic purposes and a 15 m landfill gas control zone has been established for the Site although there are no barriers in place. The Site is located within a mixed residential/agricultural area.

In 1981, a drilling program was conducted at the McPhillips Street Ash Dump Site, which included the drilling of 11 boreholes to depths ranging from 1.8 metres (m) to 8.5 m. The stratigraphy encountered at the Site reportedly included ash underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 11 boreholes drilled at the Site, 10 contained ash from surface. At 6 locations, the boreholes were terminated within the ash. The depth of waste extended to a depth greater than 8.5 m below ground surface at one location at the top of the waste fill area.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in August 1981

- P3L, drilled to a depth of 7.0 m below grade, located within the eastern portion of the ash fill area. Ash extended to a depth of 5.5 m below grade at this location;
- P4L, drilled to a depth of 8.5 m below grade, located within the central portion of the ash fill area. Ash extended to the maximum depth of investigation at this location;
- P7L, drilled to a depth of 8.5 m below grade, located within the central portion of the ash fill area. Ash extended to a depth of 7.1 m below grade at this location;
- P8L, drilled to a depth of 3.0 m below grade, located within the central portion of the ash fill area, adjacent to P7L. Ash extended to the maximum depth of investigation at this location;
- P9E, drilled to a depth of 5.5 m below grade, located at the northeast corner of the ash fill area. Ash extended to a depth of 0.5 m below grade at this location; and,
- P11L, drilled to a depth of 7.0 m below grade, located within the south portion of the ash fill area. Ash extended to the maximum depth of investigation at this location.





## APPENDIX J

### 10. McPhillips Street Dump Site (Ash Dump) – Winnipeg Landfill Status Report

A combustible gas reading of 4% of the lower explosive limit of methane (LEL) was obtained at P7L in July 2013. No other detectable methane has been reported at the Site during the most recent sampling event. The landfill is surrounded by open fields with residential properties located further east.

Ground surface is at an elevation of 230 m above sea level (masl). The water level is reportedly 0.3 m above natural grade in the waste fill area and 0.6 m below natural grade outside the fill area. There is a minimum clay thickness below the landfill of 13.1 m.

The cover material is potentially fill in the west portion of the landfill, but unknown elsewhere. Waste reportedly extends from 2.1 m below natural grade to 11.6 m above natural grade. In 1992, the Site was owned and maintained similarly to today (i.e. as a vacant field). Opportunities previously reported for the Site included potential for shelter belt plantings, winter activity, and habitat restoration. Constraints previously reported for the Site included bank stability concerns. High impact recreation which could cause surface erosion was discouraged.

The nearest industrial well is greater than 1 km east of the Site although smaller private residential or commercial wells are located closer.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the McPhillips Street Ash Dump. Findings from the most recent Site visit, completed on July 14, 2014 were as follows:

- The Site inspection was conducted by solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was overgrown with prairie grass. Some trees and cattails were located within the control zone;
- Stressed vegetation was noted along the eastern side of the slope;
- No illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit;
- No buildings were present on-Site;
- Wells P3L, P7L, P11L, W2, W3, and 3N10A were present on-Site, although installation details for W2, W3, and 3N10A were unavailable for review. P4L, P8L, and 3N10B were silted up, P9E was plugged and removed, and W1 could not be located; and,
- No landfill gas readings were obtained.



## APPENDIX J

### 10. McPhillips Street Dump Site (Ash Dump) – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was grass covered and contained steep slopes with no erosion or settling. No exposed debris was noted. The Site has a locked fence to the east of the landfill. No buildings or landfill gas migration barriers were present on-Site. No stressed vegetation was noted. A ditch runs in a west-east orientation to the north of the landfill Site, which drains the adjacent agricultural fields. It is noted that a ditch is shown based on City topographic data on Figure J2 running in a west-east orientation to the south of the landfill Site but this was not observed during the Site visit. The grass is reportedly cut twice per year. A hydro corridor is present to the west.

Previously installed leachate and landfill gas probes were still present on-Site.

See attached Table J1 and Figures J1 to J3 for Site specific details. Site photographs are provided in Figures J4 through J6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Between 1986 and 1992, annual landfill gas sampling was completed at the following locations:

- 1986 – 1 outside waste, 5 inside waste. No detectable methane concentrations;
- 1988/1989 – 1 outside waste, 5 inside waste. One inside probe had a detectable concentration less than 100% LEL. The remaining probes were non-detect;
- 1990 – 1 outside waste, 5 inside waste. Two inside probes had detectable concentrations less than 100% LEL. The remaining probes were non-detect;
- 1991 – 1 outside waste, 5 inside waste. No detectable methane concentrations; and,
- 1992 – 1 outside waste, 5 inside waste. One inside probe had a detectable concentration less than 100% LEL. The remaining probes were non-detect.

Since 1992, sporadic landfill gas sampling has been conducted at the Site at several locations, including SN10A, SN10B, P3L, P4L, P7L, P8L, and P11L. During the most recent sampling event at each location, methane was only detected at 4% LEL at P7L (2013). No other detectable landfill gas was reported at the remaining locations.



## **APPENDIX J**

### **10. McPhillips Street Dump Site (Ash Dump) – Winnipeg Landfill Status Report**

## **3.2 Groundwater**

### **3.2.1 Leachate**

Groundwater sampling events were previously conducted at the Site between 1981 and 1992 at probes P3L and P7L. Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality.

Groundwater sampling was conducted seven times at P3L and five times at P7L between November 3, 1981 and May 7, 1992. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Results were compared to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 as the area in the vicinity of the Site is used as a potable water supply.

### **3.2.2 Groundwater**

Groundwater sampling has also previously been completed at 8 wells located on surrounding residential and commercial/industrial properties. These wells were labelled GWQ 10-1 through GWQ 10-8 and were sampled a minimum of 3 times between March 4, 1982 and May 8, 1992, with the exception of GWQ 10-8, which was only sampled twice (in 1988 and 1989).

Results were compared to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 as the area in the vicinity of the Site is used as a potable water supply.

No current groundwater monitoring program has been implemented at the Site.

## **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Trace concentrations of landfill gas have historically been reported at the Site. However, results from the most recent monitoring event indicated non-detectable levels of methane were reported at all existing probes with the exception of P7L, which had a reading of 4% LEL in 2013.

Migration currently does not appear significant, based on the most recent gas probe readings. Based on the type of waste reported at this location (i.e., burned waste), the potential for landfill gas generation is low. Any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There is currently a ditch running in a north-south orientation to the east of the landfill (between the Site and residential properties) that could also act as a venting system.



## APPENDIX J

### 10. McPhillips Street Dump Site (Ash Dump) – Winnipeg Landfill Status Report

## 4.2 Groundwater

### 4.2.1 Elevations

The depths to water measured in 2014 at the Site were generally greater than 5 m below grade and most wells have been dry in the past due to the high mounded area. There is no ongoing monitoring program.

### 4.2.2 Leachate

Based on analytical results collected between 1981 and 1992, nutrients (nitrate + nitrite), cadmium, chromium, and lead were elevated above the Health Canada Drinking Water Quality Guidelines at both P3L and P7L on at least one occasion during the groundwater sampling events. Copper, sulfate, and chloride were elevated above their respective aesthetic objectives. Ammonia is moderately high and generally less than 31 mg/L.

### 4.2.3 Groundwater

When the results of the adjacent wells were compared to the Health Canada Drinking Water Quality Guidelines, with the exception of the following, no exceedances of the maximum allowable concentrations were noted:

- nutrients (nitrate + nitrite) ranging from 3.5 mg/L to 4.2 mg/L during the three sampling events (1987, 1988 and 1999) at GWQ 10-5, approximately 2.5 km southwest of the Site. There is no actual guideline for the combined concentration of nitrite and nitrate, however, the most stringent of the two parameters (nitrite at 1 mg/L), was used as a guideline; and,
- Lead (50 µg/L) during the March 1982 sampling event only at GWQ 10-1, located at the residential property to the east of the Site. Six subsequent sampling events at this location had reported concentrations of less than 5 µg/L. The guideline for lead is 10 µg/L.

The remaining exceedances noted were of aesthetic guidelines only.

Based on the results of the wells on surrounding properties, no current exceedances of the Canadian Drinking Water Standards were noted.

It appears that the groundwater on-Site has been slightly impacted by the presence of buried waste although does not appear to be impacting nearby receptors as reported concentrations in the water wells were much less than those reported on-Site and remain below guidelines. No current data or background water quality is available for review.

## 4.3 Surface Water

No surface water is present at the Site.



**TABLE J1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 10  
**Site Name** McPhillips Street Dump Site (Ash dump)

**Landfill Operation**

<b>Waste type</b>	Ash, industrial and domestic, non-combustibles, septic tank pumpings
<b>Start date</b>	1958
<b>End date</b>	1979 (capped 1984)
<b>Operated by</b>	City Incinerator
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	13.1		
Depth of waste below ground surface (metres)	2.1		
Height above ground surface (metres)	11.6		
Slope %	--	Cover thickness (metres)	West end none, rest unknown
Cover material	Potentially Fill (undocumented)		
Comment on slopes	Steep slope. No erosion concerns		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	Regional municipality of West St. Paul and Civic Property
<b>Current</b>	Seeded/mowed fields, vacant
<b>North</b>	Agricultural
<b>East</b>	Vacant, residential
<b>South</b>	Agricultural
<b>West</b>	Agricultural
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>		230.1	<b>Groundwater flow direction</b>	East/Southeast
<b>Potable water? Yes/No</b>		Yes	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	Grassmere Drain			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	226.8	<b>Max</b>	228.6
<b>Minimum clay thickness below base grades (metres)</b>		13.1		
<b>Minimum depth to till (metres)</b>		16.5		
<b>Minimum depth to bedrock (metres)</b>		18.6		
<b>Bedrock</b>		Red River (Fort Garry - lower pt., Selkirk (SW))		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	229.5	<b>Max</b>	230.4

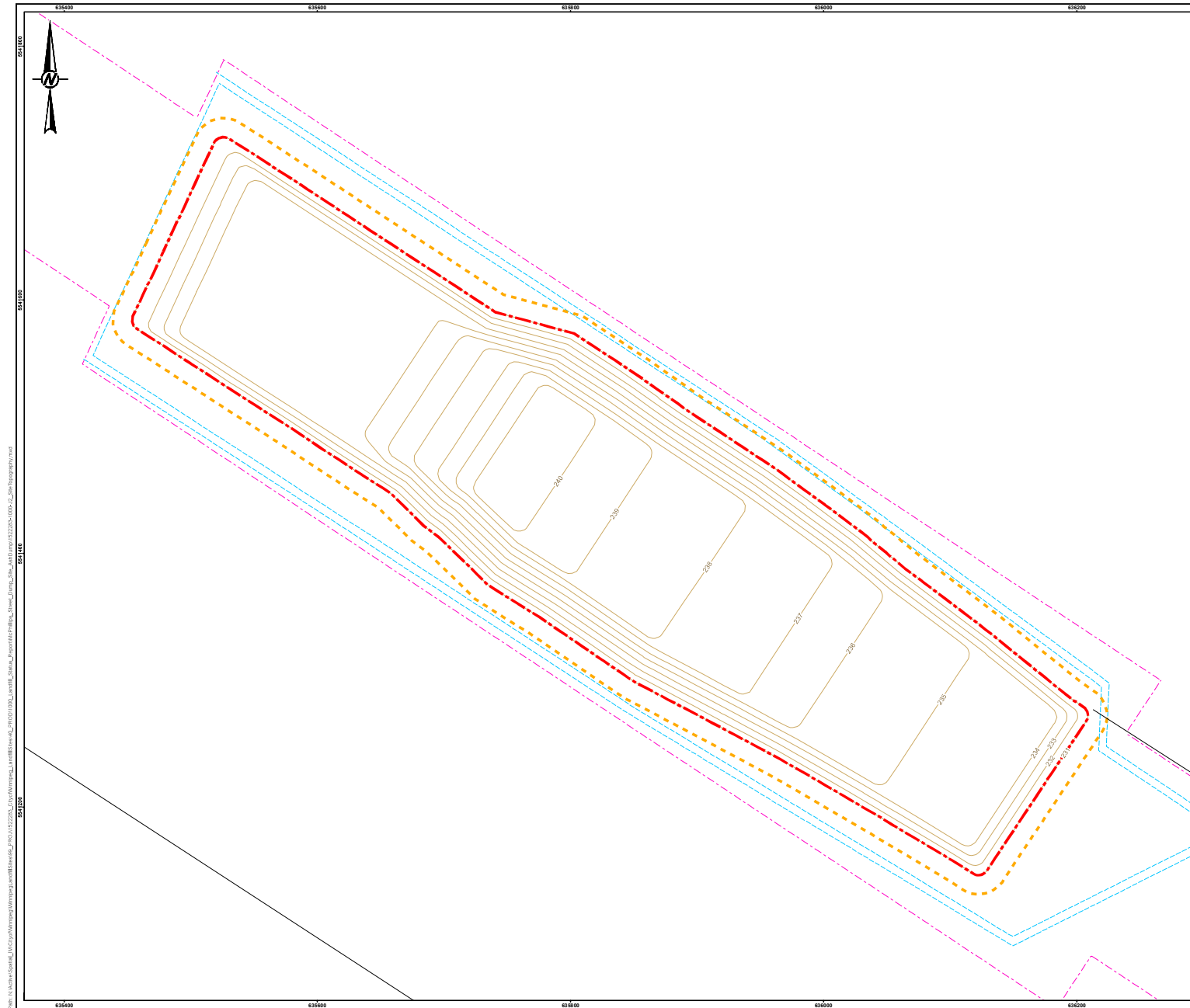
**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	yes, 4 water supply wells, 2 piezometers, leachate sampled	<b>Current</b>	0
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Steep slope. No erosion concerns
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD
- DITCH
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- TOPOGRAPH C CONTOUR, metres

**KEY MAP**

0 30 60 120  
1 3,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 10: MCPHILLIPS STREET DUMP (ASH DUMP), WINNIPEG, MANITOBA

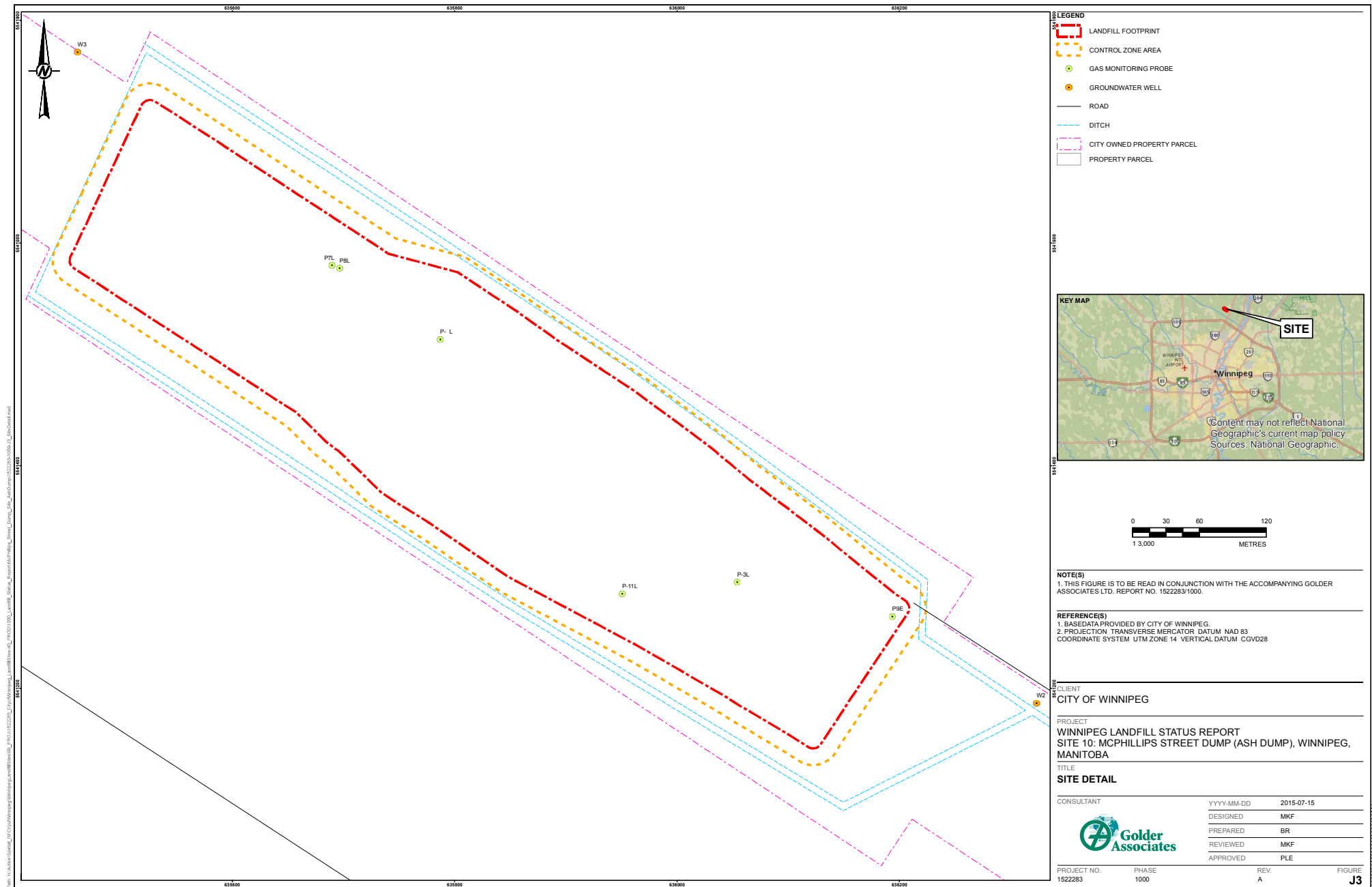
**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-15
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE J2

\\s01\projects\2015\1522283\1522283\_01\_Site Topography.mxd

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM







**Photo J1**

**View of Site looking west**

**Note: ditch in the foreground and a fence on the right side of the photograph**




**Photo J2**

**View looking southeast from the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 10: McPHILLIPS STREET DUMP SITE (ASH DUMP) PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLE Sept 2015	FIGURE J4	




**Photo J3**  
View looking west from the Site



**Photo J4**  
View looking northeast from the  
west end of the Site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT


PROJECT			
WINNIPEG LANDFILL STATUS REPORT			
TITLE			
SITE 10: McPHILLIPS STREET DUMP SITE (ASH DUMP)			
PHOTOGRAPHS			
PROJECT No. 1522283		PHASE No. 1000	
DESIGN	July 2015	SCALE AS SHOWN	REV.0
GIS	—		
CHECK	MKF	Sept 2015	
REVIEW	PIE	Sept 2015	
		<b>FIGURE J5</b>	



**Photo J5**  
**View looking north from the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 10: McPHILLIPS STREET DUMP SITE (ASH DUMP) PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	Julv 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLE Sept 2015			
		FIGURE J6			





# **APPENDIX K**

## **11. McPhillips Street Landfill Site**





## APPENDIX K

### 11. McPhillips Street Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the McPhillips Street Landfill (Site 11), located on the east side of McPhillips Street, approximately 1.1 km south of Perimeter Highway, in Winnipeg, Manitoba, as illustrated on Figure K1. The McPhillips Street Landfill covers an area of approximately 11.9 hectares (ha) and was operated by the City of Winnipeg between 1965 until it closed in 1974. The Site was used as a snow dump until at least 1992 (west of the landfill is still currently a snow dump). The Site has not been developed since it closed and is currently an open field. The waste reportedly includes all types of industrial, domestic, and bulk waste. The cover material is largely undocumented and reportedly contains fill, including clay, silt, sand, gravel, and street sweepings to depths ranging from 1.2 m to 1.8 m below grade. Groundwater in the vicinity of the Site is used for domestic purposes and a 90 m landfill gas control zone has been established for the Site although there are no landfill gas barriers or leachate collection systems in place. The Site is located within a mixed residential/agricultural/commercial/industrial area. The Site and control zone to the west is owned by the City of Winnipeg, while the control zone to the north, south and east are owned by private individuals. The Site is zoned agricultural.

In 1981, a drilling program was conducted at the McPhillips Street Landfill, which included the drilling of 34 boreholes to depths ranging from 0.6 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill and/or topsoil underlain by refuse, where present, underlain by clayey silt and clay layers to the maximum depth of investigation. Where fill or topsoil was not present, clay was reported from surface.

Of the 34 boreholes drilled at the Site, 16 contained refuse, including clayey black organics. At some locations, an oily appearance and foul odours were noted.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in May 1981

- P3E, drilled to a depth of 5.5 m below grade, located outside the northern limit of the central portion of the waste fill area;
- P4L, drilled to a depth of 5.5 m below grade, located within the northeast corner of the waste fill area (although Figure K3 shows the limits of waste further west);
- P6E, drilled to a depth of 5.5 m below grade, located east of the waste fill area;
- P7E, drilled to a depth of 5.5 m below grade, located at the northeast corner of the Site, just north of P4L;
- P15L, drilled to a depth of 5.5 m below grade, located within the south-central portion of the waste fill area;
- P17E, drilled to a depth of 5.2 m below grade, located south of the south-central portion of the waste fill area;
- P27L, drilled to a depth of 5.5 m below grade, located within the eastern portion of the waste fill area;
- P33E, drilled to a depth of 5.5 m below grade, located outside the northwest corner of the waste fill area;
- P34L, drilled to a depth of 2.7 m below grade, located within the northwestern portion of the waste fill area. Refusal was met at 2.7 m below grade and was terminated within waste; and,
- Four additional gas probes are located on-Site along the eastern property boundary, including P49E, P50E, P51E, and P52E, although no installation details have been provided electronically.



## APPENDIX K

### 11. McPhillips Street Landfill – Winnipeg Landfill Status Report

Landfill gas has historically been a concern at the Site. High landfill gas concentrations (up to 20% methane by volume) have been identified within the waste fill area, to the northwest at P33E, and to the south at P17E. The edge of the waste on the east, north, and south sides of the landfill is at the City owned property boundary. To the west, there is an active snow/fill dump. A railway is present to the east, with residential properties beyond and the property to the north and south are open fields.

Ground surface is at an elevation of 230 m above sea level (masl). The water level is reportedly at natural grade within the waste fill area and 1.2 m below natural grade outside the fill area. There is a minimum clay thickness below the landfill of 7.9 m.

The cover material is fill extending from 0.6 to 1.2 m below existing grade. Waste reportedly extends from 7.6 m below grade to 0.9 m above grade. In 1992, the Site was owned and maintained similarly to today (i.e. undeveloped and relatively flat as the majority of waste was placed below grade) with an active snow dump and residential developments nearby. Opportunities previously reported for the Site included potential for shelter belt plantings, recreational activity, and habitat restoration. Constraints previously reported for the Site included restricted foundation construction.

The nearest industrial well is greater than 1 km east of the Site although smaller private residential or commercial wells are located closer.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the McPhillips Street Landfill. Findings from the most recent Site visit, completed on July 22, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was overgrown with prairie grass. Some trees and cattails were located within the control zone;
- The trees along the north side were mostly dead;
- A truck cap was noted on-Site with some tires. No other illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit;
- No buildings were present on-Site; and,
- Wells P4L, P6E, P7E, W1, W2, P49E, P50E, P51E, and P52E were present on-Site, although installation details for W1 and W2 were unavailable for review and their locations were not provided for inclusion on Figure K3. P33L could not be located and the remaining wells/probes were terminated.



## APPENDIX K

### 11. McPhillips Street Landfill – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was grass covered with shallow slopes with no erosion or settling. No exposed debris was noted although a couch had been dumped in the southwest portion of the Site. Fill was also being placed in the western portion of the Site. No buildings or landfill gas migration barriers were present on-Site. No stressed vegetation was noted, with the exception of the trees along the north side, which were mostly dead. The distressed vegetation could be due to moisture and may not be landfill related. Ditches surround the landfill. The grass is reportedly usually maintained although was long at the time of the Site visit. A large snow dump is present to the west, agricultural fields are present to the north and south and a rail line, with residential properties are located to the east.

Previously installed leachate and landfill gas probes were still present on-Site.

See attached Table K1 and Figures K1 to K3 for Site specific details. Site photographs are provided in Figures K4 through K6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Based on electronically available reports, the landfill gas data summary for results collected between 1981 and 1984, nine probes existed (five outside the waste, four inside the waste fill area). The results indicated that probes located outside the waste fill area (P3E, P6E, P7E, P17E, and P33E) had landfill gas concentrations of greater than 20% of the lower explosive limit (LEL) of methane, or 1% methane by volume at two locations (P17E and P33E) on at least three occasions. One reading of 8% methane by volume was reported at P33E, located at the northwest corner of the waste fill area. P7E had detectable concentrations below 20% LEL on five occasions, while P3E and P6E had detectable concentrations below 20% LEL on one occasion. Probes located inside the waste fill area had landfill gas concentrations of up to 85% methane by volume (at P27L, located on the east side of the waste fill area). Probe P4L, located in the northeast corner of the Site, had no detectable methane concentrations.

Between 1985 and 1992, annual landfill gas sampling was completed at the following locations:

- 1986 – 5 outside waste, 4 inside waste. Three outside locations had detectable methane concentrations less than 20% LEL, one outside location had a methane concentration greater than 20% LEL, but less than 100% LEL, and three inside locations had methane concentrations greater than 100% LEL. The remaining 2 outside locations were non-detect;
- 1986 – 5 outside waste, 4 inside waste. One outside location had detectable methane concentrations less than 20% LEL, one outside location had a methane concentration greater than 20% LEL, and three inside locations had methane concentrations greater than 100% LEL. The remaining locations were non-detect;



## APPENDIX K

### 11. McPhillips Street Landfill – Winnipeg Landfill Status Report

- 1987 – 5 outside waste, 4 inside waste. One outside location had detectable methane concentrations less than 20% LEL and three inside locations had methane concentrations greater than 100% LEL. The remaining locations were non-detect. The vinyl chloride concentration in the landfill gas was analysed and results indicated that the concentration was 0.05 to 0.06 parts per million (ppm);
- 1988 – 5 outside waste, 4 inside waste. One outside location had a methane concentration greater than 20% LEL and three inside locations had methane concentrations greater than 100% LEL. The remaining locations were non-detect;
- 1989 – 5 outside waste, 4 inside waste. Three inside locations had methane concentrations greater than 100% LEL. The remaining locations were non-detect;
- 1990 – 5 outside waste, 4 inside waste. One outside location had a methane concentration greater than 20% LEL and three inside locations had methane concentrations greater than 100% LEL. The remaining locations were non-detect;
- 1991 – 3 outside waste, 1 inside waste. Three inside probes and two outside probes were removed for berm reconstruction. The Site was being used as a snow dump. One outside location had a methane concentration greater than 20% LEL. The remaining locations were non-detect; and,
- 1992 – 3 outside waste, 1 inside waste. Two outside locations had detectable methane concentrations less than 20% LEL and one inside probe had a detectable concentration between 20% LEL and 100% LEL. The remaining probe was non-detect.

Since 1992, sporadic landfill gas sampling has been conducted at the Site at several locations, including P4L, P6E, P14L, P7E, P33E, P49E, P50E, P51E, and P52E. During the most recent sampling event at each of these locations, including the 2013 sampling event, no detectable landfill gas was reported.

## 3.2 Groundwater

### 3.2.1 Leachate

Groundwater sampling events were previously conducted at the Site between 1986 and 1991 a minimum of once at leachate wells P4L, P15L, P27L, and P34L. Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality.

The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Results were compared to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 as the area in the vicinity of the Site is used as a potable water supply. The potable water for the nearest receptors, the residential properties to the east; however, is supplied by the City as shown on Figure K2.





## **APPENDIX K**

### **11. McPhillips Street Landfill – Winnipeg Landfill Status Report**

#### **3.2.2 Groundwater**

Groundwater sampling events were previously conducted at groundwater well P33E in 1986. Groundwater wells W1 and W2 have been sampled either annually or semi-annually since 2009.

The samples were submitted for laboratory analysis for the same parameters as leachate and compared to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program is conducted.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

Very high concentrations of landfill gas have historically been reported at the Site (up to 85% methane by volume within the waste fill area). However, results from the most recent monitoring event (2013) indicated non-detectable levels of methane were reported at all existing probes.

Based on the organic nature of waste reported at this location the potential for landfill gas generation is likely, which is confirmed by the presence of methane measured from landfill gas probes during the 1980s and 1990s. Some lateral landfill gas migration has occurred historically although the most recent gas probe readings do not demonstrate lateral gas migration. Any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There is currently a ditch surrounding the landfill that could also act as a barrier causing venting of landfill gas. No detectable landfill gas is present between the landfill and the residential properties based on the current landfill gas sampling results.

#### **4.2 Groundwater**

##### **4.2.1 Elevations**

The depth to water measured in 2014 at the Site ranged from 0.4 m below grade (P51E) to 9.3 m below grade (W1). Wells W1 and W2 are sampled annually.

##### **4.2.2 Leachate**

Based on analytical results collected between 1986 and 1991, one or more of cadmium, chromium, copper and lead were elevated above the Health Canada Drinking Water Quality Guidelines at all sampling locations on at least one occasion during the groundwater sampling events. Several additional metals, including copper, and/or lead along with sulfate and chloride were elevated above their respective aesthetic objectives. Ammonia is moderately high and generally less than 31 mg/L.



## APPENDIX K

### 11. McPhillips Street Landfill – Winnipeg Landfill Status Report

#### 4.2.3 Groundwater

When the results for wells W1 and W2 were compared to the Health Canada Drinking Water Quality Guidelines, with the exception of the following, no exceedances of the maximum allowable concentrations were noted:

- Total coliform (4 and 930) during the May and October 2013 sampling events at W2;
- E. coli (4) during the May 2013 sampling event;
- Arsenic (0.015 mg/L) in the October 2014 only at W1, and up to 0.014 mg/L during several sampling events at W2. The Health Canada Drinking Water Quality Guideline for arsenic is 0.01 mg/L;
- Chromium (0.084 mg/L) during the May 2011 sampling event only, elevated above the guideline of 0.05 mg/L; and,
- Lead (0.013 mg/L) at W1 during the November 2009 and May 2011 sampling events at W1 and 0.018 mg/L during the May 2011 sampling event, elevated above the guideline of 0.01 mg/L.

The remaining exceedances noted were of aesthetic guidelines only.

It appears that the groundwater on-Site has been impacted by the presence of buried waste. No background water quality is available for review.

#### 4.3 Surface Water

No surface water is present at the Site.

**TABLE K1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 11  
**Site Name** McPhillips Street Landfill Site

**Landfill Operation**

<b>Waste type</b>	All wastes, industrial/commercial, bulk, domestic
<b>Start date</b>	1965
<b>End date</b>	1974
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Trench, Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	11.9		
Depth of waste below ground surface (metres)	7.6		
Height above ground surface (metres)	0.9		
Slope %	--	Cover thickness (metres)	1.2 - 1.8
Cover material	Potentially Fill, including clay, silt, sand, gravel, and street sweepings (undocumented)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	Landfill and western control zone City of Winnipeg, northern, southern and eastern control zone private property
<b>Current</b>	Vacant field
<b>North</b>	Agricultural
<b>East</b>	Rail line, with residential beyond
<b>South</b>	Agricultural
<b>West</b>	Snow/fill dump
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	230.4	<b>Groundwater flow direction</b>	South/Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	226.8	<b>Max</b>	228.6
<b>Minimum clay thickness below base grades (metres)</b>	7.9			
<b>Minimum depth to till (metres)</b>	15.5			
<b>Minimum depth to bedrock (metres)</b>	24.7			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	228.3	<b>Max</b>	230.4

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes, includes domestic wells, leachate sampled	<b>Current</b>	Yes, two leachate wells, W1 and W2
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

0 30 60 120  
1:3,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 11: MCPHILLIPS STREET LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE PLAN

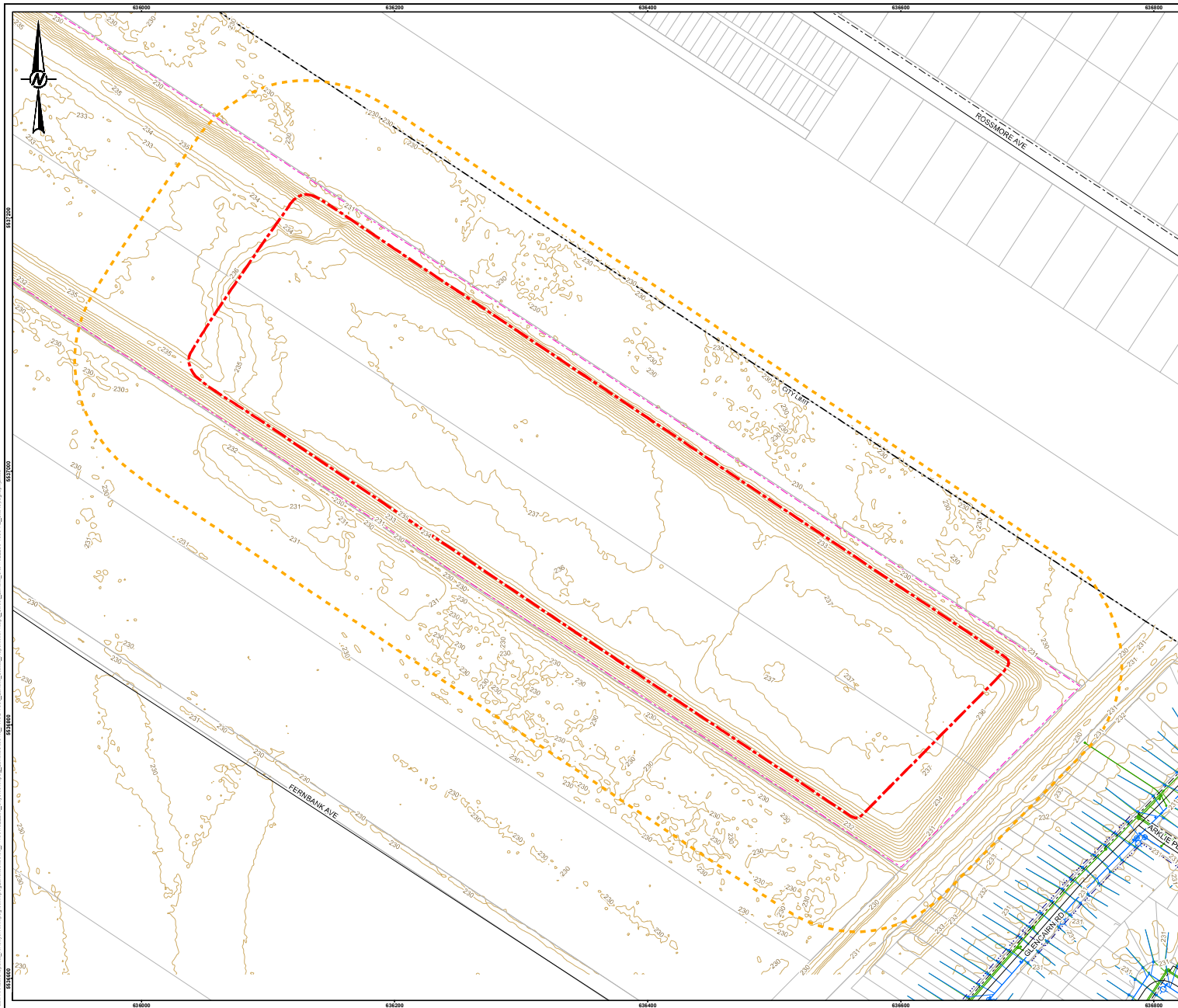
CONSULTANT	YYYY-MM-DD	2015-07-02
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE **K1**

\\s01\shared\GIS\City of Winnipeg\Landfill\Site 11\1522283\1000\Site Plan\Site Plan\_1522283\_1000\_2015-07-02.mxd

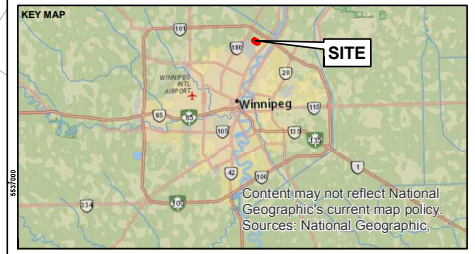
25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD
- TOPOGRAPH C CONTOUR, metres
- UTILITY
  - GAS LINE
  - MTS CABLE
  - SANITARY SEWER
  - WATER MAIN
- CITY OF WINNIPEG LIMIT BOUNDARY
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDBER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG


**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 11: MCPHILLIPS STREET LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

CONSULTANT

XXXX-MM-DD

2015-07-29

Golder Associates

DESIGNED

MKF

PREPARED

BR

REVIEWED

MKF

APPROVED

PLE

PROJECT NO.

PHASE

REV.

FIGURE

1522283

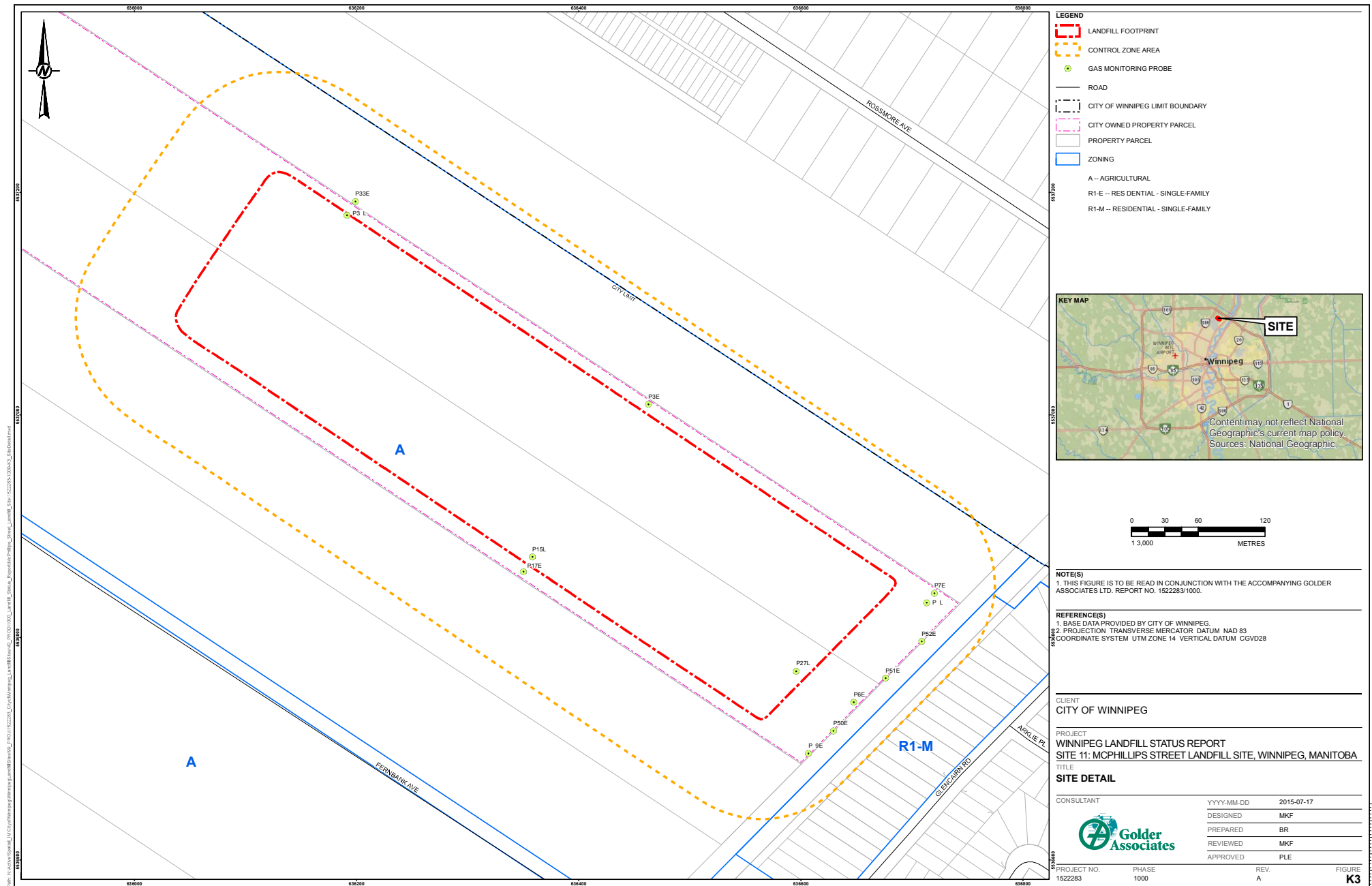
1000

A

K2

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25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM







**Photo K1**

**Neighbouring property to the east looking east**  
**Note: rail line in the foreground, with residential properties beyond**



**Photo K2**

**Drainage ditch to the south of the landfill**  
**looking south**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 11: McPHILLIPS STREET LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE K4	





**Photo K3**

**View looking west at the west side of the landfill**  
**Note: fill dumping area**




**Photo K4**

**View looking west at the snow dump from the west side of the landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 11: McPHILLIPS STREET LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		CHECK	Sept 2015
		REVIEW	Sept 2015
		SCALE AS SHOWN	REV.0
		FIGURE K5	






**Photo K5**  
**View looking south from the west side of the landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 11: McPHILLIPS STREET LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PLE	Sept 2015		
		FIGURE K6			



# **APPENDIX L**

## **12. Margaret Park Landfill Site**



## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Margaret Park Landfill Site (Site 12), located north of Southall Drive in Winnipeg, Manitoba, as illustrated on Figure L1. The Margaret Park Landfill Site covers an area of approximately 1.4 hectares (ha) and was operated from 1959 until 1963 by the City of Winnipeg. The type of waste disposed is unknown although it was reportedly disposed in multiple trenches.

A subsurface investigation was undertaken by the City in 1979 at the Margaret Park Landfill Site. The drilling program included the drilling of 49 boreholes. The depth of the 49 boreholes ranged from 1.2 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill and/or topsoil to a depth of 0.3 to 1.8 m below grade, overlying refuse (if present), underlain by silt and/or clay to the maximum depth of investigation. In areas outside of the waste footprint, an approximately 0.6 to 1.5 m layer of silt exists 0.8 to 2.1 m below ground surface at some locations.

Of the 49 boreholes drilled at the Site, 15 contained waste/refuse, including domestic waste, paper, rags and wood. The depth of waste, where present, ranged from 0.5 to greater than 1.8 m below ground surface and the thickness was 0.2 to 3.6 m thick. The 1993 Landfill Disposition Study by KGS Group (KGS) indicated that the depth of waste below ground surface was up to 4.9 m, which conflicts with the borehole data reviewed. Landfill gas probes were installed in ten of the boreholes and labelled as follows:

- P9E – drilled to a depth of 5.5 m below grade, located south of the landfill (water level 2.0 to 2.6 m below ground surface in 1979-1981);
- P10L – drilled to a depth of 5.5 m below grade, located at south end of landfill (water level 1.4 to 1.8 m below ground surface in 1979-1981);
- P15E – drilled to a depth of 2.4 m below grade, located more than 250 m east of the control zone in the adjacent soccer fields and not shown on Figure L3 (water level on average 2.2 m below ground surface in 1980);
- P17E – drilled to a depth of 3.0 m below grade, located more than 150 m east of the control zone in the adjacent soccer fields and not shown on Figure L3 (water level on average 2.3 m below ground surface in 1980);
- P29L – drilled to a depth of 5.5 m below grade, located near the southwest corner of the landfill (water level 1.4 to 1.5 m below ground surface in 1979-1981);
- P30E – drilled to a depth of 5.5 m below grade, located at southwest corner of the landfill (water level 2.3 to 4.7 m below ground surface in 1979 to 1981);
- P35E – drilled to a depth of 3.8 m below grade, located east of the landfill (water level 2.3 m below ground surface in 1979-1980);
- P38E – drilled to a depth of 5.5 m below grade, located south of the landfill (water level 2.1 to 2.6 m below ground surface in 1979-1981);
- P45E – drilled to a depth of 5.5 m below grade, located at the southeast corner of the landfill (water level 2.8 to 2.9 m below ground surface in 1971 to 1981); and,
- P47L – drilled to a depth of 5.5 m below grade, located in the southeast corner of the landfill (water level 1.6 to 2.1 m below ground surface in 1971 to 1980).



## APPENDIX L

### 12. Margaret Park Landfill – Winnipeg Landfill Status Report

Two additional probes, P78E and P79E, appear on Figure L3 but there are no borehole logs that were available for electronic review.

In 1982 a landfill gas barrier was constructed around the perimeter of the waste footprint as shown on Figure L3. The barrier consists of a cut-off trench, a chlorinated polyethylene barrier membrane and a granular gas collector system with a perforated horizontal gas collector pipe. The trench was installed to a depth of approximately 3.6 metres below ground surface, which is below the water table. Nine membrane barrier probes (P50B, P51B, P52B, P53B, P54B, P55B, P56B, P57B and P58B) and four barrier monitoring vents (V1, V2, V3 and V4) were installed within the membrane barrier although no borehole logs were available for review electronically.

Ground surface surrounding the landfill is at an elevation of 231 m above sea level (masl). There is a mounded area in the southern part of the Site with a high point of 235 masl although it is unclear if this is waste or fill. The waste is recorded approximately 4.9 metres below ground surface on average and the water level within the waste is reportedly at 233.5 masl. A maximum waste thickness is reported as 3.6 m thick.

The original cover material is undocumented; however, reportedly may have consisted of fill approximately 0.3 to 0.6 m in thickness. Additional soil was added to the baseball field within the waste footprint due to settlement issues in 2012.

A 45 m landfill gas control zone was allotted for the Site as shown on Figures L1 to L3. A constraint previously reported for the Site was restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Margaret Park Landfill Site. Findings from the most recent Site visit, completed on July 15, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The Site was mainly grass covered, well maintained with no signs of stressed vegetation;
- There was no sign of illegal dumping;
- No drainage, leachate or erosion issues were identified during the Site visit;
- No illegal dumping was occurring at the Site;
- Ground level probes near the wading pool (P78E & P77E) had sunk beneath ground level and could be a tripping hazard as they are located next to a playground that small children frequent. Casing or marking is recommended to preserve the probes and to prevent tripping; and,
- Probes P78E & P77E are very difficult to locate as they have sunk below ground level.





## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

No depressions or settlement was noted during the Site visit although some bare patches of grass were noted on top of the mounded area. This bare grass may be associated with erosion.

A railway, vacant land and a wastewater treatment plant were noted to the north of the Site and a railway and industrial lands were noted to the west. Vince Leah Park and residential development was noted to the east and south, respectively. The area of the south includes a wading pool.

No exposed refuse or dumping was observed. The waste boundary is noted as not well defined. A landfill gas migration barrier was noted around the Site and flush mounted landfill gas monitoring wells were observed.

See attached Table L1 and Figures L1 through L3 for Site specific details. Site photographs are provided in Figures L4 and L5.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs for the landfill gas probes completed for the Site.

Annual landfill gas monitoring was completed from 1980 until 1992, 2001, 2008, and 2011 to 2014. In 1980 it appears that most probes were monitored weekly and then approximately monthly in 1981. Starting in 1982 probes were monitored approximately every second month. After 1982, any monitoring completed was annually in the years noted. The results of the monitoring were as follows:

- Probes completed within the waste footprint (P10L, P29L and P47L) recorded methane readings greater than 100% the Lower Explosive Limit (LEL) consistently (more than approximately  $\frac{3}{4}$  of the sampling events) until approximately 1985 at which point it would appear that the probes within the landfill were no longer available for monitoring (either terminated, destroyed or not found);
- Probes P9E, P30E, P38E and P45E completed outside the waste footprint each had multiple concentrations of methane recorded as greater than 20% LEL in 1980, 1981 and 1982. In 1983 P38E had one recorded concentration greater than 20% LEL. In 1984 only P30E and P38E were monitored and no methane was detected;
- Probes P15E, P17E and P35E completed outside the waste footprint were monitored until 1984 and were always non-detect with the exception of <20% LEL two times in 1981 at P35E and >20% LEL one time at P15E, P17E and P35E in 1982;



## **APPENDIX L**

### **12. Margaret Park Landfill – Winnipeg Landfill Status Report**

- Probes P77E and P78E completed outside the waste footprint were monitored one time in 2001, 2008 and 2011 to 2014 and had no recorded concentrations of methane; and,
- Barrier probe P57B was monitored in 2001, 2008 and 2012 and results were non-detect with the exception of 12% methane in air in 2012. Barrier probe P58B was monitored in 2001, 2008 and 2012 to 2014 and results were non-detect.

Landfill gas sampling also occurs at floor probes and a floor drain in Vince Leah Community Centre at 1295 Salter Avenue annually. The results from 2013 and 2014 indicated that no methane was detected.

### **3.2 Groundwater**

No groundwater monitoring has occurred at this Site.

### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1980 to 1985 – An extensive monitoring program was undertaken including landfill gas probes (inside and outside the waste footprint);
- 1982 – Installation of landfill gas migration barrier;
- A 45 m control zone was implemented at the Site; and,
- 2001 to 2014 – Monitoring continues at two probes and the landfill gas barrier. Detection of methane occurred one time in the barrier.

This Site has been generating landfill gas in the past but recent results do not demonstrate consistent landfill gas migration beyond the barrier system. A water main and sanitary sewer are located to the east of the Site. The granular material in the water mains and sanitary sewers can act as a preferential pathway for the landfill gas.

### **4.2 Groundwater**

There are no current, or historical, monitoring results for groundwater available for review.

### **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.

**TABLE L1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 12  
**Site Name** Margaret Park Landfill Site

**Landfill Operation**

<b>Waste type</b>	Unknown
<b>Start date</b>	1959
<b>End date</b>	1963
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Multiple trenches
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.4		
Depth of waste below ground surface (metres)	4.9		
Height above ground surface (metres)	0		
Slope %	--	Cover thickness (metres)	0.3 - 0.6
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	--		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Membrane barrier
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	landfill - City of Winnipeg, control zone - City with small amount of residential,
<b>Current</b>	Vince Leah Community Centre parking, park, ball field
<b>North</b>	Railway, vacant land, wastewater treatment
<b>East</b>	Vince Leah Park
<b>South</b>	Park, pool, residential
<b>West</b>	Railway, industrial/commercial
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	230.9	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	--		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	228.3	<b>Max</b>	229.5
<b>Minimum clay thickness below base grades (metres)</b>	10.7			
<b>Minimum depth to till (metres)</b>	15.5			
<b>Minimum depth to bedrock (metres)</b>	24.4			
<b>Bedrock</b>	Red River (Selkirk)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	229.2	<b>Max</b>	229.8

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

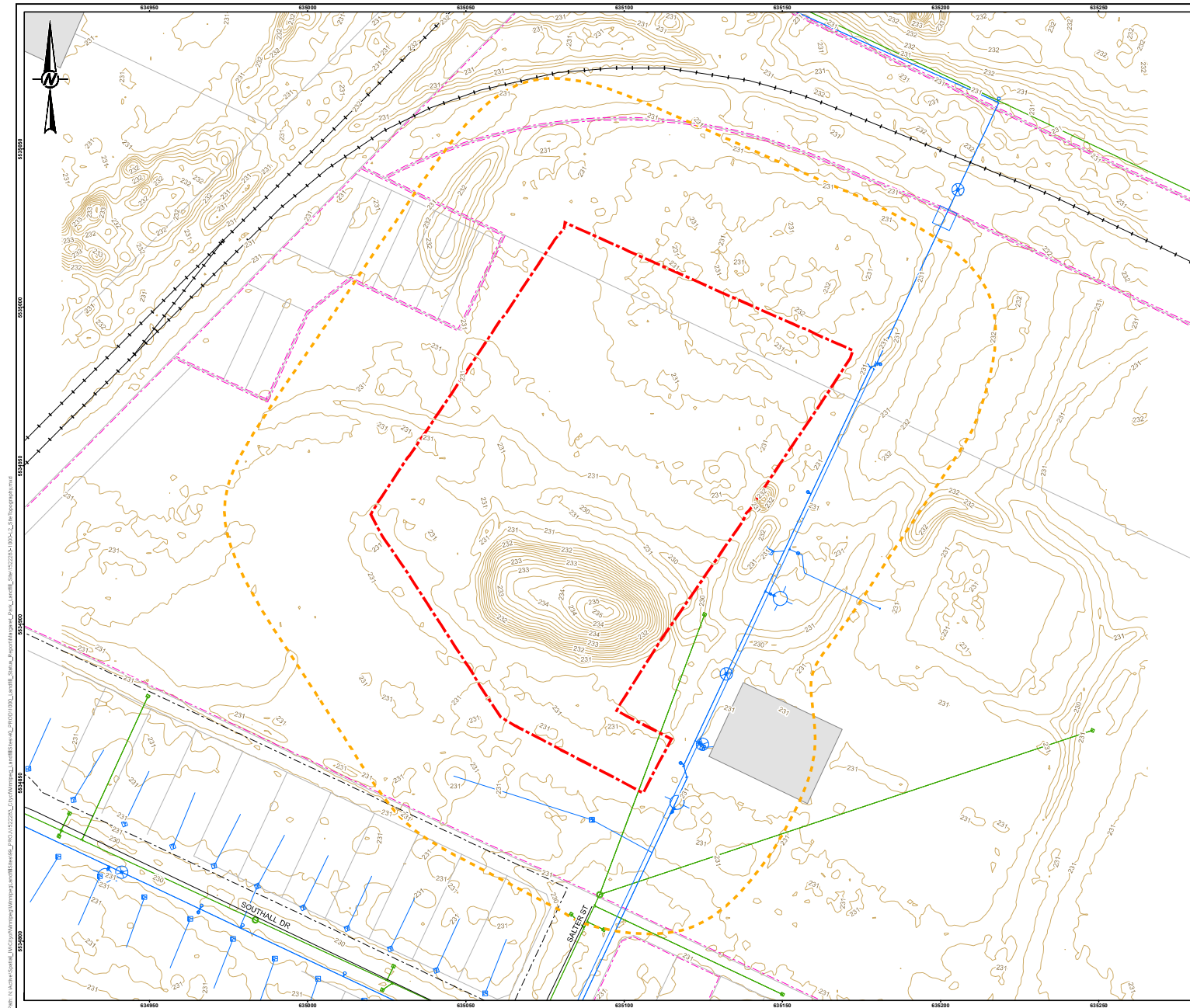
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	--
<b>Erosion</b>	Possibly a small amount on top of mound at Site
<b>Seeps</b>	No
<b>Other</b>	--

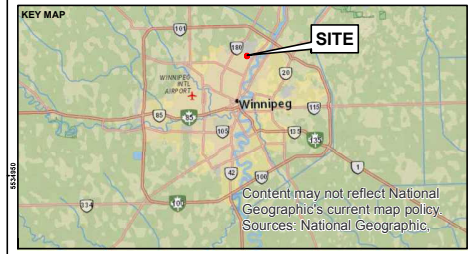








- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - ROAD
  - RAILWAY
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL
  - BUILDING FOOTPRINT
  - TOPOGRAPHIC CONTOUR, metres
  - UTILITY
    - GAS LINE
    - SANITARY SEWER
    - WATER MAIN




**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

CLIENT  
**CITY OF WINNIPEG**

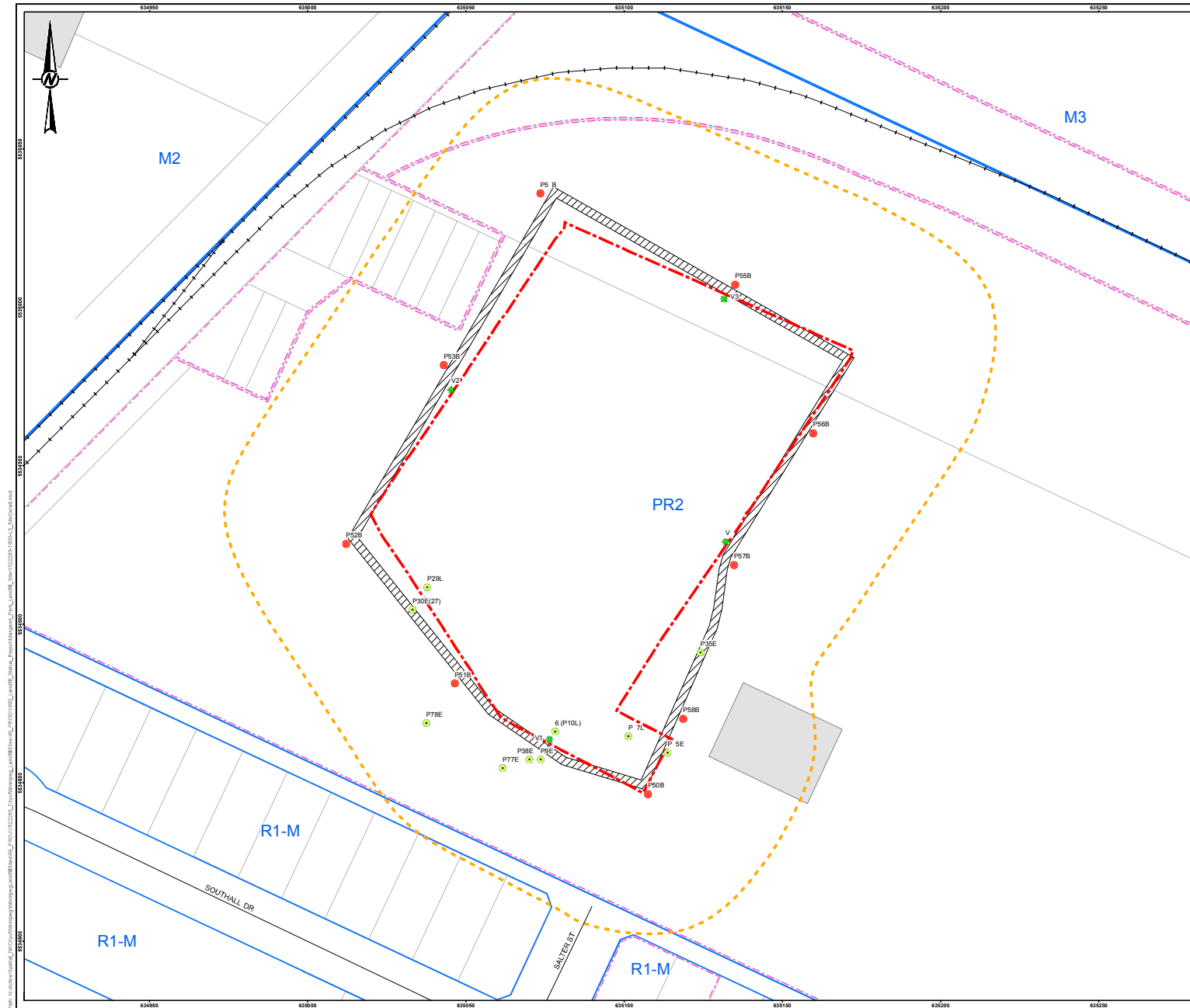
PROJECT  
**WINNIPEG LANDFILL STATUS REPORT  
SITE 12: MARGARET PARK LANDFILL SITE, WINNIPEG, MANITOBA**

TITLE  
**SITE TOPOGRAPHY**

	CONSULTANT	YYYY-MM-DD	2015-07-05
	DESIGNED	MKF	
	PREPARED	BR	
	REVIEWED	MKF	
	APPROVED	PLE	
PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>L2</b>

WINNIPEG LANDFILL STATUS REPORT - SITE 12: MARGARET PARK LANDFILL SITE, WINNIPEG, MANITOBA

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 24mm



**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- GAS MONITORING PROBE
- GAS BARRIER PROBE
- GAS BARRIER MONITORING VENT
- ROAD
- RAILWAY
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- LANDFILL GAS BARRIER
- BUILDING FOOTPRINT
- ZONING

M2 – MANUFACTURING - GENERAL  
M3 – MANUFACTURING - HEAVY  
PR2 – PARKS AND RECREATION - ACTIVE NEIGHBOURHOOD/COMMUNITY  
R1-M – RESIDENTIAL - SINGLE-FAMILY

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic

0 10 20 40  
1:2,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 12: MARGARET PARK LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE DETAIL

CONSULTANT	YYYY-MM-DD	2015-07-22
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A

**FIGURE L3**

FILE: C:\Users\jgibson\Documents\Projects\1522283\1000\1522283\_1000\_Site\_12\_Map\_1522283\_1000\_L3\_SiteDetail.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 28mm



**Photo L1**  
View looking north at the on-site mound  
from south parking lot



**Photo L2**  
View looking north from the mound

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 12: MARGARET PARK LANDFILL SITE PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015	<b>FIGURE L4</b>	





**Photo L3**  
**Wading pool in southern control zone**



**Photo L4**  
**Southeast corner of the Site - parking lot  
 and the start of the mound (left)**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 12: MARGARET PARK LANDFILL SITE PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF	Sept 2015	
		REVIEW	PIE	Sept 2015	
		FIGURE L5			





# **APPENDIX M**

## **13. Leila Avenue Landfill Site**



## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Leila Avenue Landfill (Site 13), located at 725 Kingsbury Avenue in Winnipeg, Manitoba, as illustrated on Figure M1. The Leila Avenue Landfill covers an area of approximately 6.6 hectares (ha) and was operated by the City of Winnipeg from the 1940s until it closed in 1959. The landfill is located in the central and southern portions of Garden City Park (a City-owned recreational park), which includes soccer pitches and baseball diamonds. The western portion of the Site is owned by Garden City Shopping Centre. The waste reportedly included domestic, industrial bulk, ash, possibly hospital waste.

The southeast corner of the Garden City Shopping Centre is constructed on the closed landfill. The building is a structural slab on grade with no crawlspace and has a hard asphalt surface surrounding the mall. A water main loops the building and penetrates the refuse, providing a possible contaminant pathway. There is a partial methane barrier cutoff trench and back-up methane detectors inside the cafeteria exhaust duct.

In 1979, a drilling program was conducted at the Leila Avenue Landfill, which included the drilling of 52 boreholes to depths ranging from 0.9 metres (m) to 4.0 m. The stratigraphy encountered at the Site reportedly included fill (clay/silt) to a depth of up to 1.4 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 52 boreholes drilled at the Site, 35 contained refuse, including crumbly, clay-like organics, glass, wire, cans, paper, ash, coal, wood. At another three locations, the surficial fill contained concrete, tires, wood, and/or cable in the absence of buried waste/refuse. The depth of waste, where present, ranged from 0.9 to 3.0 m below ground surface.

Monitoring wells and/or landfill gas probes were installed in select boreholes and labelled as follows:

### **Drilled and Installed in December 1979**

- P20L, drilled to a depth of 4.0 m below grade, located within the southwest corner of the waste fill area;
- P21L, drilled to a depth of 3.7 m below grade, located within the south-central portion of the waste fill area;
- P24E, drilled to a depth of 4.0 m below grade, located near the southeast corner of the waste fill area. No waste was reported at this location, but is located within the waste fill footprint on Figure M3;
- P25L, drilled to a depth of 3.7 m below grade, located within the southeast corner of the waste fill area, just west of P24E;
- P26L, drilled to a depth of 4.0 m below grade, located within the southeast corner of the waste fill area;
- P33L, drilled to a depth of 3.7 m below grade, located within the southwest corner of the waste fill area;
- P44E, drilled to a depth of 3.7 m below grade, located in the east-central portion of the Site. No waste was reported at this location, but is located within the waste fill footprint on Figure M3;
- P45L, drilled to a depth of 3.7 m below grade, located in the east-central portion of the Site;
- P46E, drilled to a depth of 2.4 m below grade, located in the northeast portion of the Site. No waste was reported at this location, but is located within the waste fill footprint on Figure M3; and,
- P49L, drilled to a depth of 2.4 m below grade, located within the northwest portion of the waste fill area.



## APPENDIX M

### 13. Leila Avenue Landfill – Winnipeg Landfill Status Report

Ground surface is at an elevation of 231 to 232 m above sea level (masl). There is reportedly a minimum silt and clay layer thickness of 7.9 m below the landfill Site.

The cover material is undocumented; however, reportedly may have consisted of fill. The fill thickness was undocumented. Waste reportedly ranges from 4.6 m below grade to grade. In 1992, the Site was owned and maintained by the City of Winnipeg and by Garden City Shopping Centre and contained a community centre, sporting fields and a shopping centre to the west. A 15 m landfill gas control zone was allotted for the Site in 1984. The control zone was historically set to 45 m in the developed portion of the Site although this is no longer reported by the City based on the drawings available for review.

The Site is located within a mixed recreational/residential/commercial area and is mainly used for recreational purposes. Constraints previously reported for the Site include restricted foundation construction with surface contact an immediate concern due to exposed waste. High impact recreation which could cause surface erosion was discouraged. No exposed waste is present currently.

The nearest industrial well is 1.4 km east of the Site. This well is used as a production/irrigation well for a cemetery and is run in the summer only. The depth is reportedly 81.4 m below grade.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Leila Avenue Landfill. Site condition findings from the most recent Site visit, completed on July 13, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was mainly grass covered with some trees and well maintained with no signs of stressed vegetation;
- No illegal dumping and no drainage, erosion, slope stability, or leachate issues were identified during the Site visit;
- No other issues were identified; and,
- No remaining probes were present on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat and grass covered. The waste fill area could not be determined. A shopping centre was noted to the west, recreational areas were noted to the north and east, and residential areas were noted to the south. No exposed debris was noted.

No groundwater monitoring wells, leachate collection systems or methane probes were noted on-Site.

See attached Table M1 and Figures M1 to M3 for Site specific details. Site photographs are provided in Figures M4 through M6.



### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Annual landfill gas sampling was performed between 1985 and 1992. No methane gas was detected at the monitored probes although only two probes were monitored in 1985, none in 1986, and one probe along Kingsbury subsequently. Oily ooze was reported in the playground in 1992 and was investigated.

In 2011, ten probe locations in the Garden City Shopping Centre were monitored for the presence of landfill gas. No detectable concentrations were reported. Additionally, one monitoring well, reportedly located in the parking lot, also had non-detectable levels of landfill gas.

Currently, a landfill gas monitoring program is performed at seven floor probe locations inside the Garden City Shopping Centre on an annual basis. During the most recent sampling event, conducted on August 12, 2014, no methane was reportedly detected.

Back-up methane detectors have been installed inside the cafeteria exhaust duct.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site. No leachate probes remain at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

No landfill gas has been detected at the Site based on the available information provided for review. Based on the type of waste reported at this location (i.e., domestic, industrial bulk, ash, possibly hospital waste), the potential for landfill gas generation is moderate. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited although the presence of utilities and the paved area surrounding the shopping centre could provide a pathway for methane generation. The monitoring inside the building should be continued and the partial methane barrier cutoff trench and back-up methane detectors should be maintained. There are additional utility lines running through the landfill which could also provide a pathway for methane generation to the east, north, and south.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.



**TABLE M1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 13  
**Site Name** Leila Avenue Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic, industrial bulk, ash, possibly hospital waste
<b>Start date</b>	1940s
<b>End date</b>	1959
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

<b>Area of footprint (ha)</b>	6.6		
<b>Depth of waste below ground surface (metres)</b>		4.6	
<b>Height above ground surface (metres)</b>		0	
<b>Slope %</b>	0	<b>Cover thickness (metres)</b>	Unknown. Fill extended to a depth of up to 1.4 m below grade in the 1979 boreholes
<b>Cover material</b>	Fill (may contain construction debris, glass, ash, etc.), formerly had areas of exposed waste (tar type waste on playing field)		
<b>Comment on slopes</b>	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Garden City shopping centre (southeast corner is on landfill). There is a partial methane barrier cutoff trench and back-up methane detectors inside the cafeteria exhaust duct.
<b>Landfill gas control zone (metres)</b>	15 (park), 45 (developed area), although this is not shown on the current drawings.

**Land Use**

<b>Ownership</b>	City of Winnipeg for landfill and control zone to the north, south and east , private for the landfill and control zone to the west
<b>Current</b>	Garden City Community Centre (ball diamonds), Garden City Shopping Centre (west)
<b>North</b>	Soccer fields
<b>East</b>	Garden City Community Centre
<b>South</b>	Kingsbury Avenue with residential beyond
<b>West</b>	Garden City Shopping Centre
<b>Comment</b>	Original site clay pits for brick site, borrow pits

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	231.6	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.2	<b>Max</b>	231.0
<b>Minimum clay thickness below base grades (metres)</b>		7.9		
<b>Minimum depth to till (metres)</b>		12.5		
<b>Minimum depth to bedrock (metres)</b>		15.8		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	229.5	<b>Max</b>	-

**Monitoring**

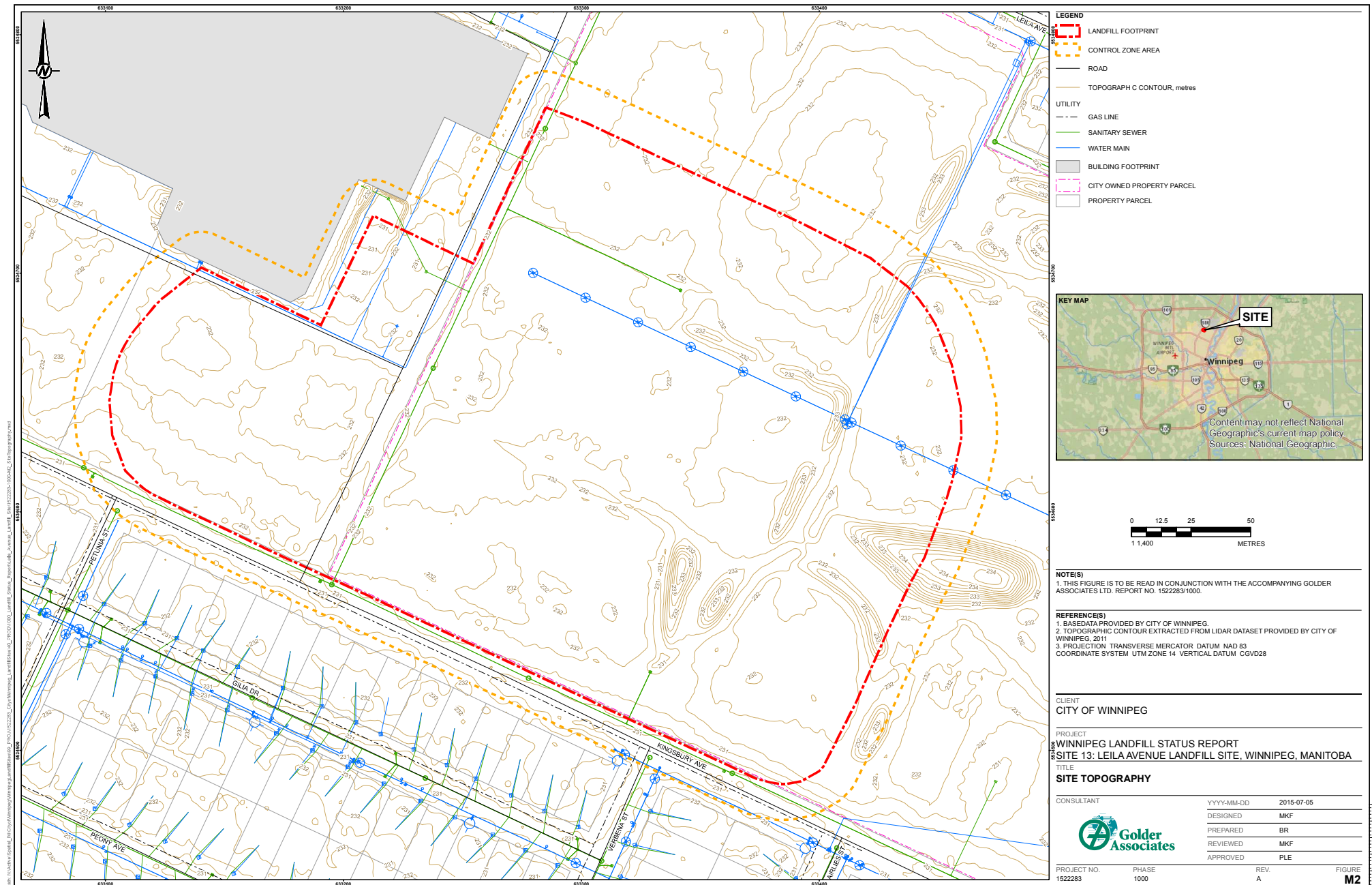
<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

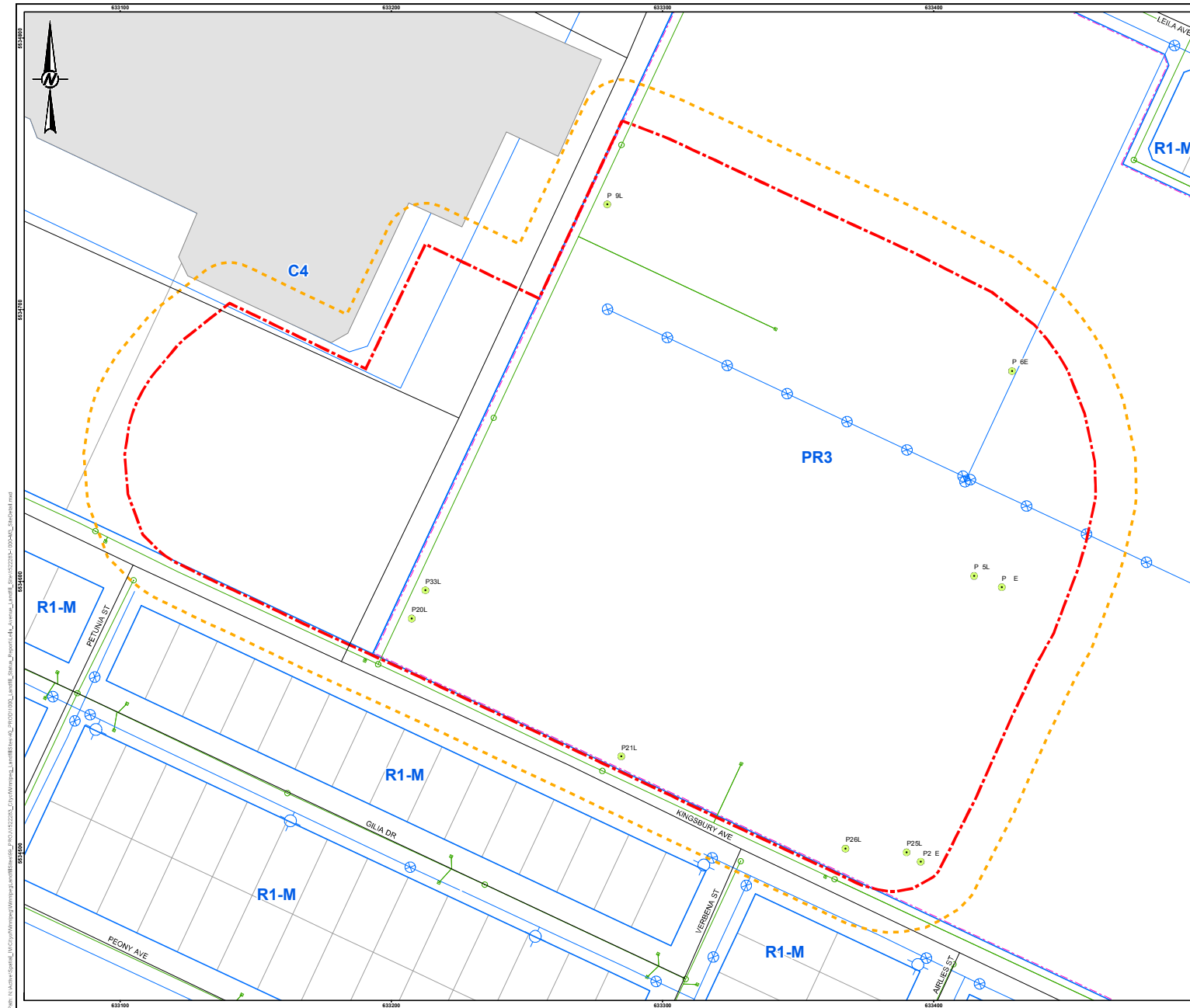
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None









**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- GAS MONITORING PROBE
- ROAD
- BUILDING FOOTPRINT
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- ZONING

C4 – COMMERCIAL - REGIONAL  
PR3 – PARKS AND RECREATION - REGIONAL/CITY-WIDE  
R1-M – RESIDENTIAL - SINGLE-FAMILY

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 12.5 25 50  
1:1,400 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

CLIENT  
**CITY OF WINNIPEG**

PROJECT  
**WINNIPEG LANDFILL STATUS REPORT  
SITE 13: LEILA AVENUE LANDFILL SITE, WINNIPEG, MANITOBA**

**SITE DETAIL**

CONSULTANT	YYYY-MM-DD	2015-07-16
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>M3</b>
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\\s01\projects\1522283\1522283\_01\_Winnipeg\_Landfill\_Status\_Report\1522283\_01\_Winnipeg\_Landfill\_Status\_Report\1522283\_01\_Winnipeg\_Landfill\_Status\_Report.mxd

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 24mm






**Photo M1**  
View of Site looking southeast



**Photo M2**  
View looking north of the landfill at the new indoor soccer fields construction

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 13: LEILA AVENUE LANDFILL PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MPF Sept 2015		
		REVIEW	PLE Sept 2015	<b>FIGURE M4</b>	






**Photo M3**  
View looking south from the landfill



**Photo M4**  
View looking north at the Canadian Tire located to the west of the landfill

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 13: LEILA AVENUE LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	Julv 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLF Sept 2015			
		FIGURE M5			



**Photo M5**  
View looking northwest at Winners located west of the landfill

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 13: LEILA AVENUE LANDFILL PHOTOGRAPHS				
PROJECT No. 1522283			PHASE No. 1000	
DESIGN	—	July 2015	SCALE AS SHOWN	REV.0
GIS	—	—	FIGURE M6	
CHECK	MKF	Sept 2015		
REVIEW	PLE	Sept 2015		





# **APPENDIX N**

## **14. Leila Avenue (West) Landfill Site**





## APPENDIX N

### 14. Leila Avenue (West) Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Leila Avenue (West) Landfill (Site 14), located on the north side of Leila Avenue, approximately 220 m east of Dunham Street in Winnipeg, Manitoba, as illustrated on Figure N1. The Leila Avenue (West) Landfill covers an area of approximately 1.9 hectares (ha) and was operated by the City of Winnipeg through the 1960s. It closed prior to 1970. The landfill is located in a vacant field and is owned by the City of Winnipeg. The 45 m control zone is owned by the City and private individuals. The waste reportedly included partially domestic, industrial bulk, and rubble.

In 1981, a drilling program was conducted at the Leila Avenue (West) Landfill, which included the drilling of seven boreholes to depths ranging from 3.7 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill (clay/silt/roadbed) to a depth of up to 1 m below grade, overlying silt and clay layers to the maximum depth of investigation. At one location the fill contained pieces of metals, but not domestic waste. No refuse was reported in the seven boreholes.

Monitoring wells and/or landfill gas probes were installed in select boreholes and labelled as follows:

### Drilled and Installed in December 1979

- P2L, drilled to a depth of 5.5 m below grade, located within the south-central portion of the waste fill area although no waste was reported in the drill log;
- P3E, drilled to a depth of 5.5 m below grade, located south of landfill;
- P7E, drilled to a depth of 5.5 m below grade, located at the northeast limit of the waste fill area;
- Locations for landfill gas probes P8E, P14E, P17E were provided by the City although no drill logs were available for review; and,
- P19E, P51E, P54E, P58E and P59L were reportedly present on-Site in 2013 although no locations nor drill logs were available electronically for review.

Ground surface is at an elevation of 231.3 m above sea level (masl). There is reportedly a minimum silt and clay layer thickness of 7.9 m below the landfill Site.

The cover material reportedly consisted of fill, which may contain construction debris, glass, ash, etc., ranging in depth from 0 m to 1.8 m below grade. Waste reportedly ranges from 4.6 m below natural grade to up to 1.2 m above natural grade. In 1992, the Site was owned and maintained by the City of Winnipeg and contained a wild grass field. The area was to become part of the Amber Trails residential area. A 45 m landfill gas control zone was allotted for the Site in 1984.

The Site is located within a residential area and is vacant. Constraints previously reported for the Site include restricted foundation construction.

The location of the nearest industrial well is unknown.



## **1.1 Previous Site Visits**

The City performs regular Site visits to the Leila Avenue Landfill. Site condition findings from the most recent Site visit, completed on July 14, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was mainly grass covered with some trees, shrubs, and thistles with no signs of stressed vegetation although the long grass prevented close inspection;
- Illegal dumping at the Site, including construction waste (concrete, gravel, soil, and metal) was noted and is reportedly a common occurrence;
- No drainage or leachate issues were identified during the Site visit;
- The slope appeared to be eroding due to run-off although the soil quality was difficult to assess due to the long grass. The slopes had little stability and were not graded nor did they have a common geographical shape;
- Safety of the Site due to public access, including children, with all of the construction waste; and,
- Several probes were present on-Site, including P7E, P8E, P14E, P17E, P19E, P51E, P54E, P58E and P59L.

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat with a small toboggan hill, reportedly made of rubble that the City pushed to the centre of the Site. Developers have reportedly used the Site to dump waste. The full waste fill area could not be determined. Rebar and other waste was noted on-Site sticking out of the top of the waste fill area. The City is reportedly bringing in topsoil to create a micro soccer field. A park structure was reportedly present on-Site within the control zone to the north.

Several wells were noted on-Site.

See attached Table N1 and Figures N1 to N3 for Site specific details. Site photographs are provided in Figures N4 and N5.



### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Annual landfill gas sampling was performed between 1985 and 1992. No methane gas was detected at the monitored probes, with the exception of a detectable reading of less than 100% LEL at one probe located inside the waste fill area in 1985. By 1987, the residential development was present in the vicinity of the Site and additional cover was recommended.

Since 2006, sporadic landfill gas sampling has been conducted at the Site at several locations, including P7E, P8E, P14E, P15E, P16E, P51E, P54E, P58E, and P59L. During the most recent sampling event conducted in July 2014, no detectable landfill gas was reported.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

Trace concentrations of landfill gas have historically been reported at the Site, although no landfill gas was detected at the Site during the most recent sampling event. Based on the type of waste reported at this location (i.e., domestic, industrial, bulk, rubble), the potential for landfill gas generation is moderate. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There are no utilities within the waste fill area.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE N1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 14  
**Site Name** Leila Avenue (West) Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic, industrial bulk, rubble
<b>Start date</b>	after 1960
<b>End date</b>	before 1970
<b>Operated by</b>	City of Winnipeg, Rural Municipality of Old Kildonan
<b>Disposal method</b>	Surface, trench
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.9		
Depth of waste below ground surface (metres)	4.6		
Height above ground surface (metres)	0.9 to 1.2		
Slope %	--	Cover thickness (metres)	0 - 1.8
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	Landfill - City of Winnipeg, control zone - City, private residential
<b>Current</b>	Vacant field
<b>North</b>	Residential
<b>East</b>	Residential
<b>South</b>	Leila Avenue, with residential beyond
<b>West</b>	Residential
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	231.3	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.8	<b>Max</b>	231.0
<b>Minimum clay thickness below base grades (metres)</b>	7.9			
<b>Minimum depth to till (metres)</b>	12.5			
<b>Minimum depth to bedrock (metres)</b>	18.3			
<b>Bedrock</b>	Red River (Fort Garry - upper pt.)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	230.1	<b>Max</b>	231.0

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Rebar and other waste was noted on-Site sticking out of the top of the waste fill area. The City is reportedly bringing in topsoil to create a micro soccer field





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 10 20 40  
1:1,200 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

**CLIENT**

CITY OF WINNIPEG

**PROJECT**

WINNIPEG LANDFILL STATUS REPORT  
SITE 14: LEILA AVENUE (WEST) LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**

SITE PLAN

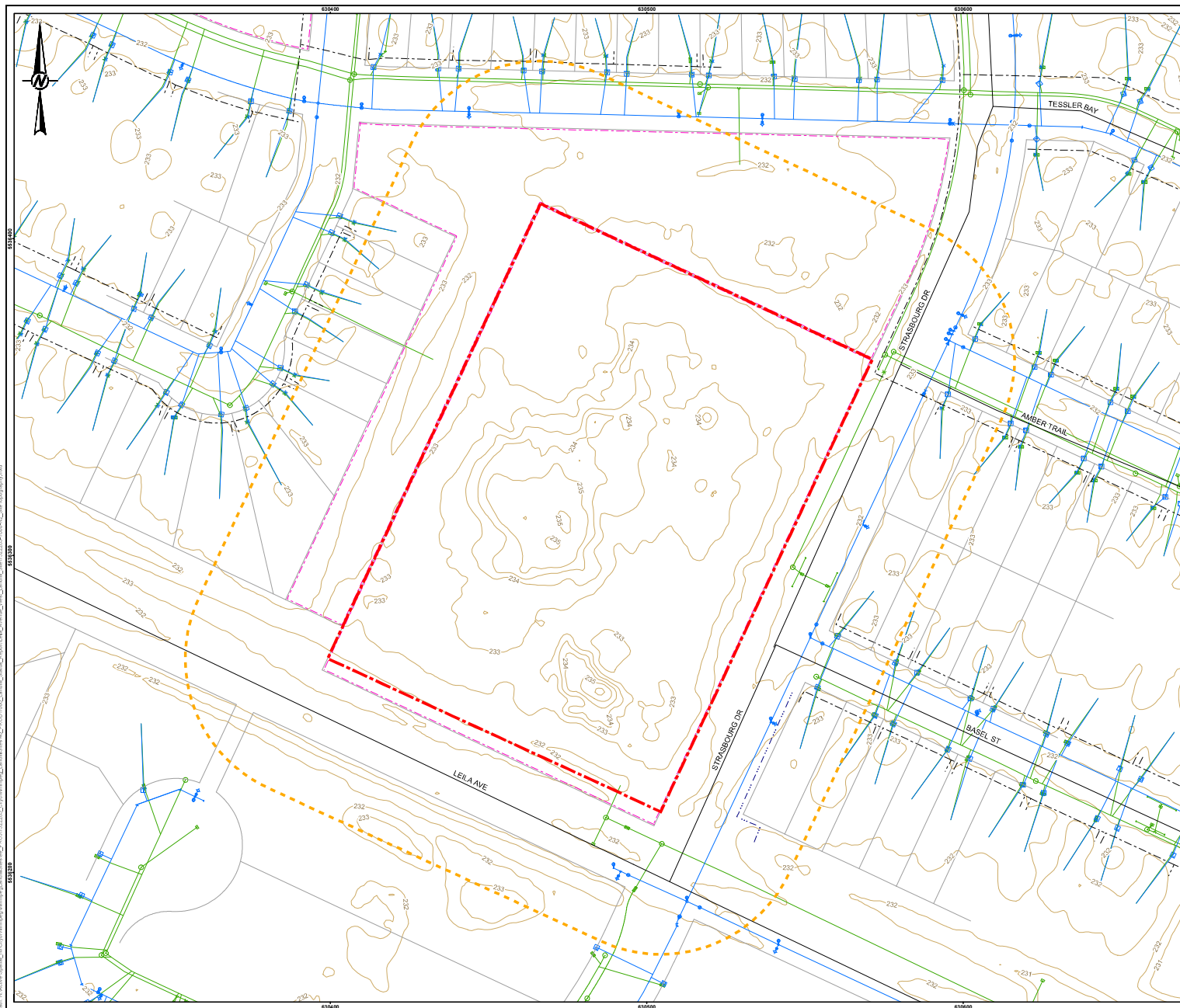
CONSULTANT	YYYY-MM-DD	2015-07-02
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>N1</b>
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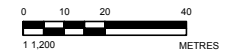
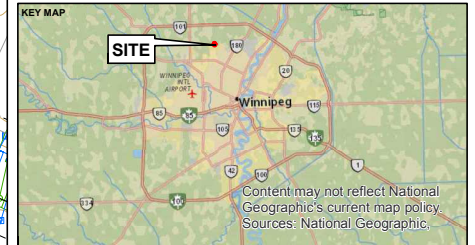
0 10 20 40  
1:1,200 METRES

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 20mm





**LEGEND**



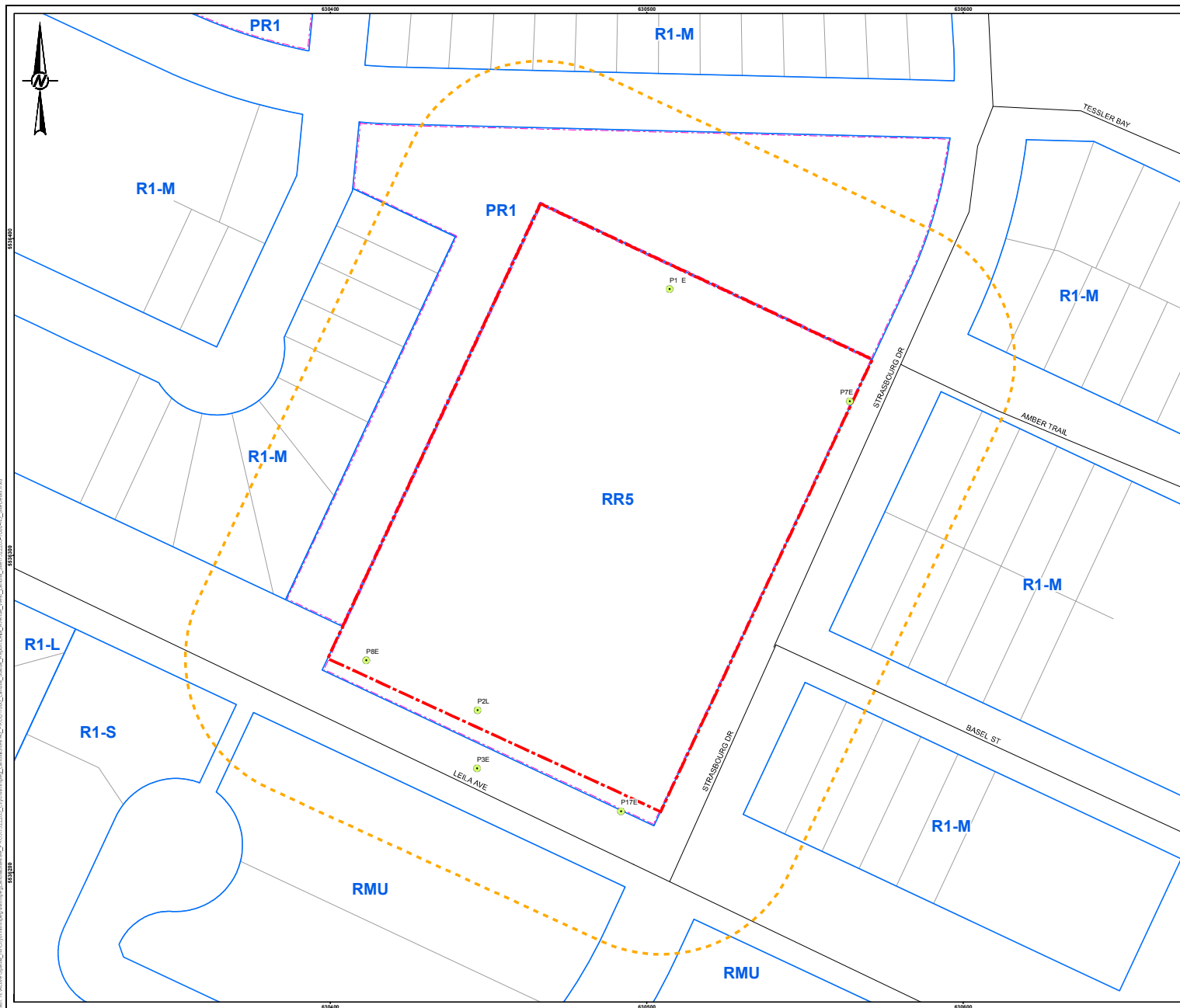
**NOTE(S)**

## REFERENCE(S)

CLIENT  
CITY OF WINNIPEG

## SITE PLAN

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	N2



R1-M

R1-M

PR1

RR5

**RMU**

R1-M

RMU

**LEGEND**



LANDFILL FOOTPRINT



CONTROL ZONE AREA



ROAD



PROPERTY PARCEL



PR1 -- PARKS AND RECREATION

D4.1 RESIDENTIAL SINGLE FAMILY

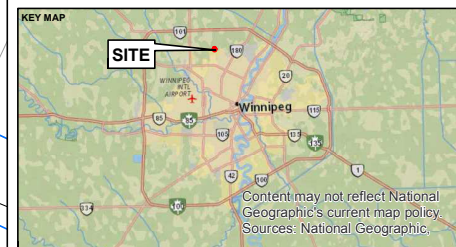
RT-L -- RESIDENTIAL - SINGLE-FAMILY

R1-M -- RESIDENTIAL - SINGLE-FAMILY

R1-S -- RES DENTIAL - SINGLE-FAMILY

RMU -- RES DENTIAL - MIXED-USE

RR5 – RURAL RESIDENTIAL - 5



## NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

## REFERENCE(S)

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

CLIENT

CITY OF WINNIPEG

PROJECT

PROJECT  
WINNIPEG LANDFILL STATUS REPORT  
• SITE 14: LEILA AVENUE (WEST) LANDFILL SITE, WINNIPEG, MANITOBA

## SITE DETAIL

CONSULTANT

YYYY-MM-DD 2015-07-20

DESIGNED	MKF
----------	-----

PREPARED	BR
----------	----

PREPARED	BR
REVIEWED	MKF

REVIEWED	DATE
APPROVED	PLE



PROJECT NO.  
1522283

PHASE  
1000

RE  
A

FIGURE  
N3



**Photo N1**  
View looking east from the landfill



**Photo N2**  
View looking north from the landfill. Note: play structure

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 14: LEILA AVENUE (WEST) LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MLF	Sept 2015		
	REVIEW	PLF	Sept 2015		
					FIGURE N4





**Photo N3**  
**View looking south from the landfill**  
**Note: toboggan hill in the foreground**



**Photo N4**  
**View looking west from the landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 14: LEILA AVENUE (WEST) LANDFILL PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS	—				
		CHECK	MKF Sept 2015				
		REVIEW	PLE Sept 2015	FIGURE N5			



# **APPENDIX O**

## **15. Saskatchewan Avenue Dump Site**



## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Saskatchewan Avenue Dump Site (Site 15), located east of Empress Street between Saskatchewan Avenue and Wellington Avenue in Winnipeg, Manitoba, as illustrated on Figure O1. The Saskatchewan Avenue Dump covers an area of approximately 9.3 hectares (ha) and was operated from 1875 until the 1950s. The landfill was operated by the City of Winnipeg and was used for disposal of incinerated waste with the incinerator located off-Site. The waste was primarily ash, with some amounts of partially burned waste.

In 1980, a drilling program was conducted at the Saskatchewan Avenue Dump Site, which included the drilling of twelve boreholes to depths ranging from 2.1 metres (m) to 7.6 m. The stratigraphy encountered at the Site reportedly included fill (clay, mixed with ash and waste) to a depth of 1 m to 2.1 m below grade underlain by clayey silt and clay layers to the maximum depth of investigation at most locations. Refuse was observed below the fill at only one location (P6L). A silt layer, up to 1.5 m thick is observed at a depth of 2 to 3 m below ground surface at some locations.

Of the twelve boreholes drilled at the Site, four contained waste/refuse (three of which had no cover), including ash type material and glass. The maximum depth of waste observed was 2.7 m below grade at one borehole location believed to be at the south east end of the Site. It should be noted that these borehole locations were near the perimeter of the landfill and are not reflective of waste depths towards the central part of the landfill.

Monitoring wells and/or landfill gas probes were installed in seven of the boreholes and labelled as follows:

- P1L, drilled to a depth of 4.4 m below grade, located in the southwest corner of parking lot at north end of Site, outside of the waste footprint. Note that this gas probe is noted as within the landfill but appears on Figure O3 as outside the landfill footprint;
- P6L, drilled to a depth of 5.8 m below grade, located at the southwest corner of the waste footprint;
- P7E, drilled to a depth of 4.3 m below grade, located at the southwest corner of the Site, outside of the waste footprint;
- P8E, drilled to a depth of 7.6 m below grade, located at the southeast corner of the Site, outside of the waste footprint;
- P10L, drilled to a depth of 7.0 m below grade, located at the north end of the southern portion of the waste footprint;
- P11L, drilled to a depth of 5.2 m below grade, located at the north end of the southern portion of the Site reportedly outside of the waste footprint according to Figure O3, but the borehole log indicates the presence of waste; and,
- P12E, drilled to a depth of 5.5 m below grade, located at the eastern side of the southern portion of the waste footprint, outside of the waste footprint.

Additional testholes and landfill gas probes were installed at an unknown time. Details of these testholes were not available for review electronically.



## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

In the 1990s, leachate seeps were noted at the west end of the Site near Omand's Creek. Also, environmental impacts were noted between the Site and the adjacent drywall manufacturing company. It was unclear which Site was causing the impacts.

A perimeter leachate collection system was installed along the west end of the landfill near Empress Street as shown on Figure O3. Details of the leachate collection system design are provided in drawings by KGS Group dated November 1997. The leachate collection system consists of a trench, 2.5 to 3.5 m deep (below a 0.6 m cover), with a perforated pipe bedded in granular material. The trench is covered with at least 0.6 m of compacted clay. A compacted clay cut-off wall is located between the perimeter leachate collection system and Omand's Creek. The cut-off wall is 0.6 m thick and has a typical depth of 1.6 m (extending below the silt layer, the presumed source of leachate seeps near Omand's Creek). Additional monitoring wells and leachate probes were installed near the perimeter leachate collection system.

Ground surface is at an elevation of 233 m above sea level (masl). The top of the waste mound at northern end reaches 247 masl, while the southern end reaches 256 masl. The water level within the waste is reportedly as 236 masl.

The cover material is undocumented; however, reportedly may have consisted of fill of an unknown thickness. A 15 m landfill gas control zone was allotted for the Site in 1988 as shown on Figures O1 to O3. The commercial buildings located to the south reportedly have an elevated construction.

Constraints previously reported for the Site included insufficient cover and bank stability concerns. High impact recreation which could cause surface erosion was discouraged.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Saskatchewan Avenue Dump Site. Findings from the most recent Site visit, completed on August 27, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- Vegetative cover is a well maintained mixture of grass and trees;
- Dead spruce and ash trees were noted on the west side of the landfill, potentially indicating the presence of methane;
- No illegal dumping, stability, drainage or leachate issues were identified during the Site visit;
- Some evidence of erosion but these areas were thought to be older and not serious;
- Gopher holes were noted around the Site; and,
- Thirteen landfill gas probes and leachate monitors could be located and were monitored (P7E, P8E, P10L, P11L, L72, IN75, L66, W1, L62, L24, L61, MH1 and MW-1).





## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was used primarily as recreational walking trails, a lookout and snow sliding in the winter. The landfill is significantly elevated compared to the surrounding area and is quite steep. A road along the south provides access to the top parking area and the walking trails. The landfill runs north/south with two elevated areas (at the north end and south end with the southern end being higher). A concrete monument exists on top of the landfill at the southern end. The north end of the Site has a bowled area that is used for sliding in the winter. It is unknown whether the berm at the north perimeter is waste or fill.

The Site is located in an industrial area. To the north is Saskatchewan Avenue, a railway and industrial land. To the east is a railway and sports fields. To the south is Wellington Avenue followed by commercial developments. At the north end, to the west is industrial plants and a radio tower. At the south end, to the west is Empress Street followed by a drywall manufacturer.

The Site was mainly grass covered with shrubs and trees throughout. The grass was mowed at the top. Dirt walking trails extend across the top of the Site. No areas of stressed vegetation were noted. No exposed waste, littering or dumping was observed. The groundhog population is healthy at the Site with many holes throughout the cover. Omand's Creek runs along the western edge of the Site. Erosion control measures, as shown on Figure O5 are present at the southwest corner, where surface runoff is directed to Omand's Creek. No erosion was noted at the Site at the time of the Site visit.

The waste boundary was fairly well defined for the waste mound, with the exception of the north end. A perimeter leachate collection system was installed along the western side of the south portion of the Site. A manhole exists at the southwest corner, from which leachate is collected twice per year (spring and fall). Landfill gas probes are located at the Site.

See attached Table O1 and Figures O1 through O3 for Site specific details. It should be noted that all landfill gas probes and wells are shown on Figure O3, but some of these may be lost or destroyed and therefore not included in the current monitoring program. Site photographs are provided in Figures O4 and O6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Landfill gas measurements were obtained from up to seven landfill gas probes between 1980 and 1995 (P1L, P6L, P7E, P8E, P10L, P11L and P12E) and two leachate probes (L14 and L15) between 1988 and 1993. Monitoring was undertaken weekly in 1980 and reduced over time to yearly in 1986.



## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

Methane was not detected in any of these probes during that time with the following exceptions:

- P6L – periodic readings of trace to 4% methane by volume in air; and,
- All locations – In 1992, increase in readings at every location, except P13L, to trace to 1.6% methane by volume in air, with a high of 7.6% methane by volume in air at P11L. Concentrations reduced to not detected to 0.6% methane by volume in air in 1993 and 1995.

Landfill gas measurements were obtained from P6L, P7E, P10L and P11L in 2001 and during 2000, 2001, 2006 and 2007 at P7E and P8E. Conflicting information is available about the methane readings during this time. It is believed that the results indicating that methane was not detected in any of these probes during that time are correct.

In recent years, landfill gas monitoring occurred at the following landfill gas probes, leachate wells, monitoring wells and manholes during 2011, 2013 and 2014: P7E, P8E, P10L, P11L, L72, IN75, L66, W1, L62, L63 (not in 2014), L24, L61, MH1 and MW-1. Methane was not detected during these recent monitoring events with the exception of probe P7E, which had trace amounts of methane detected (0.1 to 1% LEL).

### 3.2 Groundwater

Leachate is collected from the manhole located at the southwest corner of the Site two times per year. The volume of leachate collected has ranged from 290,000 litres per year in 1999 to 1,200,000 litres per year in 2005, with an average volume of leachate collected at 690,000 litres per year.

A sample of leachate is collected annually from the manhole at the southwest corner of the Site. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, metals, volatile organic compounds, PCBs, pesticides and herbicides. Leachate quality results for 1980, 1981, 1984, and 2008 through 2014 were available for review.

In addition, groundwater samples have been collected between 1985 and 2003 at one or more of the following locations: P6L, P10L, L14, L15, L23, L24, L26, L27, MW-2A (W1), L64, L66, L72 and IN75. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

### 3.3 Surface Water

Surface water samples are collected in Omand's Creek in the spring and in the fall.

One set of samples (upstream (north end), mid-Site and downstream (southwest corner)) were collected in 1996 prior to the installation of the perimeter leachate collection system and barrier trench. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, TKN, ammonia, nitrate + nitrite, chloride and conductivity.



## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

Seven sets of upstream and downstream surface water samples have been collected at the Site between April 2008 and April 2015. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total coliform, fecal coliform, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, turbidity, conductivity, calcium, magnesium, manganese, iron, sodium, arsenic, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1980 to 1995 and periodically thereafter – A monitoring program was undertaken including landfill gas probes and leachate probes. Methane was occasionally detected at low concentrations;
- 1988 – A 15 m control zone was implemented at the Site; and,
- 2011, 2013 and 2014 – Monitoring continues at seven probes. Detection of methane only occurred at trace amounts at P7E.

This landfill has not shown evidence of significant landfill gas generation over time. Low concentrations of methane have recently been detected at P7E located outside of the waste footprint but not within the waste footprint. Details on the screen depth are not available to review in comparison to water levels. Water mains and roadways are located to the north, west and south the Site. A sanitary sewer exists to the south and east of the Site and runs through the northeast corner. The granular material in the water mains, sanitary sewers and roadways can act as a preferential pathway for the landfill gas. Omand's Creek to the west of the Site acts as a barrier to landfill gas migration as the water will inhibit the migration of gas and the lower elevation of the creek will allow for venting of landfill gas that has migrated laterally in that direction.

### 4.2 Groundwater

In 2011, 2013 and 2014, the elevation of leachate in the manhole at the southwest corner has ranged from 0.5 m below the top of the manhole to 4.2 m below the top of the manhole. The range in leachate elevation likely has to do with when the leachate is pumped out.

The average water elevation measured from 1990 to 2007 from the monitors near the perimeter of the landfill (both inside and outside of the waste footprint) P6L, P7E, P8E, P10L, P11L and P12E ranged from 231.0 masl to 232.6 masl. The water levels recorded during 2011, 2013 and 2014 landfill gas monitoring events were consistent with previous water levels. The average water elevation measured from 1990 until 2004 from probe P13L located at the centre of the landfill was 236.5 masl. The water elevation at P13L was fairly consistent from 1996 until the last monitoring session in 2004.

Based on the leachate quality data from the manhole at southwest corner of the Site, the leachate at the Saskatchewan Landfill Site does not contain volatile organic compounds, PCBs, pesticides or herbicides, as evidenced by no detections during the 2008 to 2014 monitoring events. Volatile organic compounds have not been detected with the exception of detections of 1,1-dichloroethane, 1,1-dichloroethylene and 1,4-dichlorobenzene in 2009, xylenes in 2008 and hydrocarbons (fraction F3) during 2008, 2010 and 2011. Hydrocarbons were not detected in 2013 or 2014. Concentrations of boron, copper and sodium in the leachate from the manhole



## APPENDIX O

### 15. Saskatchewan Avenue Dump Site – Winnipeg Landfill Status Report

exceeded the Guidelines for Canadian Drinking Water Quality during from 2008 to 2014 (with the exception of 2009). Concentrations of chloride and iron exceeded the Guidelines for Canadian Drinking Water Quality during from 2013 and 2014 (results for these parameters were not available for earlier years).

Based on analytical results from P10L, L14, L15, L23, L24, L26, L27, MW-2A (W1), L64, L66, L72 and IN75 between 1985 and 1993, the following exceedances of the Guidelines for Canadian Drinking Water Quality were noted:

- Total dissolved solids, chloride, manganese, iron, sodium, sulphate and lead almost consistently at all locations;
- Copper at L66 in 2001 and L14 in 1990;
- Zinc at L72 in 2001; and,
- Cadmium and/or chromium for the majority of events at all locations for which it was tested, with the exception of P10L and MW-2A.

A leachate seep was sampled at the northwest corner of the Site prior to the installation of the barrier trench. Concentrations of total dissolved solids and chloride exceeded the Guidelines for Canadian Drinking Water Quality. Metals were not analyzed.

Based on the analytical results, the groundwater beneath and near the waste footprint has been impacted by the waste mound. However, there is no data available from a background monitoring source to confirm this.

#### 4.3 Surface Water

Of the parameters sampled in 1996, none exceeded the CCME Water Quality Guidelines for the protection of aquatic life. Comparison of the three samples (from upstream to downstream) during 1996 indicate that the concentrations of each parameter increased from upstream to downstream with the exception of pH, ammonia and nitrate + nitrite, which did not change significantly.

The sampling conducted after the barrier trench and perimeter leachate collection system were installed indicate that the surface water quality in Omand's Creek is generally similar upstream and downstream, with some events noting higher total organic carbon, nitrate + nitrite, and ammonia in the downstream location.

Between 2008 and 2015, the concentration of ammonia and iron exceed the CCME Water Quality Guideline of 0.016 mg/L and 0.3 mg/L, respectively, in both the upstream and downstream locations during most sampling events. Copper exceeded the CCME Water Quality Guideline (an equation based on hardness) in both the upstream and downstream locations on one occasion (April 2011). The remainder of the analysed surface water samples were less than their respective CCME Water Quality guidelines.

Based on the available results, concentrations of analysed parameters are either consistent or slightly higher in the downstream sample than in the upstream sample for select parameters, indicating that there may be minor impact from buried waste to the surface water in the vicinity of the Site. The perimeter leachate collection system and barrier trench have made a difference in the surface water quality of Omand's Creek.

n:\active\2015\3 proj\1522283 city of winnipeg landfill study\04\_reporting\landfill status report\15 saskatchewan avenue\appendix o - saskatchewan ave\_sept15 2015 docx



**TABLE O1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 15  
**Site Name** Saskatchewan Avenue Dump Site

**Landfill Operation**

<b>Waste type</b>	Ash from off-Site incineration, some partially burned refuse
<b>Start date</b>	1875
<b>End date</b>	1950s
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Unknown
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	9.3		
Depth of waste below ground surface (metres)	1.5		
Height above ground surface (metres)	23 (at southern peak), 14 (at northern peak)		
Slope %	Steep	Cover thickness (metres)	Unknown
Cover material	Potentially Fill (undocumented)		
Comment on slopes	No settlement observed		

**Environmental Controls**

<b>Description of leachate collection system</b>	Perimeter leachate collection system on west side near Empress Street
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg for the Site and the north and south control zones, City of Winnipeg and private ownership in the control zones to the west and east.
<b>Current</b>	Westview Park - walking trails, sliding areas
<b>North</b>	Saskatchewan Avenue, railway, industrial
<b>East</b>	Railway followed by sportsfields
<b>South</b>	Wellington Avenue followed by commercial
<b>West</b>	Empress Street followed by industrial (drywall manufacturer)
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	233	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Omand's Creek on west side		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	231.0	<b>Max</b>	232.6
<b>Minimum clay thickness below base grades (metres)</b>		9.4		
<b>Minimum depth to till (metres)</b>		10.1		
<b>Minimum depth to bedrock (metres)</b>		14.9		
<b>Bedrock</b>		Red River (Fort Garry - upper pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	236.2	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	Yes - leachate
<b>Current surface water</b>	Yes			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	No settlement observed
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Reports of historical leachate seeps at the Site



**LEGEND**

 LANDFILL FOOTPRINT CONTROL ZONE AREA

ROAD



## NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

## REFERENCE(S)

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

CLIENT  
CITY OF WINNIPEG

PROJECT  
WINNIPEG LANDFILL STATUS REPORT  
SITE 15: SASKATCHEWAN AVENUE DUMP SITE, WINNIPEG, MANITOBA

## SITE PLAN

CONSULTANT	YYYY-MM-DD	2015-07-02
 <b>Golder Associates</b>	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	0











**Photo 01**  
Site, facing south from the north end



**Photo 02**  
North end of Site – used as a sliding area

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 15: SASKATCHEWAN AVENUE DUMP SITE PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE 04	





**Photo 03**  
Erosion control measures at southwest corner of the Site



**Photo 04**  
Manhole, with west end Omand's Creek in the background

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 15: SASKATCHEWAN AVENUE DUMP SITE PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PTE Sept 2015
		PHASE No. 1000 SCALE AS SHOWN REV.0	
		<b>FIGURE 05</b>	






**Photo 05**  
Recreational path on top of Site,  
looking south



**Photo 06**  
Southwest corner of Site showing Omand's  
Creek along the west side

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 15: SASKATCHEWAN AVENUE DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF	Sept 2015	
				REVIEW	P.E.	Sept 2015	
				<b>FIGURE 06</b>			



# **APPENDIX P**

## **16. Barry Avenue Dump Site**





## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Barry Avenue Dump Site (Site 16), located on the south side of Sabre Crescent, west of Whytewold Road in Winnipeg, Manitoba, as illustrated on Figure P1. The Barry Avenue Dump covers an area of approximately 1.9 hectares (ha) and was operated by the City of St. James from approximately 1942 until it closed in 1952. The landfill is located in a vacant field and is owned by Canadian Forces Base (CFB) Winnipeg. The landfill reportedly included ash from partially burned waste. The landfill Site is located on the west side of the CFB Winnipeg property, west of the recreation centre. A portion of the control zone extends to this building.

According to available mapping provided for review, monitoring wells and/or landfill gas probes, including P1E, P3L, P4E, P5L, P6L, P7E, and P8E were installed previously at the Site although no drill logs were provided for review.

Ground surface is at an elevation of 237.1 m above sea level (masl). There is reportedly a minimum silt and clay layer thickness of 4.6 m below the landfill Site.

The cover material reportedly consisted of fill, which may contain construction debris, glass, ash, etc. The cover thickness is unknown. Waste reportedly ranges from 0.9 m below natural grade to approximately 6.7 m above natural grade. In 1992, the Site was owned and maintained by CFB and was used as a playground and park. A 15 m landfill gas control zone was allotted for the Site in 1984.

The Site is located within CFB Winnipeg boundaries. Opportunities previously reported for the Site included potential for shelter belt planting, variety of year round activities, and habitat restoration. Constraints previously reported for the Site include restricted foundation construction.

According to City records, there are 15 supply wells and 13 return wells within 1 km of the Site although none are used for consumption. Six operate year-round while four only operate in the summer. The depths of the supply wells range in depth from 61 m below grade to 146 m below grade. The return wells range in depth from 46 m below grade to 101 m below grade. The wells are capable of pumping up to 5000 gallons per minute.

### **1.1 Previous Site Visits**

This Site is not on the City's annual site inspection list.

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was sloped with a mound present on-Site. A play structure and walking trails were noted on-Site and an additional play structure was present to the east of the landfill Site in the control zone. A sign was noted on the east fence indicating that the Site was an unsafe sliding area. CFB Winnipeg buildings were noted to the east within the control zone. Baseball fields and an outdoor hockey rink were present to the west with industrial properties beyond. Residential properties were noted to the north, north of Sabre Crescent. Recreational areas were noted to the south.



One probe was noted on-Site (P6L).

See attached Table P1 and Figures P1 to P3 for Site specific details. Site photographs are provided in Figures P4 and P8.

### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding installations were available electronically for review.

Annual landfill gas sampling was performed between 1985 and 1992. No methane gas was detected at the monitored probes.

No additional landfill gas monitoring information was available for review.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

No landfill gas was detected at the Site between 1985 and 1992. Based on the type of waste reported at this location (i.e., ash), the potential for landfill gas generation is low. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There are no utilities within the waste fill area although sanitary sewers run through the southern and eastern control zones and could act as a migration pathway.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE P1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 16  
**Site Name** Barry Avenue Dump Site

**Landfill Operation**

<b>Waste type</b>	Ash
<b>Start date</b>	~1942
<b>End date</b>	1952
<b>Operated by</b>	City of St. James
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.9		
Depth of waste below ground surface (metres)	0.9		
Height above ground surface (metres)	~6.7		
Slope %	--	Cover thickness (metres)	Unknown
Cover material	Potentially Fill (undocumented)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	Canadian Forces Base Winnipeg
<b>Current</b>	Playground/park
<b>North</b>	Residential
<b>East</b>	Commercial/Community (CFB Winnipeg Recreation Centre)
<b>South</b>	Recreational
<b>West</b>	Recreational
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	237.1	<b>Groundwater flow direction</b>	South/Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	No		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	235.3	<b>Max</b>	235.9
<b>Minimum clay thickness below base grades (metres)</b>		4.6		
<b>Minimum depth to till (metres)</b>		5.5		
<b>Minimum depth to bedrock (metres)</b>		6.4		
<b>Bedrock</b>		Stony Mt. (Gunton)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	233.5	<b>Max</b>	235.3

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Unknown		

**Notable 2015 Site Visit Observations**

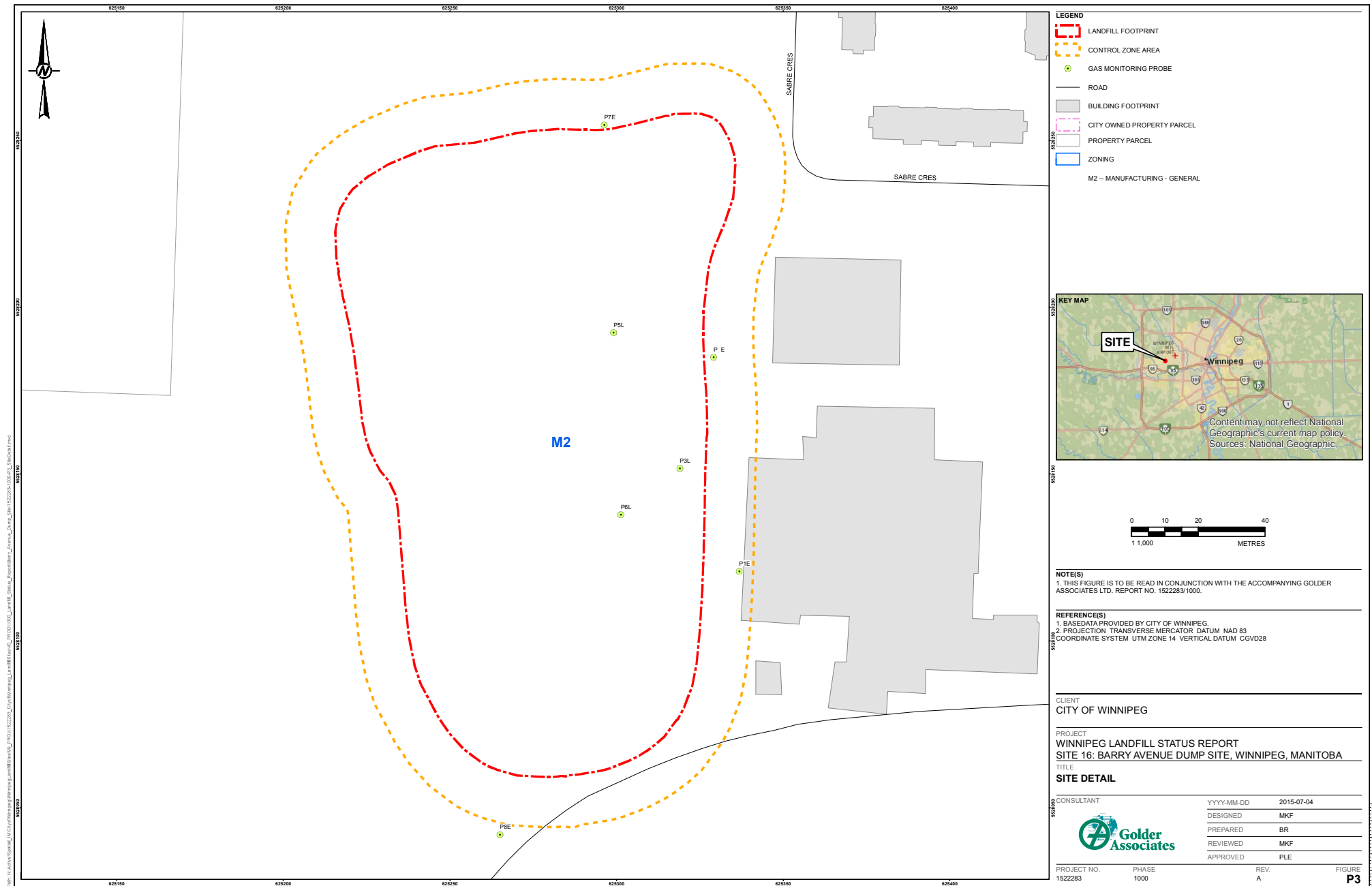
<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None














**Photo P1**  
CFB Winnipeg Recreation Centre, looking east  
from the landfill Site



**Photo P2**  
Play structure at the top of the landfill Site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 16: BARRY AVENUE DUMP PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MLF	Sept 2015		
	REVIEW	PLF	Sept 2015		
					FIGURE P4






**Photo P3**  
**Monitoring well P6L**



**Photo P4**  
**View looking north from the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 16: BARRY AVENUE DUMP PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE P5	






**Photo P5**  
**View looking west from the Site**



**Photo P6**  
**Outdoor hockey rink located north west of the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 16: BARRY AVENUE DUMP PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MLF	Sept 2015		
	REVIEW	PLF	Sept 2015		
				FIGURE P6	



**Photo P7**

**Sign indicating the Site was not suitable for sliding**




**Photo P8**

**View looking South from the Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 16: BARRY AVENUE DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015	<b>FIGURE P7</b>	






**Photo P9**  
**Top of landfill Site, looking east**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 16: BARRY AVENUE DUMP PHOTOGRAPHS				
	PROJECT No. 1522283			PHASE No. 1000
	DESIGN	—	July 2015	SCALE AS SHOWN
	GIS	—	—	REV.0
	CHECK	MKF	Sept 2015	FIGURE P8
	REVIEW	PLE	Sept 2015	



# **APPENDIX Q**

## **17. Harcourt Street Landfill Site**



## APPENDIX Q

### 17. Harcourt Street Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Harcourt Street Landfill (Site 17), located on the south side of Saskatchewan Avenue, east of Sturgeon Road, in Winnipeg, Manitoba, as illustrated on Figure Q1. The Harcourt Street Landfill covers an area of approximately 11.2 hectares (ha) and is owned by Boeing of Canada. The control zone to the north of Saskatchewan Avenue is City or privately owned. The Site operated from 1952 until it closed in 1965 by the City of St. James. The waste reportedly includes glass, ash, wire, rags, metal, and wet oily pockets. The cover material is largely undocumented and reportedly contains fill, including construction debris, glass, ash, etc. to unknown depths. Groundwater in the vicinity of the Site is not used for domestic purposes, however, several businesses, including Boeing of Canada, use the groundwater. A 90 metres (m) landfill gas control zone has been established for the Site although there are no barriers in place. The Site is located within a mixed agricultural/industrial area.

In 1981/1982, a drilling program was conducted at the Harcourt Street Landfill, which included the drilling of 41 boreholes to depths ranging from 0.8 m to 10.4 m. The stratigraphy encountered at the Site reportedly included fill to depths of up to 2.1 m below grade (absent in some places) underlain by refuse, where present, underlain by clayey silt and clay layers to the maximum depth of investigation. Where fill was not present, clay was reported from surface.

Of the 41 boreholes drilled at the Site, 17 contained refuse, including domestic waste, paper, plastic, wood, fibrous material, metal, wire, tires, glass, ash, black oil pockets, rags, concrete debris, and/or cable. At some locations, foul odours were noted.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in May 1981

- P4L, drilled to a depth of 3.0 m below grade, located within the northwest portion of the waste fill area;
- P5E, drilled to a depth of 2.7 m below grade, located outside the northwest portion of the waste fill area;
- P10L, drilled to a depth of 5.2 m below grade, located within the southern portion of the waste fill area;
- P15E, drilled to a depth of 5.5 m below grade, located outside the southern limit of the waste fill area;
- P18L, drilled to a depth of 4.0 m below grade, located within the east-central portion of the waste fill area;
- P20E, drilled to a depth of 5.4 m below grade, located within the east-central portion of the waste fill area. No waste was encountered at this location, although it was located within the waste fill footprint in Figure Q3;
- P23L, drilled to a depth of 5.5 m below grade, located within the central portion of the waste fill area;
- P26E, drilled to a depth of 5.5 m below grade, located within the northern portion of the waste fill area. No waste was encountered at this location, although it was located within the waste fill footprint in Figure Q3;
- P30L, drilled to a depth of 5.5 m below grade, located within the southeastern portion of the waste fill area;
- P31L, drilled to a depth of 5.2 m below grade, located within the southwestern portion of the waste fill area;





## APPENDIX Q

### 17. Harcourt Street Landfill – Winnipeg Landfill Status Report

- P34E, drilled to a depth of 5.5 m below grade, located northwest of the waste fill area (probe screened 1.5 m to 3.0 m below grade);
- P35E, drilled to a depth of 5.2 m below grade, located northwest of the waste fill area (probe screened 3.7 m to 4.6 m below grade);
- P36E, drilled to a depth of 5.2 m below grade, located northwest of the waste fill area (probe screened 5.2 m to 6.1 m below grade);
- P40E, drilled to a depth of 9.8 m below grade, located northwest of the waste fill area; and,
- P41E, drilled to a depth of 10.4 m below grade, located south of the waste fill area.

Landfill gas has historically been a concern at the Site. High landfill gas concentrations (greater than 100% of the lower explosive limit [LEL] of methane) have been identified both within and outside the waste fill area. High methane gas readings (5 to 10% methane by volume) have also been reported in the bedrock well installed at the Site (P40E, located northeast of the landfill). The edge of the waste on the north side of the landfill is at the privately owned property boundary. An underground water main runs through the northern portion of the waste fill area and acts as a pathway for migration of landfill gas.

Ground surface is at an elevation of 238.7 m above sea level (masl). The water level is reportedly at 2.1 m below natural grade within the waste fill area and outside the fill area. There is no clay below a portion of the landfill and the base is reportedly at the till interface at these locations.

The cover material is fill, possibly containing construction debris, glass, ash, etc. although thickness is unknown. Waste reportedly extends from 3.7 m below grade to 1.2 m above grade. In 1992, the Site was privately owned and consisted of wild grass fields and a baseball diamond (although this may be a transcription error). Opportunities previously reported for the Site included potential for periphery plantings and habitat restoration. A constraint previously reported for the Site included restricted foundation construction.

According to City records, there are 15 supply wells and 13 return wells within 1 km of the Site although none are used for consumption. Six operate year-round while four only operate in the summer. The depths of the supply wells range in depth from 61 m below grade to 146 m below grade. The return wells range in depth from 46 m below grade to 101 m below grade. The wells are capable of pumping up to 5000 gallons per minute.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Harcourt Street Landfill. Findings from the most recent Site visit, completed on August 21, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was overgrown with tall prairie grass, thistles, and trees in the control zone;
- The trees along the east and south side were dead, and may be related to the presence of methane or leachate;
- A high methane reading was obtained at P23L, with areas of sparse/no vegetation surrounding that area;



## APPENDIX Q

### 17. Harcourt Street Landfill – Winnipeg Landfill Status Report

- Illegal dumping was noted just outside the landfill consisting mostly of fill. No other illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit. It was noted that the slopes were not evenly graded;
- No buildings were present on-Site;
- Large pieces of concrete and metal were noted throughout the landfill area; and,
- Thirteen wells were present on-Site.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was overgrown with grass with shallow, uneven slopes throughout. One large mound was noted in the central portion of the Site although no erosion or settling was noted. No exposed debris was noted although illegal dumping (fill and wood) was occurring in the north portion of the Site. No buildings or landfill gas migration barriers were present on-Site. Dead trees were noted to the south. No ditches were noted within the landfill. The Site was reportedly being used by Boeing as a snow dump. Adjacent lands include a forest to the west, vacant land to the north, commercial to the east, and industrial to the south.

Previously installed leachate and landfill gas probes were still present on-Site.

See attached Table Q1 and Figures Q1 to Q3 for Site specific details. Site photographs are provided in Figures Q4 through Q6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. Little information regarding screen elevations was provided in the drill logs completed for the Site.

The electronically available reports include twelve probes with landfill gas data summary of results collected between 1981 and 1984. The results indicated that probes P20E (east-central portion of waste fill area), P26E (north portion of waste fill area), P40E (northeast of landfill), and P41E (south of the landfill) had landfill gas concentrations of greater than 20% of the LEL of methane, or 1% methane by volume on one or more occasions. Readings of up to 14% methane by volume were reported at P20E, up to 50% methane by volume at P26E, up to 10% methane by volume at P40E, and up to 12% methane by volume at P41E (one occasion only).

Probes located inside the waste fill area had landfill gas concentrations of up to 75% methane by volume (at P18L, located on the east-central portion of the waste fill area). Probes P30L and P31L, located in the southeast and southwest portions of the waste fill area, had only trace concentrations of methane on some occasions.

Since 1992, sporadic landfill gas sampling has been conducted at the Site at 13 locations, including P4L, P5E, P10L, P15E, P18L, P20E, P23L, P26E, P34E, P35E, P36E, P40E, and P41E. During the most recent sampling event, conducted on August 21, 2014, no detectable landfill gas was reported, with the exception of P41E which had a reading of 5.7% LEL. During the 2013 sampling event, P23L had a reading of 30% methane by volume and P4L had a reading of 1% methane by volume and in 2011, seven locations had trace concentrations of methane (up to 2% LEL).



## **APPENDIX Q**

### **17. Harcourt Street Landfill – Winnipeg Landfill Status Report**

## **3.2 Groundwater**

### **3.2.1 Leachate**

Groundwater sampling events were previously conducted at the Site between 1985 and 1992 a minimum of twice at leachate wells P4L, P10L, P23L, and P30L. Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality

The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc. P23L was also submitted of analysis of volatile organic compounds once.

### **3.2.2 Groundwater**

Groundwater sampling has also previously been completed at 7 wells located on surrounding residential and commercial/industrial properties. These wells were labelled GWQ 17-1 through GWQ 17-7 and were sampled a minimum of twice between 1982 and 1992.

Results were compared to the Health Canada Guidelines for Canadian Drinking Water Quality, dated October 2014 as the area in the vicinity of the Site have privately owned wells, although potable water in the area is now supplied by the City as shown on Figure Q2.

## **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program is conducted.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Very high concentrations of landfill gas have historically been reported at the Site (up to 75% methane by volume within the waste fill area). However, results from the most recent monitoring event (2014) indicated non-detectable levels of methane were reported at all existing probes, with the exception of P41E located to the south of the landfill.

Based on the organic nature of waste reported at this location the potential for landfill gas generation is likely, which is confirmed by the presence of methane measured from landfill gas probes during the 1980s and 1990s. Some lateral landfill gas migration has occurred historically although the most recent gas probe readings at some locations do not demonstrate lateral gas migration. Any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. The presence of a buried utility line running through the northern portion of the landfill could act as a migration pathway.





## APPENDIX Q

### 17. Harcourt Street Landfill – Winnipeg Landfill Status Report

## 4.2 Groundwater

### 4.2.1 Elevations

The depth to water measured in 2014 at the Site ranged from 2.4 m below grade (P10L) to 6.8 m below grade (P41E).

### 4.2.2 Leachate

Based on analytical results collected between 1985 and 1992, one or more of cadmium, chromium, and/or lead were elevated above the Health Canada Drinking Water Quality Guidelines at all sampling locations on at least one occasion during the groundwater sampling events. Additional metals, including copper, manganese, and/or zinc along with sulfate, sodium, and chloride were elevated above their respective aesthetic objectives. Ammonia is moderately high with concentrations as high as 100 mg/L at P10L. Ammonia concentrations at P30L were low (less than 1 mg/L).

### 4.2.3 Groundwater

When the results for private wells GWQ 17-1 through GWQ 17-7 were compared to the Health Canada Drinking Water Quality Guidelines, with the exception of the following, no exceedances of the maximum allowable concentrations were noted:

- GWQ 17-1, located 300 m north of the Site: nitrite or nitrate up to 33.2 mg/L. There is no guideline for the combined parameter; however, the combined values of allowable concentrations would be 11 mg/L;
- GWQ 17-3, located 300 m northeast of the Site: Lead (20 mg/L in April 1982 only), above the guideline of 10 mg/L. Five subsequent events had results less than 5 mg/L;
- GWQ 17-4, adjacent south: arsenic (23 mg/L) and lead (23 mg/L) in May 1989 only, above the guideline of 10 mg/L for both parameters. The three prior and one subsequent events had results less than or equal to the guideline; and,
- GWQ 17-5, located 900 m east of the Site: nitrite or nitrate up to 265 mg/L. There is no guideline for the combined parameter; however, the combined values of allowable concentrations would be 11 mg/L;

The remaining exceedances noted were of aesthetic guidelines only.

It appears that the groundwater on the Site has been impacted by the presence of buried waste. Based on the results of the wells on surrounding properties, the exceedances of parameters noted may not be landfill related as they are not necessarily the same as parameter with exceedances within the landfill.

No current data or background water quality is available for review.

## 4.3 Surface Water

No surface water is present at the Site.

**TABLE Q1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 17  
**Site Name** Harcourt Street Landfill Site

**Landfill Operation**

<b>Waste type</b>	Glass, ash, wire, rags, metal, wet oily pockets
<b>Start date</b>	1952
<b>End date</b>	1965
<b>Operated by</b>	City of St. James
<b>Disposal method</b>	Multiple trenches
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	11.2		
Depth of waste below ground surface (metres)	2.4 to 3.7		
Height above ground surface (metres)	0.9 to 1.2		
Slope %	-	Cover thickness (metres)	Unknown
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	No settlement observed		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	Boeing Canada
<b>Current</b>	Wild fields
<b>North</b>	Saskatchewan Avenue, with vacant land beyond
<b>East</b>	Boeing access road, with commercial beyond
<b>South</b>	Boeing of Canada
<b>West</b>	Forested, with Sturgeon Road beyond
<b>Comment</b>	Private ownership of landfill site

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	238.7	<b>Groundwater flow direction</b>	South/Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	No		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	None	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>		0.0		
<b>Minimum depth to till (metres)</b>		3.7		
<b>Minimum depth to bedrock (metres)</b>		5.2		
<b>Bedrock</b>		Stony Mt. (Gunton)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	235.3	<b>Max</b>	238.4

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes, includes industrial and domestic wells	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

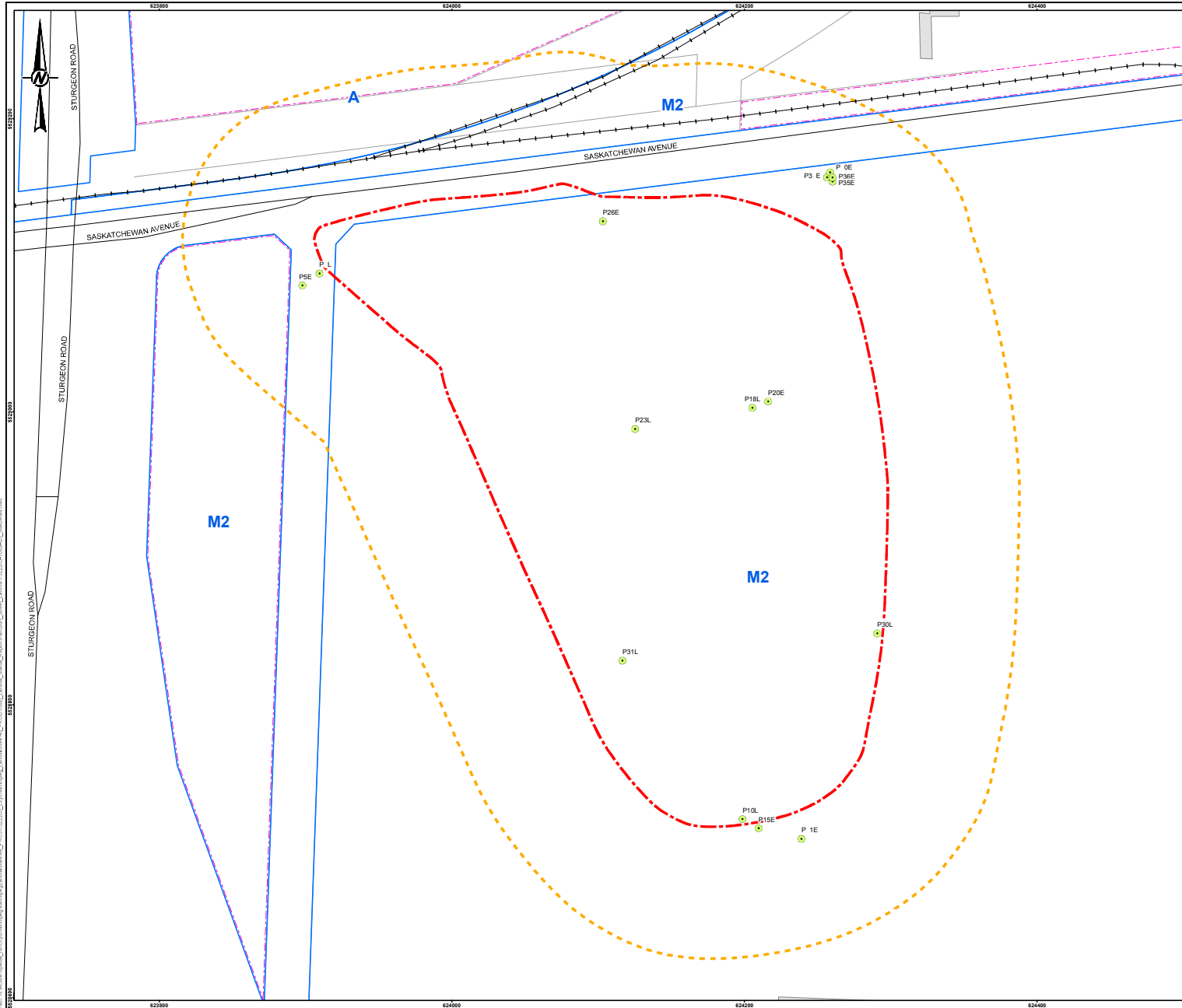
<b>Settlement/slopes</b>	No settlement observed
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Illegal dumping











**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- GAS MONITORING PROBE
- ROAD
- RAILWAY
- BUILDING FOOTPRINT
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- ZONING
- A -- AGRICULTURAL
- M2 -- MANUFACTURING - GENERAL

**KEY MAP**

0 25 50 100  
1:2,600 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**

CITY OF WINNIPEG

**PROJECT**

WINNIPEG LANDFILL STATUS REPORT  
SITE 17: HARCOURT STREET LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**

SITE DETAIL

CONSULTANT	YYYY-MM-DD	2015-07-04
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	<b>Q3</b>

\\golder\projects\1522283\1522283\_01\_Mapping\_LandfillSite\1522283\_01\_Mapping\_LandfillSite.dwg 1522283-01-01.dwg 1522283-01-01.dwg 1522283-01-01.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 20mm



**Photo Q1**  
View of Site, looking west



**Photo Q2**  
View looking southeast at dead trees  
Note: Boeing buildings beyond

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 17: HARCOURT STREET LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PLT	Sept 2015		
			FIGURE Q4		





**Photo Q3**  
**View of Site looking south**



**Photo Q4**  
**View of Site looking north**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 17: HARCOURT STREET LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE Q5	





Photo Q5  
View of Site looking east



Photo Q6  
Illegal dumping at north Site entrance

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 17: HARCOURT STREET LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PIE Sept 2015
		PHASE No. 1000	SCALE AS SHOWN
			REV.0
		FIGURE Q6	



# **APPENDIX R**

## **18. Summit Road Landfill Site**





## APPENDIX R

### 18. Summit Road Landfill Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Summit Road Landfill Site (Site 18), located on Summit Road, northeast of the intersection of the Perimeter Highway and CentrePort Canada Way (Highway 190) in Winnipeg, Manitoba, as illustrated on Figure R1. The Summit Road Landfill Site covers an area of approximately 76 hectares (ha) and was operated by the City of Winnipeg from before 1964 until it closed in 1998 (with ongoing closure occurring since then). The waste is expected to be domestic waste. The older waste (from 1964 to 1974) was placed at the eastern portion of the landfill. The central part of the landfill was filled from south to north and then the western part of the landfill was filled north to south.

Breakouts of leachate were previously noted, with potential impacts to the surrounding vegetation. A leachate collection system was installed in the mid-1990s and consists of perforated piping in granular bedding around the perimeter of the landfill. Finger drains extend into the landfill at fairly regular intervals. Manholes, and leachate vents were installed along the length of the leachate collection system. The southern portion of the landfill has an underdrain leachate collection system. Leachate is pumped from the Site five days a week and is transported to an off-Site wastewater treatment facility.

Fill material was brought to the Site on an ongoing basis for cover and grading as material was available. The cover fill included dried sludge, excess sand from street maintenance activities (which consisted of 95% sand with 5% salt for winter road application), fill from construction projects, hydrocarbon contaminated soil and soil with high concentrations of metals. City staff reviewed analytical results from soil analysis prior to acceptance of material at the Site. The fill material was placed in settled areas at the Site. The Site has been brought to final grades. Improved grading to increase runoff is currently being undertaken at the top of the landfill.

Since the 1980s, at least 438 boreholes have been drilled at the Site during various subsurface investigations. These subsurface investigations have occurred in 1986, 1988, 1989, 1992, 1994, 1995, 2001, 2008 and 2014. The depths of the boreholes ranged from 1.5 metres (m) to 19.8 m below ground surface. The stratigraphy encountered at the Site reportedly included a layer of fill cover, refuse (if present), underlain by clay, till and bedrock. The top of the till was observed from 230.3 m above sea level (masl) to 239.0 masl. Bedrock was observed at elevations ranging from 224.4 masl to 234.9 masl. Of the boreholes completed within the waste, the base of the waste was observed ranging from 234.3 to 241.7 masl. During the drilling investigations, monitoring probes were installed including groundwater monitoring wells, a lysimeter, leachate probes, piezometers and landfill gas probes. Ground surface at the perimeter of the landfill is at an elevation of 238 masl.

Groundwater flow is to the southeast. There are reportedly no water users between the Site and the watermain south of the Site. A 90 m landfill gas control zone was allotted for the Site in 1988 as shown on Figures R1 to R3. The constraint previously reported for the Site was restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.



## APPENDIX R

### 18. Summit Road Landfill Site – Winnipeg Landfill Status Report

## 1.1 Previous Site Visits

The City performs regular Site visits to the Summit Road Landfill Site. Findings from the most recent Site visit, completed June 29, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The Site was mainly grass covered with trees in the control zone;
- Areas of bare ground (assumed stressed vegetation) were noted;
- Dumping of household and construction waste was noted just past the entrance gate;
- A leachate breakout was noted on the east side of the north service road and was draining into a ditch;
- Erosion due to runoff was noted on all sides of the landfill but more significantly at the north end;
- Metal and concrete in the landfill make driving hazardous; and,
- The following instrumentation was noted:
  - Eleven bedrock groundwater monitoring wells (W1, W4 to W10, W13 to W15);
  - One lysimeter (LYS-1);
  - Thirty-two leachate probes (L107 to L110, L244, L248, L251, L255, L257, L258, L264, L267, L270, L289, L300, L305, L401, L402, L406, L412, L424, L425, L430 to L439). Probes L255 and L108 could not be located;
  - Ten leachate drains (LD442, LD446 to LD454);
  - Twelve gas probes (P10L, P11E, P13L, P15L, P16L, P19E, P20E, P21E, P22E, P231E, P250E, P51E). Gas probes P11E, P15L, P16L, P20E, P21E and P51 E could not be located;
  - Seventeen piezometers (1N206, 1N232 to 1N236, 1N238, 1N239, 2N315B, 2N321A, 2N321B, 2N323A, 2N323B, 3N23A, 3N23B and 3N23C); and,
  - Ten manholes (MH1 to MH10).

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was in the final stages of closure operations. The landfill sloped up at 4 horizontal to 1 vertical (4H:1V) side slopes. Clean fill had been brought to the Site as ongoing cover placement and for grading purposes. Composted material stockpiled at the east side of the Site was being brought to the top of the landfill for final grading in some areas. It is intended that the top of the landfill will be graded with swales.



## APPENDIX R

### 18. Summit Road Landfill Site – Winnipeg Landfill Status Report

Agricultural fields surrounded the Site with a dog kennel to the northwest, the Optimist Park with sports fields to the south and southeast and the Perimeter Highway to the west. The Site was mainly grass covered, except in the areas of new cover placement where topsoil and seeding was still required. Shrubs were growing on the side slopes and trees were noted in the control zones. None of the vegetation was stressed with the exception of a row of dead trees in the eastern control zone as shown on Figure R5. The trees have been dead for approximately 10 years and may have been related to leachate seeps on the east side of the landfill.

The waste boundary was well defined. No exposed waste was noted with the exception of some illegal dumping of material at the east end and a pile of crushed glass on the northwest corner of the landfill. The crushed glass, as noted on Figure R3, has been stockpiled to be used as filter material instead of crushed stone. The glass pile is located next to a large diameter leachate sump. The sump is being used as a trial system to reduce the leachate mound within the centre of the landfill.

A perimeter leachate collection system is located on the west, north and east sides of the landfill. Manholes are located along the system. Leachate probes, groundwater monitoring wells and landfill gas probes are located throughout the Site. A service road surrounds the waste mound. Hydro lines were evident to the north. No landfill gas migration barriers were noted.

The landfill is surrounded by a stormwater ditch with a pond located to the north, just outside of the control zone. Truro Creek is located to the east of the Site and Sturgeon Creek is located to the southwest.

See attached Table R1 and Figures R1 through R3 for Site specific details. Site photographs are provided in Figures R4 through R6.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. Landfill gas monitoring also occurs at the leachate drains and piezometers annually.

Landfill gas results from 2007 to 2015 for P10L, P11E, P13L, P19E, P22E and P205E were available for review. The results were as follows:

- P10L – No methane was detected during these sampling events with the exception of 2% of the lower explosive limit (LEL) and 1% LEL in 2011 and 2012, respectively;
- P11E – Methane was detected at 23% LEL in 2011 and reduced to 0% LEL in 2015;
- P13L – Increasing concentrations of methane with greater than 100% LEL recorded in 2013 (the last time a sample was recorded from this location);
- P19E – No landfill gas was detected during these sampling events, with the exception of trace amounts detected in 2008;
- P22E – No landfill gas was detected during these sampling events, with the exception of trace amounts detected in 2007, 2013 and 2014; and,
- P205E – Occasional detections of landfill gas of up to 5% LEL.





## APPENDIX R

### 18. Summit Road Landfill Site – Winnipeg Landfill Status Report

Methane was also monitored from leachate probes. During 2013 and 2014, methane is detected at more than half of the locations at concentrations of 7% to 63% methane by volume in air.

Methane is monitored from leachate drains and the results range from 4% methane by volume in air to 75% methane by volume in air at the locations monitored.

## 3.2 Groundwater

### 3.2.1 Leachate

Leachate is collected from the perimeter leachate collection system. From 2002 to 2010, the volume of leachate collected averaged 29,900 litres per year. From 2011 to 2014, the volume of leachate collected has averaged 20,300 litres per year, with the lowest volume in recent years reported in 2014 of 16,100 litres. The reduction in leachate volumes is likely a reflection of the improved low permeability cover at the Site.

Samples of leachate are collected annually from the manholes MH3, MH6, MH8 and MH10. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, metals, volatile organic compounds, PCBs, pesticides and herbicides. Leachate quality results for 2008 through 2014 were available for review.

### 3.2.2 Groundwater

Groundwater samples were historically collected from up to fifteen domestic water taking wells in the area around the Site. This groundwater which was likely sourced from the bedrock, was sampled from 1980 until 1990. There is currently no ongoing residential monitoring program.

Groundwater sampling is conducted in the spring and fall at bedrock groundwater monitors W4, W5, W6, W7, W9, W10 and W13, and shallow groundwater monitor IN232. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

## 3.3 Surface Water

A semi-annual (Spring and Fall) surface water monitoring program is carried out at the Site at upstream and downstream locations in Sturgeon Creek.

Eight sets of upstream and downstream surface water samples have been collected at the Site between April 2008 and October 2014. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total coliform, fecal coliform, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, turbidity, conductivity, calcium, magnesium, manganese, iron, sodium, arsenic, potassium, cadmium, chromium, copper, nickel, lead, and zinc.



## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

The Summit Road Landfill Site continues to generate landfill gas, as indicated by higher concentrations of methane in the leachate drains and leachate probes. In comparison, methane concentrations are not as high within the landfill gas probes completed within and outside of the landfill footprint. It is unknown whether the landfill gas is migrating laterally in the subsurface. The presence of the leachate collection system around the perimeter of the landfill will act as a preferential pathway for landfill gas and curtail it from migrating into the control zone.

### **4.2 Groundwater**

#### **4.2.1 Elevations**

Groundwater level and leachate level monitoring is ongoing at the Site. The groundwater levels measured from groundwater monitoring wells and piezometers between 2002 and 2015 ranged from 229.4 masl to 239.6 masl with the average water elevation at 235.3 masl. The leachate levels measured from leachate probes ranged from 234.6 masl to 248.0 masl with the average leachate elevation at 240.4 masl. The ground elevation surrounding the waste footprint is approximately 238 masl, so the highest leachate level corresponds to a mound of approximately 10 m above ground level (even higher over the base of the landfill). The leachate levels measured from the manholes ranged from 234.7 masl to 242.7 masl with the average leachate elevation at 238.4 masl.

#### **4.2.2 Leachate**

Based on the leachate quality results from manholes, MH3, MH6, MH8 and MH9 the following was noted:

- Volatile organic compounds are detected in the leachate with consistent exceedances of the Guideline for Canadian Drinking Water Quality for benzene (except MH10) and ethylbenzene. Exceedances of chlorobenzene, methylene chloride, trichloroethylene, and vinyl chloride are also noted at MH6 and 1,4-dichlorobenzene at MH3 and MH6;
- PCBs were detected at MH6 in 2014 and MH3 in 2011;
- Pesticide/herbicide MCPP and mecoprop were detected at MH10 in 2011 and 2013;
- Petroleum hydrocarbons were detected in 2013 (the only year with analysis results available) at each of the manholes sampled (MH3, MH6 and MH10);
- Exceedances of the Guideline for Canadian Drinking Water Quality for the following metals: aluminum, boron, chromium, manganese and sodium during the majority of the monitoring events, and, selenium, lead and arsenic occasionally; and,
- Exceedances of the Guideline for Canadian Drinking Water Quality for the following inorganic parameters: total dissolved solids, turbidity, chloride, total coliforms and E. Coli (periodically).



## APPENDIX R

### 18. Summit Road Landfill Site – Winnipeg Landfill Status Report

#### 4.2.3 Groundwater

Based on the groundwater quality results from groundwater monitors W4, W5, W6, W7, W9, W10, W13 and IN232, concentrations of total dissolved solids, chloride (except at W10), turbidity iron and sodium (except at W10) were elevated above the Guideline for Canadian Drinking Water Quality for the majority of the monitoring sessions. Concentrations of arsenic, cadmium, chromium, copper and zinc exceeded the Guideline for Canadian Drinking Water Quality during 2001 and 2004, but had decreased below the criteria level in subsequent years. Chloride is often a reliable landfill leachate indicator parameter. Using the average of available chloride concentrations in groundwater from background monitoring wells W7, W15 and W10 from 2001 to 2014 (303 mg/L), it is considered that each of the other bedrock monitoring wells W4, W5, W6, W9, W10, W13 have been impacted by landfill leachate with the highest concentrations of chloride recorded at the furthest downgradient monitoring well W13. Groundwater from monitoring well W14 (located at the southern control zone limit) had lower concentrations of chloride in comparison to downgradient well W13 in the early 2000s when it was sampled. This, in addition to the fact that the chloride concentration in groundwater from monitoring well W14 is decreasing over time, indicates that the peak chloride concentration from the landfill may potentially have passed this location and is moving further downgradient. Alternatively, there could be another source of the higher chloride concentrations, such as road salt from the Perimeter Highway to the west or from a former snow dump although the groundwater flow direction does not necessarily support these alternative sources being present at monitoring well W13.

Bedrock groundwater has therefore been impacted by the presence of buried waste.

#### 4.3 Surface Water

The concentrations of ammonia, iron (spring events only) exceed the CCME Water Quality Guideline in both the upstream and downstream locations during all sampling events. Concentrations of arsenic and copper also periodically exceeded the CCME Water Quality Guideline in both the upstream and downstream locations. The surface water quality is generally very similar upstream and downstream, indicating that there is no impact from buried waste to the surface water that is sampled in the vicinity of the Site.

n:\active\2015\3 proj\1522283 city of winnipeg landfill study\04\_reporting\landfill status report\18 summit\appendix r - summit road landfill\_sept15 2015.docx



**TABLE R1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 18  
**Site Name** Summit Road Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic
<b>Start date</b>	pre 1964
<b>End date</b>	1998
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Trench (to 1979), pit (new)
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	76		
Depth of waste below ground surface (metres)	5		
Height above ground surface (metres)	14		
Slope %	4H:1V	Cover thickness (metres)	2
Cover material	Clay and fill including from construction sites		
Comment on slopes	Settlement previously noted but not in 2015 Site visit		

**Environmental Controls**

<b>Description of leachate collection system</b>	Partial perimeter leachate collection system, underdrain at the south end
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	City of Winnipeg owns the landfill. Control zone to the east, west and north is privately owned.
<b>Current</b>	Vacant
<b>North</b>	Pond area and vacant land, dog kennel
<b>East</b>	Agricultural fields
<b>South</b>	Agricultural fields and Optimist Park sports fields
<b>West</b>	Agricultural fields and Perimeter Highway
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	238	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	Sturgeon Creek to the southwest, Truro Creek to the east, pond area to the north		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	Not specified	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>	0.0			
<b>Minimum depth to till (metres)</b>	4.9			
<b>Minimum depth to bedrock (metres)</b>	5.8			
<b>Bedrock</b>	Stony Mt. (Gunton)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	234.6	<b>Max</b>	248

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes, including domestic wells	<b>Current</b>	Yes
<b>Current surface water</b>	Yes			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Settlement previously noted but not in 2015 Site visit
<b>Erosion</b>	No
<b>Seeps</b>	Yes
<b>Other</b>	--



**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

Content may not reflect National Geographic's current map policy.  
Sources: National Geographic.

0 80 160 320  
1:8,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR. DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 18: SUMMIT ROAD LANDFILL, WINNIPEG, MANITOBA

**TITLE**  
SITE PLAN

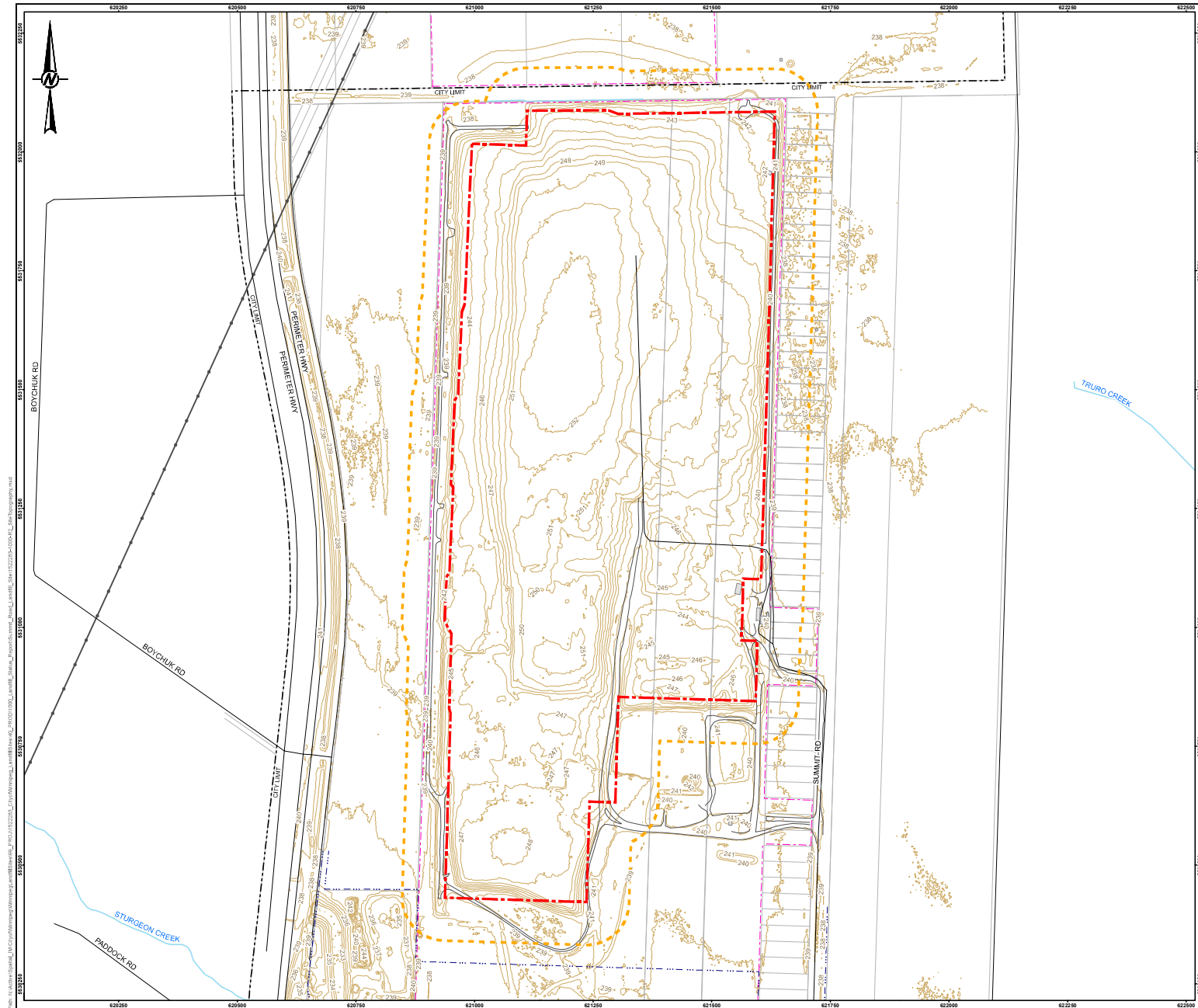
CONSULTANT	YYYY-MM-DD	2015-06-26
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>R1</b>
------------------------	---------------	-----------	---------------------

0 80 160 320  
1:8,000 METRES

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 24mm





- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - CITY OF WINNIPEG LIMIT BOUNDARY
  - BUILDING FOOTPRINT
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL
  - ROAD
  - POWER TRANSMISSION LINE (OVERHEAD)
  - TOPOGRAPH C CONTOUR, metres
  - WATERCOURSE
  - UTILITY
  - BURIED CABLE



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 18: SUMMIT ROAD LANDFILL, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-08
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE **R2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 25mm







**Photo R1**  
Looking north across the top of the landfill



**Photo R2**  
Leachate manhole MH10 at southwest corner

**NOTE**

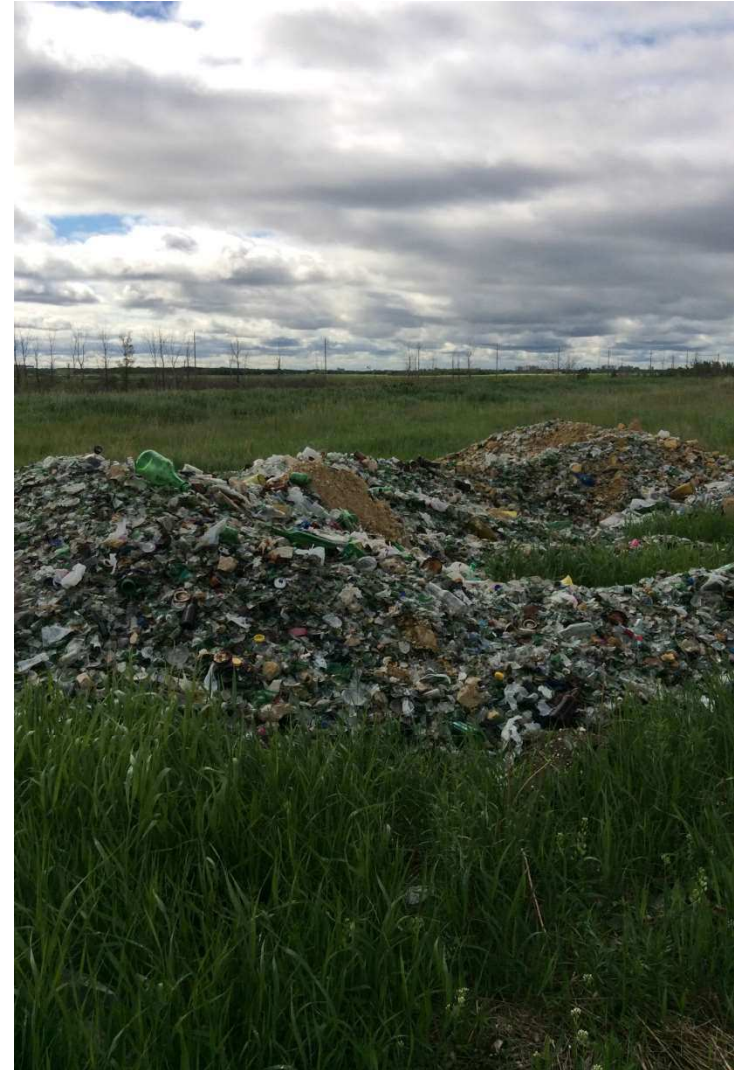
THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 18: SUMMIT ROAD LANDFILL SITE PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE R4	






**Photo R3**  
**Leachate sump trial at northeast corner of landfill**



**Photo R4**  
**Piles of glass for filter material at northeast corner of the landfill. Dead trees in background**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 18: SUMMIT ROAD LANDFILL SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF Sept 2015		
				REVIEW	PLF Sept 2015		
				<b>FIGURE R5</b>			





**Photo R5**  
**Leachate seep noted on the east side of the  
north end of landfill**



**Photo R6**  
**North end of landfill, looking north**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 18: SUMMIT ROAD LANDFILL SITE PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PIE Sept 2015
		PHASE No. 1000	SCALE AS SHOWN
			REV.0
		FIGURE R6	



# **APPENDIX S**

## **19. Shaftesbury Boulevard Dump Site**



## APPENDIX S

### 19. Shaftesbury Boulevard Dump – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Shaftesbury Boulevard Dump (Site 19), located to the northwest of the intersection of Shaftesbury Boulevard and Wilkes Avenue, north of the railway line, in Winnipeg, Manitoba, as illustrated on Figure S1. The Shaftesbury Boulevard Dump covers an area of approximately 2.6 hectares (ha) and was operated by the Town of Tuxedo from the 1950s until it closed in 1972. The Site is an open field. The waste reportedly includes domestic waste, some bulk waste, possible farm and zoo wastes, metals, concrete, and cars. The cover material is largely undocumented; however, is described as potentially fill (clay with organics, some wood pieces). It has been reported that no cover material is present with exposed waste (uncovered metal debris and waste). Groundwater in the vicinity of the Site is not used for domestic purposes and a 45 m landfill gas control zone has been established for the Site. The Site is located within a mixed residential/agricultural/recreational area.

In 1981, a drilling program was conducted at the Shaftesbury Boulevard Dump Site, which included the drilling of 13 boreholes to depths ranging from 2.1 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill or topsoil to depths of up to 1.8 m below grade underlain by refuse, if present, underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 13 boreholes drilled at the Site, five contained waste below the fill. The depth of waste extended to an average depth of 1.4 m below ground surface although at one location fill containing refuse was present from surface to 2.4 m below grade.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in August 1981

- P1E, drilled to a depth of 5.5 m below grade, located east of the landfill;
- P7L, drilled to a depth of 5.5 m below grade, located within the central portion of the waste fill area;
- P9E, drilled to a depth of 5.5 m below grade, located south of the landfill;
- P10E, drilled to a depth of 5.5 m below grade, located west of the landfill; and,
- P13L, drilled to a depth of 5.5 m below grade, located within the western portion of the waste fill area.

No wells/probes remain on-Site.

Ground surface is at an elevation of 234.7 m above sea level (masl). The water level is reportedly 0.6 m below natural grade in the waste fill area and 1.4 m below natural grade outside the fill area. There is a minimum clay thickness below the landfill of 6.1 m.

The cover material is potentially fill. Waste reportedly extends from 1.5 m below natural grade to 0.9 m above natural grade. In 1992, the Site was owned and maintained similarly to today (i.e. as a vacant field). The Site was used for horseback riding trails. In more recent years, clay from a construction project was brought to the Site and placed as additional cover. A project to naturalize the Site was undertaken. In 2011, a crushed limestone pathway and a trailhead sign were added to the Site.





## APPENDIX S

### 19. Shaftesbury Boulevard Dump – Winnipeg Landfill Status Report

Opportunities previously reported for the Site included continuation of rural character, continued trail use, and habitat restoration. Constraints previously reported for the Site included restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

The nearest industrial well is 2.8 km northeast of the Site. One supply well and one return well (for non-potable use) are operated in the summer only and are installed to depths of 62.5 m below grade and 61.0 m below grade, respectively.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Shaftesbury Boulevard Dump. Findings from the most recent Site visit, completed on July 7, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the vegetation was mainly prairie grass with no signs of stressed vegetation;
- No illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit;
- No buildings were present on-Site; and,
- No wells/probes remained on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was grass covered with gravel paths. No erosion, settling, or exposed debris was noted. No buildings or landfill gas migration barriers were present on-Site. No stressed vegetation was noted. A portion of the Assiniboine Forest is present on-Site. An overhead hydro corridor runs along the southern limit of the Site. A park sign with a canopy is present in the southern portion of the Site.

No leachate or landfill gas probes were present on-Site.

See attached Table S1 and Figures S1 to S3 for Site specific details. Site photographs are provided in Figures S4 and S5.



## **APPENDIX S**

### **19. Shaftesbury Boulevard Dump – Winnipeg Landfill Status Report**

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Between 1981 and 1992, annual landfill gas sampling was completed at the Site. Trace methane concentrations (less than 20% of the lower explosive limit [LEL] of methane) were detected at P1E and P10E, located outside the east and west waste fill areas, respectively, on at least one occasion. Methane was detected at P13L (within the western portion of the landfill) at concentrations greater than 100% LEL (up to 30% methane by volume) on several occasions. The remaining concentrations were non-detect.

No landfill gas sampling has been completed since 1992.

### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

High concentrations of landfill gas have historically been reported at the Site within the waste fill area although appear to decline at the limits of waste.

Migration currently does not appear significant. Based on the type of waste reported at this location (i.e., includes domestic waste), the potential for landfill gas generation is moderate to low. Any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited.

### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE S1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 19  
**Site Name** Shaftesbury Blvd. Dump Site

**Landfill Operation**

<b>Waste type</b>	Public use, some bulk, possible farm and zoo wastes, metals, concrete, cars
<b>Start date</b>	1950s
<b>End date</b>	1972
<b>Operated by</b>	Town of Tuxedo
<b>Disposal method</b>	Surface, trench
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	2.6		
Depth of waste below ground surface (metres)	0.6 average, 1.5 maximum		
Height above ground surface (metres)	0.9		
Slope %	Flat	Cover thickness (metres)	0 - 1.8
Cover material	Potentially fill (undocumented), areas of exposed waste (uncovered metal debris and waste), clay with		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	City of Winnipeg, south and southeast portion of the control zone are privately owned
<b>Current</b>	Vacant field
<b>North</b>	Assiniboine Forest
<b>East</b>	Shaftesbury Blvd with residential beyond
<b>South</b>	Rail line, Wilkes Avenue, with forest and agricultural beyond
<b>West</b>	Assiniboine Forest
<b>Comment</b>	-

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	234.7	<b>Groundwater flow direction</b>	East
<b>Potable water? Yes/No</b>	No	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	232.6	<b>Max</b>	233.8
<b>Minimum clay thickness below base grades (metres)</b>	6.1			
<b>Minimum depth to till (metres)</b>	8.2			
<b>Minimum depth to bedrock (metres)</b>	20.4			
<b>Bedrock</b>	Stony Mt. (Gunton)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	233.2	<b>Max</b>	234.1

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	No			

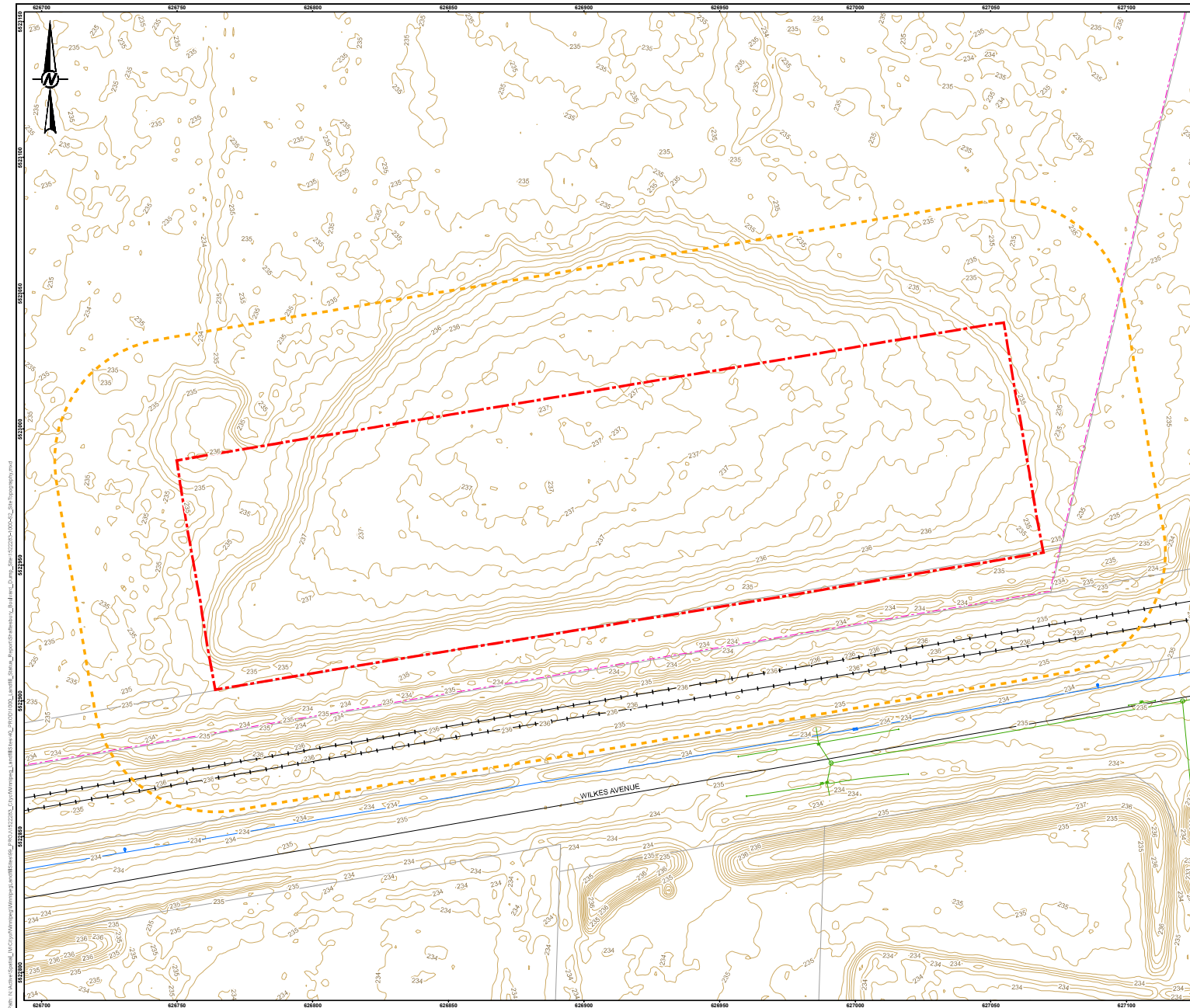
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None

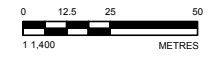
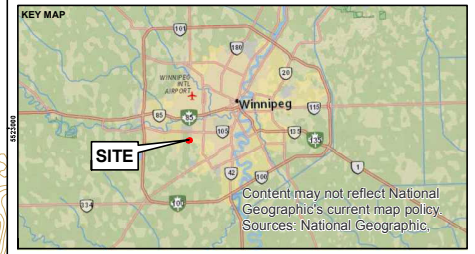








- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - ROAD
  - RAILWAY
  - TOPOGRAPHIC CONTOUR, metres
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL
  - UTILITY
  - SANITARY SEWER
  - WATER MAIN




**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

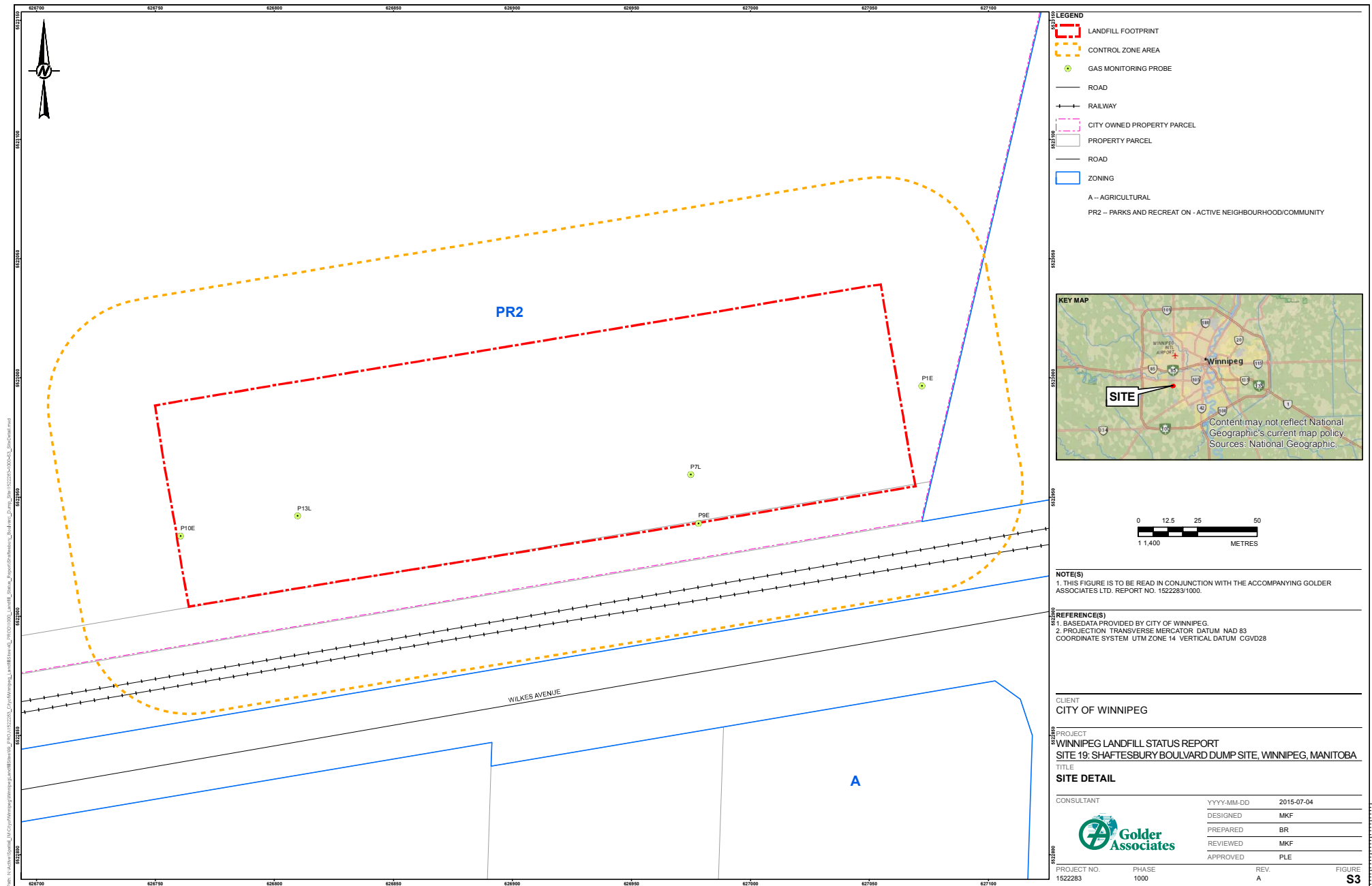
CLIENT  
**CITY OF WINNIPEG**

PROJECT  
**WINNIPEG LANDFILL STATUS REPORT  
SITE 19: SHAFESBURY BOULEVARD DUMP SITE, WINNIPEG, MANITOBA**

TITLE  
**SITE TOPOGRAPHY**

	CONSULTANT	YYYY-MM-DD	2015-07-05
	DESIGNED	MKF	
	PREPARED	BR	
	REVIEWED	MKF	
	APPROVED	PLE	
PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	<b>S2</b>

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 25mm







**Photo S1**

**Gravel path running along the southern portion of the Site. Note the park signage and hydro lines, looking west**




**Photo S2**

**Gravel path along the eastern portion of the Site, looking north**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT


PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 19: SHAFTSBURY BOULEVARD DUMP PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF Sept 2015		
				REVIEW	PIE Sept 2015		
				FIGURE S4			



**Photo S3**  
View of Site, looking northwest

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 19: SHAFTESBURY BOULEVARD DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS	—				
		CHECK	MKF Sept 2015				
		REVIEW	PLE Sept 2015	FIGURE S5			



# **APPENDIX T**

## **20. Charleswood Road Landfill Site**





## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Charleswood Road Landfill (Site 20), located to the southwest of the intersection of Charleswood Road and Wilkes Avenue in Winnipeg, Manitoba, as illustrated on Figure T1. The Charleswood Road Landfill covers an area of approximately 8 hectares (ha) and was operated by the Regional Municipality of Charleswood from 1947 until it closed in approximately 1970. The Site has been developed with a baseball diamond and a recreation area. The waste reportedly includes residential, bulk, and industrial waste, metals, cars, paper, wire, and rubble. The cover material is described as clay ranging in thickness from 0 metres (m) to 2.1 m. Groundwater in the vicinity of the Site is not used for domestic purposes and a 15 m landfill gas control zone has been established for the Site. The Site is located within a mixed residential/agricultural/recreational area.

In 1981, a drilling program was conducted at the Charleswood Road Landfill, which included the drilling of 23 boreholes to depths ranging from 1.2 m to 5.5 m. The stratigraphy encountered at the Site reportedly included fill or topsoil to depths of up to 1.2 m below grade underlain by refuse, if present, underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 23 boreholes drilled at the Site, eight contained waste. The depth of waste ranged from 1.8 m to 3.4 m below ground surface.

Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### **Drilled and Installed in May 1981**

- P5L, drilled to a depth of 5.5 m below grade, located within the central portion of the waste fill area;
- P6E, drilled to a depth of 5.5 m below grade, located northeast of the landfill;
- P16L, drilled to a depth of 5.5 m below grade, located in the north-central portion of the waste fill area (not that P16L is also shown in south-central portion of the landfill on Figure T3 and the true location is unknown);
- P17E, drilled to a depth of 5.5 m below grade, located within the south-central portion of the landfill. No waste was reported at this location; however, it is located within the landfill footprint as shown on Figure T3;
- P22E, drilled to a depth of 5.5 m below grade, located within the northwestern portion of the waste fill area. No waste was reported at this location; however, it is located within the landfill footprint as shown on Figure T3; and,
- P23L, drilled to a depth of 5.5 m below grade, located within the northwestern portion of the waste fill area, just south of P22E.

P24L is also reported on Figure T3 although no installation details were provided electronically. Three wells/probes remain on-Site, including P5L, P6E, and P25E. The location and installation details for P25E were not provided electronically. Potentially the location of P25E may be one of the locations recorded for P16L.



## APPENDIX T

### 20. Charleswood Road Landfill – Winnipeg Landfill Status Report

Ground surface is at an elevation of 237.1 m above sea level (masl). The water level is reportedly 0.9 m below natural grade in the waste fill area and 2.1 m below natural grade outside the fill area. There is a minimum clay thickness below the landfill of 2.1 m.

The cover material is clay. Waste reportedly extends greater than 4 m below natural grade. In 1992, the Site was owned and maintained similarly to today (i.e. as a baseball diamond). A constraint previously reported for the Site included restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

There are no industrial wells in the vicinity of the Site.

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Charleswood Road Landfill. Findings from the most recent Site visit, completed on July 7, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the vegetation was mainly grass with no signs of stressed vegetation. The Site was well maintained;
- No illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit;
- No permanent buildings were present on-Site. Two baseball diamonds were present. A small maintenance shed and washrooms were located on the northern portion of the Site; and,
- Three wells/probes remained on-Site.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was mainly flat and grass covered with baseball diamonds present on-Site. No erosion or settling was noted. One metal bar was noted sticking out from the ground surface in the northwest quadrant of the Site (west of the central gravel pathway). An equipment shack, several light standards, and dugouts were noted on-Site. No landfill gas migration barriers were present on-Site. No stressed vegetation was noted. Some ditches were noted throughout the Site.

Landfill gas probes were present on-Site.

See attached Table T1 and Figures T1 to T3 for Site specific details. Site photographs are provided in Figures T4 through T7.



### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Between 1985 and 1992, annual landfill gas sampling was completed at the Site in 7 or 8 probe location. No detectable methane was reported in probes located outside the waste fill area. Methane concentrations of less than 100% of the lower explosive limit (LEL) of methane were detected in two probes and greater than 100% LEL in one probe located within the waste fill area between 1985 and/or 1987. Methane concentrations of less than 100% LEL were detected in one probe located within the waste fill area in 1987 and 1991. The remaining concentrations were non-detect.

Additional sampling has been completed at the Site in 2013 and 2014. No detectable landfill gas was noted. The depth to groundwater at the Site in 2014 was approximately 1.9 m below grade, indicating that the water may have been above the top of the screened portion of the probes, not allowing for accurate measurement of the methane concentrations.

#### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

#### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

### **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

#### **4.1 Landfill Gas**

High concentrations of landfill gas have historically been reported at the Site within the waste fill area although appeared to decline at the limits of waste.

Migration currently does not appear significant. Based on the type of waste reported at this location (i.e., includes domestic waste), the potential for landfill gas generation is moderate to low. Any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited.

#### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

#### **4.3 Surface Water**

No surface water is present at the Site.



**TABLE T1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 20  
**Site Name** Charleswood Road Landfill Site

**Landfill Operation**

<b>Waste type</b>	Residential, bulk, industrial, metals, cars, paper, wire, rubble
<b>Start date</b>	1947
<b>End date</b>	~1970
<b>Operated by</b>	Regional Municipality of Charleswood
<b>Disposal method</b>	Surface, trench
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	8		
Depth of waste below ground surface (metres)	> 4		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	0 - 2.1
Cover material	Clay		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg. The west side of the control zone is owned by third parties
<b>Current</b>	Recreational fields
<b>North</b>	Wilkes Avenue, with vacant land beyond
<b>East</b>	Charleswood Road, with residential beyond
<b>South</b>	Baseball diamonds
<b>West</b>	Agricultural
<b>Comment</b>	-

**Physical Site Setting**

<b>Ground elevation (mASL)</b>		237.1	<b>Groundwater flow direction</b>	East/Northeast
<b>Potable water? Yes/No</b>		No	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	None	<b>Max</b>	-
<b>Minimum clay thickness below base grades (metres)</b>		2.1		
<b>Minimum depth to till (metres)</b>		6.1		
<b>Minimum depth to bedrock (metres)</b>		9.4		
<b>Bedrock</b>		Amaranth		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	236.2	<b>Max</b>	-

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Some exposed waste noted



WILKES AVENUE

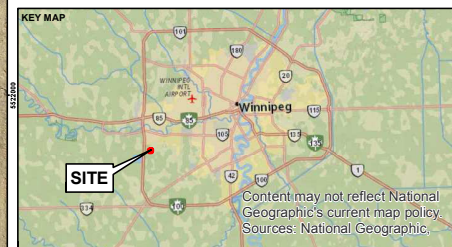
15 m  
CHARLESWOOD ROAD

15 m

**LEGEND**

 LANDFILL FOOTPRINT CONTROL ZONE AREA

8 — ROAD



## NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

## REFERENCE(S)

542-1909  
REFERENCE(S)  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

CLIENT

CITY OF WINNIPEG

PROJECT

WINNIPEG LANDFILL STATUS REPORT  
SITE 20: CHARLESWOOD ROAD LANDFILL SITE, WINNIPEG, MANITOBA

## 55218 SITE PLAN

CONSULTANT

YYYY-MM-DD 2015-07-02

DESIGNED	MKF
----------	-----

PREPARED	BR
----------	----

REVIEWED	MKF
----------	-----

APPROVED	PLE
----------	-----

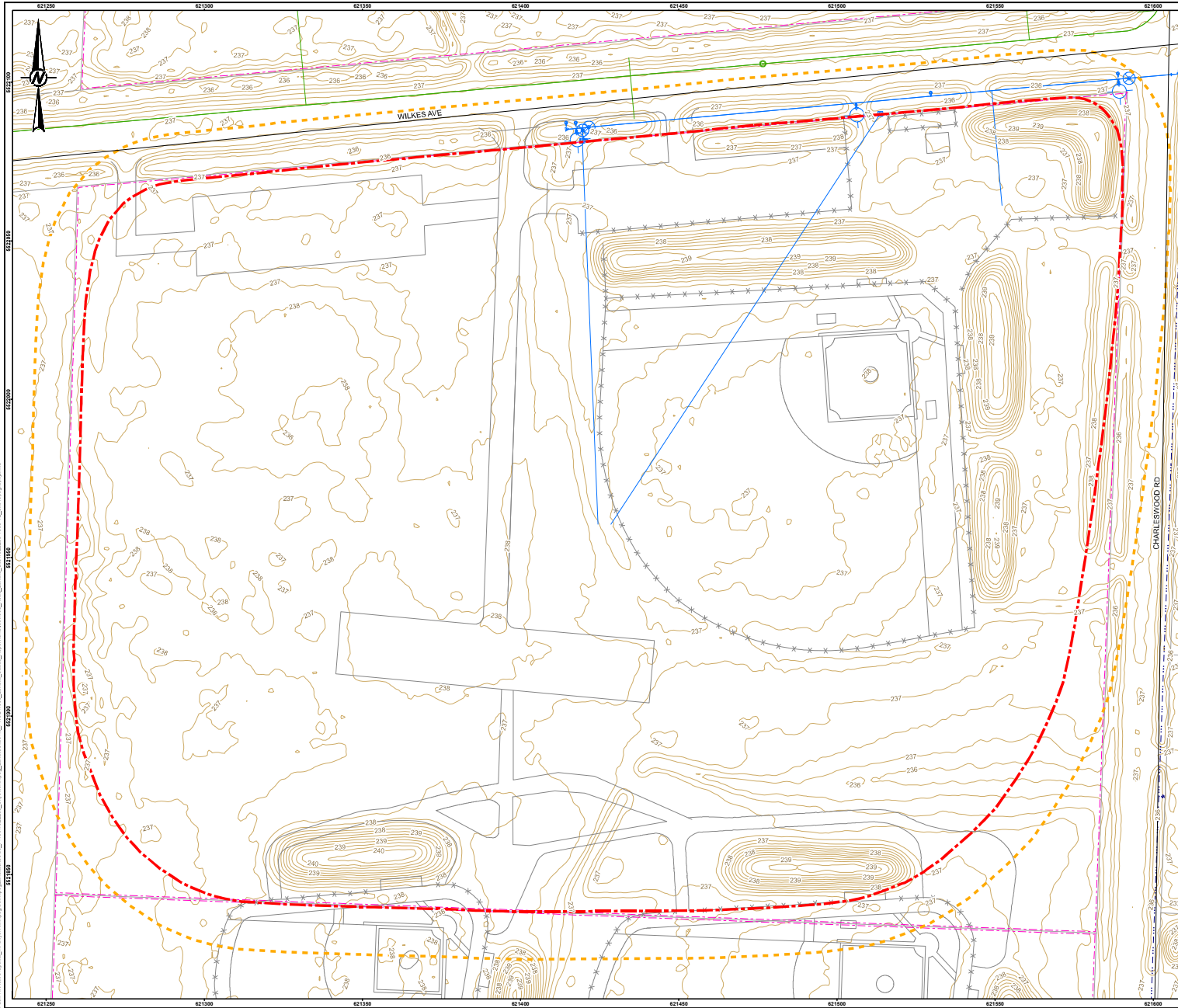


PROJECT NO.  
1522283

PHASE  
1000

REV  
AFIGURE  
T1





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD
- TOPOGRAPH C CONTOUR, metres
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- UTILITY
  - MTS CABLE
  - SANITARY SEWER
  - WATER MAIN

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 10 20 40  
1:200 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 20: CHARLESWOOD ROAD LANDFILL SITE, WINNIPEG, MANITOBA

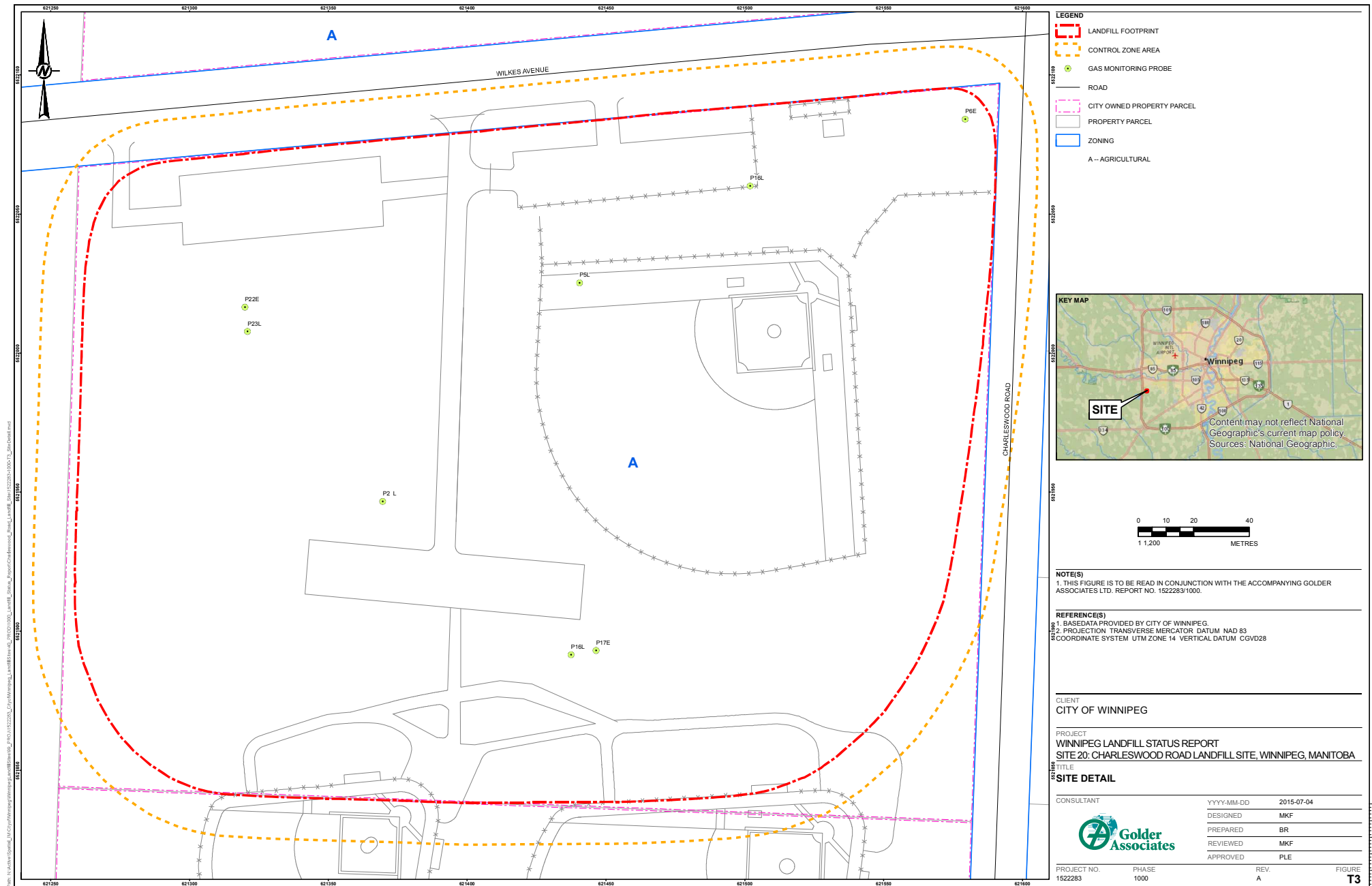
**TITLE**  
SITE TOPOGRAPHY

	CONSULTANT	YYYY-MM-DD	2015-07-07
	DESIGNED	MKF	
	PREPARED	BR	
	REVIEWED	MKF	
	APPROVED	PLE	

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	T2

WINNIPEG LANDFILL STATUS REPORT - SITE 20: CHARLESWOOD ROAD LANDFILL SITE, WINNIPEG, MANITOBA








**Photo T1**  
View of Site, looking south



**Photo T2**  
View looking south from the northwest  
portion of the Site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 20: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF	Sept 2015	
		REVIEW	PLE	Sept 2015	
		FIGURE T4			




**Photo T3**  
View looking west from the northeast  
portion of the Site



**Photo T4**  
View looking north from the south side of the  
baseball diamond

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 20: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PLE Sept 2015			
		FIGURE T5			






**Photo T5**  
View looking north from the Site



**Photo T6**  
View looking east from the north side of the baseball diamond. Note: equipment shed on the left side of the photograph

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 20: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE T6	




**Photo T7**  
View looking south from the north side of the  
baseball diamond



**Photo T8**  
Exposed metal coming from surface of  
landfill

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 20: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE T7	





# **APPENDIX U**

## **21. Charleston Street (Community Row)**





## APPENDIX U

### 21. Charleston Street (Community Row) Dump – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Charleston Street (Community Row) Dump (Site 21), located on the west side of Community Row (formerly Charleston Street), approximately 2.2 km south of Wilkes Avenue, in Winnipeg, Manitoba, as illustrated on Figure U1. The Charleston Street (Community Row) Dump covers an area of approximately 2.3 hectares (ha) and was operated by the City of Winnipeg although actual dates of operation are unknown as there is no documentation of actual dumping having occurred on the Site. The Site has not been developed. The waste reportedly includes unburned and partially burned refuse, small amount of metal, ceramics, and pottery. The cover material is undocumented and described as poor with an unknown thickness. Groundwater in the vicinity of the Site is used for domestic purposes. No landfill gas control zone has been established for the Site. The Site is located within an agricultural area and a drainage ditch runs in an east-west orientation through the central portion of the Site.

In 1981, a drilling program was conducted at the Charleston Street (Community Row) Dump, which included the drilling of 12 boreholes to depths ranging from 1.4 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included topsoil to 0.6 m below grade underlain by clay to the maximum depth of investigation. Roadbed material was noted in P12E, located on the west edge of the former Charleston Street, in place of topsoil. Oxidized metal cans were noted in the topsoil at one location in the southern portion of the Site.

Another three boreholes were drilled at Community Road, Site B, which is shown on historical mapping to be located at the intersection of Angle Street and Community Way (i.e. the north portion of the Site). These three locations were drilled depths of 2.1 m below grade and were of similar stratigraphy.

No waste was encountered in the boreholes drilled at the Site. Monitoring wells and/or landfill gas probes were installed in select boreholes. The following information was provided:

### Drilled and Installed in May 1981

- P7E, drilled to a depth of 5.5 m below grade, located within the southern portion of the Site, south of the drain; and,
- P12E, drilled to a depth of 5.5 m below grade, located in the east-central portion of the Site, north of the drain.

Ground surface is at an elevation of 236.5 m above sea level (masl). The water level is reportedly 3 m below natural grade. There is a minimum clay thickness below the landfill of 6.1 m.

No waste was encountered in the drill logs provided for the Site although small amounts of metal, ceramics, and pottery were reported. In 1992, the Site was owned and maintained similarly to today (i.e. vacant field). Opportunities previously reported for the Site included habitat preservation. Constraints previously reported for the Site included isolation.

There are no industrial wells in the vicinity of the Site.



## APPENDIX U

### 21. Charleston Street (Community Row) Dump – Winnipeg Landfill Status Report

## 1.1 Previous Site Visits

The City performs regular Site visits to the Charleston Street (Community Row) Dump. Findings from the most recent Site visit, completed in 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the vegetation was mainly prairie grass, cattails, weeds, and trees with no signs of stressed vegetation. The Site was overgrown and not maintained;
- No illegal dumping was noted and no drainage, leachate, erosion, or slope stability issues were identified during the Site visit;
- No buildings were present on-Site; and,
- The two wells/probes remained on-Site.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 18, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site had irregular slopes and vegetation included grass, shrubs and trees. Some vegetation was noted to be dead, although is likely attributed to wet conditions. No erosion, settling, or exposed debris was noted. No landfill gas migration barriers were present on-Site. A large drainage ditch runs through the central portion of the Site.

Landfill gas probes were present on-Site.

See attached Table U1 and Figures U1 to U3 for Site specific details. Site photographs are provided in Figures U4 through U7.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Between 1985 and 1992, annual landfill gas sampling was completed at the Site. No detectable methane was reported in the landfill gas probes.

Additional sampling was completed at the Site in 2011 and 2013. No detectable landfill gas was noted. The depth to groundwater at the Site in 2013 was between 2.4 m and 2.9 m below grade, indicating that the water may have been below the top of the screened portion of the probes, allowing for accurate measurement of the methane concentrations although without drill logs, this cannot be determined with certainty.



## **APPENDIX U**

### **21. Charleston Street (Community Row) Dump – Winnipeg Landfill Status Report**

## **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

## **3.3 Surface Water**

There is a drainage ditch on Site, although no historical or current surface water sampling program has been established. There are also very wet areas throughout the Site with cattails indicating wetland conditions.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Methane has not been detected at the Site. Based on the type of waste reported at this location (i.e., very limited), the potential for landfill gas generation is very low. Any landfill gas generated at the Site would likely escape through the surficial fill or via the drainage ditch and migration would be expected to be limited.

### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

### **4.3 Surface Water**

No surface water sampling has occurred at the Site.



**TABLE U1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 21  
**Site Name** Charleston St. (Community Row) Dump

**Landfill Operation**

<b>Waste type</b>	Unburned and partially burned refuse, small amount of metal, ceramics, pottery
<b>Start date</b>	Unknown - no evidence of actual dumping
<b>End date</b>	Unknown - no evidence of actual dumping
<b>Operated by</b>	City of St. James
<b>Disposal method</b>	Unknown
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	2.3		
Depth of waste below ground surface (metres)	0		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	Unknown
Cover material	Unknown - poor		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	0 (site boundary)

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Wild fields/vacant
<b>North</b>	Agricultural
<b>East</b>	Community Row, with agricultural beyond
<b>South</b>	Agricultural
<b>West</b>	Rail line
<b>Comment</b>	-

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	236.5	<b>Groundwater flow direction</b>	East
<b>Potable water? Yes/No</b>	No	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	None	<b>Max</b>	-
<b>Minimum clay thickness below base grades (metres)</b>		6.1		
<b>Minimum depth to till (metres)</b>		6.4		
<b>Minimum depth to bedrock (metres)</b>		9.4		
<b>Bedrock</b>		Stony Mt. (Penitentiary)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	-	<b>Max</b>	-

**Monitoring**

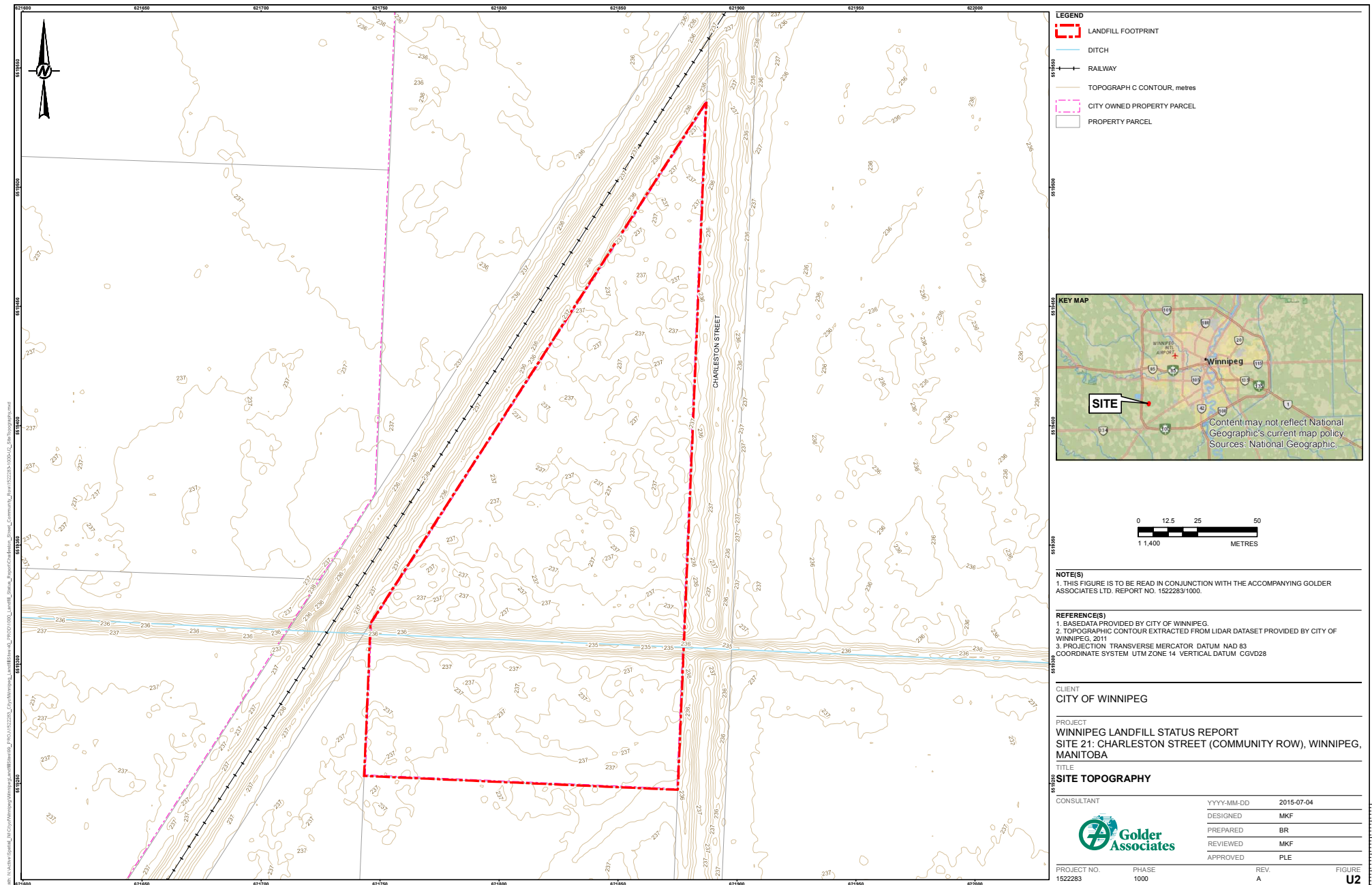
<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	yes			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None














**Photo U1**  
View looking south from the  
north corner of the Site



**Photo U2**  
View of swampy/wet area along the southeast side of  
the railway tracks, looking southwest

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 21: CHARLESTON STREET (COMMUNITY ROW) DUMP PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF	Sept 2015	
				REVIEW	PIE	Sept 2015	
				<b>FIGURE U4</b>			





**Photo U3**

**Dead trees in wet area on east side of the Site**




**Photo U4**

**Drainage ditch, looking south at Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 21: CHARLESTON STREET (COMMUNITY ROW) DUMP PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015	<b>FIGURE U5</b>	






**Photo U5**  
**View of Site looking south**



**Photo U6**  
**View of Site looking east**

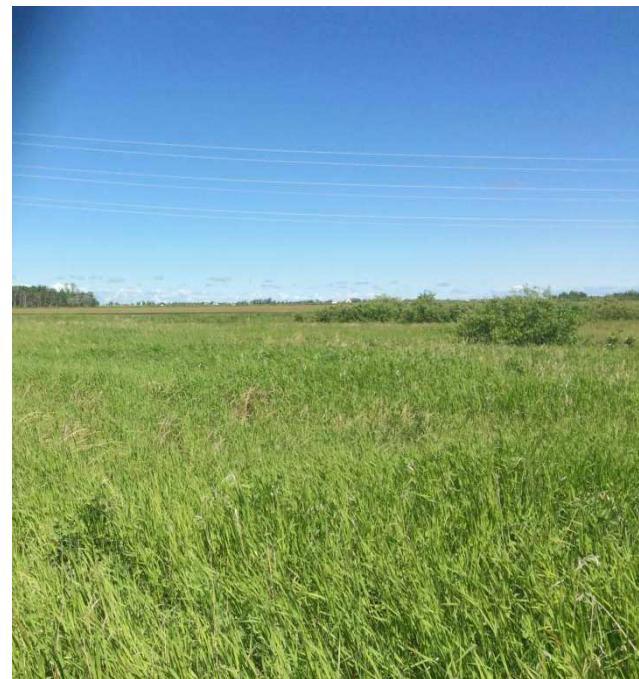
**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 21: CHARLESTON STREET (COMMUNITY ROW) DUMP PHOTOGRAPHS	
		PROJECT No. 1522283	PHASE No. 1000
		DESIGN	July 2015
		GIS	—
		CHECK	—
		REVIEW	—
		SCALE AS SHOWN	REV.0
		FIGURE U6	




**Photo U7**  
View of drainage ditch looking southeast



**Photo U8**  
View from Site looking west across  
the railway tracks

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 21: CHARLESTON STREET (COMMUNITY ROW) DUMP PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PIE Sept 2015			
		FIGURE U7			



# **APPENDIX V**

## **22. Charleswood Road (South) Landfill Site**





## APPENDIX V

### 22. Charleswood Road (South) Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Charleswood Road (South) Landfill (Site 22), located at the southern limit of Charleswood Road, approximately 830 m east of Perimeter Highway, at the Winnipeg, Manitoba city limit, as illustrated on Figure V1. The Charleswood Road (South) Landfill covers an area of approximately 5.2 hectares (ha) and was operated by the Regional Municipality of Charleswood from 1970 until it closed in 1975. The landfill is a vacant field surrounded by agricultural fields. A rail line runs through the southeastern portion of the control zone. The Charleswood unopened road allowance runs through the eastern control zone. The waste reportedly included domestic waste, with a limited amount of industrial waste.

In 1981, a drilling program was conducted at the Charleswood Road (South) Landfill, which included the drilling of 23 boreholes to depths ranging from 1.2 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill (clay/silt) or topsoil to a depth of up to 2.1 m below grade, overlying refuse (if present), underlain by clayey silt and clay layers to the maximum depth of investigation.

Of the 23 boreholes drilled at the Site, 11 contained refuse, including crumbly, clay-like organics, glass, metal, wire, ash, paper, cables, and wood. The depth of waste, where present, ranged from surface to greater than 5.5 m below ground surface.

Monitoring wells and/or landfill gas probes were installed in select boreholes and labelled as follows:

### Drilled and Installed in May 1981

- P10L, drilled to a depth of 5.5 m below grade, located within the northeast portion of the waste fill area;
- P15E, drilled to a depth of 5.2 m below grade, located within the northeast portion of the waste fill area. No waste was reported at this location, but is located within the waste fill footprint on Figure V3;
- P21E, drilled to a depth of 5.5 m below grade, located outside the northwest portion of the waste fill area; and,
- P23L, drilled to a depth of 5.5 m below grade, located in the northwest portion of the waste fill area, just east of P21E.

Ground surface is at an elevation of 238.4 m above sea level (masl). There is reportedly a minimum silt and clay layer thickness of 2.7 m below the landfill Site.

The cover material is undocumented; however, reportedly may have consisted of sandy, gravelly fill containing clay with organics, some wood pieces. The fill thickness reportedly ranged from 0.3 m to 2.1 m below grade. Waste reportedly ranges from 3.7 m below grade to grade. In 1992, the Site was owned and maintained by the City of Winnipeg's District 6 Operations and was a vacant field. A 45 m landfill gas control zone was allotted for the Site in 1984.

The Site is located within an agricultural area. Opportunities previously reported for the Site included a suitable location for nuisance recreation (guns, model airplanes, etc.). Constraints previously reported for the Site include isolation, restricted foundation construction, and landfill gas production. High impact recreation which could cause surface erosion was discouraged.



## APPENDIX V

### 22. Charleswood Road (South) Landfill – Winnipeg Landfill Status Report

## 1.1 Previous Site Visits

The City performs regular Site visits to the Charleswood Road (South) Landfill. Site condition findings from the most recent Site visit, completed on July 10, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was mainly prairie grass and thistles. No signs of stressed vegetation were noted;
- No illegal dumping and no drainage, erosion, slope stability, or leachate issues were identified during the Site visit;
- No other issues were identified; and,
- Two of the four probes were present on-Site, including P10L and P21E.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 18, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat and overgrown with long grass. The waste fill area was fairly well defined. The Site was surrounded by agricultural land, with a railway line and hydro line present to the east. No exposed debris was noted.

No leachate collection systems or building were present on Site. Two methane probes were noted on-Site.

See attached Table V1 and Figures V1 to V3 for Site specific details. Site photographs are provided in Figures V4 and V5.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Annual landfill gas sampling was performed at the four probes between 1981 and 1992. Trace concentrations of methane were noted at P21E. Methane concentrations of up to greater than 20% of the lower explosive limit [LEL] of methane were noted at P15E and at concentrations greater than 100% LEL at P10L (up to 9% methane by volume) and P23L (up to 75% methane by volume).

Currently, a landfill gas monitoring program is performed at the two remaining gas probe locations. No detectable landfill gas was measured at P10L or P21E during the 2013 sampling event. These monitors could not be located in 2014.



## **APPENDIX V**

### **22. Charleswood Road (South) Landfill – Winnipeg Landfill Status Report**

## **3.2 Groundwater**

### **3.2.1 Leachate**

Groundwater sampling events were previously conducted at the Site between 1988 and 1991 at leachate wells P10L and P23L. Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality.

Groundwater sampling was conducted annually (i.e. four times) at both locations. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Results were compared to the Ontario Ministry of the Environment Table 3 generic site condition standards for all types of property use, coarse textured soil ("MOE Table 3 SCS") as groundwater in this part of Winnipeg is non-potable.

### **3.2.2 Groundwater**

No current groundwater monitoring program has been implemented at the Site.

## **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

High landfill gas (up to 75% methane by volume) has been detected at the Site based on the available information provided for review although the migration potential currently does not appear significant, based on the most recent gas probe readings obtained in 2013. Based on the type of waste reported at this location (i.e., domestic and industrial waste), the potential for landfill gas generation is moderate. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There are no utilities running through the waste fill area.

## **4.2 Groundwater**

### **4.2.1 Elevations**

The depth to water measured in 2013 at the Site were generally 2 m below grade and may be above the screened interval of the existing probes (both drilled to a depth of 5.5 m below grade). There is no ongoing monitoring program.





## **APPENDIX V**

### **22. Charleswood Road (South) Landfill – Winnipeg Landfill Status Report**

#### **4.2.2 Leachate**

Based on analytical results collected between 1988 and 1992, one or more of copper, nickel, lead, and zinc was elevated above the MOE Table 3 SCS at both locations on at least one occasion during the groundwater sampling events. Ammonia is relatively high generally ranged from 40 mg/L to 80 mg/L.

It appears that the groundwater on-Site has been slightly impacted by the presence of buried waste although no current data or background water quality is available for review.

#### **4.3 Surface Water**

No surface water is present at the Site.

**TABLE V1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 22  
**Site Name** Charleswood Rd. (South) Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic, limited industrial
<b>Start date</b>	1970
<b>End date</b>	1975
<b>Operated by</b>	Regional Municipality of Charleswood
<b>Disposal method</b>	Trench
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	5.2		
Depth of waste below ground surface (metres)	3.7		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	0.3 - 2.1
Cover material	Potentially Fill (undocumented), clay with organics, some wood pieces, sandy, gravelly		
Comment on slopes	No		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	City of Winnipeg and private owners (control zone to the north)
<b>Current</b>	Wild fields/vacant
<b>North</b>	Agricultural
<b>East</b>	Agricultural/rail line
<b>South</b>	Agricultural
<b>West</b>	Agricultural
<b>Comment</b>	-

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	238.4	<b>Groundwater flow direction</b>	East
<b>Potable water? Yes/No</b>	No	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	No		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	None	<b>Max</b>	-
<b>Minimum clay thickness below base grades (metres)</b>	2.7			
<b>Minimum depth to till (metres)</b>	6.4			
<b>Minimum depth to bedrock (metres)</b>	9.4			
<b>Bedrock</b>	Stony Mt. (Gunton, Penitentiary(E))			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	236.2	<b>Max</b>	237.4

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes (2 leachate wells)	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

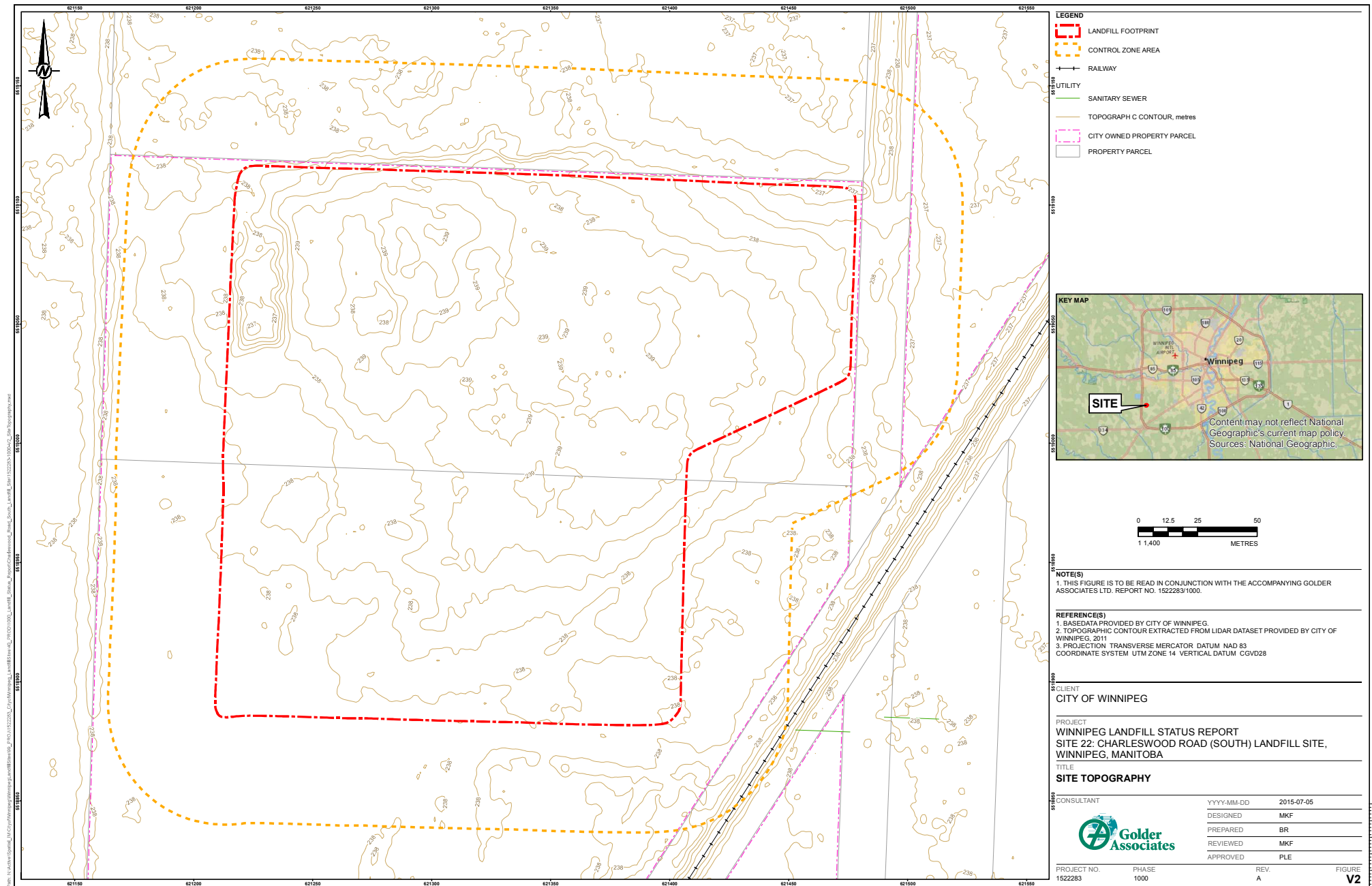
**Notable 2015 Site Visit Observations**

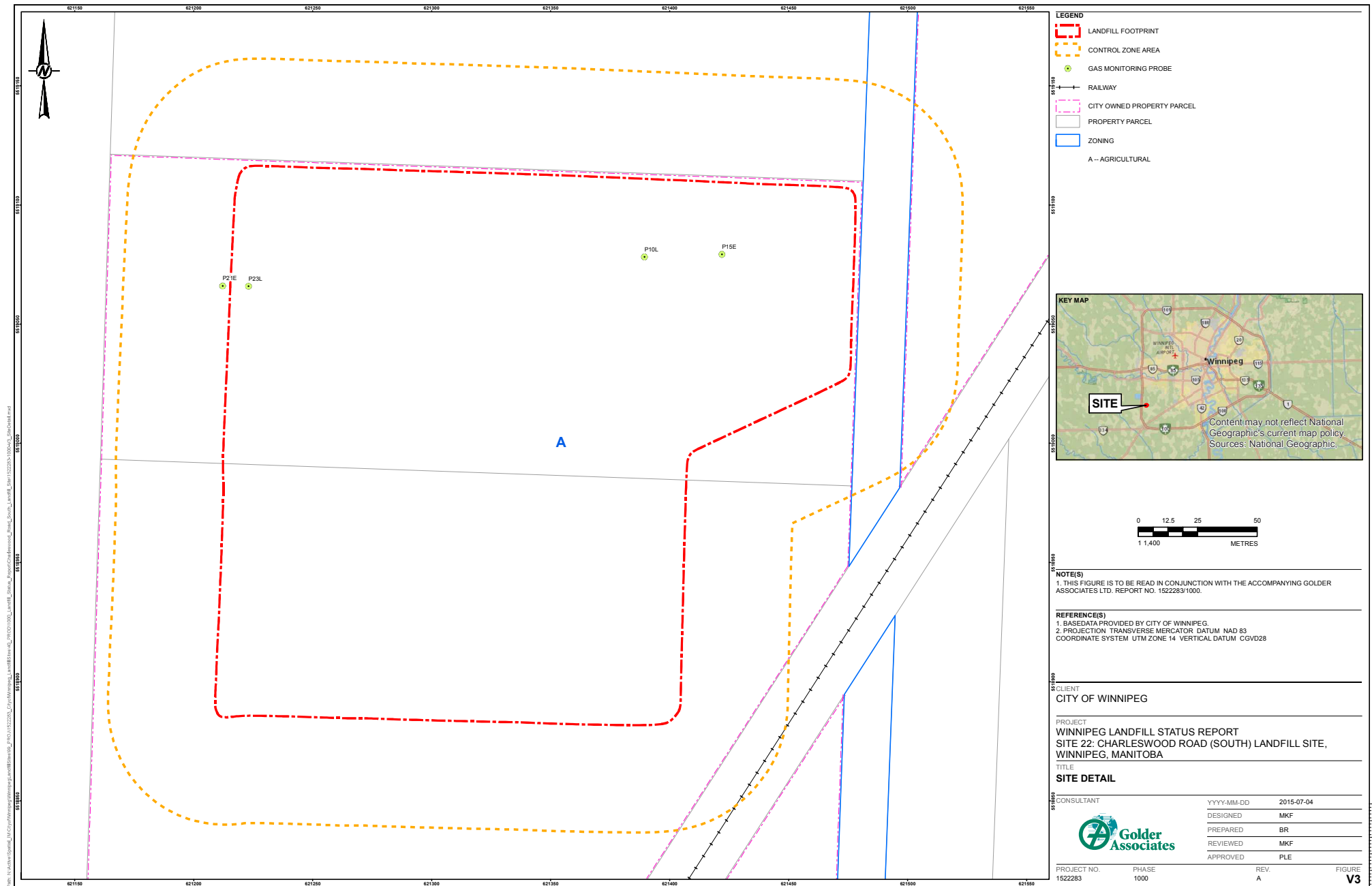
<b>Settlement/slopes</b>	No
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None














**Photo V1**  
View of Site looking south



**Photo V2**  
View of Site looking southeast

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT				
TITLE				SITE 22: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS				
		PROJECT No. 1522283		PHASE No. 1000		FIGURE V4		
		DESIGN	July 2015	SCALE AS SHOWN				REV.0
		GIS						
		CHECK	MLF Sept 2015					
		REVIEW	PLF Sept 2015					






**Photo V3**  
View looking east from the landfill



**Photo V4**  
View looking east from the southern portion of the landfill

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 22: CHARLESWOOD ROAD (SOUTH) LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	Julv 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PIE Sept 2015			
		FIGURE V5			



# **APPENDIX W**

## **24. Cadboro Road (West) Landfill Site**



## APPENDIX W

### 24. Cadboro Road (West) Dump – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Cadboro Road (West) Dump Site (Site 24), located southeast of Cadboro Road and Brady Road in Winnipeg, Manitoba, as illustrated on Figure W1. The Cadboro Road (West) Dump Site covers an area of approximately 10.4 hectares (ha) and was operated by Johnson Disposal (WSI) and the Fort Garry Municipality from 1965 until 1975. The landfill was used for domestic waste, industrial bulk metals, liquids and reportedly an entire auto wrecker's yard disposal. The waste was disposed using large cells and trenches.

A subsurface investigation was undertaken by the City in 1981 at the Cadboro Road (West) Dump Site. The drilling program included the drilling of 21 boreholes. The depth of the 21 boreholes ranged from 0.9 metres (m) to 7.0 m. The stratigraphy encountered at the Site reportedly included fill (clay, silt) and/or topsoil to a depth of 0.3 to 1.8 m below grade, overlying refuse (if present), underlain by clay to the maximum depth of investigation. In areas outside of the waste footprint, an approximately 1 m layer of silt exists 1 m below ground surface at some locations.

Of the 21 boreholes drilled at the Site, ten contained waste/refuse, including domestic waste, fibrous refuse, rubble, ash, paper, metal and plastic. The depth of waste, where present, ranged from 2.1 to greater than 5.5 m below ground surface. The 1993 Landfill Disposition Study by KGS Group indicated that the depth of waste below ground surface was up to 9.1 m, which conflicts with the borehole data reviewed. Landfill gas probes were installed in six of the boreholes and labelled as follows:

- P4E – drilled to a depth of 7.0 m below grade, located north of the landfill. Depth to water at this location ranged from 1.8 m below grade (March 2, 1982) to 2.5 m below grade (September 23, 1983);
- P5L – drilled to a depth of 4.0 m below grade, located at north end of landfill. Depth to water at this location was 1.1 m below grade (March 2, 1982 and September 23, 1983);
- P10E – drilled to a depth of 5.5 m below grade, located west of the landfill. Depth to water at this location ranged from 1.4 m below grade (December 13, 1982) to 2.0 m below grade (March 2, 1982);
- P11L – drilled to a depth of 5.5 m below grade, located at the west end of the landfill. Depth to water at this location was 2.7 m below grade (March 2, 1982 and September 23, 1983);
- P18L – drilled to a depth of 5.5 m below grade, located at southwest corner of the landfill. Depth to water at this location was 3.8 m below grade (March 2, 1982 and September 23, 1983); and,
- P19E – drilled to a depth of 5.5 m below grade, located southwest of the landfill. Depth to water at this location ranged from 3.3 m below grade (March 2, 1982) to 3.5 m below grade (September 23, 1983).

Leachate probes were installed in 1987 and labelled as follows:

- L20 – drilled to a depth of 2.1 m below grade, located at the north end of the landfill. Well screen for the leachate probes was installed from 0.9 m to 2.1 m below grade. Depth to water at this location was 1.5 m below grade (November 10, 1987); and,
- L21 – drilled to a depth of 7.0 m below grade, located at the north end of the landfill. Well screen for the leachate probes was installed from 3.7 m to 6.7 m below grade. Depth to water at this location was 4.3 m below grade (November 10, 1987).





## APPENDIX W

### 24. Cadboro Road (West) Dump – Winnipeg Landfill Status Report

Landfill gas probe P4E was destroyed in 1987, P5L was destroyed in 1990 and L21 was destroyed in 1990.

In 2012 and 2013 additional landfill gas monitoring wells and groundwater monitoring wells were installed north, east and south of the Site and were labelled GW12-01 to GW12-08, MW12-01 to MW12-03, and GW13-01 to GW13-05, GW13-06A, GW13-06B and GW13-07. The location of MW12-03 is unknown. In 2014, nine of the wells installed in 2012 were decommissioned. The well screens for the 2013 monitoring wells were completed as follows:

- GW13-01 – from approximately 1 m to 2 m below ground surface;
- GW13-02 – from approximately 0.4 m to 1.2 m below ground surface;
- GW13-03 – from approximately 0.8 m to 1.4 m below ground surface;
- GW13-04 – from approximately 1 m to 1.9 m below ground surface;
- GW13-05 – from approximately 1.1 m to 2.1 m below ground surface;
- GW13-06A – from approximately 3 m to 6 m below ground surface;
- GW13-06B – from approximately 1.1 m to 2.3 m below ground surface; and,
- GW13-07 – from approximately 1.3 m to 2.3 m below ground surface.

Gas probes GP1 and GP2 also exist at the Site. The screen for GP1 exists from 3.2 m to 5 m below ground surface.

Probes LP1, LP2 and LP3 exist at the Site. Details of their construction were not available for review.

An investigation was undertaken by MMM Group in 2014 to assess the potential for methane gas migration in the 90 metre control zone around the Site and is described in the report titled, “Methane Gas Monitoring Report in the 90 Metre Buffer Zone of the City of Winnipeg Landfill #24 Property” dated May 2015. The investigation included landfill gas sampling and groundwater monitoring. A detailed description of the subsurface conditions is provided in that report.

Ground surface surrounding the landfill is at an elevation of 234 m above sea level (masl). The top of the landfill is at an elevation of approximately 237 masl. The waste is approximately 4.6 to 9.1 metres below ground surface on average and the water level within the waste is reportedly at 233.5 masl.

The original cover material is undocumented; however, reportedly may have consisted of fill approximately 0.6 m in thickness. An additional 1.0 m of cover material was added in June of 2014 and consisted of compacted clay. An additional 0.4 m to 2.5 m of clay or silt was added for the desired grading. Topsoil was placed in the spring of 2015 and the area vegetated.

The Site was previously used as a radio controlled airplane flying club. A 90 m landfill gas control zone was allotted for the Site as shown on Figures W1 to W3. Constraints previously reported for the Site include isolated Site and restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.



## APPENDIX W

### 24. Cadboro Road (West) Dump – Winnipeg Landfill Status Report

#### 1.1 Previous Site Visits

The City performs regular Site visits to the Cadboro Road (West) Dump Site. Findings from the most recent Site visit, completed on July 10, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The Site was mainly grass covered with weeds and cattails;
- The grass was tall with some stressed (dead) vegetation thought to be caused by methane near landfill gas probe P18L;
- There is a ditch running along Brady Road next to the landfill;
- Standing water was noted in the more central portion of the landfill and water was noted pooling by landfill gas probes LP1, LP2 and LP3;
- No leachate or erosion issues were identified during the Site visit; and,
- The four remaining landfill gas probes on the landfill were in good condition (P19E, P18L, P10E, P11L) and the nine landfill gas probes and groundwater monitoring wells installed by MMM Group (GW13-01, GP-1, GW13-02, GW13-03, GW13-04, GW13-05, GW13-06B, GW13-06A, GW13-07) were also in good condition. It was noted that seven groundwater monitoring wells installed by MMM Group were missing and assumed to be destroyed.

#### 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 18, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, additional cover had been added to the landfill for regrading purposes after settlement was noted at the landfill. The additional cover material was sourced from the excavation of stormwater management ponds for the nearby residential development. The additional cover material was compacted. The landfill slope was typical of a landfill (in the 4 horizontal: 1 vertical range), with a more gentle slope on top. Some shaping of the top of the landfill had been completed to add interesting features to the Site. No depressions or settlement was noted.

At the time of the Site visit, topsoil had been added and the Site had been reseeded. Vegetation was still in the process of growing. As such, the vegetation was sometimes sparse. Some areas appeared bare, indicative of potential effects of landfill gas. Slight areas of erosion from surface water runoff were noted at the northwest corner of the landfill. This was likely due to sparse vegetation.

A residential development was noted to the north of the Site and agricultural fields were noted to the west. Construction for new residential developments was noted to the east and south. The intent is for the Site to become a park area with walking trails for the new residential development. Development will not occur in the control zone, with the exception of recreational fields.



No exposed refuse was observed, however some minor dumping at the northwest corner of the Site was noted at the time of the Site visit. The waste boundary is well defined. Hydro lines were evident to the west. No leachate collection systems or landfill gas migration barriers were noted. Landfill gas probes and groundwater monitoring wells were observed.

See attached Table W1 and Figures W1 through W3 for Site specific details. Site photographs are provided in Figures W4 and W5.

### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs for the landfill gas probes completed for the Site prior to 2013. Probes or gas wells installed after this time had appropriate drill logs.

Annual landfill gas monitoring was completed from 1986 until 1995, 2000 until 2002, 2007, 2011, 2013 and 2014. The results of the monitoring were as follows:

- Probes completed outside of the waste footprint – No methane was detected, with the exception of trace amounts (less than 20% of the Lower Explosive Limit (LEL) at two unnamed locations in 1986 and 2.7% methane by volume in air at P10E in 1995;
- Probes completed inside of the waste footprint up until 1992 – Methane detected at greater than 100% LEL at all locations with the exception of 1988 and 1989 when there was detections at less than 100% LEL at two and three locations, respectively; and,
- P11L and P18L (completed within the waste footprint) – concentrations of methane reduced from 1995 until 2013 (at a low of 1% LEL for P11L and 0% LEL for P18L) and then increased to 21.1% methane by volume in air and 60.4% methane by volume in air (i.e. greater than 100% LEL) in July 2014.

The MMM Group 2014 investigation (MMM Group, 2015) provides details about the current potential for landfill gas migration at the Site. MMM Group considered the presence of groundwater and the elevation of the screens when monitoring the landfill gas at the Site. If a monitoring well screen was saturated, the well water was purged, the cap replaced, the air purged and then a sample collected. The following observations were made in the MMM Group report:

- The 2014 monitoring program did not detect methane in the monitoring wells completed in the control zone (all of these locations had saturated well screens);
- Methane was detected at greater than 100% LEL at GP1, P11L and P18L (all completed within the waste footprint) with the highest landfill gas concentrations noted in September, 2014 and reducing in October 2014); and,
- Methane was detected at up to 50% LEL at GP2 (also completed within the waste footprint).





## **3.2 Groundwater**

### **3.2.1 Leachate**

Groundwater sampling was historically conducted at the following locations: P5L (1986, 1988 and 1989), P18L (1990, 1991, 1992) and L21 (1987, 1988 and 1989). Details of the screen installation in these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in these probes and the probes are representative of leachate quality. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

Groundwater samples were collected from GP2 and P18L in October, 2014 as part of the MMM Group investigation. The samples were submitted for laboratory analysis of one of the following: conductivity, hardness, pH, total dissolved solids, alkalinity, bicarbonate, carbonate, hydroxide, chloride, nitrate, nitrite, sulfate, calcium, magnesium, manganese, iron, mercury, sodium, potassium, benzene, ethyl benzene, toluene, xylenes and hydrocarbons.

### **3.2.2 Groundwater**

Groundwater sampling was historically conducted at P4E in 1986. Groundwater samples were collected from GW13-02 and GW13-07 in October, 2014 as part of the MMM Group investigation. The samples were submitted for laboratory analysis of one or more of the following: conductivity, hardness, pH, total dissolved solids, alkalinity, bicarbonate, carbonate, hydroxide, chloride, nitrate, nitrite, sulfate, calcium, magnesium, manganese, iron, mercury, sodium, potassium, benzene, ethyl benzene, toluene, xylenes and hydrocarbons.

## **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1986 until present (on and off annual sampling) – No detectable landfill gas was reported in probes completed outside of the waste footprint. Methane of 100% LEL was detected within the landfill and had shown a decreasing trend since 1995. In 2014, the methane concentrations increased again to greater than 100% LEL;
- A 90 m control zone exists at the Site; and,
- 2014 – Additional landfill gas monitoring undertaken by MMM Group found methane generated within the landfill but no detection of methane within the control zone.



## APPENDIX W

### 24. Cadboro Road (West) Dump – Winnipeg Landfill Status Report

To date there is no indication of subsurface lateral landfill gas migration. The gas generating capacity of the waste was reducing over time as seen in the declining methane concentrations from 1995 until 2013. The increased methane concentrations within the waste footprint in 2014 correspond to the additional cover material placed during June of 2014. Compacted clay will limit the upward movement of landfill gas to the atmosphere causing it to accumulate within the landfill. The depths to water in the control zone (1.25 m below grade) are near surface. The non-detectable methane concentrations in the control zone may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen. MMM Group used alternative sample collection methods for the wells with saturated screens, however, due to the low permeability nature of the clay soil, it is not known whether the samples collected would be representative of landfill gas in the unsaturated zone.

## 4.2 Groundwater

### 4.2.1 Elevations

The depth to water measured by the City from 1990 to 2014 in the landfill gas probes installed within the waste fill area ranged from 2.1 to 3.8 m below the top of the pipe, while the water level measured in the probes located just outside of the waste fill area ranged from 0.9 to 6.6 m below the top of the pipe (2.1 m average). The water levels measured by the MMM Group in wells completed in the control zone were less than 1.25 m below ground surface.

### 4.2.2 Leachate

Based on analytical results collected between 1986 and 1992 the following parameters were consistently elevated above the Ontario Ministry of the Environment Table 3 generic site condition standards for all types of property use, coarse textured soil ("MOE Table 3 SCS"):

- P5L (completed within the waste footprint): cadmium, copper and lead;
- L21 (completed within the waste footprint): cadmium, copper and lead; and,
- P18L (completed within the waste footprint): copper and lead.

Based on the 2014 groundwater monitoring results from MMM Group, petroleum hydrocarbons (Fraction F2) were detected above the MOE Table 3 SCS.

It appears that the groundwater within the waste footprint has been impacted by the presence of buried waste.



### **4.2.3 Groundwater**

Based on analytical results in 1986 the following parameters were elevated above the MOE Table 3 SCS at P4E:

- Cadmium, copper and lead.

Based on the 2014 groundwater monitoring results from MMM Group, the following is noted:

- The concentrations of most parameters were higher in the groundwater from the monitoring wells completed within the waste footprint compared to the groundwater from monitoring wells completed in the control zone.

It cannot be determined if the groundwater in the control zone has been impacted by landfill leachate as there is no background water quality data available for review.

## **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.



**TABLE W1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 24  
**Site Name** Cadboro Rd. (West) Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic, industrial bulk metals, liquids, entire auto wreckers yard disposal
<b>Start date</b>	1965
<b>End date</b>	1975
<b>Operated by</b>	Johnson Disposal (WSI), Fort Garry Municipality
<b>Disposal method</b>	Large cells and trenches
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	10.4		
Depth of waste below ground surface (metres)	4.6 to reportedly 9.1 (although borehole logs reviewed indicate 5.5)		
Height above ground surface (metres)	2.7		
Slope %	~25%	Cover thickness (metres)	1.6
Cover material	Potentially Fill (undocumented)		
Comment on slopes	--		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	Landfill and most of control zone City of Winnipeg, west part of control zone neighbouring municipality
<b>Current</b>	Vacant
<b>North</b>	Residential
<b>East</b>	Fields and construction for residential
<b>South</b>	Fields and construction for residential
<b>West</b>	Agricultural
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	234.4	<b>Groundwater flow direction</b>	Northeast
<b>Potable water? Yes/No</b>	No	<b>Water Taking Unit</b>	Bedrock
<b>Nearby Water Bodies</b>	Surface water ditch to the west near Brady Road		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	232.6	<b>Max</b>	233.5
<b>Minimum clay thickness below base grades (metres)</b>	0.3			
<b>Minimum depth to till (metres)</b>	9.4			
<b>Minimum depth to bedrock (metres)</b>	12.2			
<b>Bedrock</b>	Stony Mt. (Gunn)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	233.5	<b>Max</b>	235

**Monitoring**

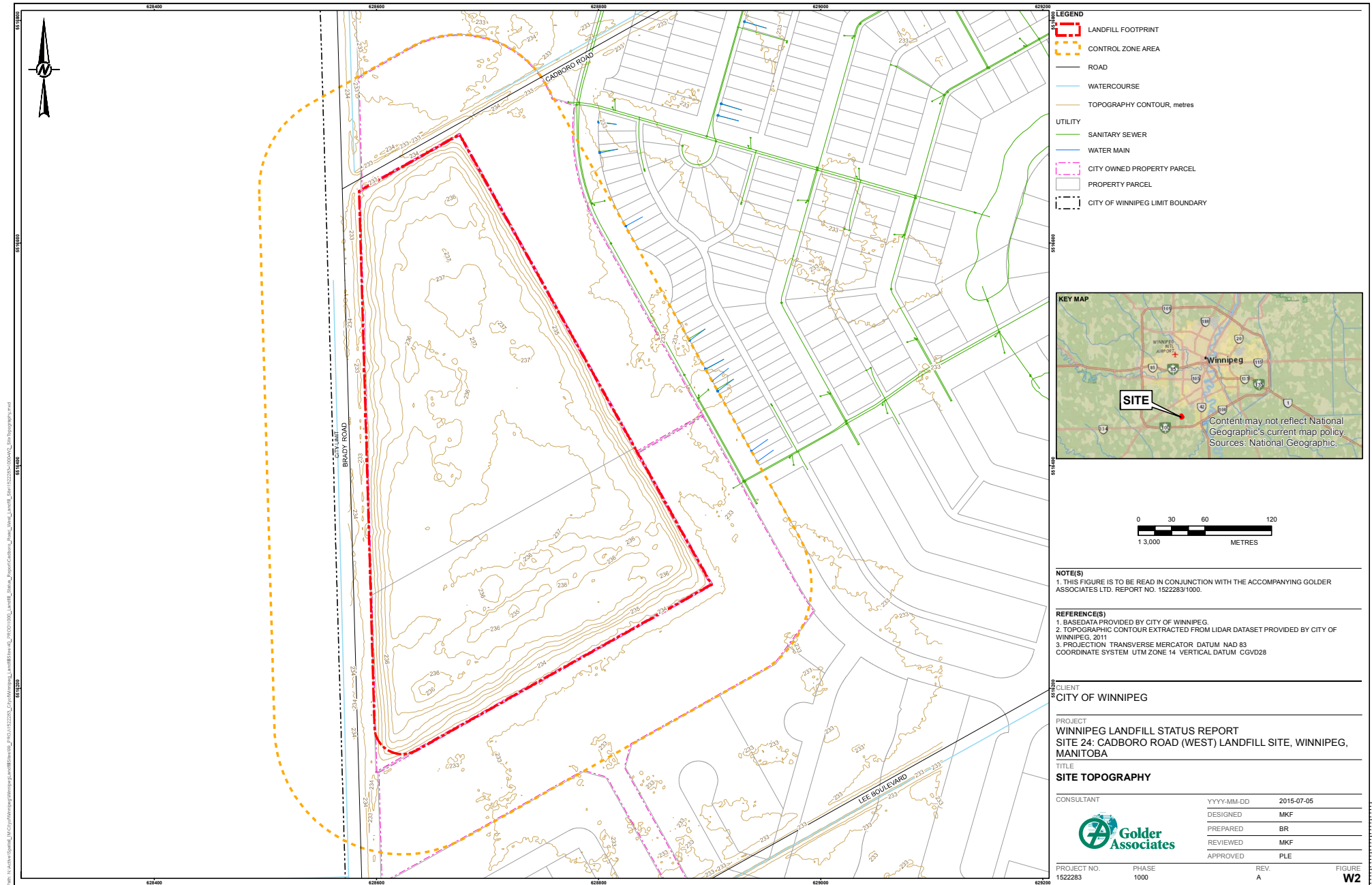
<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	Yes
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

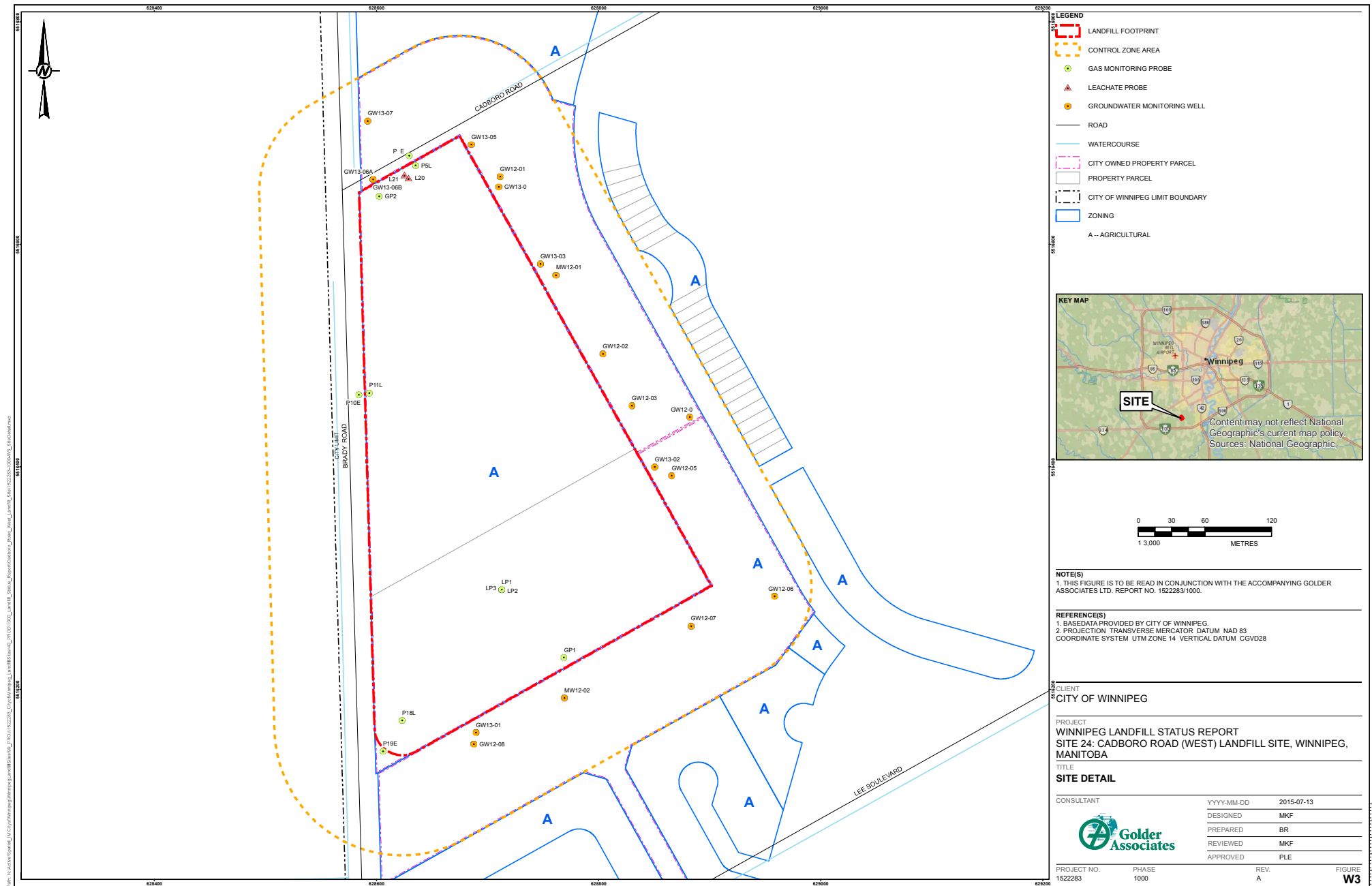
<b>Settlement/slopes</b>	--
<b>Erosion</b>	Minor at north end due to sparse vegetation
<b>Seeps</b>	None observed
<b>Other</b>	Some areas of stressed vegetation (bare areas) may be due to landfill gas













**Photo W1**  
**Southwest corner of Site showing**  
**sparse vegetation**



**Photo W2**  
**Area at the top of the landfill intended**  
**for a gravel pad**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT


PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 24: CADBORO ROAD (WEST) DUMP SITE PHOTOGRAPHS	
	PROJECT No. 1522283		PHASE No. 1000
	DESIGN	July 2015	SCALE AS SHOWN
	GIS	—	REV.0
	CHECK	MKF Sept 2015	FIGURE W4
	REVIEW	PIE Sept 2015	



**Photo W3**  
**On the landfill looking northeast**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT				
WINNIPEG LANDFILL STATUS REPORT				
TITLE				
SITE 24: CADBORO ROAD (WEST) DUMP SITE PHOTOGRAPHS				
	PROJECT No. 1522283			PHASE No. 1000
	DESIGN	-	July 2015	SCALE AS SHOWN
	GIS	-	-	REV.0
	CHECK	MKF	Sept 2015	FIGURE W5
	REVIEW	PLE	Sept 2015	





# **APPENDIX X**

## **26. & 27. Elmwood and Nairn Avenue Landfill Sites**



## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Elmwood Landfill Site and the Nairn Avenue Landfill Site (Sites 26 and 27, respectively), located south of Nairn Avenue between Grey Street and Panet Road in Winnipeg, Manitoba, as illustrated on Figure X1. The Elmwood Landfill Site covers an area of approximately 37 hectares (ha) and was operated by the City of Winnipeg from 1912 until 1948. The landfill was used for domestic waste, industrial waste and ash, with the ash placed at the southern portion of the Site. The Nairn Avenue Landfill Site is directly east of the Elmwood Landfill Site and covers an area of approximately 52 hectares (ha) and was operated from 1950 until 1960. The landfill was used for mostly ash and construction and demolition waste, with some domestic and bulk industrial waste as well. The area was previously used as clay borrow pits. These pits were filled with waste.

A subsurface investigation was undertaken by the City in 1980 at the Elmwood Landfill Site. The drilling program included the drilling of 39 boreholes. The depth of the 39 boreholes ranged from 1.5 metres (m) to 8.2 m. The stratigraphy encountered at the Site reportedly included fill (clay, rubble) to a depth of 0.3 to 2.4 m below grade (some locations did not have fill over the refuse), overlying refuse (if present), underlain by clay to the maximum depth of investigation. An approximately 0.3 to 2 m layer of silt exists approximately 2.5 m below ground surface at some locations. Of the 39 boreholes drilled at the Site, 22 contained waste/refuse, including black ash-type material, granular material, glass, clay, metal (nails, tin, wires), rope, sand and gravel, concrete rubble, fibrous material, and wood. The depth of waste, where present, ranged from 1 to 5.2 m below ground surface. Landfill gas probes were installed in five borehole locations (one outside of the waste footprint and four inside of the waste footprint). It is known that other gas probes may have been installed at the Site, however, details of the probes and monitoring results have not been provided electronically.

A subsurface investigation was undertaken by the City in 1980 at the Nairn Avenue Landfill Site. The drilling program included the drilling of 27 boreholes. The depth of the 27 boreholes ranged from 3.7 m to 7.3 m. The stratigraphy encountered at the Site reportedly included fill (clay, rubble) to a depth of 0.6 to 2.1 m below grade, overlying refuse (if present), underlain by clay to the maximum depth of investigation. In areas outside of the waste footprint, an approximately 0.3 to 1 m layer of silt exists approximately 2 m below ground surface at some locations. Of the 27 boreholes drilled at the Site, five contained waste/refuse, including black, oily, peat-like material/clay and ash. The depth of waste, where present, ranged from 1.8 to 3.0 m below ground surface. Landfill gas probes were installed in six borehole locations (four outside of the waste footprint and two inside of the waste footprint). It is known that other gas probes may have been installed at the Site, however, details of the probes and monitoring results have not been provided electronically.

In 2008 a site assessment was completed by KGS Group (KGS) titled, "City of Winnipeg, Former Elmwood/Nairn Avenue Landfill Site, Preliminary Site Conditions Assessment, Final Report" dated December 2008 (hereafter referred to as the KGS report). The assessment was completed in preparation for the Public Works Yard Complex and covered the eastern half of Elmwood Landfill Site and all of Nairn Avenue Landfill Site. The investigation portion of the assessment included review of background data, a geophysical survey, 77 test pits, and groundwater sampling and analysis. The KGS report indicates that the area was east-west elongated swampy areas that were later filled in with asphalt, concrete and soil from road renewal projects from the 1950s until the 1990s (this information is not consistent with the 1993 Landfill Disposition Report also by KGS). The general geology for the Site as stated in the KGS report is, "1 m of soil cover, 2 to 3 m of asphalt, concrete and soil underlain by reeds and bulrushes with about 0.3 m of bog/peat deposit overlying brown, undisturbed



## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

silty clay". Groundwater samples were collected from the four remaining probes on-Site. The report concluded that the area east of Chester Street contains street renewal waste and the area west of Chester Street to the north of an existing snow dump area had some municipal waste. The geophysical survey indicated elevated conductivity likely related to leachate in the snow dump area or from surface water runoff from the snow dump itself. Groundwater had elevated pH and total dissolved solids (TDS) and this was attributed to concrete and soil dissolution.

The ground surface surrounding the landfill is at an elevation ranging from 231 to 235 m above sea level (masl). The waste is approximately 4.6 metres below ground surface on average and the water level within the waste is reportedly at 231 masl. The original cover material is undocumented; however, reportedly may have consisted of fill of varying thickness.

A 15 to 45 m landfill gas control zone was allotted for the Site as shown on Figures X1 to X3. Constraints previously reported for the Nairn Avenue Landfill Site include soil salinity and restricted foundation construction.

Some of the buildings constructed at the Sites have been constructed to restrict the migration of landfill gas into the building. The insect control building at the north end of Elmwood has an elevated construction while the Public Works Yard Complex buildings were constructed with a methane extraction system. The methane extraction system consists of granular layer that is vented to the atmosphere with a membrane between it and the concrete floor slab.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Elmwood Landfill Site and the Nairn Avenue Landfill Site. Findings from the most recent Site visit to the Elmwood Landfill Site, completed on July 11, 2014 were as follows

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The Site has been commercially developed with many buildings across the Site;
- The vegetation is mostly grass, trees and shrubs with no sign of stress;
- Some garbage and concrete were noted at the south end of the Site;
- No leachate or erosion issues were identified during the Site visit; and,
- Gas readings could only be collected from P35L and P36L. Landfill gas probes P3L, P34E and P38E were listed as destroyed and P37L could not be located (likely under the Bumper Exchange shop).





## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

Findings from the most recent Site visit to the Nairn Avenue Landfill Site, completed on July 8, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The vegetation is mostly grass, trees and shrubs with no sign of stress;
- The Site is well maintained and no dumping of waste was observed;
- No leachate or erosion issues were identified during the Site visit; and,
- Gas readings could only be collected from P27E and from a 2-inch well. Landfill gas probes P25E, P26L, P24E were listed as destroyed or terminated, P23E is bent at an angle and P19E could not be located (a hole in the ground was observed in the former location of the probe – it is assumed to be destroyed).

## 2.0 LANDFILL STATUS

A walkabout was conducted at the Nairn Avenue and Elmwood Landfill Sites on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch. The following sections outline the observations made during these visits.

It was noted by City staff during the visits that the Elmwood Landfill Site has more municipal solid waste than the Nairn Avenue Landfill Site, which has more construction and demolition type waste. See attached Tables X1 and X2, and Figures X1 through X3 for Site specific details. It should be noted that all landfill gas probes and wells are shown on Figure X3, but some of these may be lost or destroyed and therefore not included in the current monitoring program. Site photographs are provided in Figures X4 through X10.

### 2.1 Elmwood Landfill Site

At the time of the Site visit, the north end of the Site (near Nairn Avenue) was commercially developed. The central portion of the western half of the landfill housed an insect control building (including a hanger and helicopter landing pad) and a Native Tall Grass Prairie Restoration Project. The southern portion of the western half of the Site was an open field. On the central portion of the eastern half of the Site is private industrial land and a snow dump exists at the southern portion of the eastern half of the Site.

The area was noted to be generally flat, with roadways, roadside ditches and sewers throughout the developed portions of the land. Besides the ditches, no other bodies of water were noted at the Site.

A residential development was noted to the north of the Site and the Nairn Avenue Landfill (with commercial and industrial land) was to the east. South of the Site is a railway followed by more industrial lands. West of the Site is a recycling facility, a concrete plant and other industrial type buildings.

The ground cover included grass, parking lots and buildings. The observed grass did not appear stressed. Exposed waste was not observed, however, dumping of mattresses was noted on a curb and storage of waste was noted within a fenced yard (see location marked on Figure X3 and photographs on Figure X6). A danger “open hole” sign is located on the fenced property and review of the aerial photo on Figure X1 indicates that the entire fenced property may be being used for dumping of waste. Fill of unknown origin was stored in a pile at the



## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

entrance to the snow dump as seen in Figure X8. Piles of concrete rubble, earth and brush are present on the west end of the Public Works Yard Complex as shown on Figure X9.

No leachate collection systems were noted. The insect control building is elevated as a methane protection measure. Landfill gas probes exist within some buildings. Landfill gas probes were observed.

## 2.2 Nairn Avenue Landfill Site

At the time of the Site visit, the north half of the Site was developed with commercial and industrial properties. The southwest corner is a City of Winnipeg Public Works East Yard Complex including stormwater management ponds, maintenance garage, office buildings and parking lots. The southeast portion of the Site has a yard filled with construction equipment (loaders, excavators, graders, etc.).

The area was noted to be generally flat, with roadways, roadside ditches and sewers throughout the developed portions of the land. Stormwater management ponds are located in the southwest corner of the Site.

A residential development was noted to the north of the Site and the Elmwood Landfill (with commercial and industrial land) was to the west. South of the Site is a railway followed by more industrial lands. East of the Site are industrial properties.

The ground cover included grass, parking lots (paved and dirt) and buildings. The observed grass did not appear stressed. Exposed waste or illegal dumping of waste were not observed.

No leachate collection systems were noted. Landfill gas probes exist within some buildings. No landfill gas probes are located on the Nairn Avenue Landfill Site.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs for the landfill gas probes completed for the Site.

Landfill gas monitoring in the landfill gas probes at the Nairn Avenue Landfill Site started weekly in 1980 and reduced gradually over time to annually by 1985. Historic Groundwater monitoring results are available until 1993. The results of the monitoring were as follows:

- Probes completed outside of the waste footprint – No methane was detected with the following exceptions:
  - 0.04% methane by volume in air at P26L in 1986;
  - 0.15% and 0.05% methane by volume in air at P27L in 1981;
  - 0.05% methane by volume in air or less at P23E in 1981 and 1983; and,
  - 0.05% methane by volume in air at P24E periodically in 1981 and 1982.
- Probes completed inside of the waste footprint – No methane was detected, with the exception of <100% lower explosive limit (LEL) measured at one location in 1985.



## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

Annual landfill gas monitoring results are available from 1985 until 1992 at the Elmwood Landfill Site. The results of the monitoring were as follows:

- Probes completed outside of the waste footprint – No methane was detected; and,
- Probes completed inside of the waste footprint – No methane was detected, with the exception of <100% LEL measured at one location in 1986, 1987, 1989 and 1991.

Annual landfill gas monitoring results are available for the years 2007, 2008 and 2011 through 2014 at probes P19E, P23E, P27L, a 2" well, P35L and P36L. The results of the monitoring were as follows:

- All probes had trace amounts of methane detected periodically, with the highest methane concentration detected at 4% methane by volume at P27L in July 2008; and,
- Methane was not detected in the 2" well.

Monitoring of methane within the businesses and buildings on the waste footprints and within the buffer zone are undertaken annually. Historic data for landfill gas probes exist at the following buildings were available for review:

- 18 Stapleton – three indoor probes (results from 1979 until 1996, 2013 and 2014); and,
- 633 Tyne – one indoor probe (results for 1980 until 1995, 2013 and 2014).

No methane has been detected in these probes, with the exception of variable readings in GP2 in 1979 that were as high as 5% methane by volume in air and once in 1980 at GP2 with a concentration of 18% methane by volume in air.

Current landfill gas monitoring is completed annually at 63 locations. The results from 2013 and 2014 indicate the no methane is detected with the following exceptions:

- Up to 5% methane by volume in air in 2014 and over 100% LEL in 2013 at 481 Panet Road from the floor probes. The mid-air readings were non-detectable;
- 48% and 49% LEL in 2013 at two floor probes at 700 Mission Street. The mid-air readings were non-detectable;
- Trace amounts (0.1% methane by volume in air) at 650 and 980 Nairn Avenue in 2014; and,
- 1% LEL at 730 and 1006 Nairn Avenue, and 960 Thomas in 2013.

## 3.2 Groundwater

### 3.2.1 Leachate

Seepage samples were collected from two locations at the Nairn Avenue Landfill Site in 1985 and from a location called "Foster outfall" (location unknown), an east manhole and west manhole in 1986. The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, conductivity, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.





## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

Groundwater samples were collected from probes P36L, P37L, and P27L and from seven test pits completed within the waste footprint in November 2008 as part of the KGS Group investigation. Details of the screen construction in the probes are unknown, although the probes are known to be within the waste footprint. For the purposes of this report it has been assumed that the waste is screened and that the probes are representative of leachate quality. The samples from the probes were submitted for laboratory analysis of the following: conductivity, hardness, pH, total organic carbon, total solids, total suspended solids, total dissolved solids, alkalinity, ammonia, total phosphorus, total kjeldahl nitrogen (TKN), arsenic, calcium, chromium, copper, magnesium, manganese, iron, sodium, nickel, lead and zinc. The samples from the test pits were submitted for laboratory analysis of the following: conductivity, hardness, pH, bicarbonate, carbonate, hydroxide, total dissolved solids, chloride, sulphate, nitrate & nitrite, calcium, magnesium, manganese, iron, potassium, sodium.

#### 3.2.2 Groundwater

Groundwater sampling from monitoring wells was not historically conducted.

Groundwater samples were collected from probes P19E as part of the KGS Group investigation. The sample from the probe was submitted for laboratory analysis of the same list of parameters as the leachate probe samples.

### 3.3 Surface Water

There is no evidence of historical surface water monitoring at this Site.

## 4.0 INTERPRETATION OF CURRENT MONITORING RESULTS

### 4.1 Landfill Gas

Historical landfill gas sampling at the Site included the following:

- 1986 until present in landfill gas probes (on and off annual sampling) – low readings of methane within the landfill footprint over time with some trace readings of landfill gas outside of the waste footprint at times;
- A 15 to 45 m control zone exists at the Site; and,
- Commercial building sampling is mostly non-detectable methane with some areas of higher methane readings.

Recent landfill gas monitoring would indicate that the Elmwood and Nairn Avenue Landfill Sites are not generating much landfill gas and that it is not migrating into on-Site buildings. However, there are some methane readings within floor probes in buildings that are higher than would be expected.

There are roadways, sanitary sewers and water mains throughout the northern portions of the Sites that will act as preferential pathways for landfill gas. The shallow groundwater will limit the lateral migration of landfill gas.



## APPENDIX X

### 26. & 27. Elmwood / Nairn Ave Landfill Sites – Winnipeg Landfill Status Report

## 4.2 Groundwater

### 4.2.1 Elevations

The depth to water measured by the City from 2007 to 2014 in the landfill gas probes installed within the waste fill area ranged from 1.2 to 2.4 m below the top of the pipe, while the water level measured in the probes located just outside of the waste fill area ranged from 0.9 to 2.5 m below the top of the pipe.

### 4.2.2 Leachate

Based on analytical results from seepage collected between 1985 and 1986 the following parameters were consistently elevated above the Guidelines for Canadian Drinking Water Quality:

- Nairn seepage sites and seepage in manholes: sulphate, chloride, manganese, iron, and sometimes lead; and,
- Foster outfall: iron.

Based on the 2008 groundwater monitoring results from KGS Group, the following is noted:

- Concentrations of total dissolved solids, chloride and sodium exceeded the Guidelines for Canadian Drinking Water Quality in the majority of groundwater samples from the test pits, with the groundwater from test pit TP69 exhibiting the highest concentrations of these parameters;
- Groundwater from some test pit locations had pH greater than 8.5; and,
- Concentrations of chloride, sulphate, sodium, iron, manganese, total dissolved solids, chromium and lead exceeded the Guidelines for Canadian Drinking Water Quality in the groundwater.

### 4.2.3 Groundwater

Based on the 2008 groundwater monitoring results from KGS Group, the following is noted:

- Concentrations of chloride, sulphate, sodium, iron, manganese, total dissolved solids, chromium and lead exceeded the Guidelines for Canadian Drinking Water Quality in the groundwater from the external probe P19E.
- External probe P19E reported lower concentrations than the internal probes for concentrations of each of these parameters with the exception of lead, which is the highest in groundwater from the external probe.

It appears that the groundwater within the waste footprint has been impacted by the presence of buried waste. It cannot be determined if the groundwater in the control zone has been impacted by landfill leachate as there is no background water quality data available for review.

## 4.3 Surface Water

There are no current or historical monitoring results for surface water available for review.

**TABLE X1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 26  
**Site Name** Elmwood Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic, industrial, ash
<b>Start date</b>	1912
<b>End date</b>	1948
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	37		
Depth of waste below ground surface (metres)	4.6		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	Unknown
Cover material	Potentially Fill (undocumented)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Buildings have mebranes (or other passive protection)
<b>Landfill gas control zone (metres)</b>	15 or 45

**Land Use**

<b>Ownership</b>	City of Winnipeg (south portion), private (north portion and south control zone)
<b>Current</b>	Commercial/industrial development (north), insect control (central), vacant field and snow dump (south)
<b>North</b>	Nairn Avenue, residential
<b>East</b>	Nairn Avenue Landfill Site
<b>South</b>	Railway, industrial land
<b>West</b>	Industrial Land
<b>Comment</b>	Old clay borrow pits

**Physical Site Setting**

Ground elevation (mASL)		231 to 234	Groundwater flow direction	South/Southwest
Potable water? Yes/No		Yes	Water Taking Unit	--
Nearby Water Bodies	Roadside ditches			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.5	<b>Max</b>	229.8
<b>Minimum clay thickness below base grades (metres)</b>		10.7		
<b>Minimum depth to till (metres)</b>		15.2		
<b>Minimum depth to bedrock (metres)</b>		20.1		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.3	<b>Max</b>	--

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--



**TABLE X2**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 27  
**Site Name** Nairn Avenue Landfill Site

**Landfill Operation**

<b>Waste type</b>	Mostly ash, construction and demolition waste, some domestic and bulk, industrial
<b>Start date</b>	1950
<b>End date</b>	1960
<b>Operated by</b>	Undocumented but believed to be the City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	52		
Depth of waste below ground surface (metres)	4.6		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	Unknown
Cover material	Potentially Fill (undocumented)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Buildings have mebranes (or other passive protection)
<b>Landfill gas control zone (metres)</b>	15 or 45

**Land Use**

<b>Ownership</b>	Private (north portion, east portion and south control zone), City (south portion)
<b>Current</b>	Commercial/industrial development (north), Public Works East Yard Complex (south)
<b>North</b>	Nairn Avenue, residential
<b>East</b>	Industrial Land
<b>South</b>	Railway, industrial land
<b>West</b>	Elmwood Landfill Site
<b>Comment</b>	Old clay borrow pits

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	231 to 234	<b>Groundwater flow direction</b>	South/Southwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Stormwater management ponds		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	228.9	<b>Max</b>	231.0
<b>Minimum clay thickness below base grades (metres)</b>		10.7		
<b>Minimum depth to till (metres)</b>		15.2		
<b>Minimum depth to bedrock (metres)</b>		20.1		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.0	<b>Max</b>	--

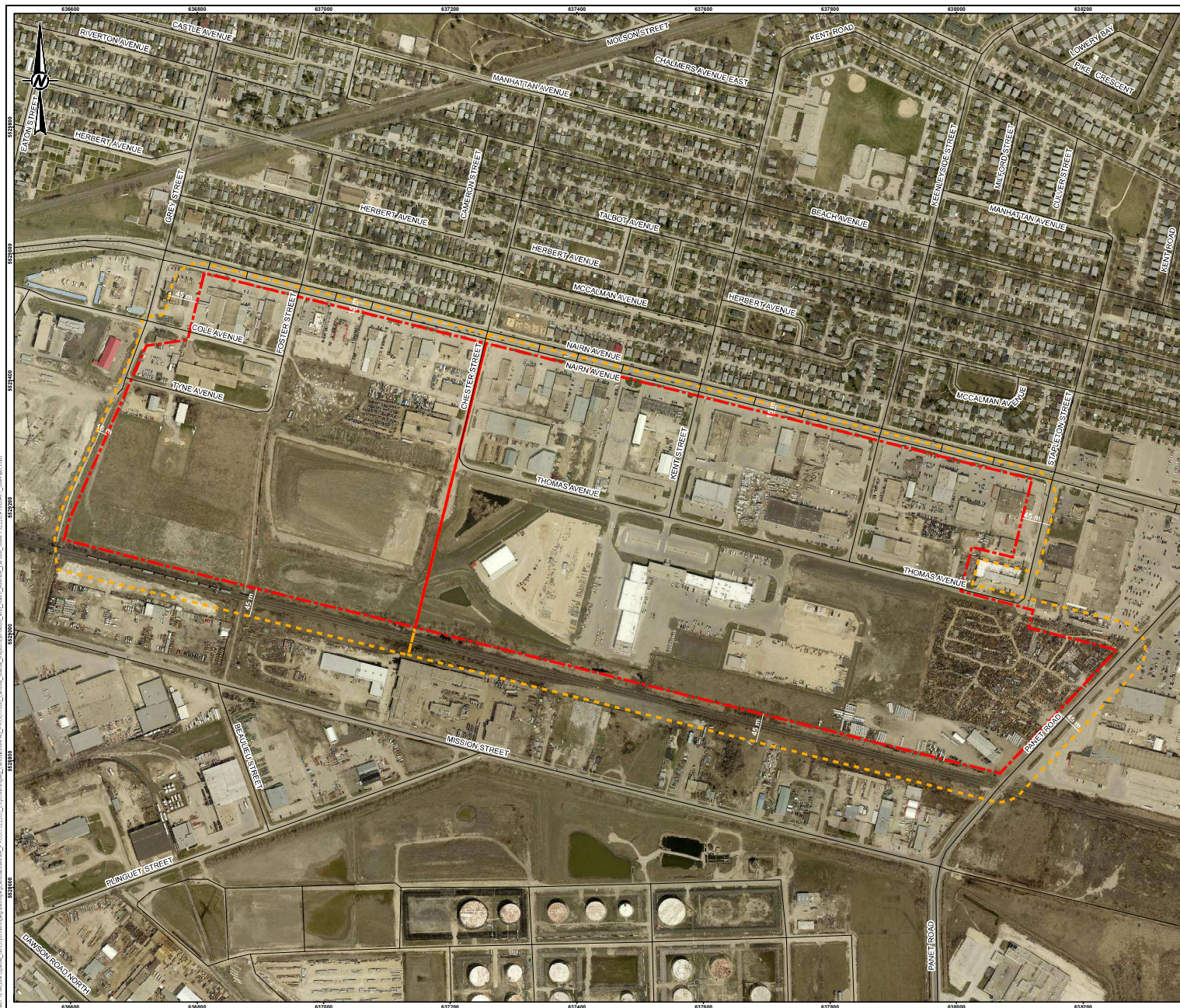
**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--





**LEGEND**



## LANDFILL FOOTPRINT



CONTROL ZONE AREA

---

ROAD



**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

## REFERENCE(S)

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

CLIENT

CITY OF WINNIPEG

PROJECT

**WINNIPEG LANDFILL STATUS REPORT  
SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL  
SITES, WINNIPEG, MANITOBA**

## SITE PLAN

CONSULTANT

YYYY-MM-DD 2015-07-02

DESIGNED	MKF
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PREPARED	BR
----------	----

REVIEWED	MKF
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APPROVED	PLE
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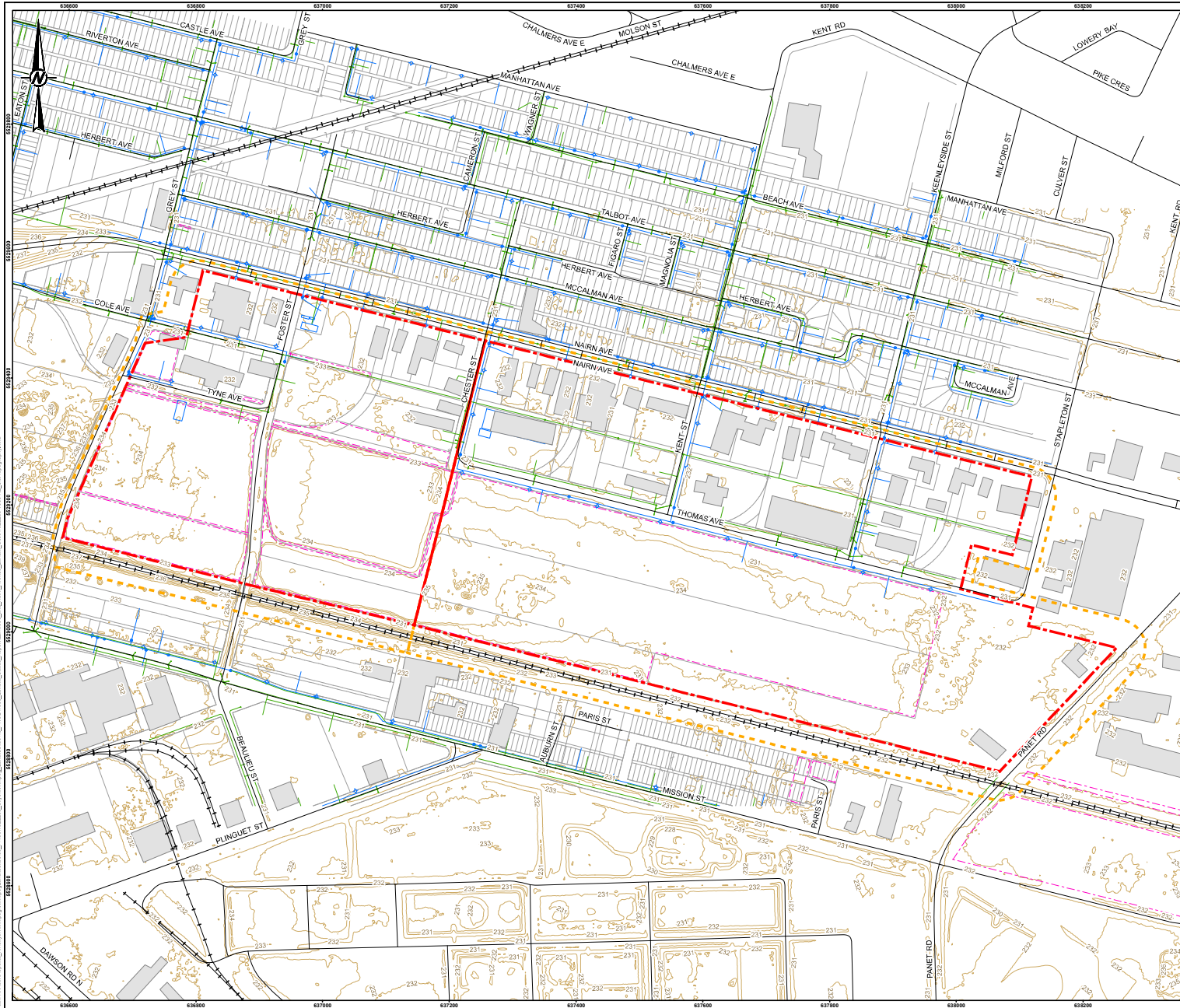


PROJECT NO.  
1522283

PHASE  
1000

REV  
AFIGURE  
X1





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD
- RAILWAY
- TOPOGRAPHIC CONTOUR, metres
- UTILITY
  - SANITARY SEWER
  - WATER MAIN
- BUILDING FOOTPRINT
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 60 120 240  
1:6,000 METRES

**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES, WINNIPEG, MANITOBA

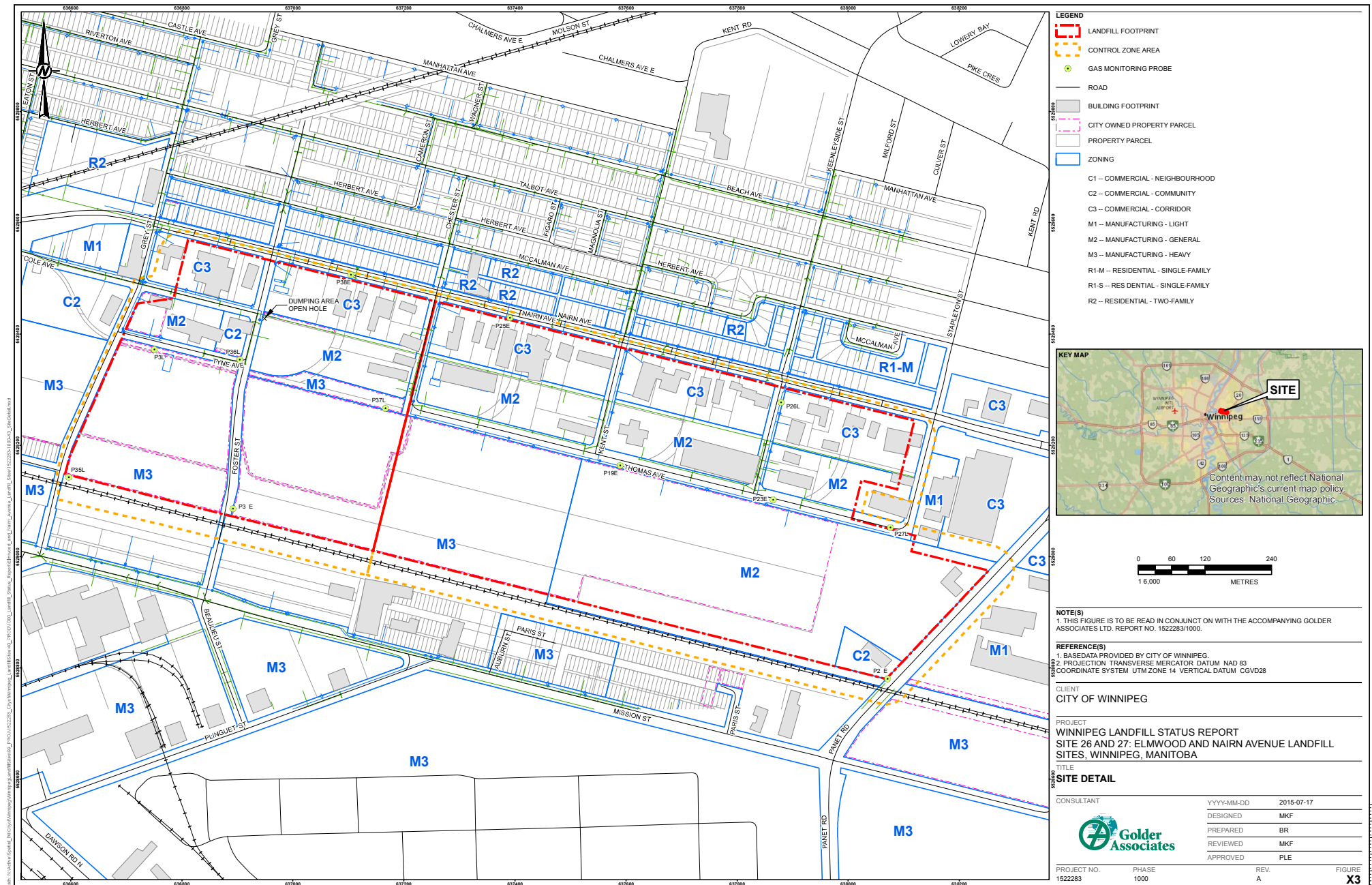
**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-04
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	X2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 28mm








**Photo X1**  
**Elmwood Landfill - looking south along western edge**



**Photo X2**  
**Elmwood Landfill - insect control building (heliport)**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS			
PROJECT No. 1522283				PHASE No. 1000			
DESIGN		July 2015		SCALE AS SHOWN		REV.0	
GIS							
CHECK	MKF	Sept 2015					
REVIEW	PIE	Sept 2015					
				FIGURE X4			






**Photo X3**  
**Elmwood Landfill – Native tall grass prairie restoration project**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT



**Photo X4**  
**Elmwood Landfill – industrial properties to the north**

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS			
				CHECK	MKF Sept 2015		
				REVIEW	PLF Sept 2015		
				<b>FIGURE X5</b>			





**Photo X5**  
**Elmwood Landfill – private property**  
**noting an open hole**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT



**Photo X6**  
**Elmwood Landfill – private property with**  
**dumping of waste**

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS			
PROJECT No. 1522283				PHASE No. 1000			
DESIGN	–	July 2015		SCALE AS SHOWN		REV.0	
GIS	–						
CHECK	MKF	Sept 2015					
REVIEW	PTE	Sept 2015					



**FIGURE X6**






**Photo X7**  
**Elmwood Landfill – snow dump**



**Photo X8**  
**Elmwood Landfill – Tanks stored at north  
 edge of snow dump**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS	
PROJECT No. 1522283		PHASE No. 1000	
DESIGN	July 2015	SCALE AS SHOWN	REV.0
GIS	–		
CHECK	MKF	Sept 2015	
REVIEW	PIE	Sept 2015	
		<b>FIGURE X7</b>	





**Photo X9**

**Nairn Avenue Landfill – stormwater management pond and Public Works Yard Complex**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT



**Photo X10**

**Fill on the border of Nairn Avenue and Elmwood Landfills at the entrance to snow dump**

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS			
PROJECT No. 1522283				PHASE No. 1000			
DESIGN	–	July 2015		SCALE AS SHOWN		REV.0	
GIS	–						
CHECK	MKF	Sept 2015					
REVIEW	PIE	Sept 2015					



**FIGURE X8**





**Photo X11**  
**Nairn Avenue Landfill – Equipment storage at southeast corner of landfill**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT



**Photo X12**  
**Nairn Avenue Landfill – looking south from Thomas Avenue between Public Works Yard Complex and equipment storage area**

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS	
PROJECT No. 1522283		PHASE No. 1000	
DESIGN	July 2015	SCALE AS SHOWN	REV.0
GIS	–		
CHECK	MKF	Sept 2015	
REVIEW	PIE	Sept 2015	




**FIGURE X9**



**Photo X13**  
**Nairn Avenue Landfill – looking north across**  
**Thomas Avenue**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 26 AND 27: ELMWOOD AND NAIRN AVENUE LANDFILL SITES PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000			
		DESIGN	July 2015	SCALE AS SHOWN		REV.0	
		GIS	—				
		CHECK	MLF Sept 2015				
		REVIEW	PLF Sept 2015	FIGURE X10			



# **APPENDIX Y**

## **28. Brooklands Landfill Site**





## APPENDIX Y

### 28. Brooklands Landfill – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Brooklands Landfill (Site 28), located between Oak Point Highway and the Canadian Pacific (CP) Railway, west of Hyde Avenue as illustrated in Figure Y1. The Brooklands Landfill covers an area of approximately 2.4 hectares (ha) and was operated by the Village of Brooklands from 1950 until it was closed in 1968. The waste dimensions of the landfill are 1.5 metres (m) to 3 m above ground and 1.5 m below surface with 0.3 m to 0.6 m of cover. The landfill was used for private industrial use and local dumping that consisted of mostly domestic waste, septic waste, drums, and rubble. The waste type at the landfill was primarily ash, partially burned and unburned refuse. The central and western portions of the landfill are owned by the City of Winnipeg, while the eastern portion of the landfill and the control zones and to the north and east are owned privately. The control zone to the south and a small portion of the landfill footprint are owned by CP Rail.

Reports on the general Site conditions and stratigraphy at the Site indicate approximately 12.2 m of clay below the depth of the waste (1.5 m below grade), 2.5 m of silt till at approximately 12.5 m below grade, and carbonate bedrock at approximately 15 m below grade. This is consistent with the regional geology that consists of an upper complex zone of silty clay and silt, a glaciolacustrine silty clay layer at 3 m below grade, a silt till layer at 12 m to 15 m below grade, and a Paleozoic carbonate bedrock layer at 15 m to 21 m below grade. Actual Site conditions at the Brooklands Landfill cannot be determined as there was no drilling program established to install monitoring wells at the Site.

Ten landfill gas probes were reportedly previously installed but no historic drilling reports from the installations are currently available electronically. A 15 m landfill gas control zone was also allotted for the Site in 1984.

Ground surface is at an elevation of 236.8 m above sea level (masl). The overburden depth to water ranges from 0.9 m to 2.4 m.

The landfill cover evaluation at the Brooklands Landfill is large areas of undocumented cover that appears to be fill that may contain construction debris, glass, ash etc. The cover material at the Site ranges in thickness from 0.3 m to 0.6 m.

In 1992, the landfill portion of the Brooklands Landfill remained undeveloped wild fields and was reported as relatively dormant under The City of Winnipeg's District 3 Operations control. The private area remained under private ownership/control at this time.

Constraints previously reported for the Site include restricted foundation construction. Active recreation that causes surface erosion was discouraged.



## **1.1 Previous Site Visits**

The City of Winnipeg performs regular Site visits to the Brooklands Landfill. Findings from the most recent Site visit completed on August 20, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the concrete barriers that were mentioned in the 2013 site visit were moved aside allowing for full access from Route 90 and westbound Selkirk to the closed landfill;
- The vegetation at the Site had limited signs of stress in remote locations by slopes of the landfill and the vegetation was much shorter than in the previous year;
- Some signs of dumping of construction waste such as concrete, metal, and yard trimmings was noted;
- No drainage, leachate, or erosion issues were identified during the Site visit;
- No buildings on Site were noted; and,
- Probe P7E had been destroyed with the casing top found hung from the fence line by the probe location.

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 15, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was flat with some fill placement noted in the central portion of the landfill. The Site was vacant and overgrown with grass.

No erosion or stressed vegetation or debris was noted.

Two probes were noted on-Site, although based on the previous monitoring event, only one can be sampled.

See attached Table Y1 and Figures Y1 to Y3 for Site specific details. Site photographs are provided in Figures Y4 and Y5.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site.

Annual landfill gas sampling was performed between 1983 and 1992. Trace methane concentrations (less than 20% lower explosive limit (LEL)) were detected at the monitored probes P6E, P7E, and P16L in 1983. Locations P7E and P6E are located approximately 30 m northeast and 70 m east of the northeast corner of the landfill control zone, respectively. P16L is located approximately 270 m southeast of the landfill and control zone. One landfill gas probe located outside the waste fill area also had trace concentrations of methane in 1987. The remainder of the readings were non-detect.



## **APPENDIX Y**

### **28. Brooklands Landfill – Winnipeg Landfill Status Report**

Since 2011, sporadic landfill gas sampling has been conducted at the Site at P12L (in 2011, 2013 and 2014), located in the control zone to the north, and P7E (in 2011 and 2013, but was destroyed in 2014). Trace concentration of methane were reported at P7E in 2011 (2% of the LEL of methane) and 2013 (1% LEL). No detectable landfill gas was reported at P12L during the three sampling events.

### **3.2 Groundwater**

No current or historical groundwater monitoring program has occurred at the Site.

### **3.3 Surface Water**

There is no surface water present at the Site and therefore no historical or current surface water sampling program.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Trace concentrations of landfill gas have historically been reported at the Site. The presence of methane in wells fairly distant from the landfill control zone and within the area where utilities are present (i.e. at P7E and P16L), indicates that migration of landfill gas has occurred in the past and has the potential to continue to occur. Based on the type of waste reported at this location (i.e., domestic waste, ash, septic waste, drums, and rubble), the potential for landfill gas generation is moderate to low. As there are no natural landfill gas barriers (i.e. surface water), any landfill gas generated at the Site would likely escape through the surficial fill and migration would be expected to be limited. There are no utilities within the waste fill area although, as described above, may act as migration pathways outside the landfill limits.

### **4.2 Groundwater**

No groundwater sampling has occurred at the Site.

### **4.3 Surface Water**

No surface water is present at the Site.

n:\active\2015\3 proj\1522283 city of winnipeg landfill study\04\_reporting\landfill status report\28 brooklands\appendix y - brooklands landfill\_sept 15 2015 docx



**TABLE Y1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 28  
**Site Name** Brooklands Landfill Site

**Landfill Operation**

<b>Waste type</b>	Mostly domestic, septic waste and rubble, ash
<b>Start date</b>	1950
<b>End date</b>	1968
<b>Operated by</b>	Village of Brooklands
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	2.4		
Depth of waste below ground surface (metres)	1.5		
Height above ground surface (metres)	1.5 to 3		
Slope %	Flat	Cover thickness (metres)	0.3 - 0.6
Cover material	Potentially Fill (undocumented)		
Comment on slopes	None		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg (Landfill), private (private area)
<b>Current</b>	Wild fields, private area (local dumping, drums, rubble)
<b>North</b>	Vacant fields and industrial
<b>East</b>	Industrial
<b>South</b>	Rail line and industrial
<b>West</b>	Industrial
<b>Comment</b>	-

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	236.8	<b>Groundwater flow direction</b>	Pump well immediately South
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	N/A
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	233.2	<b>Max</b>	234.1
<b>Minimum clay thickness below base grades (metres)</b>		12.2		
<b>Minimum depth to till (metres)</b>		12.2		
<b>Minimum depth to bedrock (metres)</b>		14.9		
<b>Bedrock</b>		Red River, Stony Mt. (W) (FT. Garry - upper pt.,		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	233.9	<b>Max</b>	--

**Monitoring**

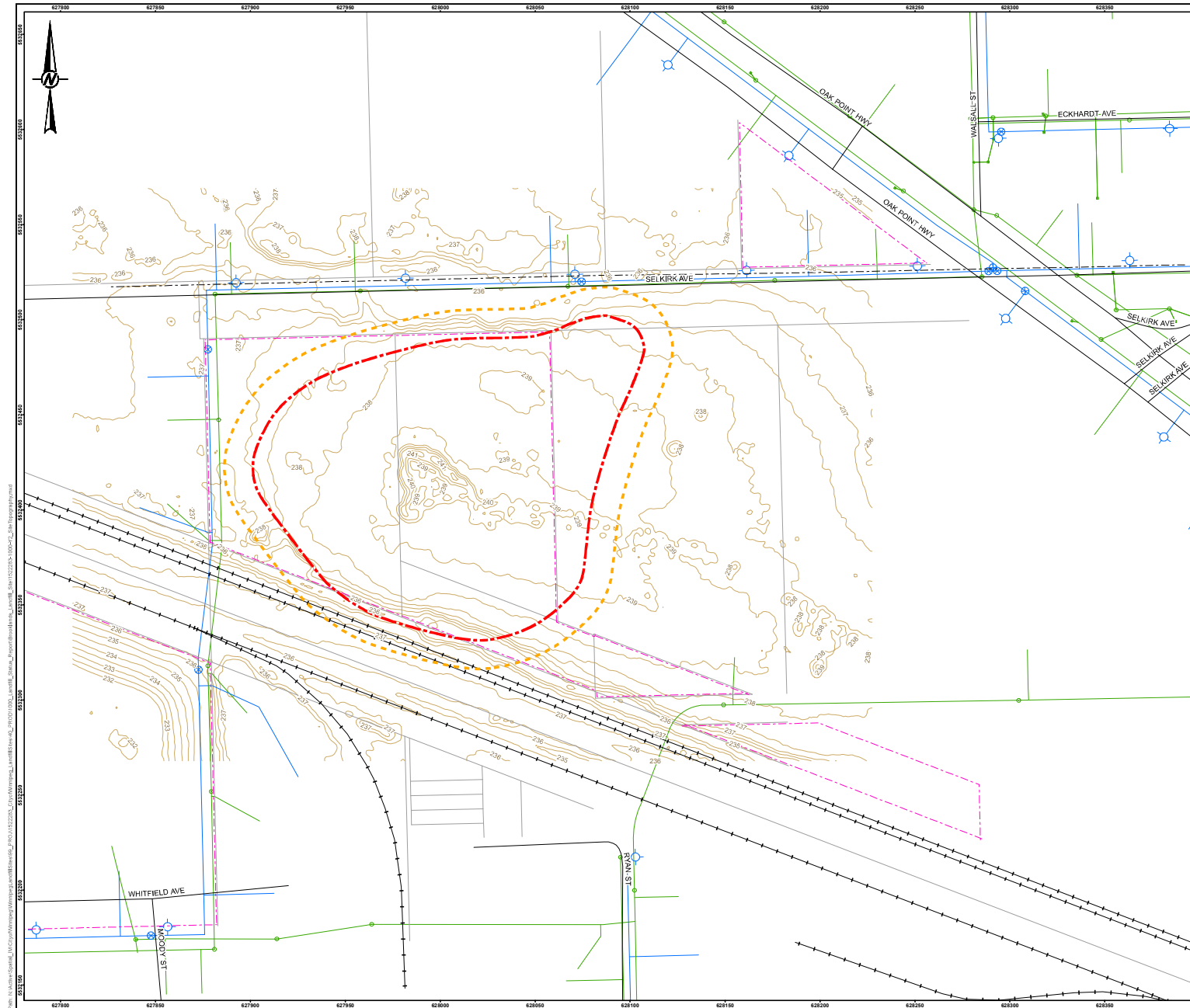
<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

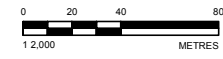
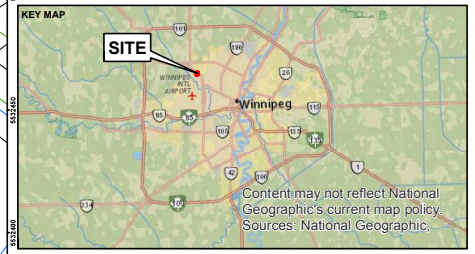
<b>Settlement/slopes</b>	None
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	None







- LEGEND**
- LANDFILL FOOTPRINT
  - CONTROL ZONE AREA
  - RAILWAY
  - TOPOGRAPH C CONTOUR, metres
  - UTILITY
    - GAS LINE
    - SANITARY SEWER
    - WATER MAIN
  - CITY OWNED PROPERTY PARCEL
  - PROPERTY PARCEL



**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 28: BROOKLANDS LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY


CONSULTANT	YYYY-MM-DD	2015-07-21
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE
PROJECT NO. 1522283	PHASE 1000	REV. A

FIGURE  
**Y2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 25mm








**Photo Y1**  
**Fill piles located in the central portion of the Site**



**Photo Y2**  
**Adjacent property to the northwest, looking west**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 28: BROOKLANDS LANDFILL PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PIE Sept 2015			
		FIGURE Y4			






**Photo Y3**  
Property to the west, looking west



**Photo Y4**  
Property to the south, looking south

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 28: BROOKLANDS LANDFILL PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015		
		FIGURE Y5			





# **APPENDIX Z**

## **29. CNR – Dugald Road Landfill Site**



## APPENDIX Z

### 29. CNR-Dugald Road Landfill Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the CNR-Dugald Road Landfill Site (Site 29), located northwest of the intersection of Ravenhurst Street and Dugald Road in Winnipeg, Manitoba, as illustrated on Figure Z1. The CNR-Dugald Road Landfill Site covers an area of approximately 7.4 hectares (ha) and was used by the Canadian National Railway (CNR). The Site was formerly used for storage of demolished railcars. The start date of landfilling and the type of waste placed in the landfill are unknown. Waste was disposed of at surface until it closed in 1968.

An investigative program was conducted at the CNR-Dugald Road Landfill Site, which included the drilling of 34 testholes (the borehole logs were not available for review). Landfill gas probes were installed in three of the boreholes and labelled as follows: P1L, P3L and P13L, as shown on Figure Z3. An easement allowed the City to access the Site from 1985 until 1988 when the easement expired. P13L was reportedly destroyed in 1990. The boundary of the landfill was revised in 1990.

Ground surface is at an elevation of 235 m above sea level (masl). The water level within the waste reportedly ranges from 232.6 to 234.4 masl.

In 1998, it was indicated that no cover material was present at the Site and that there was exposed waste at surface. A 15 m landfill gas control zone was allotted for the Site as shown on Figures A1 to A3.

The Site is located north of railway tracks and is within a generally industrial area. The landfill itself is vacant land that is not generally used.

## 1.1 Previous Site Visits

The City performs regular Site visits to the CNR-Dugald Road Landfill Site. The most recent Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch on July 1, 2014. Findings from this most recent Site visit were as follows:

- The Site consisted of trees, cattails, grasses and thistles;
- The vegetation was overgrown but did not appear stressed;
- No dumping, drainage or leachate issues were identified during the Site visit; and,
- One landfill gas probe was found but it was too rusty to open.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, a portion of the Site was fenced off for land used by a furniture company. The portion of the landfill within the fenced area was mostly vacant land with two piles of chipped wood, rows of material storage and a coverall structure located at the northern edge of the landfill and across the northern control zone. The unfenced portion of the Site was actively being used for the disposal of fill, unbeknownst to City staff. A hand-made sign by an unknown person/company was placed on the landfill indicating that only “mud” should



be deposited (no concrete). Fill was stored in piles and there was evidence of the fill being spread over the landfill as shown on Figures Z5 and Z6.

The Site was fairly flat but irregular due to the recent addition of fill. Some areas of the landfill appeared depressed and water was not able to properly drain. An area of cattails was noted at the northern edge of the central part of the landfill.

The area of the landfill is primarily industrial with the Transcona Rail Yards to the west, railway tracks to the south, and vacant fields to the east and north. Further north is a residential development.

Exposed debris was noted, but appeared to be associated with the newer fill being brought to the Site. The area of the landfill being used for placement of fill was not well vegetated, likely due to the presence of the fill. The remainder of the Site appeared to have unstressed vegetation.

No groundwater monitoring wells, leachate collection systems or landfill gas migration barriers were noted. One landfill gas probe was present on-Site.

See attached Table Z1 and Figures Z1 through Z3 for Site specific details. Site photographs are provided in Figures Z4 through Z6.

### **3.0 MONITORING PROGRAMS**

#### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations (or drill logs) were provided for the Site.

Landfill gas was monitored annually at the three landfill gas probes from 1985 until 1987 when the easement granting the City access to the Site expired. In 1985 it was noted that the water level was 1 m below ground surface. During the three years of landfill gas monitoring, trace amounts of methane was detected consistently at one monitor, although it is unknown which monitor that was. Monitoring at the two other landfill gas probes did not detect methane.

In recent years only one landfill gas probe could be found. The gas probe could not be opened as the lock was rusted. Therefore, there are no recent landfill gas monitoring results.

#### **3.2 Groundwater**

There is no evidence of historical groundwater monitoring at this Site.

#### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.





## **APPENDIX Z**

### **29. CNR-Dugald Road Landfill Site – Winnipeg Landfill Status Report**

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1985 to 1987 – Three landfill gas probes were installed within the waste fill area. No detectable landfill gas was reported at two of the probes and trace amounts were measured at one location;
- 1988 – A 15 m control zone was implemented at the Site; and,
- 2013 – Only one remaining gas probe in 2013 (P3L or P1L). The gas probe could not be opened.

Since there are no landfill gas probes located outside of the waste footprint, it is not possible to determine if landfill gas is migrating in the subsurface. The depths to water at the Site are quite shallow. The non-detectable methane concentrations may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen.

### **4.2 Groundwater**

There are no current, or historical, monitoring results for groundwater available for review.

### **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.

**TABLE Z1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 29  
**Site Name** CNR - Dugald Rd. Landfill Site

**Landfill Operation**

<b>Waste type</b>	Unknown
<b>Start date</b>	Not available
<b>End date</b>	Not available
<b>Operated by</b>	Canadia National Railway
<b>Disposal method</b>	surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	7.4		
Depth of waste below ground surface (metres)	1.5		
Height above ground surface (metres)	0		
Slope %	0	Cover thickness (metres)	None
Cover material	None		
Comment on slopes	generally flat, but is uneven because of the large amounts of fill brought to the Site.		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	Private (Canadian National Railway)
<b>Current</b>	Vacant, with piles of fill
<b>North</b>	fields, storage building
<b>East</b>	field
<b>South</b>	Railway and fields
<b>West</b>	fields, industrial
<b>Comment</b>	Fill was being brought to the site but this action was not known by the City prior to the Site visit.

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	235	<b>Groundwater flow direction</b>	West
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	232	<b>Max</b>	233.0
<b>Minimum clay thickness below base grades (metres)</b>		12.5		
<b>Minimum depth to till (metres)</b>		15.2		
<b>Minimum depth to bedrock (metres)</b>		16.8		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.6	<b>Max</b>	234.4

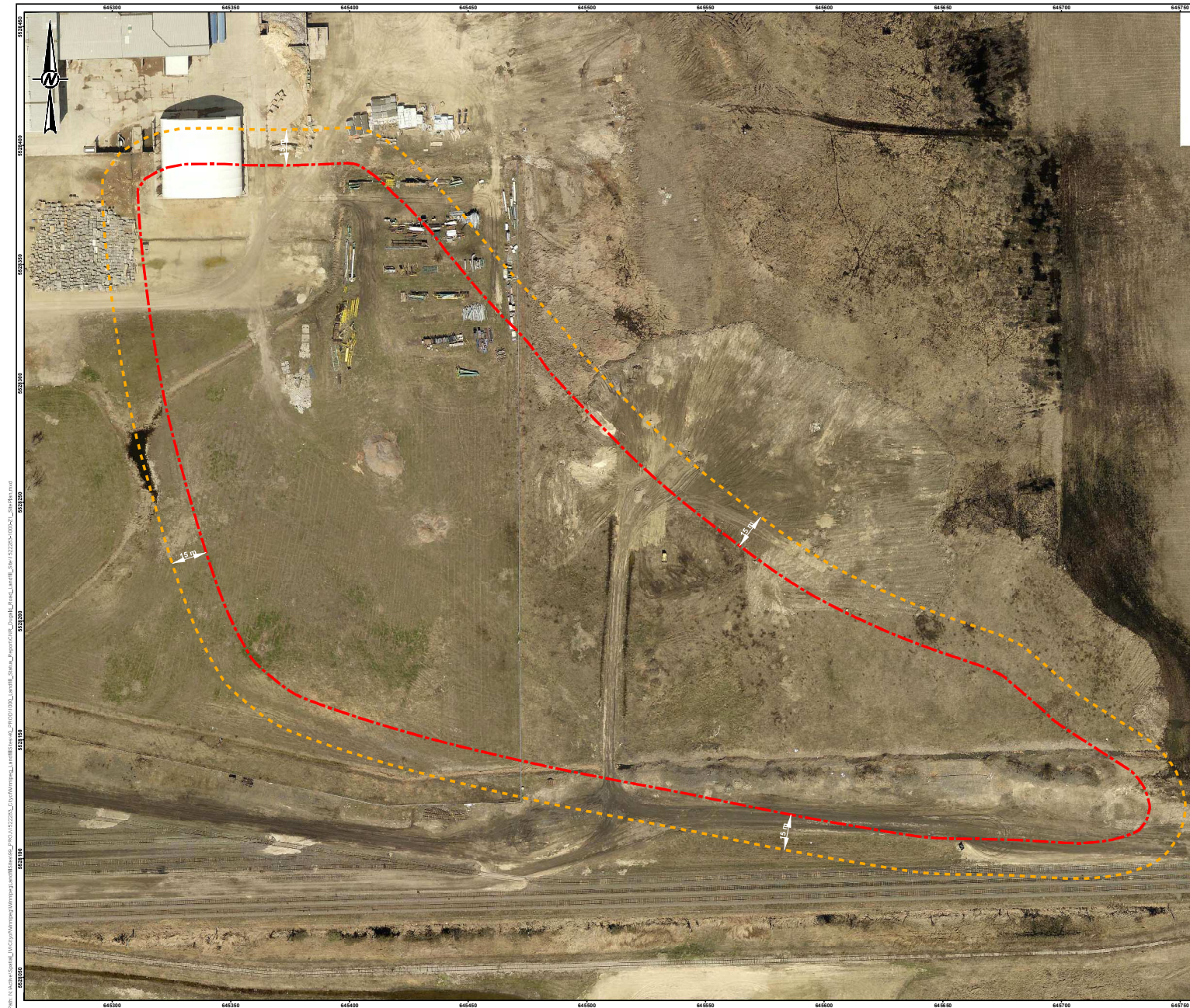
**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	generally flat, but is uneven because of the large amounts of fill brought to the Site.
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Exposed waste related to fill

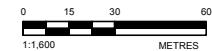
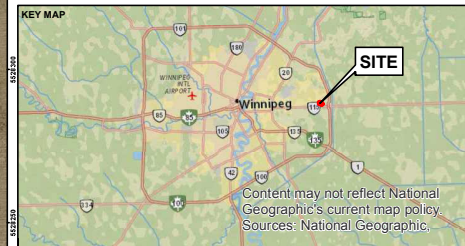




LEGEND

LANDFILL FOOTPRINT

CONTROL ZONE AREA



NOTE(S)

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

REFERENCE(S)

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.

2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83

COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

CLIENT

CITY OF WINNIPEG

PROJECT

WINNIPEG LANDFILL STATUS REPORT

SITE 29: CNR - DUGALD ROAD LANDFILL SITE, WINNIPEG, MANITOBA

TITLE

SITE PLAN

CONSULTANT	YYYY-MM-DD	2015-07-02
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283

PHASE 1000

REV. A

FIGURE Z1

FILE: G:\Information\Map\City of Winnipeg\Landfill\Site 29\Site 29 - Dugald Road Landfill Site - 1522283-1000-01-01.dwg

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- RAILWAY
- TOPOGRAPH C CONTOUR, metres
- BUILDING FOOTPRINT
- UTILITY
  - SANITARY SEWER
  - WATER MAIN
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 15 30 60  
1:600 METRES

**NOTE(S)**  
1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**  
1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

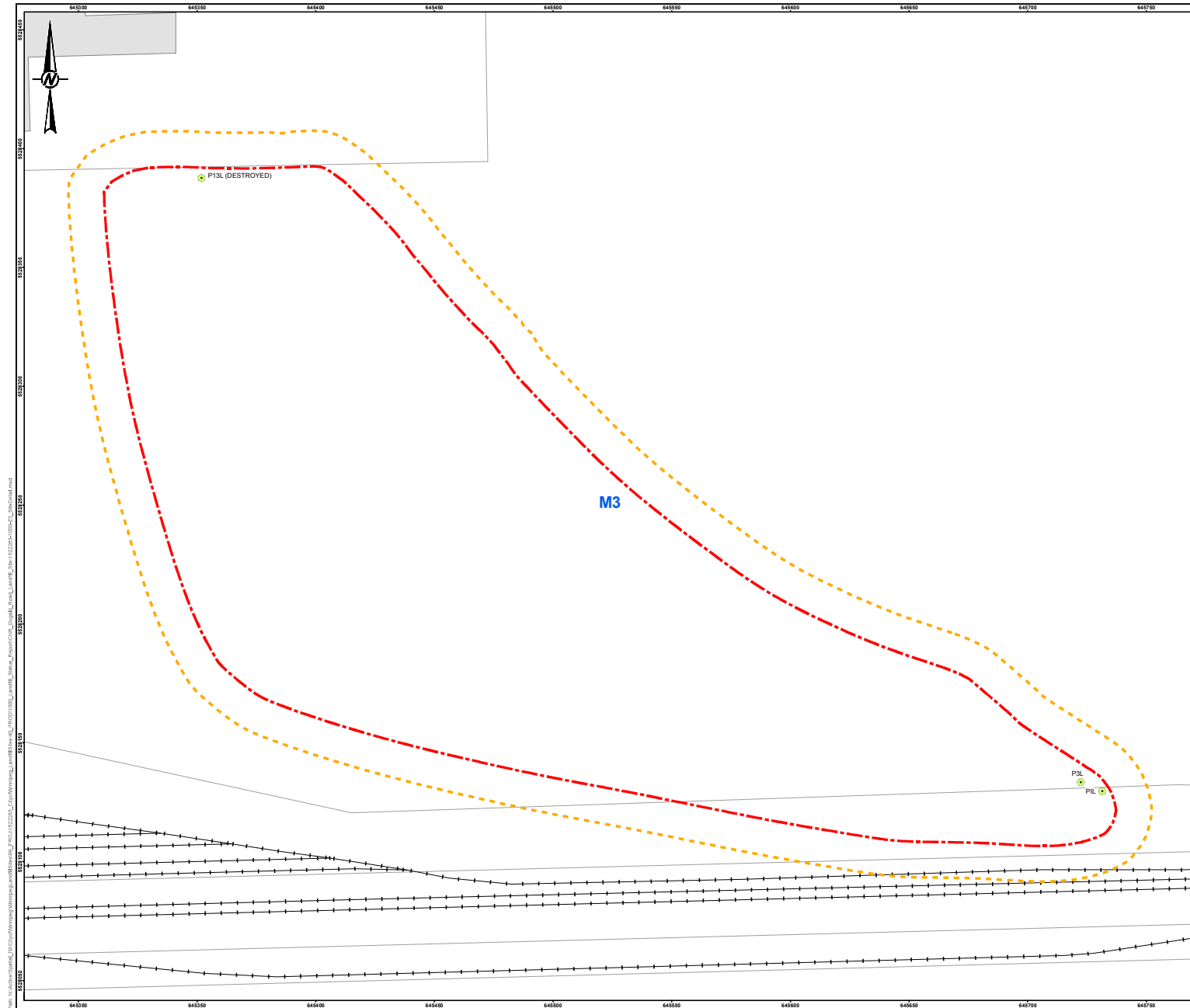
**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 29: CNR - DUGALD ROAD LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-04
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	<b>22</b>

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 22mm



**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- GAS MONITORING PROBE
- RAILWAY
- BUILDING FOOTPRINT
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- ZONING
- M3 -- MANUFACTURING - HEAVY

**KEY MAP**

Winnipeg

Content may not reflect National Geographic's current map policy. Sources: National Geographic.

0 15 30 60  
1:1,600 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 29: CNR - DUGALD ROAD LANDFILL SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE DETAIL

CONSULTANT	YYYY-MM-DD	2015-07-09
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283 PHASE 1000 REV. A FIGURE **Z3**

\\s01-11\shared\GIS\CityMapping\GIS\MapDocs\1522283\_29\1522283\_29\_SiteDetail.mxd

25mm  
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM






**Photo Z1**  
**Landfill site looking northwest**



**Photo Z2**  
**Fill piles**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 29: CNR-DUGALD ROAD LANDFILL SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PIE	Sept 2015		
		FIGURE Z4			






**Photo Z3**  
 Fill pushed up against low wet area with  
 western portion of landfill beyond the fence



**Photo Z4**  
 Exposed waste in the fill

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 29: CNR-DUGALD ROAD LANDFILL SITE PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PIE Sept 2015
		PHASE No. 1000	REV.0
		SCALE AS SHOWN	
		FIGURE Z5	




**Photo Z5**  
Looking north to fill piles. Lack of vegetation likely due to placement of fill.



**Photo Z6**  
Looking southwest. Poor vegetation growth due to placement of fill.  
Low lying area.

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 29: CNR-DUGALD ROAD LANDFILL SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PIE Sept 2015			
		FIGURE Z6			



# **APPENDIX AA**

## **30. Corydon-Osborne Dump Site**





## APPENDIX AA

### 30. Corydon-Osborne Dump Site – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Corydon-Osborne Dump Site (Site 30), located along the banks of the Red River at the end of Corydon Avenue in Winnipeg, Manitoba, as illustrated on Figure AA1. The Corydon-Osborne Dump Site covers an area of approximately 0.8 hectares (ha) and was operated by the Canadian National Railway (CNR) from the 1950s until an unknown time. The landfill was used for surface disposal of ash and partially burned waste. The waste was pushed over the side of the bank towards the river. The average thickness of waste is 1.5 metres (m).

Ground surface ranges in elevation from 224 to 233 m above sea level (masl). The Red River is at an elevation of approximately 224 masl. No cover material was recorded to have been placed and no grading was undertaken. There is no landfill gas control. The control zone for the Site is 0 m.

The Site is located on a river bank near a transit corridor (rail line and City rapid transit) and is used for informal recreation purposes. Constraints previously reported for the Site include concerns with the stability of the bank.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Corydon-Osborne Dump Site. The most recent Site visit was conducted on August 20, 2014 by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch. Findings from this most recent Site visit were as follows:

- The Site was vacant but used as part of a recreational pathway;
- Access to the Site was by foot from Mulvey Avenue;
- The Site was covered by healthy grasses, thistles and trees with the recreational trails running throughout;
- Litter was noted on the ground;
- No drainage, leachate or erosion issues were identified during the Site visit; and,
- Landfill gas probes were not listed for the Site but three monitoring probes were found that were rusted shut.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 18, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visits by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was a grassy area sloped downward to the Red River. The grass, shrubs, and some trees that covered the Site did not appear to be stressed. The Site has walking trails that run parallel with the river along the Sites eastern boundary and a railroad and rapid transit corridor to the west of the Site boundary. To the north and south are treed areas with commercial/industrial buildings further south. No exposed debris or litter were noted.

The waste boundary was not well defined. Review of Figure AA1 indicates that the landfill is located in a treed area along the river bank. During the Site visit, the area south of the waste footprint indicated on Figure AA1 was believed to be the location of the landfill due to the lack of trees and due to the presence of two monitoring probes found near the Red River in this area.



## **APPENDIX AA**

### **30. Corydon-Osborne Dump Site – Winnipeg Landfill Status Report**

No leachate collection systems or landfill migration barriers were noted.

See attached Table AA1 and Figures AA1 through AA3 for Site specific details. Site photographs are provided in Figure AA4. Figure AA2 indicates that there is an MTS cable running west-east across the Site.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

There is no evidence of historical landfill gas monitoring at this Site, however two monitoring well casings were found at the Site during the Site visit.

### **3.2 Groundwater**

There is no evidence of historical groundwater monitoring at this Site.

### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

There are no current, or historical, monitoring results for landfill gas, groundwater or surface water available for review.

**Site Number** 30  
**Site Name** Corydon - Osborne Dump Site

**Landfill Operation**

<b>Waste type</b>	Ash, unburned waste
<b>Start date</b>	Active 1950
<b>End date</b>	?
<b>Operated by</b>	Canadia National Railway
<b>Disposal method</b>	surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	0.8		
Depth of waste below ground surface (metres)	0		
Height above ground surface (metres)	~1.5		
Slope %	Fair	Cover thickness (metres)	None
Cover material	None		
Comment on slopes	Sloped towards the river		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	0 (site boundary)

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Pathway in a vacant field along the river bank.
<b>North</b>	Wooded area with walking trails
<b>East</b>	Red River
<b>South</b>	Wooded area with walking trails. Some industry/commercial buildings further south.
<b>West</b>	rail line, City rapid transit
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>		224 to 233	<b>Groundwater flow direction</b>	East
<b>Potable water? Yes/No</b>		Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Red River			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	--	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>		18.0		
<b>Minimum depth to till (metres)</b>		18.0		
<b>Minimum depth to bedrock (metres)</b>		--		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	--	<b>Max</b>	--

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	No			

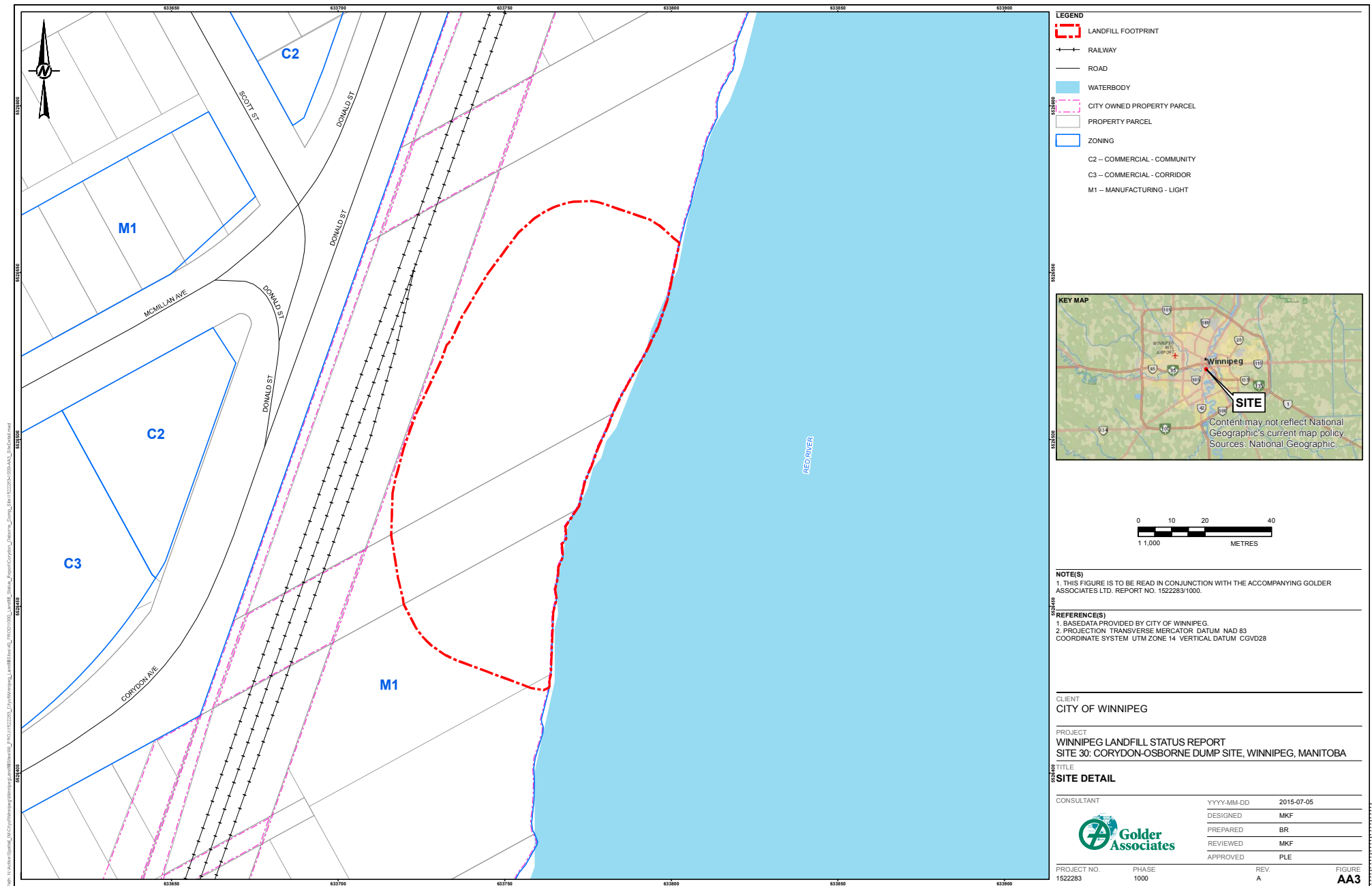
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Sloped towards the river
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--













**Photo AA1**

**Area evaluated during site visit – expected landfill site from the northwest with walking trails**


**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT



**Photo AA2**

**Monitoring probe at the banks of the Red River**

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 30: CORYDON-OSBORNE DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF Sept 2015		
				REVIEW	PIE Sept 2015		
				<b>FIGURE AA4</b>			



# **APPENDIX BB**

## **31. Red-Assiniboine River Junction Dump Site**



## APPENDIX BB

### 31. Red-Assiniboine River Junction Dump – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Red-Assiniboine River Junction Dump Site (Site 31), located at The Forks in Winnipeg, Manitoba, as illustrated on Figure BB1. The Red-Assiniboine River Junction Dump Site covers an area of approximately 3.0 hectares (ha). The area has a full cultural history as a meeting place, an Aboriginal settlement area, an area for the fur trade and the development of the railway.

Archaeological investigations have been undertaken at the Site. Many archaeological reports are available for the area of the Site but these have not been reviewed extensively as part of this work. Since the time of the presence of the railway to the south of the Site, the Site was used to deposit railway waste, with evidence of gravel, railroad cinder, metal and parts of machinery. The thickness of the waste is up to approximately 5 metres (m). The cover thickness is unknown; however, the cover reportedly consists of fill and may contain construction debris, glass and ash.

Details for the Site can be seen in Figures BB1 to BB3. Ground surface ranges in elevation of 232 m above sea level (masl) at the top of the bank to 223 masl at the Red River. The slope is sometimes gradual, and other areas range from 20% up to a 50% slope. Records of monitoring wells and/or landfill gas probes installation associated with the landfill were not found. The landfill gas control zone for the Site is 0 m.

The Site has been developed as a tourist and recreational area. There are walking trails, meeting places, the Forks Historic Port and some forested areas. The area surrounding the Site has a market, parks and restaurants.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Red-Assiniboine River Junction Dump Site. Findings from the most recent Site visit, completed on August 20, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The Site is located within The Forks and is well maintained;
- The Riverwalk, a pathway along the edge of the Red River, was closed due to high water levels;
- No signs of dumping;
- No drainage or leachate issues were identified during the Site visit; and,
- Probes were previously observed buried in mud closer to the River's edge. It is unknown what these probes are for.





## **APPENDIX BB**

### **31. Red-Assiniboine River Junction Dump – Winnipeg Landfill Status Report**

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. At the time of the Site visit, the Riverwalk was closed due to high water levels so the portions of the Site closer to the river could not be accessed.

The Site sloped from an upper walkway area down towards the river. The Site is well used by the public including a sandy area (the Forks Historic Port) at the south end and the walking trails towards the north. Footpaths appear to weave through the treed areas toward the shore. The treed areas appear to have sediment deposited from previous flooding and there was evidence of some erosion as shown on the photograph on Figure BB5. Ground cover ranged from mown grass, dirt paths and beach areas to forested areas. All of the vegetation appeared unstressed. Exposed waste, litter or debris was not observed.

The waste boundary is not well defined. No groundwater monitoring wells, leachate collection systems or landfill gas migration barriers were noted.

See attached Table BB1 and Figures BB1 through BB3 for Site specific details. Site photographs are provided in Figures BB4 through BB6.

## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

There is no evidence of historical landfill gas monitoring at this Site.

### **3.2 Groundwater**

There is no evidence of historical groundwater monitoring at this Site.

### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

There are no current, or historical, monitoring results for landfill gas, groundwater or surface water available for review.

**TABLE BB1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 31  
**Site Name** Red - Assiniboine River Junction Dump Site

**Landfill Operation**

<b>Waste type</b>	Railway waste
<b>Start date</b>	Not available
<b>End date</b>	?
<b>Operated by</b>	Private
<b>Disposal method</b>	Surface
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	3		
Depth of waste below ground surface (metres)	Up to 5 metres		
Height above ground surface (metres)	Unknown		
Slope %	20 to 50%	Cover thickness (metres)	Unknown
Cover material	Fill (may contain construction debris, glass, ash, etc.)		
Comment on slopes	Sloped towards the river		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	None
<b>Landfill gas control zone (metres)</b>	0 (site boundary)

**Land Use**

<b>Ownership</b>	Parks Canada
<b>Current</b>	"The Forks" developed tourist area with walkways.
<b>North</b>	The Forks market and buildings
<b>East</b>	Red River
<b>South</b>	Red River
<b>West</b>	Forested area along the banks of the Red River
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	223 to 232	<b>Groundwater flow direction</b>	Southeast
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	Red River		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	--	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>	--			
<b>Minimum depth to till (metres)</b>	--			
<b>Minimum depth to bedrock (metres)</b>	--			
<b>Bedrock</b>	Red River (Fort Garry - lower pt.)			
<b>Leachate elevation (mASL)</b>	<b>Min</b>	--	<b>Max</b>	--

**Monitoring**

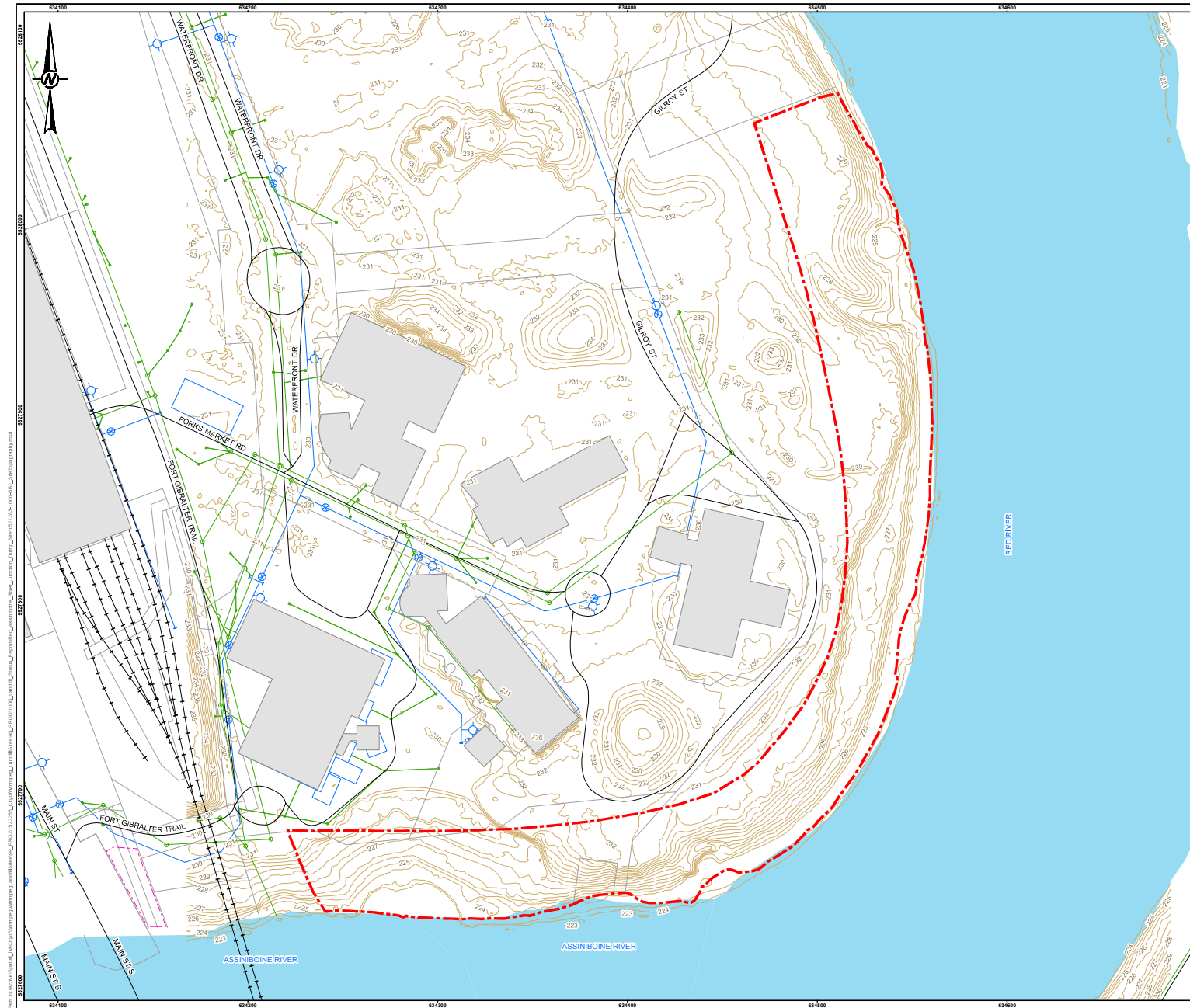
<b>Groundwater</b>	<b>Historical</b>	No	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	No			

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Sloped towards the river
<b>Erosion</b>	Some areas along the banks of the river
<b>Seeps</b>	No
<b>Other</b>	--







**LEGEND**

- LANDFILL FOOTPRINT
- ROAD
- RAILWAY
- BUILDING FOOTPRINT
- WATERBODY
- TOPOGRAPHIC CONTOUR, metres
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL
- UTILITY
  - SANITARY SEWER
  - WATER MAIN

**KEY MAP**

Content may not reflect National Geographic's current map policy. Sources: National Geographic.

0 20 40 80  
1:2,000 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION: TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**

CITY OF WINNIPEG

**PROJECT**

WINNIPEG LANDFILL STATUS REPORT  
SITE 31: RED-ASSINIBOINE RIVER JUNCTION DUMP SITE, WINNIPEG, MANITOBA

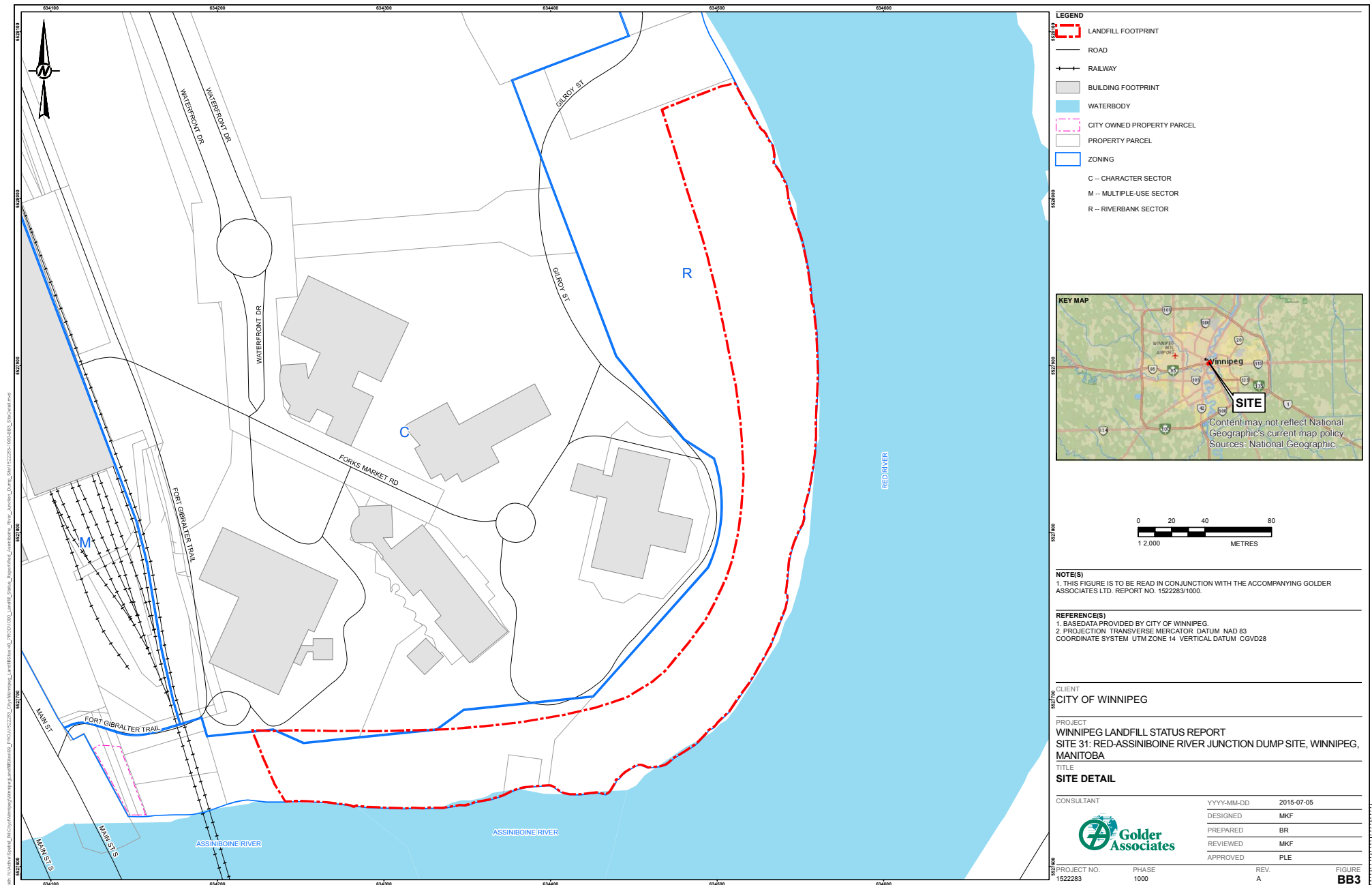
**TITLE**

SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-05
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO. 1522283	PHASE 1000	REV. A	FIGURE <b>BB2</b>
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM 25mm





**Photo BB1**

**The Forks Historic Port at the southwest end of the Site**


**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT



**Photo BB2**

**Looking at the southern portion of the Site from a pedestrian bridge over the Red River**

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 31: RED-ASSINIBOINE RIVER JUNCTION DUMP SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN		July 2015	SCALE AS SHOWN	REV.0
	GIS				
	CHECK	MKF	Sept 2015		
	REVIEW	PLF	Sept 2015		
			FIGURE BB4		





**Photo BB3**  
**Northern portion of the Site**



**Photo BB4**  
**Evidence of erosion**

**NOTE**

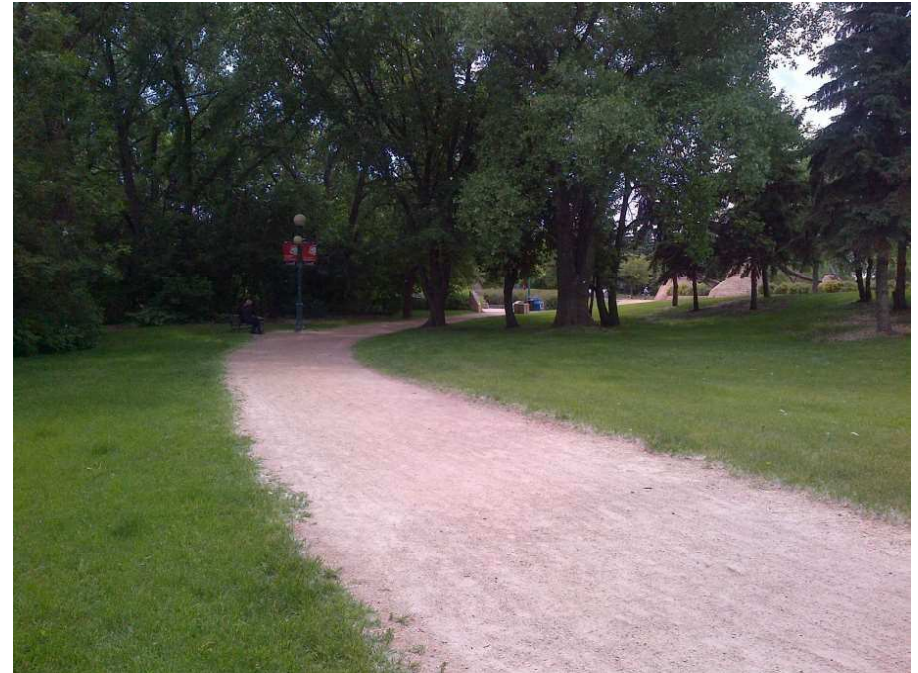
THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 31: RED-ASSINIBOINE RIVER JUNCTION DUMP SITE PHOTOGRAPHS	
	PROJECT No. 1522283		PHASE No. 1000
	DESIGN	July 2015	SCALE AS SHOWN
	GIS		REV.0
	CHECK	MKF Sept 2015	
	REVIEW	PLF Sept 2015	
			FIGURE BB5






**Photo BB5**  
Lower treed area prone to flooding



**Photo BB6**  
Walking paths near the Site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 31: RED-ASSINIBOINE RIVER JUNCTION DUMP SITE PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PLE Sept 2015
		PHASE No. 1000	SCALE AS SHOWN
		REV.0	
		FIGURE BB6	



# **APPENDIX CC**

## **32. Lot 61, St. Mary's Road Dump Site**





## APPENDIX CC

### 32. St. Mary's Road Dump – Winnipeg Landfill Status Report

## 1.0 HISTORY

This appendix describes the current (2015) landfill status at the Lot 61, St. Mary's Road Dump Site (Site 32), located on Sandrington Drive between Carriage House Road and Peach Tree Bay in Winnipeg, Manitoba, as illustrated on Figure CC1. The Lot 61, St. Mary's Road Dump Site covers an area of approximately 6.7 hectares (ha) and serviced the City of St. Vital from the 1950s until it was closed in 1974. During the period of landfilling there was evidence of pits, including water filled pits. Evidence of typical domestic refuse has not been found. The landfill reportedly includes wood waste, leaves, street sweepings, septic sludge, sand, gravel, tar, concrete rubble and some metals. Inclusion of car bodies has also been noted.

In 1979, a subsurface investigation was undertaken by the UMA Group on behalf of the City as outlined in the report titled, "Investigation of River Lot 61, St. Mary's Road" by UMA Group dated March 1979. The report indicated that the area west of Sandrington Drive had organic material capable of generating gas at levels approaching the "hazard range" and provided recommendations for construction in that area, since at that time a residential development was proposed for the area and which subsequently was built. The area east of Sandrington (the current Site) was noted to have organic and inorganic material, areas of perched water that correspond to previously water filled areas as evidenced by an aerial photo review. Gas was generated at "hazard levels" within the fill area at the Site.

In October 1980, twelve boreholes were drilled at the Site and in February 1981, six more boreholes were drilled at the Site (one at the same location as a previous borehole). The depth of the 18 boreholes ranged from 2 metres (m) to 5.5 m. The stratigraphy encountered at the Site reportedly included fill (clay, silt) and/or topsoil to a depth of 0.6 to 1.2 m below grade, overlying refuse (if present), underlain by clay, with layers of silt in some locations, to the maximum depth of investigation.

Of the 18 boreholes drilled at the Site, six contained waste/refuse, including gravel, fibrous refuse, concrete rubble, clay and one instance of fill with an oily appearance. The depth of waste, where present, ranged from 1.8 to 2.4 m below ground surface. Water levels were not included on the borehole logs.

Monitoring wells and/or landfill gas probes were installed in eleven of the boreholes and labelled as follows:

- P6E, drilled to a depth of 5.5 m below grade, located south of east end of landfill. In recent years the depth to water has been as high as 2.97 m below grade (August 16, 2011);
- P7L, drilled to a depth of 5.5 m below grade, located within the south edge of the waste footprint on the east end. In recent years the depth to water has been as high as 2.33 m below grade (August 16, 2011);
- P8L, drilled to a depth of 5.5 m below grade, located within the northwest corner of the waste footprint;
- P9E, drilled to a depth of 5.5 m below grade, located on the north edge of the control zone at the west end of the Site. In recent years the depth to water has been as high as 2.0 m below grade (July 9, 2013);
- P10E, drilled to a depth of 5.5 m below grade, located within the control zone south of the west end of the waste footprint;
- P18L, drilled to a depth of 4.0 m below grade, located within the northeast corner of the waste footprint. In recent years the depth to water has been as high as 2.0 m below grade (July 9, 2013);



## APPENDIX CC

### 32. St. Mary's Road Dump – Winnipeg Landfill Status Report

- P20E, drilled to a depth of 4.0 m below grade, located within the control zone south of the central portion of the waste footprint;
- P21E, drilled to a depth of 4.5 m below grade, within the control zone south of the western end of the waste footprint. In recent years the depth to water has been as high as 2.1 m below grade (July 9, 2013);
- P23E, drilled to a depth of 4.3 m below grade, located within Sandrington Drive right-of-way at the northwest corner of the Site;
- P24E, drilled to a depth of 4.0 m below grade, located within the control zone south of the central portion of the waste footprint; and,
- P25L (replaced P1L), drilled to a depth of 4.0 m below grade, located at the north end of the eastern half of the waste footprint. In recent years the depth to water has been as high as 1.9 m below grade (August 16, 2011).

Subsequently, an additional 24 gas probes were installed and labelled as follows: P13E, P14E, P15L (labelled as within the landfill but actually in the control zone), P16E, P34E, P35E, P36E, P37E, P41E, P42E, P43E, P45L (times three), P46E, P47E, P48E, P51E, P52E, P54L, P56E, P57E, P58E and P59E. Borehole logs were not available for review.

In 1985 concerns about landfill gas at the retirement home north of the Site prompted the installation of the landfill gas barrier trench around the building. Details of this installation have not been reviewed.

In 2009, benches, signage a pathway and a playground were installed within the control zone near Sandrington Drive.

Ground surface is at an elevation of 233 m above sea level (masl). The water level within the waste is reportedly 231 to 232 masl.

The cover material is undocumented; however, reportedly may have consisted of fill. A 15 m landfill gas control zone was allotted for the Site as shown on Figures CC1 to CC3.

The Site is located within a residential area and is a park. Constraints previously reported for the Site include contact risk with leachate and restricted foundation construction. High impact recreation which could cause surface erosion was discouraged.

## 1.1 Previous Site Visits

The City performs regular Site visits to the Lot 61, St. Mary's Road Dump Site. Findings from the most recent Site visit, completed on August 20, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The vegetation was well maintained;
- The Site was mainly grass covered with a forested area within the Site and surrounding the Site;
- The ground was fairly even;



## APPENDIX CC

### 32. St. Mary's Road Dump – Winnipeg Landfill Status Report

- No illegal dumping was noted;
- No drainage or leachate issues were identified during the Site visit; and,
- Five landfill gas probes were found. The status of each probe was as follows:
  - P9E – loose PVC within the casing;
  - P16E – inner casing loose but otherwise in good condition;
  - P18L – cannot be closed;
  - P25L – good condition, needs new lock; and,
  - P52E – inner casing is disconnected and readings could not be taken.

## 2.0 LANDFILL STATUS

A Site walkabout was conducted in the general area on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch. Historical aerial photos of the Site were reviewed.

The Site is a fairly flat park area. A residential development is located to the north (with a retirement home) and to the west. Forested areas are located to the south and east. The Site is mainly grass covered with forested areas towards the south.

The Site is used as a park. A playground structure is located at the southwest corner of the Site. No groundwater monitoring wells, leachate collection systems or landfill gas migration barriers were noted.

See attached Table CC1 and Figures CC1 through CC3 for Site specific details.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided in the drill logs completed for the Site. During this time, of the probes installed outside of the waste footprint, methane was detected in only three probes in 1986 and this was attributed to changes due to filling activities on-Site. Of the probes completed within the waste, the majority had no detections of methane with the exception of one to three probes each year (with the exception of 1990) that had detection of methane less than 100% of the Lower Explosive Limit (LEL).

In recent years the majority of the landfill gas probes could not be located, were destroyed, or were damaged and could not be used. In 2014, only four probes (P9E, P16E, P18L, P25L) were monitored. During 2013 and/or 2011 landfill gas probes P21E, P35E, P7L and P6E were also monitored. During these three years, no methane was detected with the exception of measurements of 1% of methane by volume at P35E and 1% LEL at P6E during 2011.

Landfill gas monitoring is scheduled to be undertaken annually at the retirement home. During 2014, the probes could not be opened and measurements were therefore not taken.





## **3.2 Groundwater**

Water levels are monitored within the landfill gas probes annually.

### **3.2.1 Leachate**

Groundwater from one probe (P18L) at the Site was historically sampled for groundwater. While this probe still exists, there is no current or ongoing analytical groundwater monitoring program conducted at the Site. Details of the screen installation in this probe are unknown, although it is known to be within the waste footprint. For the purposes of this report it has been assumed that the waste has been partially screened in this probe and the probe is representative of leachate quality.

Groundwater sampling was conducted two times at the Site (June 1992 and August 1995). The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate + nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, conductivity, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

## **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1985 to 1992 – 23 to 40 landfill gas probes were monitored. With the exception of 1986 no methane was detected outside of the waste footprint. Small amounts of methane were detected at one to three probes located within the waste footprint;
- 1988 – A 15 m control zone was implemented at the Site; and,
- 2011, 2013 and 2014 – Four to nine landfill gas probes exist. No detectable landfill gas was reported with the exception of measurements of 1% of methane by volume at P35E and 1% LEL at P6E during 2011. Monitoring is completed at the retirement home north of the Site but recent monitoring results were not available for review.

To date there is minimal evidence of landfill gas migration occurring at the Site. The depths to water at the Site are also quite shallow (1 to 2 m below grade). The non-detectable methane concentrations may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen. The organic nature of some of the waste would be expected to produce landfill gas.

As shown on Figure CC2, there are utilities located on the Site and nearby the Site, which could act as a preferential pathway for landfill gas. A sanitary sewer runs north-south through the Site and a roadway and water main runs along the western edge as well as at the northeast corner.



## **4.2 Groundwater**

### **4.2.1 Elevations**

The depth to water measured in 2013 and 2014 in the landfill gas probes installed within the waste fill area ranged from 1.9 to 2.7 m below the top of the pipe, while the water level outside the waste fill area ranged from 1.9 to 3.0 m below the top of the pipe.

### **4.2.2 Leachate**

Based on analytical results from P18L, collected in 1992 and 1995, total dissolved solids, nitrate + nitrite, sulphate and several metals, including manganese, iron, sodium, chromium and lead were elevated above the Guidelines for Canadian Drinking Water Quality during the two groundwater sampling events. The results of these analyses represent the quality of leachate and do not represent the potential impact from the landfill to the surrounding groundwater. There is no current data or background water quality data available for review.

### **4.2.3 Groundwater**

There is no ongoing analytical groundwater monitoring program.

## **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.

**TABLE CC1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 32  
**Site Name** Lot 61, St. Mary's Rd. Dump Site

**Landfill Operation**

<b>Waste type</b>	Primarily car bodies, construction, rubble, wood waste, street sweepings, leaves, septic sludge and soil fill
<b>Start date</b>	Early 1950s
<b>End date</b>	1974
<b>Operated by</b>	City of St. Vital
<b>Disposal method</b>	pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	6.7		
Depth of waste below ground surface (metres)	1.8 average, 4.3 maximum		
Height above ground surface (metres)	0.9		
Slope %	Flat	Cover thickness (metres)	Unknown?
Cover material	Potentially Fill (undocumented)		
Comment on slopes	--		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Landfill gas venting system around retirement home
<b>Landfill gas control zone (metres)</b>	15

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Park setting with playground
<b>North</b>	Residential including a retirement home
<b>East</b>	Forested area
<b>South</b>	Residential and forested area
<b>West</b>	Sandrington Drive and residential
<b>Comment</b>	--

**Physical Site Setting**

<b>Physical Site Settings</b>				
<b>Ground elevation (mASL)</b>		232.6	<b>Groundwater flow direction</b>	Northwest
<b>Potable water? Yes/No</b>		Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>		None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	231	<b>Max</b>	232.0
<b>Minimum clay thickness below base grades (metres)</b>		10.7		
<b>Minimum depth to till (metres)</b>		12.5		
<b>Minimum depth to bedrock (metres)</b>		15.5		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.0	<b>Max</b>	232

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes from one leachate monitor	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	--
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--





**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD

**KEY MAP**

Content may not reflect National Geographic's current map policy  
Sources: National Geographic.

0 12.5 25 50  
1:1,400 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASE DATA PROVIDED BY CITY OF WINNIPEG.  
2. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83  
COORDINATE SYSTEM: UTM ZONE 14 VERTICAL DATUM: CGVD28

**CLIENT**

CITY OF WINNIPEG

**PROJECT**

WINNIPEG LANDFILL STATUS REPORT  
SITE 32: LOT 61, ST. MARY'S ROAD DUMP SITE, WINNIPEG,  
MANITOBA

**TITLE**

**SITE PLAN**

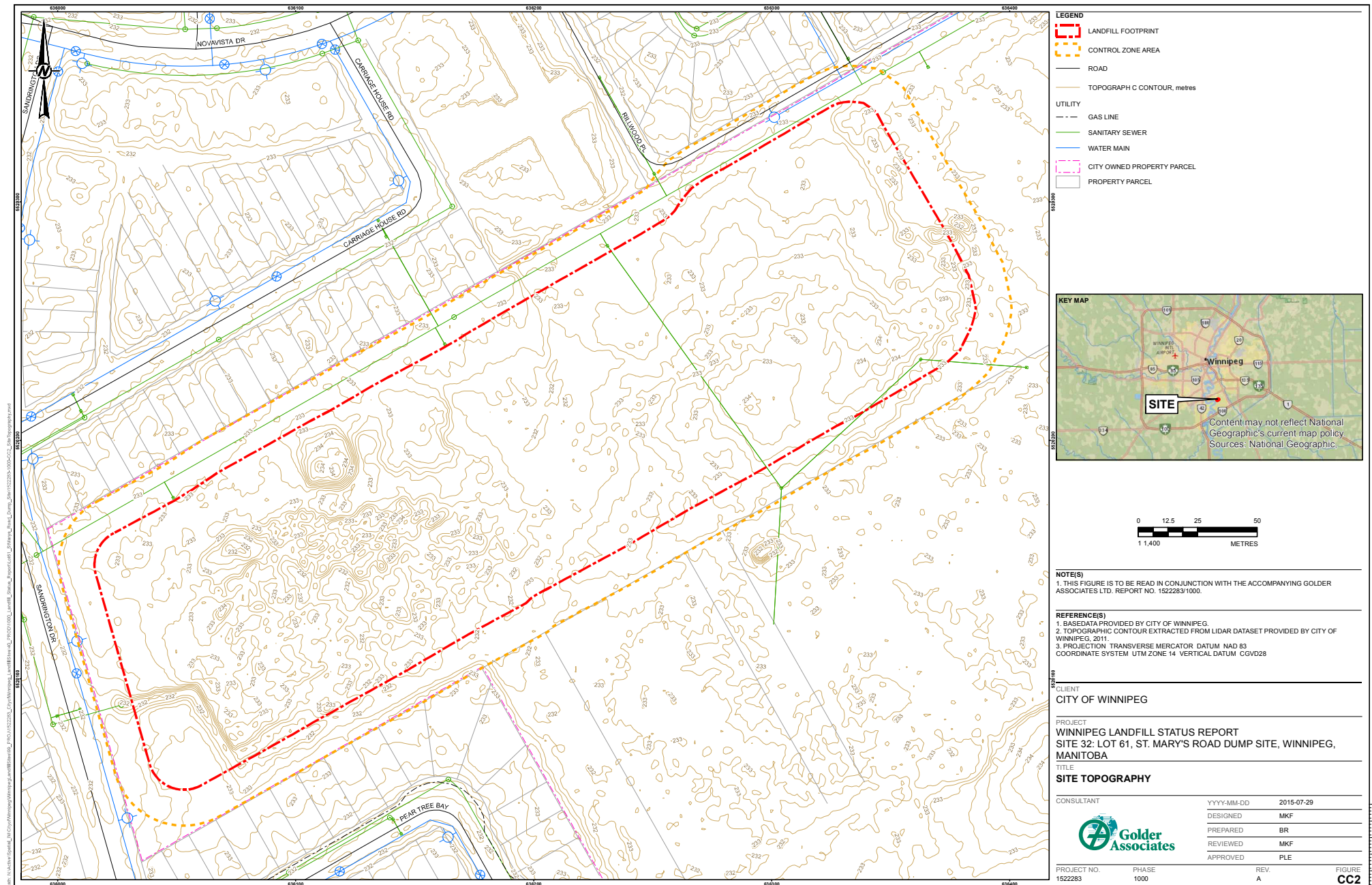
CONSULTANT	YYYY-MM-DD	2015-07-02
DESIGNED	MKF	
PREPARED	BR	
REVIEWED	MKF	
APPROVED	PLE	

PROJECT NO. 1522283 PHASE 1000 REV. A

**FIGURE**

**CC1**











# **APPENDIX DD**

## **33. Riel Dump Site**



## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Riel Dump Site (Site 33), located on Ashworth Street between Meadowood Drive and Wales Avenue in Winnipeg, Manitoba, as illustrated on Figure DD1. The Riel Dump Site covers an area of approximately 1.9 hectares (ha) and was operated by the City of St. Vital from 1968 until 1972. The area of the Site was used as a borrow pit for dike material for a flood in 1950. Subsequently (potentially earlier than the 1968 start date) the pit was filled with sand bags, clay fill, street sweepings and unknown types of fill, including a Christmas tree collection.

By 1972 houses were being built on Ashworth Street and Meadowood Drive. During the foundation excavation for homes on Ashworth Street a green seepage was encountered. A clay lined trench was reportedly installed at that time. The dimensions and integrity of the clay barrier are not known.

Evidence of waste deposited using a trench was found when the sewer main was installed along Ashworth Street. A subsurface investigation was undertaken by the City and included drilling of eighty test holes to a maximum depth of 4.3 metres (m). Refuse was found at varying depths (up to 4.3 m) interspersed across the Site with areas of fill. Three areas were investigated as follows:

- Sports fields: Mostly fill but includes some organic clay fill, oily black fibrous fill, black granular ash material, clay mixed with wood and fibreboard, gravel and sandy fill;
- Meadowood Drive: various clay and organic fill material to a depth of 2 to 2.5 m; and,
- Ashworth Street: Material consists of clay and organic fill with refuse type clay appearing oily, grey black with a foul smell. Test holes/probes installed in the backyards of homes on Ashworth had evidence of fill to a depth of at least 3.9m.

The stratigraphy encountered at the Site reportedly included 0.3 to 0.6 m of upper clay overlying 0.6 to 1 m of silt (the silt unit appears at a greater depth of 1.6 to 2.7 m in some areas although borehole logs are not available and these details do not reference if these measurements are from ground surface. A lower clay unit was reported below the silt to the depth of the investigation.

Twenty-five monitoring wells and/or landfill gas probes were installed around the Site and control zone and labelled as follows: P19E, P21L, P22L, P27L, P28E, P32L, P35L, P41L, P44L, P56L, P57L, P58L, P59L, P60L, P62L, P66L, P67U, P69L, P71E, P74L, P75L, P76L, P77L, P78L and, P79L. Probe construction details were not available for review.

Ground surface is at an elevation of 232 m above sea level (masl). The water level within the waste is reportedly at 230.4 masl.

The cover material is undocumented; however, the cover reportedly consisted of fill 0.6 m to 1.2 m in thickness. A 45 m landfill gas control zone exists for the Site as shown on Figures DD1 to DD3.

Constraints previously reported for the Site include potential soil salinity issues, landfill gas production in areas of structures and leachate migration.



## **1.1 Previous Site Visits**

The City performs regular Site visits to the Riel Dump Site. Findings from the most recent Site visit, completed on August 9, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- At the time of this Site visit, the Site was a recreational field and park;
- The Site was mainly grass covered with a few trees;
- The grass was well maintained at the Site and the vegetation did not appear stressed;
- No illegal dumping was noted;
- No drainage or leachate issues were identified during the Site visit; and,
- The landfill gas probes were flushmounts (i.e. flush with the ground) and only three could be located.

## **2.0 LANDFILL STATUS**

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was fairly flat as it was used for sports fields to the southeast and for residential homes. The Site is in a residential area with the back ends of houses along Meadowood Drive and entire houses along Ashworth Street within the waste footprint. The waste footprint also extends to portions of some homes along Woodford Bay, west of Ashworth Street. The Site is bisected by Ashworth Road and includes the back laneway for the houses on Meadowood Drive and paved parking for the sports fields. The Site was mainly grass covered for the sports fields and residential lawns, with some trees. In other areas, the Site was paved for roadways, parking and driveways. An in-ground pool is located within the waste footprint with others also located within the control zone. No exposed waste or debris were noted.

No groundwater monitoring wells, leachate collection systems or landfill gas migration barriers were noted. The landfill gas probes were noted to be flushmounts and difficult to locate. Landfill gas probe P58L was observed during the Site visit.

See attached Table DD1 and Figures DD1 through DD3 for Site specific details. Site photographs are provided in Figure DD4.





## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations or drill logs were provided.

Methane monitoring results for the Site from 1980 to 1992 were reviewed. In 1980 and 1982 methane was monitored on an almost monthly basis. The monitoring program reduced in 1983 with some locations only monitored once per year. By 1986 the landfill gas probes were only monitored once per year. A summary of the results are as follows:

- Methane ranged from non-detection to greater than 100% of the Lower Explosive Limit (LEL) (up to 80% methane by volume in air at P66L, a backyard probe);
- The highest methane production occurred at P66L, P69L, P74L, P75L and P76L, with methane detected almost consistently greater than 100% LEL until 1987;
- Methane was detected at concentrations greater than 100% LEL in 1988 at P66L, and in 1989 and 1992 at P66L and P76L; and,
- Trace amounts of landfill gas were detected in probes completed outside of the waste periodically in the early 1980s but was not detected in these probes after 1982.

In recent years the majority of the landfill gas probes could not be located, were destroyed, or were damaged and could not be used. In 2013 and 2014, only three probes (P28E, P32L and P58L) were monitored. During 2011 landfill gas probe P59L was also monitored. During these three years, no methane was detected.

Landfill gas monitoring within residences is scheduled annually at 43 houses on Meadowood Drive, Woodford Bay and Ashworth Street. In 2013 and 2014, monitoring occurred at 17 and 14 homes respectively (i.e. residents were not home at the majority of houses). Methane is measured from floor cracks or sewer drains. Methane was not detected in 2013 in any of the houses monitored. Trace amounts of methane were detected in three houses on Woodford Bay in 2014 (0.1% methane by volume in air) and one house on Meadowood Drive (0.2% methane by volume in air). The houses on Ashworth near P66L (the probe with greater than 100% LEL readings in 1992) were not monitored because there was no answer at the door. One house near P76L (the other probe with greater than 100% LEL readings in 1992) was monitored in 2013 and 2014 and had no detections of methane.

### **3.2 Groundwater**

Water levels are monitored annually within the landfill gas probes that are located at the Site.

#### **3.2.1 Leachate**

Groundwater from four probes (P21L, P22L, P32L and P59L) at the Site was historically sampled for groundwater monitoring. Details of the depth of these probes are unknown, although they are known to be within the waste footprint. For the purposes of this report it has been assumed that the probes were completed in the waste and are representative of leachate quality.



Groundwater sampling was conducted as follows:

- P21L – 1981, 1986, annually from 1988 to 1993, 1995;
- P22L – 1992 and 1993;
- P32L – 1981; and,
- P59L – 1981 and annually from 1988 to 1993.

The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate + nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, conductivity, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

### **3.3 Surface Water**

There is no evidence of historical surface water monitoring at this Site.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1980 to 1992 – 21 landfill gas probes were monitored, including 10 in the residential backyards. Methane was detected at amounts greater than 100% LEL in monitors at the west end of the Site, near homes on Ashworth Street;
- 2011, 2013 and 2014 – Four to five landfill gas probes were found. No detectable landfill gas was reported. Monitoring is completed within residential houses when the residents are home. The majority of readings of methane were non-detectable with the exception of trace amounts detected in basements of houses on Woodford Bay and Meadowood Drive; and,
- A 45 m control zone exists at the Site.

There is evidence of previous landfill gas generation within the waste footprint. Lateral subsurface landfill gas migration appears to be minimal based on non-detectable methane readings in probes completed outside of the waste. It should be noted, however, that the depths to water at the Site are also quite shallow (1 to 2 m below grade). The non-detectable methane concentrations (both outside the waste footprint historically and recently in probes completed within the waste footprint) may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen.

As shown on Figure CC2, there are utilities located on the Site and nearby the Site, which could act as a preferential pathway for landfill gas. An MTS cable, sanitary sewer and water main run north-south through the Site along Ashworth Street. The MTS cables also run east-west through the northern portion of the Site. A sanitary sewer and water main exist within the control zone along Meadowood Drive and Woodford Bay.



## **4.2 Groundwater**

### **4.2.1 Elevation**

The depth to water measured in 2011, 2013 and 2014 in the landfill gas probes installed within the waste fill area ranged from 0.9 to 2.1 metres below the top of the pipe (the probes are flushmount so the top of pipe is expected to be close to the ground surface), while the water level outside the waste fill area ranged from 2.1 to 2.5 metres below the top of the pipe.

### **4.2.2 Leachate**

Groundwater monitoring was only undertaken at monitoring wells completed within the waste footprint in the sports field. Based on the analytical results, the following parameters were elevated above the Guidelines for Canadian Drinking Water Quality:

- P59L (1991 and 1988 through 1993): total dissolved solids, sulphate, chloride and several metals, including manganese, iron and sodium consistently exceeded criteria and lead exceeded criteria during the majority of the sampling events;
- P32L (1981): total dissolved solids, chloride, iron and lead;
- P21L (1981, 1986, annually from 1988 to 1993, 1995): total dissolved solids, sulphate, manganese, iron and lead exceeded criteria during the majority of the sampling events; and,
- P22L (1992 and 1993): total dissolved solids, sulphate, chloride, manganese, iron, sodium and lead consistently exceeded criteria.

The results of these analyses represent the quality of leachate and do not represent the potential impact from the landfill to the surrounding groundwater. There is no current data or background water quality data available for review.

### **4.2.3 Groundwater**

There is no ongoing analytical groundwater monitoring program.

## **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.



**TABLE DD1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 33  
**Site Name** Riel Dump Site

**Landfill Operation**

<b>Waste type</b>	Grass cuttings, wood waste, street sweepings, leaves and soil fill
<b>Start date</b>	1968
<b>End date</b>	1972
<b>Operated by</b>	City of St. Vital
<b>Disposal method</b>	pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	1.9		
Depth of waste below ground surface (metres)	4.3		
Height above ground surface (metres)	0		
Slope %	Flat	Cover thickness (metres)	0.6 - 1.2
Cover material	Potentially Fill (undocumented)		
Comment on slopes	--		

**Environmental Controls**

<b>Description of leachate collection system</b>	None
<b>Landfill gas migration barriers description</b>	Undocumented clay lined trench installed for homes along Ashworth during construction
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	Private (West and north), City of Winnipeg
<b>Current</b>	Open field park
<b>North</b>	Residential
<b>East</b>	Park and residential
<b>South</b>	Park and residential
<b>West</b>	Ashworth St and residential
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	232	<b>Groundwater flow direction</b>	Northwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	229.2	<b>Max</b>	230.4
<b>Minimum clay thickness below base grades (metres)</b>		11.0		
<b>Minimum depth to till (metres)</b>		15.2		
<b>Minimum depth to bedrock (metres)</b>		21.0		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	230.4	<b>Max</b>	--

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes	<b>Current</b>	No
<b>Current surface water</b>		No		
<b>Current landfill gas</b>		Yes		

**Notable 2015 Site Visit Observations**

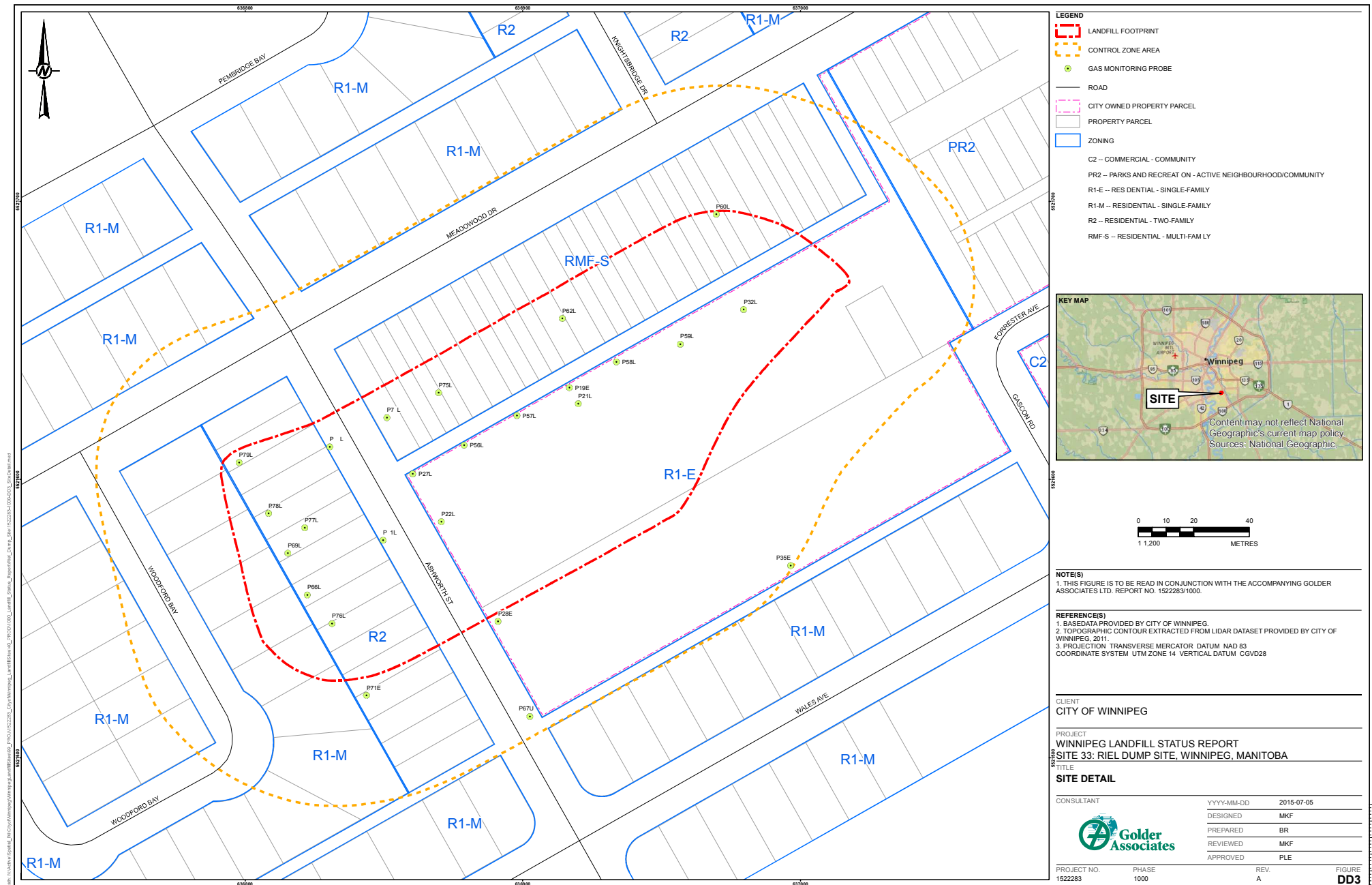
<b>Settlement/slopes</b>	--
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--














**Photo DD1**  
**Soccer fields on landfill site – looking east**



**Photo DD2**  
**Back lane for houses on Meadowood Drive – looking west**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
 REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 33: RIEL DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS			
				CHECK	MKF	Sept 2015	
				REVIEW	PIE	Sept 2015	
				<b>FIGURE DD4</b>			



# **APPENDIX EE**

## **35. River Road Dump Site**





## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the River Road Dump Site (Site 35), located near River Road and Kilmarnock Bay in Winnipeg, Manitoba, as illustrated on Figure EE1. The River Road Dump Site covers an area of approximately 2 hectares (ha) and was operated by the City of St. Vital from post 1960 until it closed in 1968. The landfill was used for pit disposal of refuse. The area was an old borrow pit that was backfilled with wood waste, street sweepings, leaves and soil fill.

Investigations have been previously undertaken at the Site including 46 test holes and three test pits to delineate the extent of the waste horizontally and vertically. Landfill gas probes were installed in fifteen of the test holes at the Site as follows: P5, P5E, P6E, P7L P10, P13 (at two locations), P14, P15, P21 (at two locations), P27, P31, P33, and P38, as shown on Figure EE3. A groundwater monitoring well was installed in one test hole at P7L to monitor leachate quality. Installation details of the gas probes and monitoring well are not available for review.

In 2008 a playground and pathways were installed within the control zone, southeast of the waste footprint.

The surrounding ground surface is at an elevation of 232 m above sea level (masl). The waste is approximately 7.6 m below ground surface to 1.5 m above the ground surface. The water elevation within the waste is reportedly near the surrounding ground surface elevation of 231.6 masl.

The cover material is undocumented; however, reportedly may have consisted of fill 0.9 to 1.2 m thick. A 45 m landfill gas control zone was allotted for the Site in 1988.

The Site is located within a residential area and is used for informal recreation purposes. Constraints previously reported for the Site include restricted foundation construction and highly organic soils.

### **1.1 Previous Site Visits**

The City performs regular Site visits to the River Road Dump Site. The most recent Site visit was conducted on August 20, 2014 by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch. At the time of this Site visit, the following was noted:

- The Site was mainly grass covered and treed in the control zone;
- The vegetation was not visibly stressed;
- No dumping of household waste was noted;
- No drainage or leachate issues were identified during the Site visit;
- Some cracking was noted of the ground and was attributed to the warm, dry summer; and,
- The landfill gas probes could not be located.



## APPENDIX EE

### 35. River Road Dump Site – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 17, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was a generally flat field/park surrounded by trees. A portion of the landfill extends beneath the residential area to the northeast. A residential development surrounds the Site to the north, east and south of the Site. St. Vital Park and more trees are located to the west, across River Road. The Site was mainly grass covered and treed in the control zone. The grass was well maintained. No exposed waste or debris was observed.

The waste boundary was fairly well defined and the Site was being used as a park with a walking path. No leachate collection systems or landfill gas migration barriers were noted. None of the landfill gas probes or the leachate monitoring well were found.

See attached Table EE1 and Figures EE1 through EE3 for Site specific details. Site photographs are provided in Figure EE4.

## 3.0 MONITORING PROGRAMS

### 3.1 Landfill Gas

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. No information regarding screen elevations was provided.

Landfill gas measurements (% of lower explosive limit (LEL)) were obtained on an approximately weekly basis during 1980 from P10, P37, P38, P5, P21, P33, P15, P27, P14, P13 and P21. Monitoring continued at a less frequent basis until 1984 at P21, P38 and P37. Results were as follows:

- P5, P21, P33 (located at the eastern edge of the park area next to the residential homes) – No methane was detected;
- P10 (located within the waste) – Methane was measured at 100% LEL with the exception of three readings in April and May 1980 which were 0% LEL and one in June 1980 which was 30% LEL;
- P37 (unknown location) – Methane was measured at 100% LEL from February to August, 1980 with the May and June, 1980 results at 0% LEL. From the end of August, 1980 until 1984 the majority of the measurements were in the 30% LEL to 50% LEL range;
- P38 (northern corner of the waste footprint) – No methane was detected during the majority of the monitoring events. When methane was detected it was less than 15% LEL with the exception of one measurement of 30% LEL during November 1980;
- P15 (within the control zone, near a residential home) – Methane was measured at 100% LEL during February and March 1980 and then reduced to 0% LEL in April 1980. The remainder of the measurements were 0% LEL with the exception of 1% LEL reported in July 1980 and 8.5% LEL reported in August 1980;
- P27 (within the landfill footprint that extends eastward below the residential area) – Methane was measured between 22% LEL and 52% LEL during the February and March 1980 and then reduced to 0% LEL for the majority of the remaining measurements. Measurements of 100% LEL were reported in July 1980 and September 1980;



## APPENDIX EE

### 35. River Road Dump Site – Winnipeg Landfill Status Report

- P14 (within the landfill footprint that extends eastward below the residential area) – Methane measurements varied from 0% LEL to 100% LEL;
- P13 (within the landfill footprint that extends eastward below the residential area) – No methane was detected during the majority of the monitoring events. When methane was detected it ranged from 1% LEL to 40% LEL; and,
- P21 (located at the eastern edge of the park area next to the residential homes) – No methane was detected during the majority of the monitoring events. When methane was detected it ranged from 2% LEL to 100% LEL.

Landfill gas was monitored from three probes (two outside of the waste and one inside the waste) annually from 1985 until 1992. It is unknown which three probes were monitored during this time. From 1987 until 1992 there was no methane detected with the exception of 0.26% methane by volume in air from the probe inside the waste in 1992.

The landfill gas probes could not be located in recent years, and therefore, there are no recent landfill gas monitoring results.

Landfill gas is also measured annually in thirteen residential homes on the landfill and within the control zone (all located on Kilmarnock Bay). The measurements are taken from the floor drains/floor cracks and mid-air. The results from 2013 and 2014 were reviewed. During 2013 and 2014, only three homes were monitored during each session (there was no one home at the remaining homes). Methane was not detected during 2013 or 2014.

## 3.2 Groundwater

### 3.2.1 Leachate

One probe (P7L) was historically located on the Site for groundwater monitoring; however, this probe can no longer be located and there is no current or ongoing groundwater monitoring program conducted at the Site. Details of the depth of this probe are unknown, although it is known to be within the waste footprint. For the purposes of this report it has been assumed that the probe was completed in the waste and is representative of leachate quality.

Groundwater sampling was conducted three times at the Site (August 1988, June 1992 and August 1995). The samples were submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate + nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.

### 3.2.2 Groundwater

There is no evidence of historical groundwater monitoring from probes located outside of the waste footprint at this Site.

## 3.3 Surface Water

There is no evidence of historical surface water monitoring at this Site.





## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

Historical landfill gas sampling at the Site included the following:

- 1980 to 1984 – eleven probes were installed within the waste fill area and control zone with the majority of probes detecting methane;
- 1985 to 1992 – monitoring from three probes with no detection of methane with the exception of a minor amount from the probe completed in waste in 1992;
- 1988 – A 45 m control zone was implemented at the Site; and,
- 2013 and 2014 – Landfill gas probes can no longer be located. Three residential homes were monitored and no detectable landfill gas was reported.

Based on the organic nature of waste reported at this location the potential for landfill gas generation is likely, which is confirmed by the presence of methane measured from landfill gas probes during the early 1980s. The non-detectable methane concentrations at some locations may be due to the screened interval being below the depth to groundwater, which would not allow for the measurement of any landfill gas in the unsaturated zone above the screen. Based on the results of the landfill gas monitoring program in the early 1980s, there is evidence of lateral subsurface migration of landfill gas.

To date there is no indication of landfill gas migration within the residential homes monitored on Kilmarnock Bay.

As shown on Figure EE2, there are utilities located on the Site and nearby the Site, which could act as a preferential pathway for landfill gas. A gas line, sanitary sewer and water main run through the Site along Kilmarnock Bay. A sanitary sewer and water main exist within the control zone along River Road.

### **4.2 Groundwater**

#### **4.2.1 Leachate**

Based on analytical results from P7L, collected between 1988 and 1995, total dissolved solids, sulphate, chloride and several metals, including manganese, iron, sodium, cadmium, chromium and/or lead were elevated above the Guidelines for Canadian Drinking Water Quality during the three groundwater sampling events. The results of these analyses represent the quality of leachate and do not represent the potential impact from the landfill to the surrounding groundwater.

#### **4.2.2 Groundwater**

There is no ongoing monitoring program so no current data is available for review.

### **4.3 Surface Water**

There are no current, or historical, monitoring results for surface water available for review.

**TABLE EE1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 35  
**Site Name** River Road Dump Site

**Landfill Operation**

<b>Waste type</b>	wood waste, street sweepings, leaves and soil fill
<b>Start date</b>	post 1960
<b>End date</b>	1968
<b>Operated by</b>	City of St. Vital
<b>Disposal method</b>	pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	2		
Depth of waste below ground surface (metres)	7.62		
Height above ground surface (metres)	1.5		
Slope %	0	Cover thickness (metres)	0.9 - 1.2
Cover material	Potentially Fill (undocumented)		
Comment on slopes	Gentle slope		

**Environmental Controls**

<b>Description of leachate collection system</b>	N/A
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	45

**Land Use**

<b>Ownership</b>	Private (north, east, south), City of Winnipeg (west)
<b>Current</b>	Open field park
<b>North</b>	Residential
<b>East</b>	Park and residential
<b>South</b>	Park and residential
<b>West</b>	Ashworth St and residential
<b>Comment</b>	--

**Physical Site Setting**

<b>Ground elevation (mASL)</b>	231.6	<b>Groundwater flow direction</b>	Northwest
<b>Potable water? Yes/No</b>	Yes	<b>Water Taking Unit</b>	--
<b>Nearby Water Bodies</b>	None		

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	Not specified	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>		7.6		
<b>Minimum depth to till (metres)</b>		15.2		
<b>Minimum depth to bedrock (metres)</b>		21.0		
<b>Bedrock</b>		Red River (Fort Garry - lower pt.)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	231.6	<b>Max</b>	--

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Leachate monitoring	<b>Current</b>	No
<b>Current surface water</b>	No			
<b>Current landfill gas</b>	Yes			

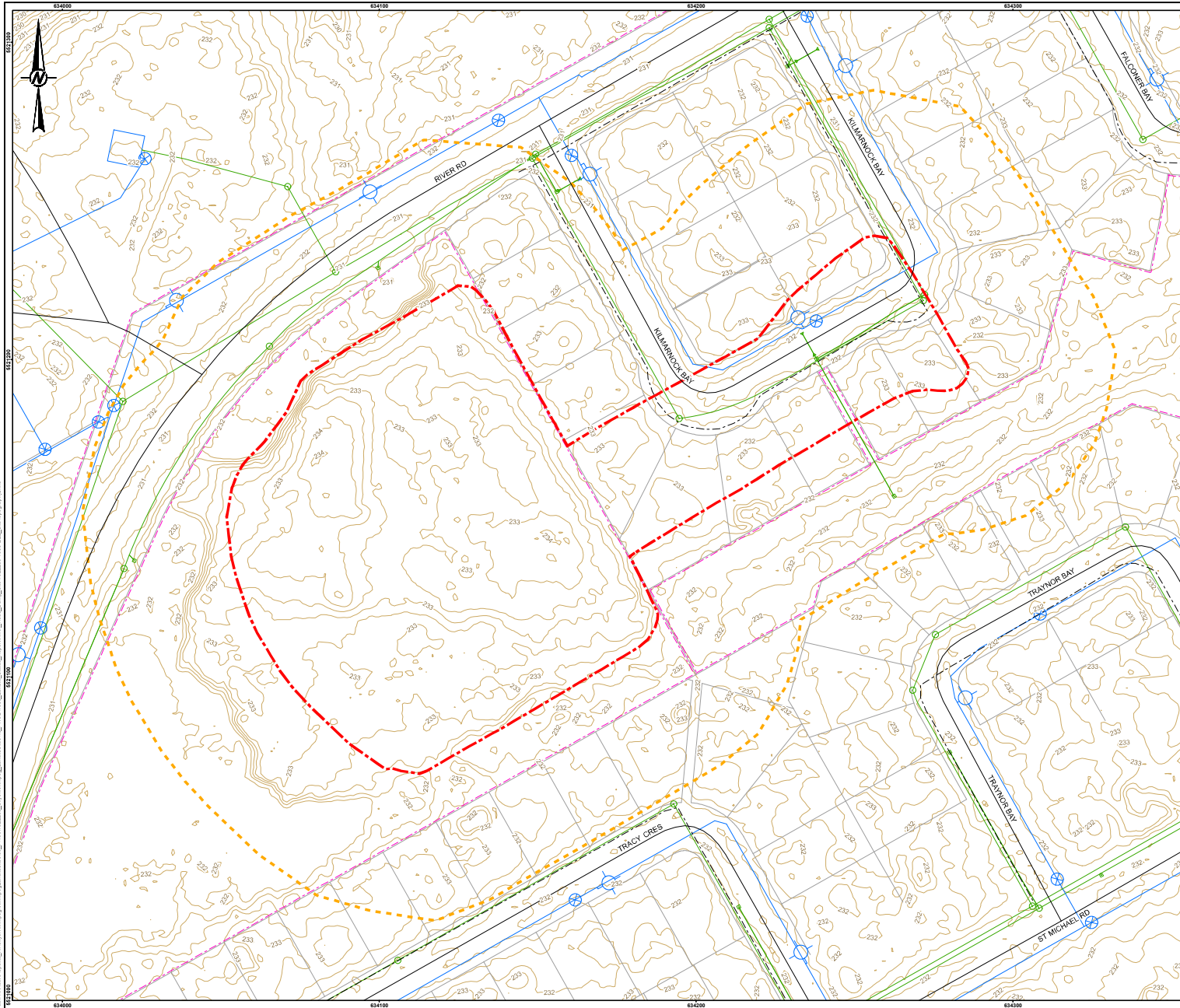
**Notable 2015 Site Visit Observations**

<b>Settlement/slopes</b>	Gentle slope
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	--









**LEGEND**

- LANDFILL FOOTPRINT
- CONTROL ZONE AREA
- ROAD
- TOPOGRAPH C CONTOUR, metres
- UTILITY
  - GAS CABLE
  - SANITARY SEWER
  - WATER MAIN
- CITY OWNED PROPERTY PARCEL
- PROPERTY PARCEL

**KEY MAP**

0 10 20 40  
1:200 METRES

**NOTE(S)**

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. REPORT NO. 1522283/1000.

**REFERENCE(S)**

1. BASEDATA PROVIDED BY CITY OF WINNIPEG.  
2. TOPOGRAPHIC CONTOUR EXTRACTED FROM LIDAR DATASET PROVIDED BY CITY OF WINNIPEG, 2011.  
3. PROJECTION TRANSVERSE MERCATOR DATUM NAD 83  
COORDINATE SYSTEM UTM ZONE 14 VERTICAL DATUM CGVD28

**CLIENT**  
CITY OF WINNIPEG

**PROJECT**  
WINNIPEG LANDFILL STATUS REPORT  
SITE 35: RIVER ROAD DUMP SITE, WINNIPEG, MANITOBA

**TITLE**  
SITE TOPOGRAPHY

CONSULTANT	YYYY-MM-DD	2015-07-29
	DESIGNED	MKF
	PREPARED	BR
	REVIEWED	MKF
	APPROVED	PLE

PROJECT NO.	PHASE	REV.	FIGURE
1522283	1000	A	EE2

\\golder\projects\1522283\1522283\_01\_Site35\_Topography.mxd, 2015-07-29 10:00:00, 1522283\_01\_Site35\_Topography.mxd, 2015-07-29 10:00:00, 1522283\_01\_Site35\_Topography.mxd

25mm IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM

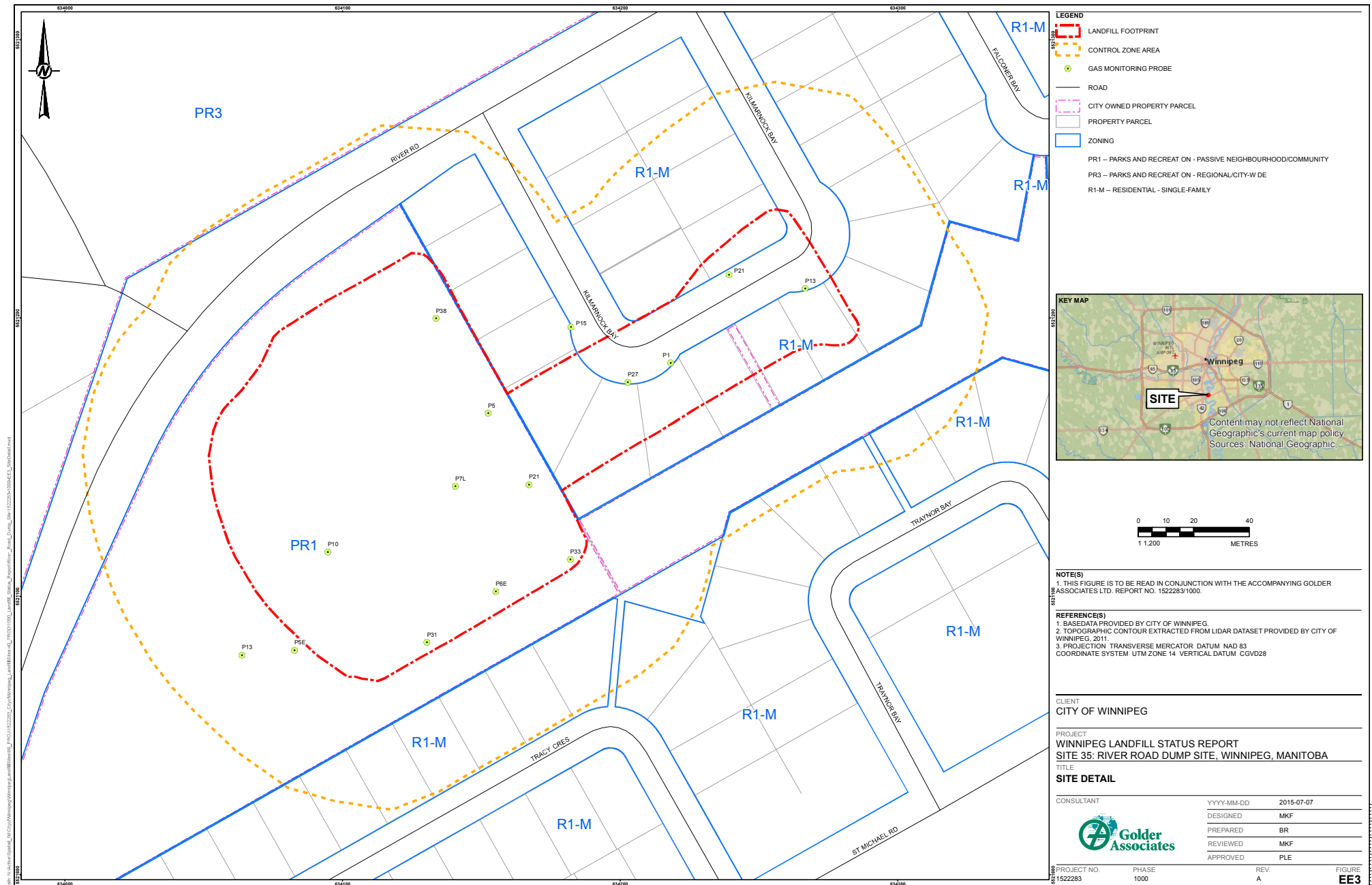







Photo EE1  
Landfill site



Photo EE2  
Houses to the east of the landfill site

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG  
REPORT

PROJECT				WINNIPEG LANDFILL STATUS REPORT			
TITLE				SITE 35: RIVER ROAD DUMP SITE PHOTOGRAPHS			
				PROJECT No. 1522283		PHASE No. 1000	
				DESIGN	July 2015	SCALE AS SHOWN	REV.0
				GIS	—		
				CHECK	MKF	Sept 2015	
				REVIEW	PLE	Sept 2015	
				FIGURE EE4			





# **APPENDIX FF**

## **36. Kilcona Park Landfill Site**



## **1.0 HISTORY**

This appendix describes the current (2015) landfill status at the Kilcona Landfill Site (Site 36), located east of Lagimodiere Boulevard between Knowles Avenue and Springfield Road in Winnipeg, Manitoba, as illustrated on Figure FF1. The Kilcona Park Landfill Site covers an area of approximately 178 hectares (ha) and was operated by the City of Winnipeg from 1976 until it closed in 1987. The waste is expected to be domestic waste.

The subsurface stratigraphy of the area of the Site consists of clay and silty clay underlain by a glacial till and then bedrock. The Paleozoic Carbonate bedrock serves as a regional aquifer. Groundwater flow in the overburden is downward towards to bedrock. The groundwater within the bedrock flows to the southwest.

Order number 472 VO was issued by the Manitoba Clean Environment Commission on December 5, 1975 for the approval of operations at the Kilcona Park Landfill Site. Construction of the base started in 1976 and waste was accepted thereafter.

The landfill base was constructed by excavating 6.0 metres (m) below grade. The natural clay base was not compacted prior to waste placement. The base of the landfill was designed to slope at 1.5%, however, it is unclear if the base was constructed that way. In 1977 a perimeter leachate collection system was installed. The collection system consists of a perforated pipe placed in sand gravel bedding within a 1 metre deep trench located at the perimeter of the base of the landfill. Leachate riser pipes were installed along the side slopes of the excavation with one end in the sand gravel bedding (i.e. the riser pipe is not connected to the collector pipe). The western and southern sides of the western waste mound were surrounded by a perimeter dyke.

During operation of the landfill a series of ponds were constructed around the two waste mounds for stormwater management and aesthetic purposes. Surface water flows to the southwest corner of the Site where it discharges to the Cordite Drain. In 1987 the Site was officially closed. The waste mounds were designed with 5 horizontal to 1 vertical (5H:1V) side slopes and a 1% grade at the top. The final design of the landfill called for a 2 m clay cover. Actual cover thickness of 1.5 m to 4 m has been reported. The scale house was converted to a maintenance building for the park.

Water supply wells on or adjacent to the Site include a water well at the Kilcona Park Recreation Complex (WD25) (formerly known as Harbourview Recreation Complex), the maintenance building (WD24) and at the picnic shelter to the west of the Site (WD26). Domestic water supply wells are used for the residential areas north and west of the Site. Industrial water supply wells are used south of the Site.

Settlement at the Site has been ongoing. The City has brought in material to fill in areas of settlement. Studies addressing issues of slope stability for the southern slope of the western mound were completed in 1986 and 1989 (after a failure of the slope in 1985). In 1993 slope stabilization for the southern slope of the western mound was completed by KGS Group.

In 2013 two reports were completed: "Strategic Renewal and Action Plan for Kilcona Park/Harbourview Recreation Complex" by HTFC Planning & Design, and "Kilcona Landfill Site Assessment" by KGS Group. The Kilcona Landfill Site Assessment provides an overview of the status of the landfill and has been used within this summary.



The surrounding ground elevation at the Site is 232 m above sea level (masl). The bedrock groundwater is at 223 masl, while the groundwater in the overburden is at approximately 230 masl. The leachate within the west waste mound ranges from 226 masl to 238 masl, and the leachate within the east waste mound ranges from 228 masl to 231 masl.

A 90 m landfill gas control zone was allotted for the Site in 1988 as shown on Figures FF1 to FF3. The constraints previously reported for the Site were restricted foundation construction, settlement, bank stability and landfill gas.

## **1.1 Previous Site Visits**

The City performs regular Site visits to the Kilcona Park Landfill Site. Findings from the most recent recorded Site visit, completed June 26, 2014 were as follows:

- The Site inspection was conducted by [REDACTED] solid waste staff from the City of Winnipeg Environmental Branch;
- The ground cover was mostly prairie grass, cattails and a mixture of trees;
- The landfill was well groomed;
- No issues with drainage or leachate were noted;
- No illegal dumping was noted;
- Some cracking in the ground was noted across the Site but primarily at the south end. The cracking could be due to heat;
- Sloughing was noted in the control zone along the edge of the lake; and,
- A City of Winnipeg building is located on-Site and is in good repair.

The following instrumentation was noted in 2014:

- Eleven bedrock groundwater monitoring wells (W2, W4 to W11, W13 to W14);
- One lysimeter (LYS-1);
- Two thermocouples (T4 and T5);
- Three settlement plates (S1, S3 and S4);
- Eleven leachate probes (L1, L4, L5, L7 to L14);
- Nineteen gas probes (P10L, P13E, P14E, P15E, P16E, P19E, P25E, P2E, P28E to P38E). Gas probes, P13E and P16E could not be monitored due to damage;
- Eight risers (R1, R2, R5 to R10). Riser R2 could not be monitored as the cap could not be removed; and,
- Thirty-six piezometers (5N9A to E [except 5N9C which was destroyed], 5N13A to E, 5N15A to D, 5N17A to E, 5N19A to E, 4N20A to D, 4N21A to D, 5N22A to E).





## APPENDIX FF

### 36. Kilcona Park Landfill – Winnipeg Landfill Status Report

## 2.0 LANDFILL STATUS

A Site walkabout was conducted on June 16, 2015 by Megan Farnel from Golder Associates. Megan Farnel was accompanied during the visit by solid waste staff from the City of Winnipeg Environmental Branch.

At the time of the Site visit, the Site was being used as a recreational park with walking trails throughout. It is used by many dog owners in the City. The landfill is split into an east and west portion with a natural gas pipeline running north-south through the centre (with no waste in the area of the pipeline). The side slopes were typically 5H:1V with a gently sloping top. Clean fill has recently been brought to the Site and is intended to be placed in some low-lying areas. The old scale-house area for the landfill is located between the two sections of landfill, within the control zone and is used as a maintenance building.

The direct waste footprint is surrounded by more of Kilcona Park including sports fields and a picnic area (with building) to the west. Beyond the park to the west is another residential area. To the north, beyond the park is a residential area that has domestic groundwater supply wells. To the east are a golf course and the Kilcona Park Recreation Complex, which also has a groundwater well. Beyond the park to the south are commercial and industrial areas.

The Site was mainly grass covered with shrubs, cattails and trees. An area of stressed vegetation was noted near R6 on Figure FF3. Areas of settlement (also noted on Figure FF3) have become wet and overgrown with shrubs and cattails. Fill is being used to bring these settled areas up to grade. Stormwater management ponds are located to the south and north of the Site. The surface water flows to the southwest corner of the Site at which point it discharges to an off-Site drainage network (Cordite Drain) that discharges to Bunn's Creek and eventually the Red River.

Review of the topography on Figure FF2, indicates that the side slopes of both of the waste mounds are outside of the landfill footprint. As well, based on the understanding of the construction of the leachate risers, it would be expected that the riser outlet would be closer to the waste footprint than risers R1, R2, R5 and R6 are to the west waste mound footprint, as shown on Figure FF3. As such, there is potential that the landfill footprints do not accurately reflect the limits of waste. No exposed waste, littering or debris were noted.

A perimeter leachate collection system is around each waste mound with leachate risers installed in the collection system. Leachate probes, groundwater monitoring wells and landfill gas probes are located throughout the Site. A service road provides access to the western waste mound. No landfill gas migration barriers were noted.

See attached Table FF1 and Figures FF1 through FF3 for Site specific details. Site photographs are provided in Figures FF4 through FF7.



## **3.0 MONITORING PROGRAMS**

### **3.1 Landfill Gas**

Landfill gas probes were previously installed at the Site to measure methane gas concentrations in the vicinity of the Site. The landfill gas probes are monitored twice per year. Landfill gas monitoring also occurs at the floor probes in the maintenance building annually.

Landfill gas results from 2001 to 2014 for P10L, P14E, P15E, P19E, P25E, P2E, P28E to P38E were available for review. The results were as follows:

- P15E (east side of east mound) – variable methane detection ranging from non-detectable to 88% of the lower explosive limit (LEL);
- P33E (south side of west mound) – methane detected between 1 and 5% LEL from 2009 to 2012 with no detections since then;
- P38E (southwest of east mound) – variable methane concentrations over time from non-detectable to 44% LEL; and,
- Remainder of locations had no methane detection the majority of the time, with some readings of trace to up to 2% LEL.

Methane has not been detected in the on-Site maintenance building floor probes.

### **3.2 Groundwater**

#### **3.2.1 Leachate**

Leachate is collected from the perimeter leachate collection system. The volume of leachate collected has varied over time from 240,000 litres in 2001 to 2,730,000 litres in 2012, with the average volume at approximately 1,100,000 litres per year. In 2013 and 2014, the volume of leachate was below average at 690,000 and 780,000 litres per year, respectively.

Samples of leachate are collected annually from the leachate risers R1, R5 and R7. The samples are submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, total kjeldahl nitrogen (TKN), ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, metals, volatile organic compounds, polychlorinated biphenyls (PCBs), pesticides and herbicides. Leachate quality results for 2008 through 2014 were available for review.

#### **3.2.2 Groundwater**

Groundwater sampling is conducted in the spring and fall at bedrock groundwater monitors W2, W4 to W11, and W13 to W14. The samples are submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, Total Coliform, fecal coliform, standard plate count, fecal streptococcus, volatile fatty acids, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, and zinc.



### **3.2.3 Water Supply**

Historically, up to 43 domestic, industrial and commercial water supply wells have been monitored in the area of the Site. Water supply wells at the Kilcona Park Recreation Complex (WD25), the on-Site maintenance building (WD24) and at the picnic shelter to the west of the Site (WD26) are sampled twice per year. The samples are submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, soluble organic carbon, turbidity, conductivity, total coliform, fecal coliform, standard plate count, fecal streptococcus, volatile fatty acids, arsenic, calcium, magnesium, manganese, iron, sodium, potassium, cadmium, chromium, copper, nickel, lead, zinc, and volatile organic compounds.

### **3.3 Surface Water**

A semi-annual (spring and fall) surface water monitoring program is carried out at the Site at upstream and downstream locations in the pond system. It should be noted that the downstream location is located at the southwest corner of the Site near Lagimodiere Boulevard and Springfield Road, and may be affected by road salting activities. Two additional locations were added in 2014, although their exact location is unknown.

Fifteen sets of upstream and downstream surface water samples have been collected at the Site between April 2008 and April 2015. The samples are submitted for laboratory analysis of one or more of the following: pH, alkalinity, hardness, total dissolved solids, total suspended solids, total coliform, fecal coliform, total phosphorus, TKN, ammonia, nitrate, nitrite, sulfate, chloride, total organic carbon, turbidity, conductivity, metals and volatile organic compounds.

## **4.0 INTERPRETATION OF CURRENT MONITORING RESULTS**

### **4.1 Landfill Gas**

The Kilcona Park Landfill Site continues to generate landfill gas that has migrated into the control zones. It is noted that organic material has been reported to be placed near P15E and may be contributing to the methane concentrations. Nearby P28E does not detect methane.

It would be expected that the presence of the leachate collection system around the perimeter of the landfill would act as a preferential pathway for landfill gas and curtail it from migrating into the control zone, however, the sand gravel may have become clogged and will not act as a preferential pathway.

### **4.2 Groundwater**

#### **4.2.1 Elevations**

Groundwater level and leachate level monitoring is ongoing at the Site. The groundwater levels measured from bedrock groundwater monitoring wells between 2002 and 2014 ranged from 220 masl to 228 masl with the average water elevation at 223 masl. Groundwater levels measured from the overburden piezometers indicated a groundwater elevation of approximately 230 masl. The leachate within the west waste mound in general ranges from 226 masl to 238 masl, and the leachate within the east waste mound in general ranges from 228 masl to 231 masl. The higher leachate levels may be indicative of perched water conditions.





#### **4.2.2 Leachate**

Based on the leachate quality results from leachate risers R1, R5 and R7 the following was noted:

- Volatile organic compounds are detected in the leachate;
- PCBs were not detected;
- Pesticide/herbicide MCP, 2,4,5-TP (Silvex) and mecoprop were detected;
- Petroleum hydrocarbons (fraction F2) were detected in 2013 (the only year with analysis results available) at leachate riser R7;
- Exceedances of the Guideline for Canadian Drinking Water Quality for the following metals: boron (R7), chromium, manganese, iron, sodium, copper (periodically) and lead; and,
- Exceedances of the Guideline for Canadian Drinking Water Quality for the following inorganic parameters: total dissolved solids, turbidity and chloride.

#### **4.2.3 Groundwater**

Based on the groundwater quality results from bedrock groundwater monitors W2, W4 to W11, and W13 to W14, concentrations of total dissolved solids and turbidity at most locations were elevated above the Guideline for Canadian Drinking Water Quality for the majority of the monitoring sessions. Concentrations of iron, lead and zinc exceeded the Guideline for Canadian Drinking Water Quality occasionally at some of the locations.

Based on the KGS Group's "Kilcona Landfill Site Assessment", the bedrock groundwater is not interpreted to be impacted by landfill leachate.

#### **4.2.4 Water Supply**

Based on the groundwater quality results from water supply wells at the Kilcona Park Recreation Complex (WD25), the on-site maintenance building (WD24) and at the picnic shelter to the west of the Site (WD26) concentrations of total dissolved solids and iron (WD26) were elevated above the Guideline for Canadian Drinking Water Quality for the majority of the monitoring sessions. It is not expected that the water supply wells have been impacted by landfill leachate.

### **4.3 Surface Water**

The concentrations of ammonia exceed the CCME Water Quality Guideline in both the upstream and downstream locations during most sampling events. Concentrations of arsenic (upstream and downstream), pH (upstream) and iron (upstream) also periodically exceeded the CCME Water Quality Guideline. The surface water quality is variable although is sometimes similar between the upstream and downstream.

**TABLE FF1**  
**LANDFILL STATUS REPORT**  
**WINNIPEG, MANITOBA**

**Site Number** 36  
**Site Name** Kilcona Park Landfill Site

**Landfill Operation**

<b>Waste type</b>	Domestic
<b>Start date</b>	1976
<b>End date</b>	1987
<b>Operated by</b>	City of Winnipeg
<b>Disposal method</b>	Pit
<b>Other</b>	

**Landfill Design Details**

Area of footprint (ha)	34		
Depth of waste below ground surface (metres)	6.1		
Height above ground surface (metres)	12.2		
Slope %	1% top slope, 5H:1V side slope	Cover thickness (metres)	1.5 - 4.6
Cover material	compacted clay (1.5 to 4.6 metres)		
Comment on slopes	Some areas of settlement with ponding		

**Environmental Controls**

<b>Description of leachate collection system</b>	Perimeter leachate collection system with leachate risers
<b>Landfill gas migration barriers description</b>	N/A
<b>Landfill gas control zone (metres)</b>	90

**Land Use**

<b>Ownership</b>	City of Winnipeg
<b>Current</b>	Kilcona Park - walking trails, dog park
<b>North</b>	Kilcona Park, followed by residential
<b>East</b>	Kilcona Park followed by golf course and Harbour View Recreation Complex
<b>South</b>	Kilcona Park followed by industrial/commercial land
<b>West</b>	Kilcona Park followed by residential
<b>Comment</b>	--

**Physical Site Setting**

Ground elevation (mASL)		232	Groundwater flow direction	Southwest
Potable water? Yes/No		Yes	Water Taking Unit	Upper Carbonate Aquifer
Nearby Water Bodies	Cordite Drain			

**Site Geology and Hydrogeology**

<b>Range in silt layer elevation (mASL)</b>	<b>Min</b>	Not specified	<b>Max</b>	--
<b>Minimum clay thickness below base grades (metres)</b>		6.1		
<b>Minimum depth to till (metres)</b>		6.1		
<b>Minimum depth to bedrock (metres)</b>		15.2		
<b>Bedrock</b>		Red River (Selkirk)		
<b>Leachate elevation (mASL)</b>	<b>Min</b>	226 (west), 228 (east)	<b>Max</b>	238 (west), 231 (east)

**Monitoring**

<b>Groundwater</b>	<b>Historical</b>	Yes, including domestic water supply wells	<b>Current</b>	Yes
<b>Current surface water</b>	Yes			
<b>Current landfill gas</b>	Yes			

**Notable 2015 Site Visit Observations**

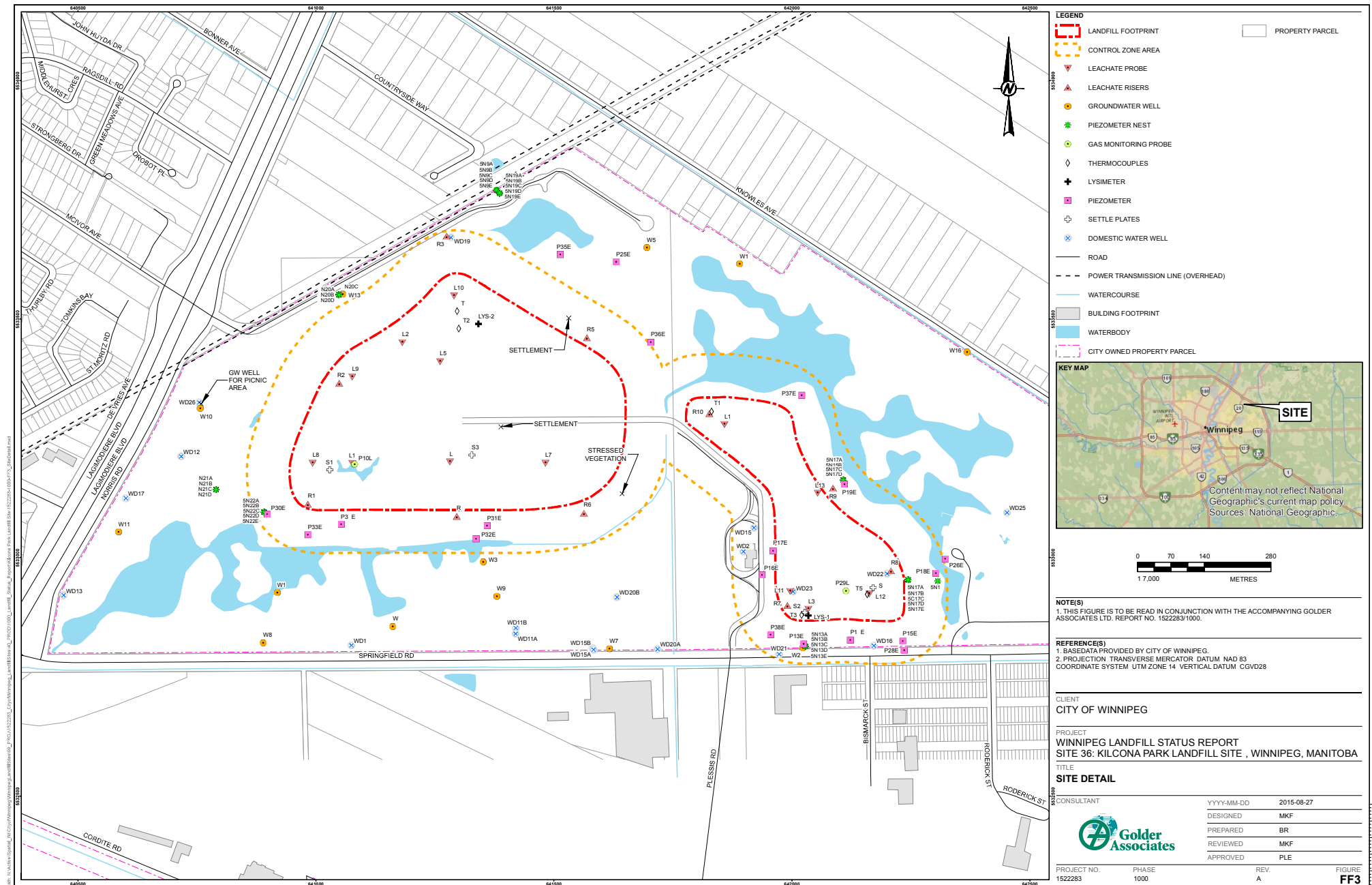
<b>Settlement/slopes</b>	Some areas of settlement with ponding
<b>Erosion</b>	No
<b>Seeps</b>	No
<b>Other</b>	Stressed vegetation noted















**Photo FF1**  
Leachate riser pipe



**Photo FF2**  
Looking southwest at the west mound. Low area with marsh type vegetation growing in foreground.

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT	
TITLE		SITE 36: KILCONA PARK LANDFILL SITE PHOTOGRAPHS	
		PROJECT No. 1522283	
		DESIGN	July 2015
		GIS	—
		CHECK	MKF Sept 2015
		REVIEW	PLF Sept 2015
		PHASE No. 1000	REV.0
		SCALE AS SHOWN	
		FIGURE FF4	






**Photo FF3**  
**Looking northeast with eastern mound**  
**shown at the right.**



**Photo FF4**  
**Southern portion of west mound, looking**  
**east**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
 REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 36: KILCONA PARK LANDFILL SITE PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PIE Sept 2015		
		FIGURE FF5			



**Photo FF5**  
**Area of stressed vegetation**



**Photo FF6**  
**Stormwater management pond at south end of Site**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANY NG REPORT

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 36: KILCONA PARK LANDFILL SITE PHOTOGRAPHS			
	PROJECT No. 1522283		PHASE No. 1000		
	DESIGN	July 2015	SCALE AS SHOWN		REV.0
	GIS				
	CHECK	MKF Sept 2015			
	REVIEW	PIE Sept 2015			
		FIGURE FF6			





**Photo FF7**  
**Eastern mound with Kilcona Park Recreation  
 Complex in background near the water**

**NOTE**

THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING  
 REPORT



**Photo FF8**  
**Maintenance garage in the area between the  
 two mounds**

PROJECT		WINNIPEG LANDFILL STATUS REPORT			
TITLE		SITE 36: KILCONA PARK LANDFILL SITE PHOTOGRAPHS			
		PROJECT No. 1522283		PHASE No. 1000	
		DESIGN	July 2015	SCALE AS SHOWN	REV.0
		GIS	—		
		CHECK	MKF Sept 2015		
		REVIEW	PLF Sept 2015		
		<b>FIGURE FF7</b>			



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