



MEMORANDUM

TO Sandra Brunet, B.Sc., City of Barrie

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CC

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PROJECT No. 11-1170-0043

SUMMARY OF WORK PROGRAMS CONDUCTED AT THE DYMENT'S CREEK LANDFILLS CITY OF BARRIE

Golder Associates Ltd. ("Golder") has been retained by the City of Barrie ("City") to provide a summary of the work programs conducted at the Dymont's Creek Landfills between 2011 and 2016. The desktop and initial field portions of the investigations were initiated in 2011 and have been ongoing since. This memorandum summarizes the main findings of the following reports:

- Golder Associates Ltd., 2013. *D-4 Study and Environmental Assessment – Final Report, Dymont's Creek Landfills, City of Barrie*. Report prepared for the City of Barrie and dated April 2013 (**2013 D-4 Study and Environmental Assessment Report**).
- Golder, 2014. *Supplemental Environmental Investigations – Final Report, City of Barrie's Dymont's Creek Historical Landfills*. Report prepared for the City and dated September 2014 (**2014 Supplemental Environmental Investigations**).
- Golder Associates Ltd., 2015. *2014 Annual Monitoring Report – Final Report, Dymont's Creek Landfills – City of Barrie*. Report prepared for the City of Barrie and dated September 24, 2015 (**2014 Annual Monitoring Report**).
- Golder Associates Ltd., 2016. *2015 Annual Monitoring Report – Final Report, Dymont's Creek Landfills – City of Barrie*. Report prepared for the City of Barrie and dated June 6, 2015 (**2015 Annual Monitoring Report**).
- Golder Associates Ltd., 2017. *2016 Annual Monitoring Report – Final Report, Dymont's Creek Landfills – City of Barrie*. Report prepared for the City of Barrie and dated April 2017 (**2016 Annual Monitoring Report**).

Background

The Ministry of the Environment and Climate Change (MOECC, Ministry) identified nine possible closed waste disposal sites within the City on the basis of information collected largely in 1979, supplemented with information available up to 1994 when the Ministry Waste Inventory was finalized. Two of these landfills were investigated and concluded that they were reported in error and were removed from the Ministry inventory. The remaining landfills were operated from approximately 1930 to 1964, following which the City commenced the use of the Sandy Hollow Landfill (now known as the Barrie Landfill). The exact limits of the sites were not known, however it was expected that they were largely completed by filling of low lying lands, in most cases next to Bunker's and Dymont's Creeks, including the areas known as Milligan's Pond, Brock Park, and the west end of Frederick Street. Residential, commercial, and industrial development has occurred on parts of the waste sites; the remainder is public parkland.

The Dymont's Creek landfills are present on both sides of Dymont's Creek, and are bounded by Anne Street to the west, Bradford Street to the east, John Street to the north, and Brock Street to the south. The landfills operated



MEMORANDUM

from approximately 1961 to 1963, and are expected to have largely operated as infilling within the low lying areas along Dymont's Creek.

These investigations were initially completed to assess and reduce the area required to have specialized studies (i.e. D-4 Studies) completed prior to planning approvals for proposed development. MOECC guidelines state that D-4 Studies are required to be completed within 500 m of any operating or closed landfill unless a reduction in this 500 m limit can be supported by additional investigations.

2013 D-4 Study and Environmental Assessment Report and the 2014 Supplemental Environmental Investigations

Summary of Work

- Historical investigation
 - A limited historical information study was conducted to determine if historical information could be used to confirm or refute the presence of landfills at properties identified in the Ministry Waste Disposal Site Inventory (MOECC, 1991). It was determined that seven sites could be combined into two essentially contiguous waste disposal sites located along parts of Bunker's Creek (Sites 1, 2, 3 and 7) and Dymont's Creek (Sites 4, 5 and 6) between Anne Street and Bradford Street.
- Subsurface Investigation
 - Drilling 39 boreholes in 2011 and 10 boreholes in 2013 to characterize the limits of waste. Locations were chosen inside and outside the anticipated waste disposal area footprint;
 - Installation of seven monitoring wells in 2011 and two additional monitoring wells in 2013 to allow for the assessment of groundwater quality in the vicinity of the waste. The deepest wells were installed at the base of waste, if present. A shallow landfill gas probe was installed above the water table at these same locations, where possible;
 - Installation of an additional 12 landfill gas probes in 2011 and nine in 2013 in areas to assess landfill gas;
 - Collection of soil samples during drilling for visual characterization, headspace screening of volatile organic compounds and submission to the analytical laboratory where warranted;
 - Collection of groundwater samples from the monitoring wells;
 - A minimum of one soil sample was submitted for each borehole where waste was encountered during drilling and was analyzed for typical landfill parameters (i.e., common for similar historical landfill sites in Ontario) and waste classification;
 - Groundwater samples were collected from each monitoring well at least twice and submitted for analysis of typical landfill parameters; and,
 - Measurement of landfill gas (methane, carbon dioxide and oxygen) concentrations at the gas probes using a GEM 2000 gas meter.

Based on these investigations, the combined area requiring D-4 Assessment was reduced from approximately 219 hectares (i.e. a 500 m radius from the limits of the landfills) to 23.2 hectares with some areas reduced to the



MEMORANDUM

limits of waste. This reduction was reviewed and approved by the MOECC. Monitoring of conditions in the Landfills was recommended following the completion of the 2013 investigations.

2014 Annual Monitoring Report

Summary of Work

In 2014, the following monitoring program was conducted:

- Collection of groundwater samples from nine monitoring wells (MW-D1 through MW-D7, MW-D26, and MW-D29);
- Collection of surface water samples from five locations along Dymont's Creek upstream, adjacent to and downstream of the Dymont's Creek Landfills (SWD1 through SWD5); and,
- Measurement of landfill gas (methane, carbon dioxide and oxygen) concentrations at 28 landfill gas monitors (GP-D1 through GP-D28) using a GEM 2000 gas meter; and,
- Submission of groundwater and surface water samples for chemical analysis of typical landfill parameters.

2015 Annual Monitoring Report

Summary of Work

In 2015, the following monitoring program was conducted:

- Collection of groundwater samples from nine monitoring wells (MW-D1 through MW-D7, MW-D26, and MW-D29);
- Collection of surface water samples from five locations along Dymont's Creek upstream, adjacent to and downstream of the Dymont's Creek Landfills (SWD1 through SWD5);
- Measurement of landfill gas (methane, carbon dioxide and oxygen) concentrations at 28 landfill gas monitors (GP-D1 through GP-D28) in March (frozen ground), September and December using a GEM 2000 gas meter; and,
- Submission of groundwater and surface water samples for chemical analysis of typical landfill parameters.

2016 Annual Monitoring Report

Summary of Work

In 2016, the following monitoring program was conducted:

- Decommissioning of gas probe GP-D28;
- Groundwater and landfill gas monitoring, including:
 - Collection of groundwater samples in September 2016 from nine monitoring well locations;
 - Collection of surface water samples from five locations along Dymont's Creek upstream, adjacent to and downstream of the Dymont's Creek Landfills (SWD1 through SWD5) in September 2016;
 - Analysis of collected groundwater and surface water samples for typical landfill related parameters; and,



MEMORANDUM

- Measurement of landfill gas (methane, carbon dioxide and oxygen) concentrations at select locations (i.e., GP-D2, GP-D3, GP-D4, GP-D5, GP-D6, GP-D8, GP-D9, GP-D10, GP-D11, GP-D12, GP-D13, GP-D14, and GP-D18) in March (frozen ground) and October 2016.

Findings

Golder has carried out monitoring of groundwater, surface water and landfill gas in the area of the Dymont's Creek Landfills since 2011. Based on the overall findings of the monitoring program completed to date, the following information is of note:

- **Soil** – soil impacts, where present, are limited to materials within the waste fill limits.
- **Groundwater** – there have been no significant changes in groundwater quality during the completion of the Annual Monitoring Programs. Impact located hydraulically up-gradient of Site 6 and south of John Street is interpreted to be due to road salt. Wells located within the waste fill area are impacted by the presence of waste, however the results are not significantly changing over time. Monitoring well MW-D29, located downgradient from the landfills does not appear to be impacted by the presence of the landfills.
- **Surface Water** – Surface water quality in the vicinity of the landfills does not appear to be significantly impacted by the landfills. Chemical concentrations above the Provincial Water Quality Objectives are typical of surface water quality throughout the City and are not considered to indicate landfill related impacts.
- **Landfill Gas** – It is known that elevated landfill gas concentrations in the past have been an issue in the east portion of the landfills and have been the subject of correspondence and investigation by the MOECC and the City. It appears that the landfill gas concentrations above 5% of the Lower Explosive Limit of methane are limited to the waste fill area and that there is little to no migration of landfill gas detected beyond those limits. Whereas continued monitoring is warranted to ensure conditions do not change, the risk associated with methane concentrations in this area is not expected to increase.

Recommendations

Based on the findings of the most recent Annual Monitoring Programs, the following recommendations were provided:

- Further assessment and remediation, where required, of landfill gas migration from City-owned lands, specifically near the north edge of the west portion of the landfills, should be undertaken;
- Due to consistent results since 2011 which do not show that groundwater is impacted by the landfills, further groundwater monitoring is not recommended;
- The surface water quality should be monitored annually at the established locations; and,
- The samples should be analyzed for typical landfill related parameters, consistent with previous sampling events.