

# Groundwater Plume Delineation Closed Sabiston Landfill, Markham, Ontario

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9 October 2013



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# Outline

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- Site History and Background
- Primary Environmental Concerns Related to the Former Sabiston Landfill:
  - Landfill Gas
  - Leachate
- Current Groundwater Quality Observations
- Why additional monitoring well are required
- Proposed method to be used to install new monitoring wells
- Questions / Discussion

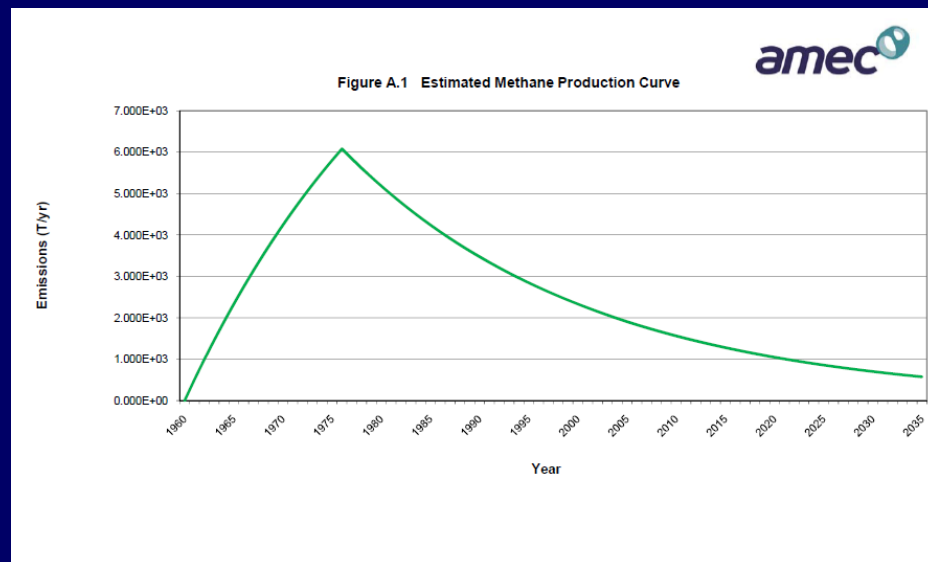
# Site Background / History

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- Former sand pit operated by James Sabiston Ltd.
- Wastes were deposited in the western part of the Site from 1960s to 1975. Wastes typically consisted of:
  - Household (e.g. fabric, glass, foods, plastic, paper, rubber)
  - Building rubble (e.g. wood, bricks, cement, insulation, asphalt)
  - Metal waste (e.g. copper, iron)
- Fill was also deposited in eastern portion of the Site from 1975 to 1989 that typically consisted of soil with some brick, plastic, wood, asphalt, and rail ties
- No impermeable liner, waste rests directly on sand aquifer
- Ownership of the Site and associated environmental liabilities were transferred to the City of Markham in the 1980s
- As the owner of the Site, the City of Markham has an obligation to monitor groundwater quality and evaluate potential impacts to the environment

# Landfill Gas

- Landfill gas is produced during the decomposition of waste – primarily composed of methane and carbon dioxide
- Monitoring information indicates that the volume of methane collected at the blower from January 2010 to April 2012 ranged from 480 to 1,200 T/yr
- The on-going presence of landfill gas at the Sabiston Landfill is evidence that the waste is still actively undergoing decomposition
- Modeling completed by AMEC also indicates that landfill gas will continue to be generated at the Site for many more years (see graph below)
- The landfill gas collection system and associated monitoring program will continue to operate at the Site until landfill gas concentrations decrease to level that no longer pose a risk



# Landfill Leachate

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- Landfill leachate is produced when rainwater infiltrates through the landfill and becomes impacted by the buried wastes
- Leachate can adversely impact groundwater and surface water quality
- Primary concerns with respect to leachate at the Sabiston Landfill :
  - Potential impacts to the surface water quality in the German Mills Creek
  - Impacts to downgradient groundwater users such as the Bayview Golf and Country Club (Irrigation Well)
- Groundwater and surface water quality are monitored at the Former Sabiston Landfill two times per year as part of an annual environmental monitoring program that is conducted by the City in cooperation with the Ontario Ministry of the Environment

# Contaminating Lifespan

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- The period of time during which a landfill will produce leachate at levels that could have unacceptable impact if they were discharged to the surrounding environment
- The amount of leachate produced by a landfill decreases over time, but it typically takes many decades before leachate levels no longer pose a threat to the environment
- Even at a low production rates, leachate is still capable of causing impacts to the environment
- Groundwater quality monitoring must continue to be performed long after a landfill is closed
- The results of the on-going water quality monitoring program indicates that the Sabiston Landfill is still producing leachate that could potentially impact the environment and hence must continue to be monitored

# Summary of Current Groundwater Quality at Sabiston Landfill

- Ground water quality monitoring program indicate that the following leachate parameters exceeded the applicable MOE Standards in 2012:
  - Trichloroethylene - max. concentration = 89 ug/L
    - 55 times higher than MOE Standard of 1.6 ug/L
  - Cis 1,2 – Dichloroethene – max. concentration = 5.2 ug/L
    - 3 times higher than MOE Standard of 1.6 ug/L
  - Vinyl Chloride – max. concentration = 0.66 ug/L
    - Marginally higher than MOE Standard of 0.5 ug/L
  - Arsenic – max. concentration = 0.13 mg/L
    - 5 times higher than MOE Standard of 0.025 mg/L
  - Chloride – max. concentration = 5200 mg/L
    - 20 times higher than MOE Standard of 250 mg/L
  - Dissolved Organic Carbon – max. concentration = 190 mg/L
    - 38 times higher than MOE Standard of 5 mg/L
- The occurrence of these parameters is evidence that the landfill continues to produce leachate that has the potential to cause unacceptable impacts to the environment

## Risks Associated with Leachate Impacted Groundwater

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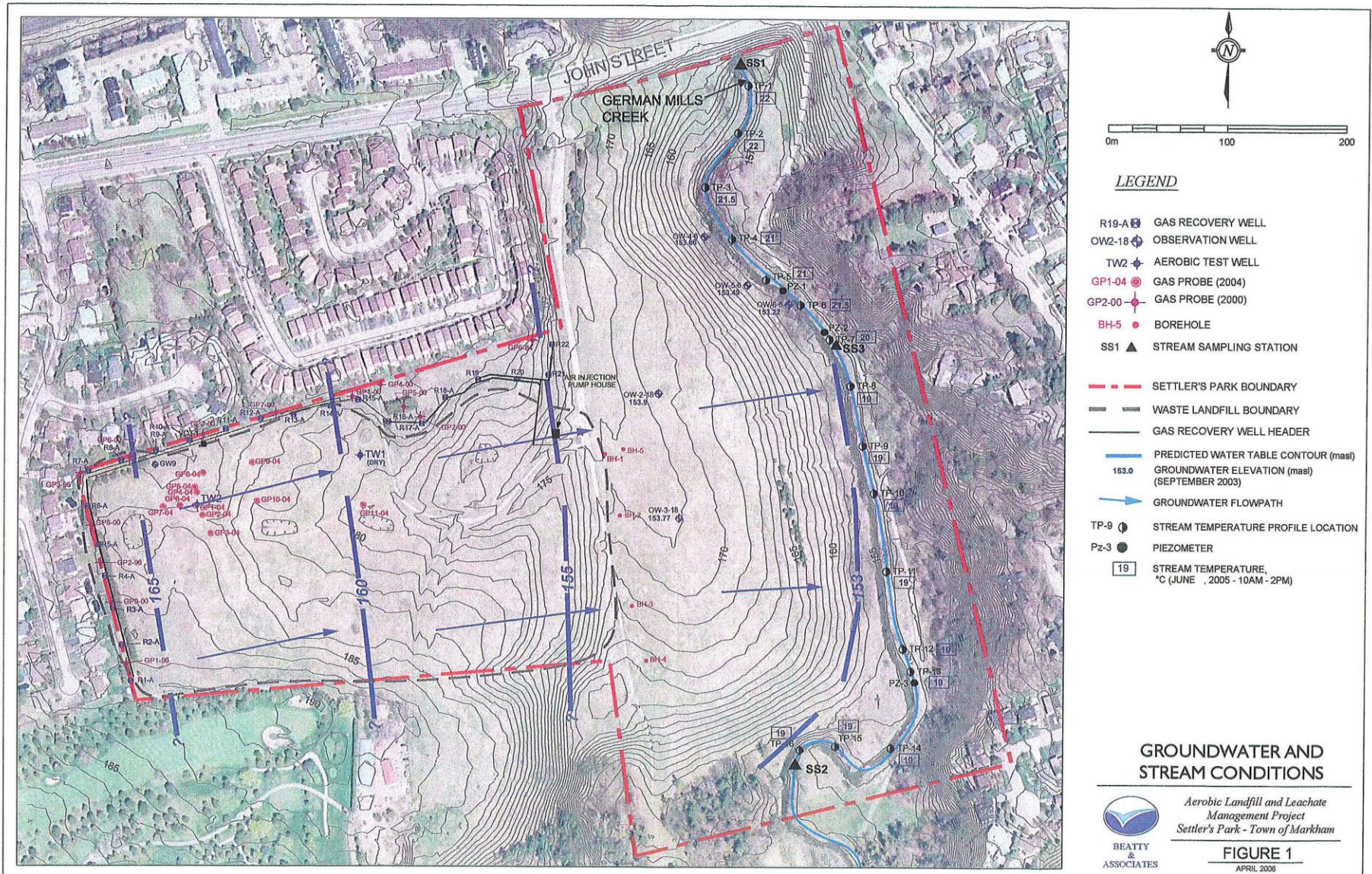
- Primary concern relates to the potential for leachate impacts to impair water quality in German Mills Creek
  - If they were allowed to occur such impacts could represent a violation of the Federal *Fisheries Act*, *Ontario Water Resources Act* and *Ontario EPA*
  - For example, in 2004 the City of Kingston was convicted for violations under the Fisheries Act related to the Closed Belle Park Landfill Site (which received wastes from 1952 to 1974) for allowing leachate to enter the Inner Harbour
- Other potential risks include:
  - Impacts to groundwater quality at the Bayview Golf and Country Club irrigation well
  - Impacts to indoor air quality related to the migration of vapours into buildings
- The annual environmental monitoring program allows the City to proactively identify potential issues so steps can be taken to address them before they cause unacceptable impacts

# Why are new monitoring wells required ?

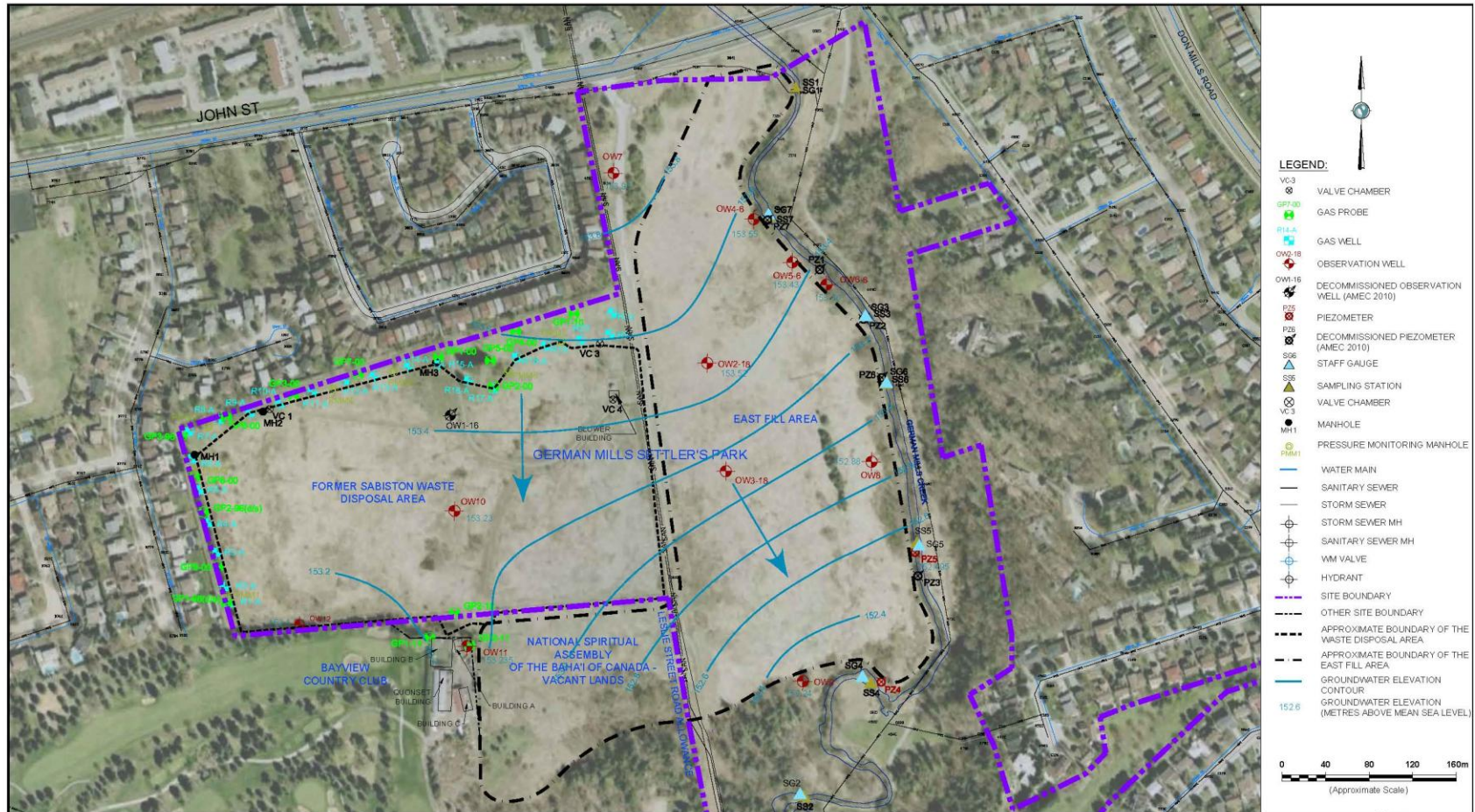
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- From time-to-time it is necessary to modify landfill monitoring programs to address new issues that arise and as the understanding of a Site changes based on new information
- Prior to 2009 the groundwater at the Sabiston Landfill Site was assumed to flow in an easterly direction, however, additional information obtained in 2010 indicated that groundwater actually flows in a south-southeasterly direction
- In 2012 it was determined that groundwater on the southern boundary (OW 11) of the Site was impacted with trichloroethylene (a degreasing solvent)
- Other leachate indicator parameters such as chloride also exceed the applicable Standards downgradient of the landfill
- These changes in the understanding of the Site conditions requires that additional monitoring wells be installed to the south and east of the landfill to allow for potential leachate impacts to be identified and addressed
- The additional monitoring wells are required to ensure that landfill operates in compliance with environmental statutes and regulations

# Groundwater Flow - ca. 2006 Interpretation

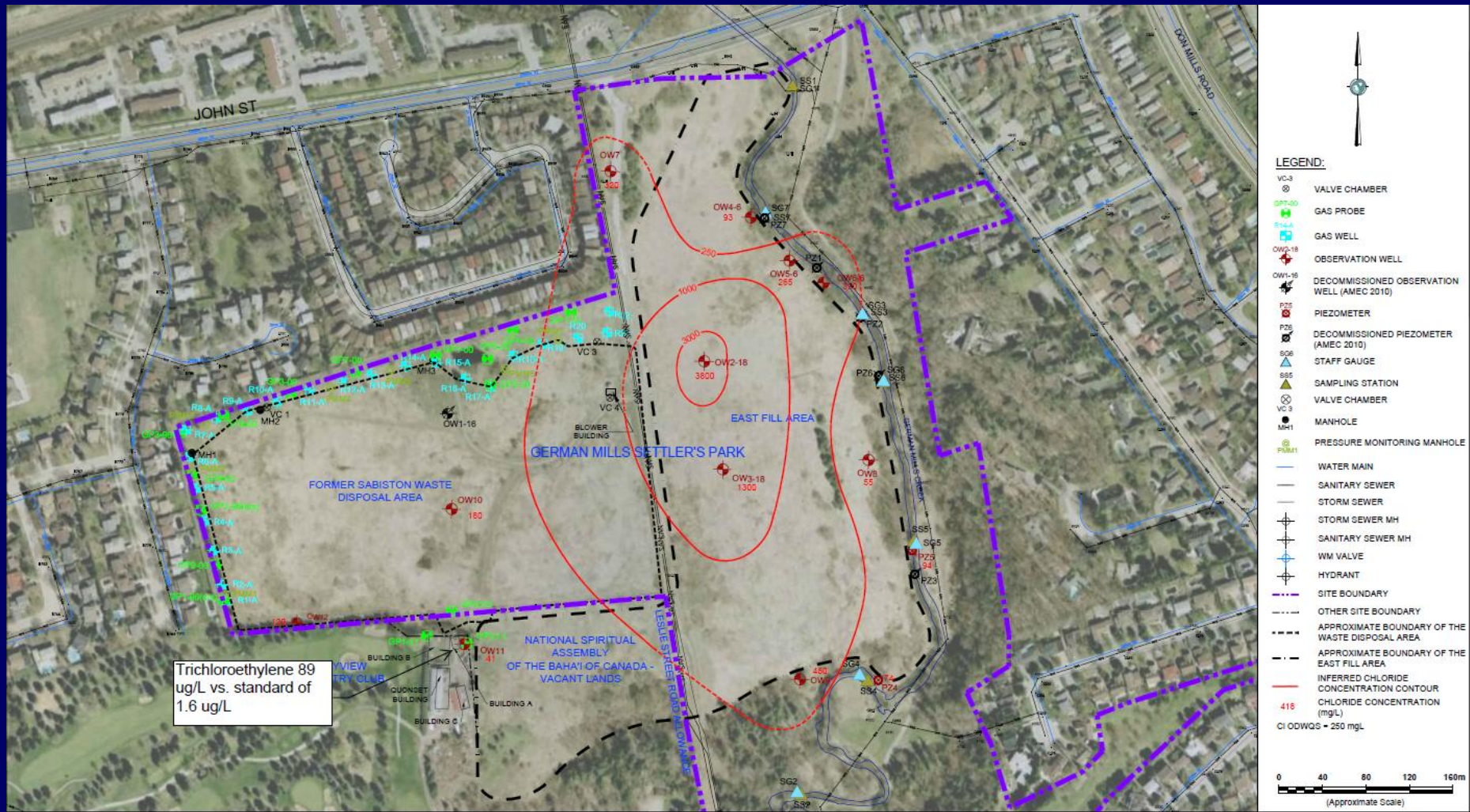


# Groundwater Flow – ca. 2012 Interpretation



<p><b>NOTE:</b></p> <p>GROUNDWATER CONTOURS ARE BASED ON GROUNDWATER ELEVATIONS MEASURED IN MONITORING WELLS ON OCTOBER 16, 2012. THE MEASURED GROUNDWATER ELEVATION AT OW5-18 WAS NOT CONSIDERED REPRESENTATIVE, SINCE THIS MONITORING WELL IS NOT SCREENED IN THE SAME UNIT AS THE REMAINING MONITORING WELLS (I.E., THE UPPER AQUIFER)."</p>	<p><b>CLIENT:</b></p> <p>CITY OF MARKHAM</p> <p><b>AMEC Environment &amp; Infrastructure</b> 3190 Steeles Avenue East, Unit #305 Markham, Ontario L3R 1G9</p>	<p><b>OWN BY:</b> ZF</p> <p><b>CHKD BY:</b> TC</p> <p><b>DATE:</b></p> <p><b>PROJECTION:</b></p> <p><b>SCALE:</b> AS SHOWN</p>	<p><b>PROJECT</b></p> <p>2012 ENVIRONMENTAL MONITORING REPORT FORMER SABISTON LANDFILL, MARKHAM, ONTARIO</p> <p><b>TITLE</b></p> <p>GROUNDWATER ELEVATIONS IN UPPER AQUIFER - 16 OCTOBER 2012</p>	<p><b>DATE:</b> MARCH 2013</p> <p><b>PROJECT NO.:</b> T0110010.2000</p> <p><b>REV. NO.:</b> A</p> <p><b>FIGURE NO.:</b> 11</p>
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# Groundwater Impacts – Chloride / TCE



CLIENT:  
CITY OF MARKHAM

AMEC Environment & Infrastructure  
3190 Steeles Avenue East, Unit #305  
Markham, Ontario L3R 1G9



OWN BY: ZF  
CHKD BY: TC  
DATE:  
PROJECTION:  
SCALE: AS SHOWN

PROJECT  
2012 ENVIRONMENTAL MONITORING REPORT  
FORMER SABISTON LANDFILL, MARKHAM, ONTARIO  
TITLE  
CHLORIDE CONCENTRATIONS IN GROUNDWATER  
17 OCTOBER 2012

DATE: MARCH 2013  
PROJECT NO: TO110010.2000  
REV. NO: A  
FIGURE NO: 13

# Proposed Well Installations – How?

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- **Installation of 11 new monitoring wells at 8 locations**
  - Strategically located to assess groundwater conditions downgradient of the Site and in deeper aquifer
- **Sensitive to protection of natural habitat**
  - no clearing, located in grassed areas
  - drilling schedule to take place outside of ground bird nesting period
  - Work will be completed in accordance with requirements of the Conservation Authority and Ministry of Natural Resources
  - erosion and sediment controls will be implemented to contain drill cuttings
  - rehabilitation and re-seeding will be completed as necessary
- **Similar to previous drilling work completed in 2010 and 2011**
  - limited localized disturbance - drill sites will only occupy the footprint of a medium-size truck
  - short-term disturbance (about 1 month to complete)
  - comparable to routine maintenance activities that are performed at the Site for both the landfill gas collection system and the sanitary sewer forcemains
- **Once installed, monitoring wells have minimal footprint**
  - no impact on natural habitat
  - monitoring activities are not noisy, hand-held equipment used only, similar to public use of park

# Proposed Monitoring Well Locations



# Proposed Well Installations – Drill Rigs



# Summary

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- While the landscape has naturalized, the results of the water quality monitoring indicate that the underlying waste is still generating leachate that is capable of causing unacceptable impacts to the environment
- An improved understanding of groundwater flow and the results of recent water quality sampling indicate that additional monitoring wells need to be installed to monitor for possible leachate impacts downgradient of the Site and in the deeper aquifer
- Monitoring wells will be installed in a manner that minimizes any disturbance to the natural habitat
- Work is necessary to ensure that Site continues to operate in compliance with environmental statutes and regulations

## Questions / Discussion

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- Questions ?

