PHASE III LANDFILL INVESTIGATION WORK PLAN

G&H LANDFILL SITE
MACOMB COUNTY, MICHIGAN

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1.0 INTRODUCTION

Conestoga-Rovers & Associates (CRA) has prepared this Phase III Landfill Investigations Work Plan (Work Plan) on behalf of the G&H Landfill PRP Group (Group), detailing the proposed additional investigation activities on the west side of the Phase III Landfill, part of the G&H Landfill Site, located in Shelby Township, Michigan (Site). The additional investigations are being performed to further define subsurface conditions in the vicinity of the Phase III Landfill.

The Phase III Landfill Investigation Work Plan is organized into the following sections:

Section 1.0 Introduction
Section 2.0 Background/Purpose
Section 3.0 Work Plan Outline
Section 4.0 Implementation
2.0 BACKGROUND/PURPOSE

Orange-colored discharges have been observed at various Phase III Landfill tile drains that discharge precipitation from the drainage layer of the landfill cap. According to the Michigan Department of Environmental Quality (MDEQ), the orange-colored discharges from the perimeter drainage trench and associated drainage tiles/daylights could represent leachate passing through the drainage media of the toe drain system and entering the perimeter drainage trench during elevated hydraulic head conditions. In addition, the MDEQ measured elevated levels of methane in one of the drainage tiles along the southwestern side of the landfill during a Site visit in September 2012.

The purpose of this work plan is outlined below:

- Provide supplemental information to assess the potential origin of orange-colored discharges observed at the Phase III Landfill perimeter tile drains
- Verify the groundwater hydraulic profile on the west side of the Phase III Landfill
- Assess whether landfill gas is present in the subsurface west of the Phase III Landfill and whether landfill gas may potentially be migrating off site
- Further define the geologic/hydrogeologic conditions on the west side of the Phase III Landfill

If it is determined that the orange-colored discharges from the drainage tiles/daylights is from leachate, the data and information generated from implementation of this work plan will be utilized to assess potential pathways for leachate entering the perimeter drainage trench and associated drainage tiles/daylights. The information obtained from implementation of the work plan will also provide useful information to better understand the conditions in the Phase III Landfill area. The Work Plan for the additional investigations along the west side of the Phase III Landfill is presented in the following sections.
3.0  WORK PLAN OUTLINE

The following investigation activities are proposed for the west side of the Phase III Landfill:

- Installation of two series of three piezometers each (six piezometers total) to allow the hydraulic profile of the groundwater/leachate to be better understood across the Phase III Landfill and whether the groundwater/leachate may be entering the perimeter drainage trench during elevated hydraulic head conditions. The three piezometers for each series are as follows: series 1: PZ-4A, B, C and series 2: PZ-5A, B, C. The locations of the piezometers are presented on Figure 1. A profile of the piezometer locations on the west of the slope of Phase III Landfill is presented on Figure 2 as discussed below:
  - Two piezometers will be installed near the top of the Phase III Landfill slope to better understand the depth of the groundwater/leachate beneath the landfill (series 1: PZ-4A, series 2: PZ-5A).
  - Two piezometers will be installed on the up-gradient side of the leachate toe drain system (series 1: PZ-4B, series 2: PZ-5B).
  - Two piezometers will be installed between the collection toe drain and the perimeter tile drain trench (series 1: PZ-4C, series 2: PZ-5C).
  - The PZ-4 piezometer series will be aligned with existing monitoring wells GH30A/B, RL-29 and GW-11 to create a hydraulic profile across the Phase III Landfill. Similarly, the PZ-5 piezometer series will be beneath the refuse.

- Installation of two boreholes immediately west of the Phase III Landfill toe drain to confirm the geology in this area. The location of the two additional boreholes, BH-01-12, BH-02-12 is presented on Figure 1. Upon completion, the two boreholes will be completed as gas probes to assess the presence of landfill gas west of the Phase III Landfill. The gas probes will be designated as GP-11 and GP-12 to maintain the numbering sequence from the existing perimeter gas probes currently in place.

- Following installation, a round of static water levels will be obtained from all Phase III Landfill piezometers and monitoring wells.

- The new and existing gas probes and cap drains/vents on the Phase III Landfill will be monitored for the presence of landfill gas including methane, carbon dioxide, oxygen and pressure (if applicable).
4.0 IMPLEMENTATION

Prior to initiating any field activities, CRA will update the Site specific Health and Safety Plan (HASP). The updated HASP will include all field activities to be performed to complete the installation of piezometers and boreholes/monitoring wells and will document all physical and chemical hazards associated with the completion of the Work Plan.

Prior to mobilization to the Site, the drill rig and all associated downhole drilling and sampling equipment will be thoroughly decontaminated.

The location of utilities on the west side of Phase III Landfill will be verified prior to all installation activities. The location of the perimeter drainage trench and toe drain will be verified using geophysical methods or direct excavation.

The following paragraphs provide a detailed description of the installation of piezometers and boreholes to be converted into monitoring gas probes.

4.1 PIEZOMETER INSTALLATION

The locations of the six piezometers are presented on Figure 1 and Figure 3. The piezometers at the toe of the landfill (PZ-4B & C and PZ-5B & C) will be advanced to a depth that is at the bottom elevation of the Phase III Landfill toe drain. The piezometers on the top of the landfill (PZ-4A and PZ-5A) will penetrate the refuse and end in natural soils underneath the landfill, for a complete understanding of the stratigraphy on the west side of Phase III Landfill. Accordingly, the piezometers will be advanced to the following depths:

- The two piezometers near the top of the Phase III Landfill slope (PZ-4A and PZ-5A) will be advanced to a depth of approximately 55 feet below the ground surface (bgs)
- The two piezometers on the up-gradient side of the leachate toe drain system (PZ-4B and PZ-5B) will be advanced to a depth of approximately 20 feet bgs
- The two piezometers between the collection toe drain and the perimeter tile drain trench (PZ-4C and PZ-5C) will be advanced to a depth of approximately 15 feet bgs

The construction details for the proposed piezometers are shown on Figure 4. The piezometers will be drilled and installed employing hollow-stem auger (HSA) drilling techniques to produce an 8-inch diameter borehole. The boreholes will be advanced to
the approximate depths, as specified above, depending on their location on the slope of the Phase III Landfill. Representative samples will be collected for geologic characterization purposes using split-spoon samplers. Soil samples collected from the boreholes will be logged detailing geologic conditions encountered, soil classification in accordance with the Unified Soil Classification System (USCS), relative moisture content and photoionization detector (PID) headspace readings for volatile organic compounds (VOCs). Soil samples collected from each borehole will be screened in the field for evidence of impact based on visual and olfactory observations and on VOC readings, as measured by the PID. Drill cuttings will be temporarily containerized in storage drum(s) in an area at the Site designated by CRA.

The piezometers will be constructed of 2-inch diameter polyvinyl chloride (PVC) (Schedule 40) sonic welded wire wrapped well screens attached to 2-inch diameter PVC riser pipes with flush threaded joints. Well screens will be No. 10 slot size and 5-feet long. The artificial sandpack will consist of 20 mesh sand and will be placed by the tremie method to a variable height of no more than 2 feet above the top of the screen. A 1-2 foot thick bentonite pellet seal will be placed above the sandpack, depending on the location of the piezometers on the slope of Phase III Landfill. An additional bentonite seal will be placed across the clay layer of the landfill cap to restore the seal of the low permeability layer of the cap. To provide additional protection, a GCL skirt will be installed along with a repair boot. The annular space above both of the bentonite pellet seal will be sealed with bentonite/cement grout by the tremie method. The upper 1-2 feet of the annular space will be filled with concrete to form an apron which will slope away from the well to drain surface water. The piezometers will be equipped with a lockable steel protective casing.

Following installation, the piezometers will be developed until a sediment-free condition is achieved by purging five to ten well volumes. The volume of water removed from the well during development will be recorded.

A round of static water levels will be collected from the Phase III piezometers and monitoring wells following development of each location. Water levels will be subsequently collected on a quarterly basis and during periods when discharge from the perimeter tile drains is observed.

The locations of the piezometers, as well as the top-of-casings and ground surface, will be surveyed by a Michigan accredited land surveyor. Additionally, the extraction well and two piezometers (TEW-1-12, PZ-1-12 and PZ-2-12) installed to perform an aquifer
pumping test in June 2012 will be re-surveyed to obtain the top-of-casing and ground surface elevations, as well as location.

4.2 BOREHOLE/GAS PROBE INSTALLATION

Figure 1 presents the location of the boreholes to be converted into gas probes. The location of the two boreholes on the west side of the Phase III Landfill toe drain was selected to confirm the geology in this area and to assess the presence of landfill gas based on the MDEQ’s measurement of high levels of landfill gas in a perimeter tile drain during a Site visit in September 2012.

A borehole will be advanced at each location to the groundwater table which is estimated to be approximately 4 to 6 feet bgs in the area. If the groundwater table is encountered at a depth of two feet bgs or less, the gas probe will be abandoned and an alternative method for evaluating methane migration will need to be evaluated.

Soil samples collected from the boreholes will be logged detailing geologic conditions encountered, soil classification (USCS), relative moisture content and PID headspace readings for VOCs. Soil samples collected from each borehole will be screened in the field for evidence of impact based on visual and olfactory observations and on VOC readings, as measured by the PID. Drill cuttings will be temporarily containerized in storage drum(s) in an area on site designated by CRA.

The gas probes will be constructed of ½- inch diameter Schedule 40 PVC with a 1-foot screen and completed with threaded ½- inch diameter Schedule 40 PVC riser pipe. The screen will be located a minimum 1 foot above the water table, as measured at the time of borehole installation. Should the borehole extend below the planned depth of the screen, it will be backfilled with bentonite beneath the screen interval. A sand pack of 1 foot will be placed to separate the bentonite and the bottom of the screen. A sand pack will be installed around the screen, extending approximately 12 inches above the screen. A minimum of 1 foot of hydrated bentonite pellets will be placed directly above the sand/gravel pack. A surface seal of 6 inches of concrete will be placed around an aboveground protective casing draining away from the gas probe; and the probe will be sealed with a ½-inch friction cap completed with a hose barb and valve assembly. The locations of the gas probe top-of-casings and ground surface will be surveyed by a Michigan accredited land surveyor.

Following installation of the gas probes, the new and existing gas probes and cap drains/vents on the Phase III Landfill will be monitored for the presence of landfill gas.
including methane, carbon dioxide, oxygen and pressure (if applicable). The gas pressure will be monitored with a digital manometer (collected at gas probes only), and the landfill gas will be monitored with a Landtec portable gas analyzer. The results of the gas monitoring will be utilized to determine if additional investigations or actions are required.
PROPOSED PIEZOMETER AND BOREHOLE LOCATIONS - CLOSE UP

LEGEND

- LANDFILL BOUNDARY
- USEPA SITE FENCE/BOUNDARY
- DITCH, STREAM OR RIVER
- LEACHATE COLLECTION SYSTEM
- BARRIER WALL ALIGNMENT
- PERIMETER GRANULAR TRENCH
- CLEANOUT
- GH-63 EXISTING MONITORING WELL
- PROPOSED PIEZOMETER LOCATION
- PROPOSED BOREHOLE GAS PROBE LOCATION

SOURCE: ADVANCED MAPPING TECHNOLOGIES
AERIAL PHOTOGRAPHY DATE: FEB. 5, 1993

G&H LANDFILL
Macomb County, Michigan

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PROFILE WEST OF PHASE III LANDFILL AND PROPOSED PIEZOMETER LOCATIONS
G&H LANDFILL
Macomb County, Michigan
PROPOSED PIEZOMETER AND BOREHOLE LOCATIONS
G&H LANDFILL
Macomb County, Michigan

LEGEND

LANDFILL BOUNDARY
USEPA SITE FENCE/BOUNDARY
DITCH, STREAM OR RIVER
RAILROAD GRADE (ABANDONED)
DWSD SANITARY SEWER
DWSD WATERMAIN
LEACHATE COLLECTION SYSTEM
BARRIER WALL ALIGNMENT

EXISTING MONITORING WELL
PROPOSED PIEZOMETER LOCATION
PROPOSED BOREHOLE / GAS PROBE LOCATION

figure 3

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TYPICAL PIEZOMETER CONSTRUCTION DETAILS
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