



May 11, 2020

HWA Project No. 98165-675

City of Everett Public Works Department
3200 Cedar Street
Everett, WA 98201

Attention: Mark Sadler

**Subject: Gas Monitoring Probes, East Side of Landfill
Everett Landfill/Tire Fire Site
Everett, Washington**

Dear Mark,

This letter describes landfill gas monitoring and compliance issues at the Everett landfill east boundary (north of the 41st Street roundabout). Landfill gas probes in this area have consistently detected concentrations of methane exceeding compliance criteria. This letter provides discussion of these probes, and proposes actions to address compliance criteria during future monitoring.

Background and Location Information

The leachate/gas collection trench runs along the entire eastern boundary of the landfill. Construction of the collection trench in 1998 at its present location (i.e., not entirely outside of fill materials) was constrained by access issues at the time of construction due to topography, the adjacent railroad tracks, drainage features, and property boundaries. The upper, unsaturated portion of the gravel-filled trench was converted into a landfill gas extraction trench in 2015 by applying a vacuum to it, via blowers and collection pipes. North of the 41st Street Roundabout along the eastern boundary, the trench is installed to an approximate depth of 20 feet below ground surface, which is below the seasonal high ground water level.

Landfill gas probes along the eastern boundary of the landfill (north of the 41st Street Roundabout) include LG-14, LG-15, and LG-16 (see Figure 1). The three gas probes are located just exterior of the leachate/gas collector trench, around 5 to 10 feet east of it (Figure 1). The probe depths range from 9 to 11 feet. Methane exceeding 5% by volume has been historically detected in all of these probes. The presence of methane in these probes was not unexpected however, and the landfill Compliance Monitoring and Contingency Plan (CMCP) discusses that due to completion in fill, “the existing perimeter sampling locations along the eastern side of the landfill, LG-13 through LG-16, will continue to be used, but only for informational data, and not for site compliance.” The CMCP also states that compliance probe locations would be installed east

of these locations, however additional probes were not installed due to access constraints (railway, private property) and property use restrictions.

Fill and debris extend just outside (east of) the leachate/gas collector trench likely only a few feet, as a drainage ditch associated with the former railroad tracks was located just east of the landfill east boundary. Boring logs indicate fill soils with little to no debris in LG-14, LG-15, and LG-16, with wood fibers and wood chips encountered.

A series of test pits conducted in 2007 east of the leachate collector (from LG-16 to the southern tip of the landfill) indicated the presence of construction debris including wood, concrete, and metal in many of the locations, with burn fill and landfill type waste (glass, plastic, tires, etc.) in some areas.

Surface Emissions Monitoring

In response to the elevated methane readings in gas probe locations LG-14, LG-15, and LG-16, the City conducted surface emissions monitoring (measuring methane presence above the ground surface) to determine if there is a potential for exposure to landfill gas in this area. Surface emissions monitoring was conducted along the east landfill boundary and public walking trail in July 2019, February 2020, and April 2020. Surface gas monitoring procedures were conducted per 40 CFR 60.753(d), and followed the Environmental Protection Agency Code of Federal Regulations Part 60 Subpart WWW *Standards of Performance for Municipal Solid Waste Landfills*. The monitoring was performed utilizing a flame ionization detector (FID), traversing the eastern landfill boundary in a serpentine pattern, measuring gas at 30-meter intervals, and based on visual observations, e.g., distressed vegetation, cracks, or seeps in the ground. The probe of the FID was held between 5 to 10 centimeters above the ground surface during the survey.

Results of all three rounds show no appreciable (above zero or a background of 0.2 ppm) methane detected in any areas monitored, i.e., well below the 500 ppm (0.05% by volume) action level.

Bar Hole survey

In an attempt to determine the extent of methane gas outside the leachate/gas collection trench, assumed to be associated with debris present east of the trench, HWA conducted a bar hole survey in April 2020 to investigate soil gas concentrations east of the landfill. The survey was conducted using a slide hammer to bore an approximately 0.5-inch hole to a depth of 3.5-feet below ground surface (bgs). Rigid polyethylene tubing was lowered half way down the bore hole and the surface opening was sealed prior to testing. When groundwater was encountered, readings were taken just above the groundwater level.

Surficial soils were found to be saturated at shallow depths (2.4 to 3.5 feet bgs) at many of the locations.

The survey included four linear traverses, heading east from LG-13, LG-14, LG-15, and LG-16 (see Figure 2). Many attempted sampling locations were in marshy areas and had ponded water or high groundwater. Sampling locations, marshy areas, and results are shown on Figures 3 and 4. Results indicated no detected methane east of LG-13, LG-14, or LG-15. At LG-16, the westernmost bar hole (closest to LG-16) had 5.4% methane, but 20 feet away from the leachate/gas collector trench the bar holes east of that had no detected methane.

Besides limited gas generating materials outside the leachate/gas collector trench, the surrounding marsh type soils, surface water features, and high groundwater, all act as a hydraulic barrier to any soil gas from the landfill.

Compliance Monitoring Conclusions

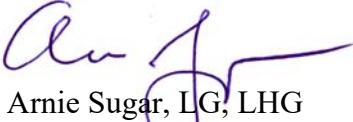
All the land north of the 41st Street Roundabout and east of the landfill is zoned Aquatic, Conservancy Wetland, or Urban Conservancy, and can never be developed. This area contains Bigelow Creek and associated wetlands, surface water features, and ponded areas that are hydraulically connected to the Snohomish River. Because of this, there are no receptors in this area, and no structures or even vaults east of the leachate/gas collector trench. The only potential human receptors are people walking the public trail. The surface emission monitoring described above monitors and confirms there are no elevated concentrations of methane gas in the immediate zone next to the asphalt and in the open air along the trail. The area is characterized by abundant surface water and very high groundwater levels. There are also no structures present that may trap soil gas, nor will there ever be, given the zoning and wetland condition of the area. For these reasons, and given the narrow extent of methane gas detected east of the landfill by the bar hole survey, the City believes ongoing monitoring to confirm conditions are stable is sufficient to document compliance, and additional soil gas monitoring through installation of additional gas probes east of the existing network is not necessary. Protectiveness in this area can be confirmed through ongoing monitoring of the existing system, and completion of surface emissions monitoring if conditions in the existing gas probes change over time.



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We appreciate the opportunity to provide our services. Please feel free to call if you have any questions or need more information.

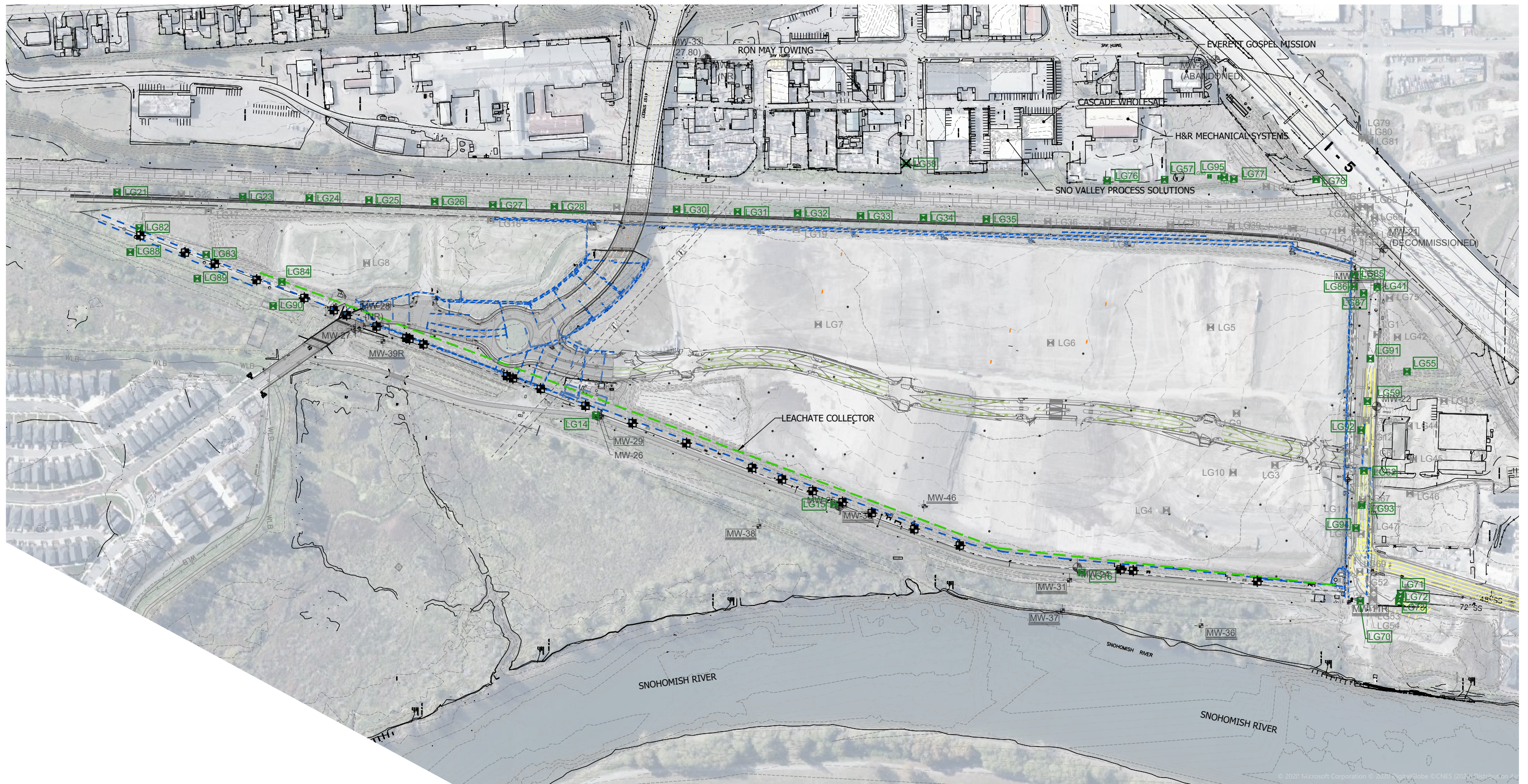
Sincerely,
HWA GEOSCIENCES INC.









Arnie Sugar, LG, LHG
Principal Hydrogeologist

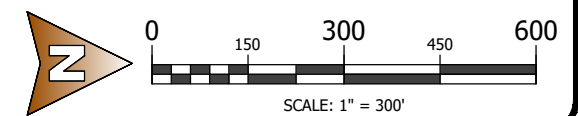
Attachments:

- Figure 1 Landfill Gas Probe Location Map
- Figure 2 4/23/2020 Bar Hole Survey Areas
- Figure 3 Survey Area 1 and Survey Area 2
- Figure 4 Survey Area 3 and Survey Area 4



EXPLORATION LEGEND

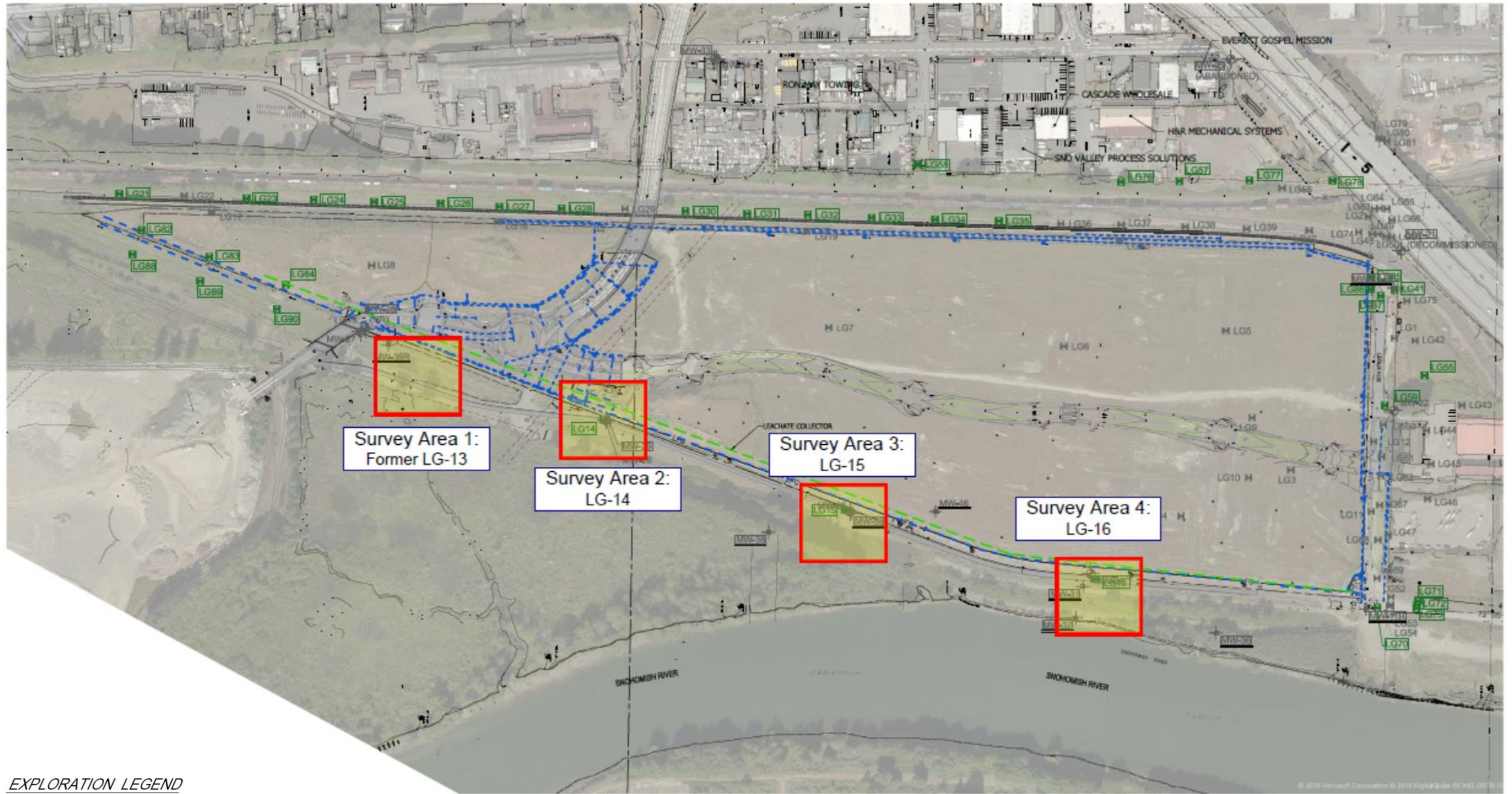
-  TEST PIT
-  LANDFILL GAS COLLECTION TRENCH
-  LEACHATE COLLECTOR
-  EXISTING LFG GAS PROBES
-  DECOMMISSIONED, ABANDONED OR DAMAGED LFG PROBES
-  PROPOSED LFG PROBE TO DECOMMISSION



EVERETT LANDFILL
EVERETT, WASHINGTON

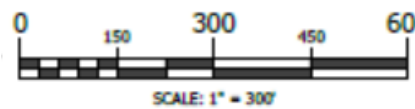
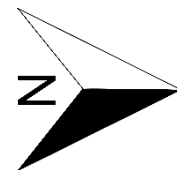
LANDFILL GAS PROBE
LOCATION MAP

DRAWN BY: CF / BFM	FIGURE NO.: 1
CHECK BY: AS	PROJECT NO.: 2015-061-21 TASK 600



EXPLORATION LEGEND

- - - - - LANDFILL GAS COLLECTION TRENCH
- - - - - LEACHATE COLLECTOR
- LG-84 ■ EXISTING LFG GAS PROBES
- LG-13 ■ DECOMMISSIONED, ABANDONED OR DAMAGED LFG PROBES
- BAR HOLE SURVEY LOCATIONS (4/23/20)



4/23/2020 BAR HOLE SURVEY AREAS

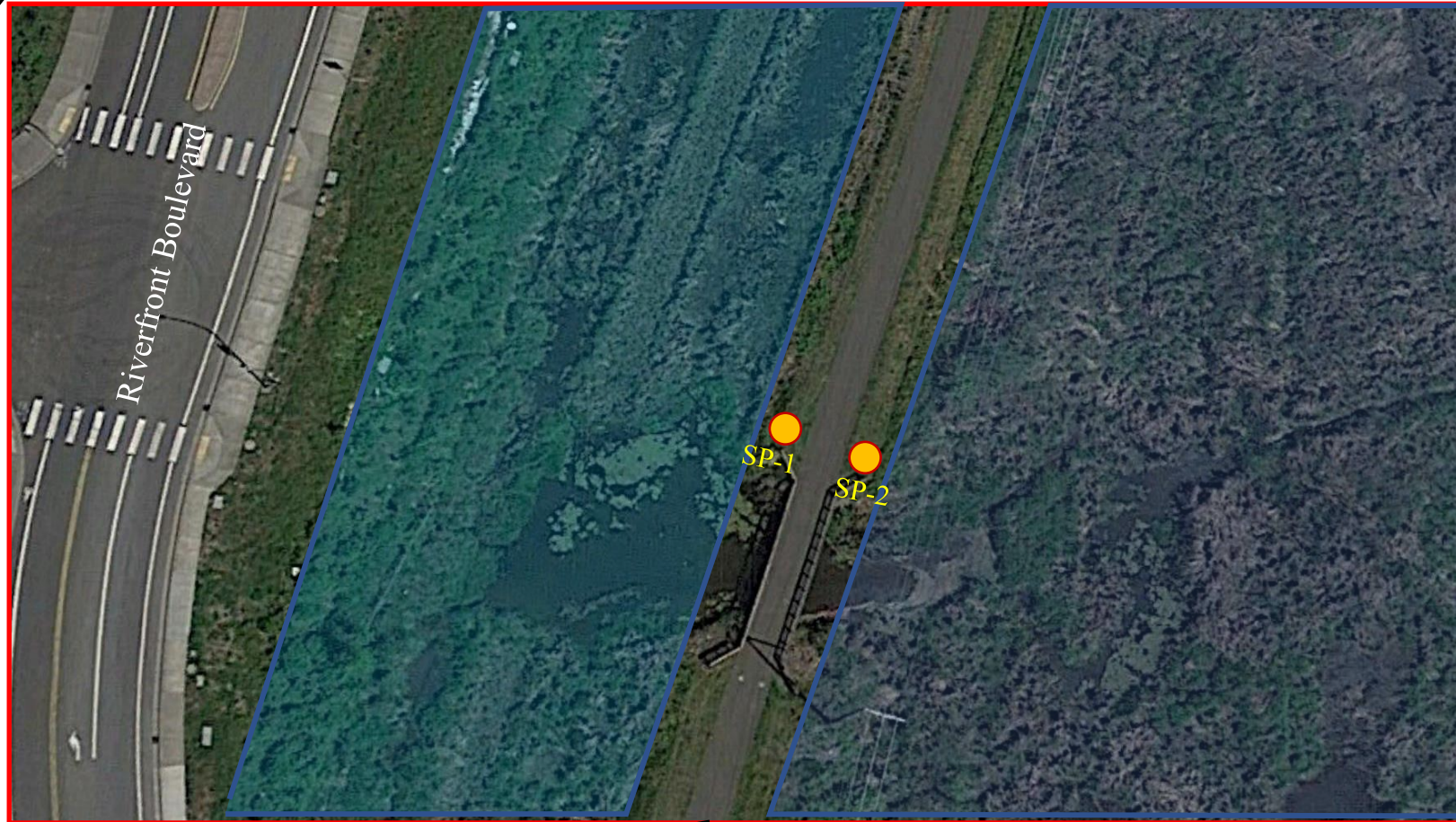
EVERETT LANDFILL
EVERETT, WASHINGTON

FIGURE NO.

2

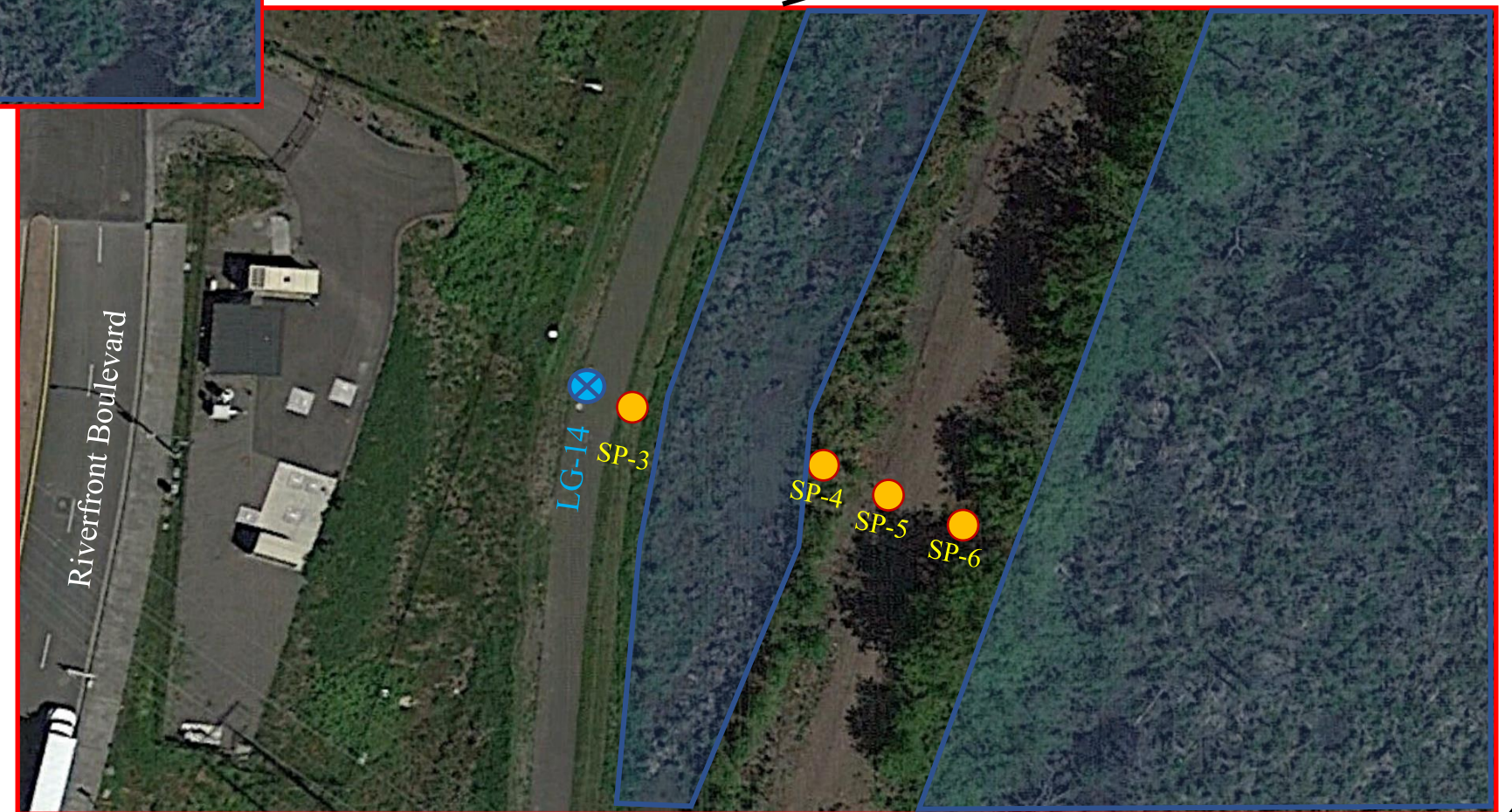
PROJECT NO.





1998-165



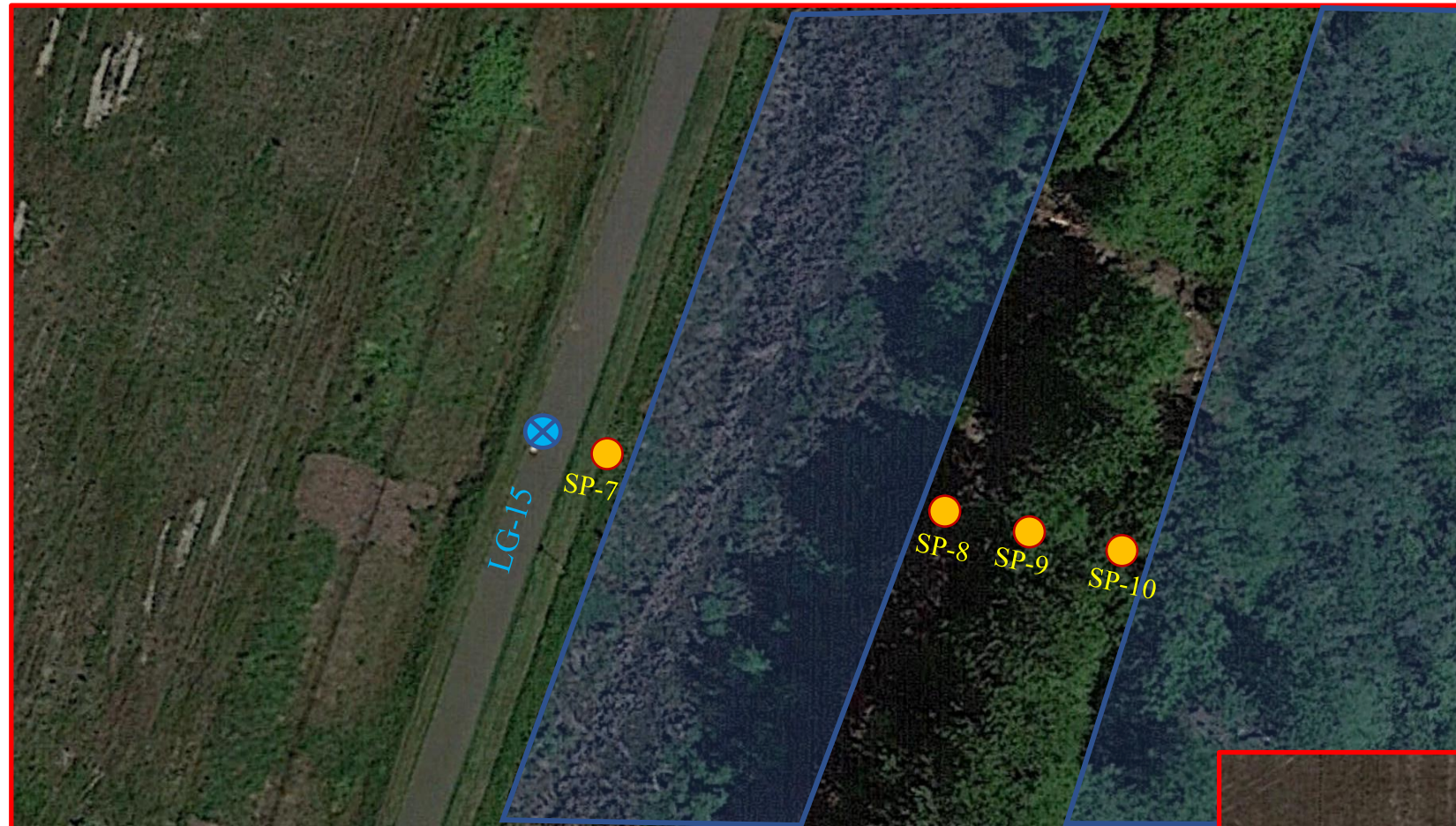
Survey Area 2					
Gas Probe ID	CH ₄	CO ₂	O ₂	Depth to Water	Location
SP-3	0	1.5	19.6	2.4	20' east of LG-14
SP-4	0	0.4	20.2	3.3	75' east of LG-14
SP-5	0	0.8	19.8	-	95' east of LG-14
SP-6	0	0.6	20.1	-	115' east of LG-14

Survey Area 1					
Gas Probe ID	CH ₄	CO ₂	O ₂	Depth to Water	Location
SP-1	0	1.0	19.8	3.5	-
SP-2	0	1.4	19.7	3.5	-



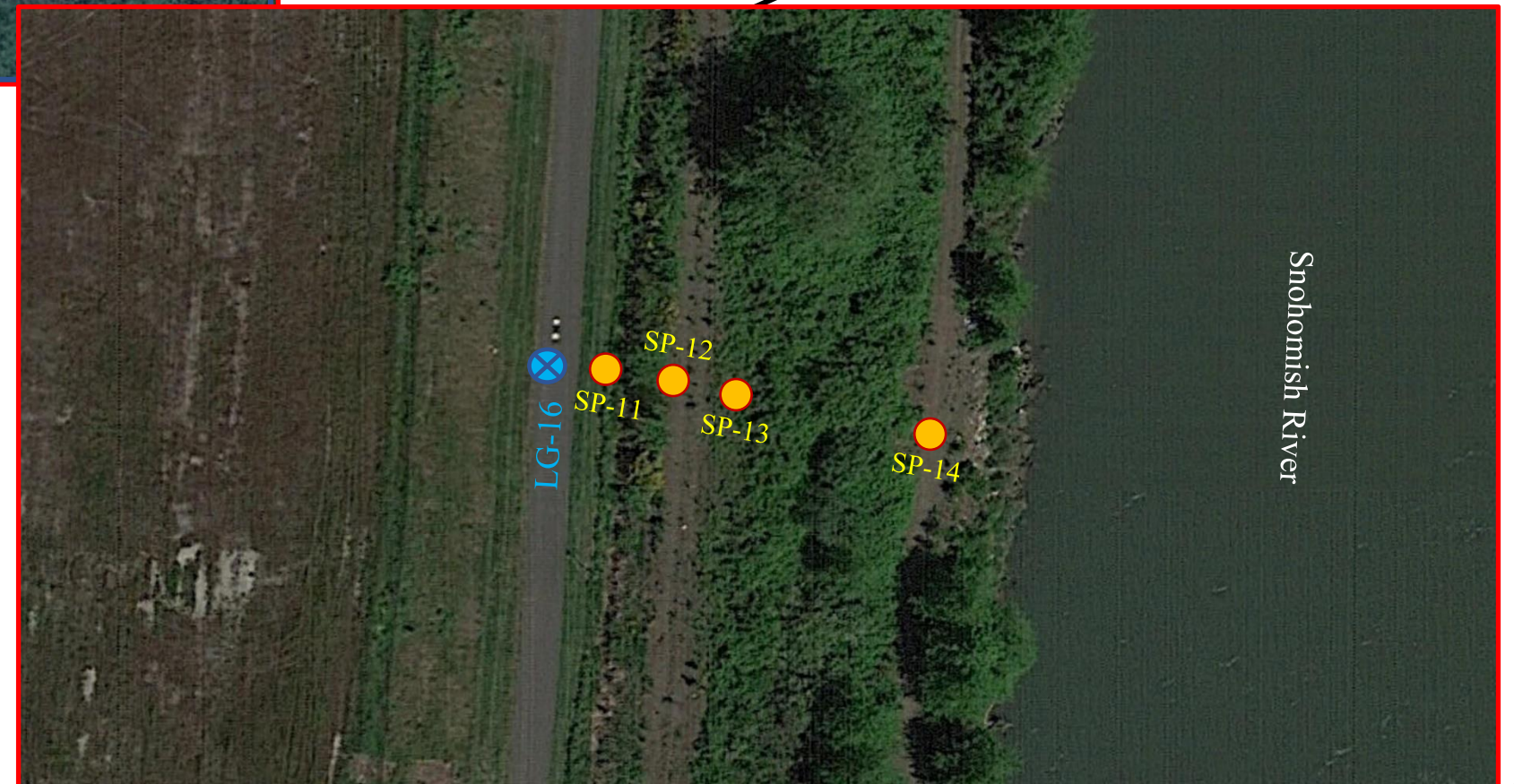
-  - Bar Hole Survey Point
-  - Bar Hole Survey Point
-  - Marsh Area
-  - Landfill Gas Probe Location










Survey Area 4					
Gas Probe ID	CH ₄	CO ₂	O ₂	Depth to Water	Location
SP-11	5.4	1.6	17.6	2.9	15' east of LG-16
SP-12	0	1.7	19.6	-	40' east of LG-16
SP-13	0	2.0	19.4	-	60' east of LG-16
SP-14	0	0.5	20.2	-	115' east of LG-16

Survey Area 3					
Gas Probe ID	CH ₄	CO ₂	O ₂	Depth to Water	Location
SP-7	0	1.5	19.8	3.5	20' east of LG-15
SP-8	0	2.1	18.5	-	100' east of LG-15
SP-9	0	1.4	19.8	-	120' east of LG-15
SP-10	0	6.5	15.0	-	140' east of LG-15



-  - Bar Hole Survey Point
-  - Bar Hole Survey Point
-  - Marsh Area
-  - Landfill Gas Probe Location
-  - Landfill Gas Probe Location

