

## **1.0 INTRODUCTION**

Environmental Information Logistics, LLC (EIL) was retained by Waters Landfill to perform Tier 2 landfill gas sampling and analysis at the site, located in Frederic, Michigan. The sampling was performed to determine non-methane organic compound (NMOC) concentrations and compare them to the Federal Plan (40 CFR Part 62 Subpart OOO) emission threshold of 34 megagrams per year (Mg/year) and the revised Landfill NESHAP (40 CFR 63 Subpart AAAA) threshold of 50 Mg/year. The testing was conducted in accordance with the revised Landfill NESHAP, the Federal Plan and Method 25C of 40 CFR 60 Appendix A.

A Tier 2 testing workplan was submitted to the Michigan Department of Environment, Great Lakes, and Energy (EGLE) on August 27, 2021. The test was performed on September 27, 2021, with an EGLE representative present to observe portions of the test events.

## **2.0 REGULATORY BACKGROUND**

Waters Landfill, a municipal solid waste landfill owned and operated by Waste Management of Michigan, Inc., began accepting waste in 1972. The facility is subject to the revised Landfill NESHAP – 40 CFR 63 Subpart AAAA and to 40 CFR 62, Subpart OOO – Federal Plan Requirements for Municipal Solid Waste Landfills that Commenced Construction, Reconstruction or Modification before July 17, 2014 and Have Not Been Modified or Reconstructed Since July 17, 2014.

The facility submitted a Tier 1 calculation to USEPA Region 5 and EGLE on September 15, 2021. NMOC emissions using Federal Plan default parameters were greater than 34 Mg/year. §62.16718(a)(3) and §63.1959(a)(3) allow the landfill owner to establish a site-specific NMOC concentration for use in establishing Federal Plan applicability within six months of submittal of the Tier 1 calculation which exceeds 34 Mg/year.

Waters Landfill decided to improve the accuracy of the emission calculation by performing Tier 2 landfill gas sampling and analysis to show the facility NMOC emissions may be less than the 34 Mg/year NSPS and the 50 Mg/year NESHAP emission thresholds. The Tier 2 NMOC value must be retested every 5 years thereafter.

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Based on the sampling results provided in this report, gas collection and control requirements are not applicable to the facility, since NMOC emissions using the new Tier 2 value do not exceed 34 Mg/yr in 2021. The measured site-specific NMOC concentration was determined to be 238.97 ppm NMOC as hexane. This value was used in the NSPS/NESHAP equation to calculate NMOC emissions of 22.26 Mg/year in 2021.

NMOC emissions are not estimated to exceed 34 Mg/yr and therefore additionally not expected to exceed 50 Mg/yr for the next five years, using an assumed waste intake rate of 275,000 tons/year of municipal solid waste (MSW). The five year projection is provided in Appendix A of this report. Pursuant to 40 CFR 62.16724(c)(3) and 63.1981(c)(1)(ii)(A), the landfill owner or operator may submit a five year report in lieu of annual reports, as long as the actual waste volumes received in subsequent years are less than the estimated projections.

The Tier 2 testing results are valid for five years according to 40 CFR 62.16718 and 40 CFR 63.1959. A new site-specific NMOC concentration will have to be obtained in 2026.

### **3.0 SAMPLING AND ANALYTICAL PROCEDURES**

#### **3.1 Sample Locations**

Method 25C requires collection of two samples per hectare of landfill surface area in which waste has been in-place for a minimum of two years. The site is comprised of multiple landfill units. Two closed areas exist on the north and northeast sides of the site (see Figure 1). These areas have been closed for several years, and had a geosynthetic cap (PVC) placed during final closure. The area designated as “Act 641/Phase 3” is approximately 26 acres, or 10.56 hectares. The area designated as “Act 87” is approximately 21 acres, or 8.5 hectares. Neither of these areas have an active landfill gas collection system, although the Act 641 landfill has 17 passive gas vents installed. Both closed areas are covered by a geosynthetic (PVC) cap.

Another 11.6 acres (4.7 hectares) closed area, Phase 4, has an active landfill gas collection system installed. The landfill gas collection system has also been constructed in the site’s active area, which is delineated by Cells A, B, C, D & E. These five cells are approximately 44.5 acres (18 hectares) in size. The active gas collection system therefore covers 56.1 acres, or 55% of the site’s constructed acreage. Gas is directed to an open flare for combustion.

In the workplan submitted to EGLE on August 27, 2021, EIL proposed to follow the same approved variance as in previous Tier 2 tests for testing conducted in the older areas of the facility. Specifically, this consisted of not installing sampling probes in the Act 87 Area at all due to watering-in of probes in previous Tier 2 tests, but to instead check the gas quality in the Act 641 vents and only sample those vents with gas quality meeting the Method 25C criteria during the field check of LFG quality. This protocol was approved by EPA in 2011 and in the 2016 Tier 2 retest, EPA indicated that the state regulatory agency had authority to approve the protocol. Therefore, this variance was directly proposed to EGLE in the 2021 test plan and not to EPA.

The EIL sampling technician used an Envision hand-held gas meter to measure the gas quality in each of the 21 passive vents on September 27, 2021. Only 2 of the 21 vents had sufficient gas quality suitable for Tier 2 sampling. At least one liter of sample was collected from each gas vent as required by Method 25C. No compositing was performed although the test plan had proposed compositing samples up to a 3:1 ratio. Sample locations of the passive vents are shown on Figure 1.

The required three samples from the main header to the utility flare were also collected for Tier 2 analysis during the sampling event. Actual sampling locations at the header pipe leading to the flare station are shown on the map on Figure 1.

Field data for gas quality and sampling data at the flare is provided in Table 1. Initial passive vent gas quality check data and the later sampling data for the vents containing suitable gas are provided in Tables 2 and 3 respectively.

### **3.2 Analysis**

The samples were collected from the header and from the two passive vents at a flow rate of less than 500 ml/min. Summa canisters were utilized for each of the main header samples and for the passive vent samples. Each summa canister was half filled with helium so that the samples could be safely shipped as non-hazardous. The methane, carbon dioxide, and oxygen levels were measured with an Elkins Earthworks Envision meter. The balance gas level was estimated by difference from 100% of the other constituents to assure the samples were valid in the field (less

than 5 percent O<sub>2</sub> or 20 percent N<sub>2</sub>). Ambient temperature and barometric pressure was also measured with the Envision meter prior to sampling, and recorded (see Tables 2 and 3).

Analysis was performed at the AtmAA Inc. laboratory in Calabasas, California. The flare samples were analyzed for oxygen and nitrogen following Method 3C. The three flare samples collected from the active system showed concentrations of oxygen below 5%; thus they were all suitable for Method 25C analysis and were all included in the final average for the landfill. The two samples collected from the passive vents were also determined to be suitable for Method 25C analysis, since oxygen was below 5% and nitrogen was below 20%. Each sample was therefore analyzed for methane, carbon dioxide and NMOC (following Method 25C). NMOC results are reported as carbon, and must be divided by six to obtain NMOC values as hexane for use in the emissions equation. NMOC concentrations were corrected for nitrogen as required by Method 25C. A schematic of the Method 25C sampling train is found in Figure 2.

#### **4.0 RESULTS**

Samples cannot contain oxygen and nitrogen above the acceptable thresholds (i.e. greater than 5% oxygen or greater than 20% nitrogen). All samples from the flare and the probes were acceptable for use in the calculations. Laboratory analytical data is provided in Appendix B. A summary of laboratory results is shown in Table 4.

The average NMOC value for the site was 238.97 parts per million (ppm). The equations provided in 40 CFR 62.16718(b) and 40 CFR 63.1959(a) were used to calculate Tier 2 emissions (See Appendix A).

The NMOC emission rate of 22.26 Mg/yr for the year 2021 is below the 34 Mg/year and the 50 Mg/year trigger for installation of gas collection and control systems. The Tier 2 sampling results are valid for five years - until 2026. At that time, a new Tier 2 value will need to be obtained. Appendix A also contains the calculations for projected yearly uncontrolled NMOC emissions for five years, as permitted by 40 CFR 62.16724(c)(3) and 40 CFR 63.1981(c)(1)(ii)(A). Based on the projected waste intake rates, emissions of NMOC stay below 34 Mg/year for the next five years.

# *TABLES*

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**Table 1: Waters Landfill  
Tier 2 Sampling Field Data  
Frederic, Michigan**

| Sample #          | Canister #  | Barometric Pressure (inches w.c.) | Temperature (°F)           | Weather |                  |                       |
|-------------------|-------------|-----------------------------------|----------------------------|---------|------------------|-----------------------|
| #1                | 102         | 28.24                             | 59                         | Cloudy  |                  |                       |
| Gas Quality Check | Time        | %CH4                              | %CO2                       | %O2     | % Bal. Gas       |                       |
|                   | 8:57        | 52.9                              | 36.1                       | 2.5     | 8                |                       |
| Leak Check        | Vac.        | Time                              | Vac.                       | Time    |                  |                       |
|                   | -21.5       | 8:51                              | -21.5                      | 8:56    |                  |                       |
| Sample            | Sample Date | Sample Time                       | Initial Vac. (inches w.c.) | Time    | Flare Flow (cfm) | End Vac (inches w.c.) |
|                   | 9/27/2021   | 9:06                              | -22                        | 9:13    | 345              | -5                    |

| Sample #          | Canister #  | Barometric Pressure (inches w.c.) | Temperature (°F)           | Weather |                  |                       |
|-------------------|-------------|-----------------------------------|----------------------------|---------|------------------|-----------------------|
| #2                | 119         | 28.24                             | 62                         | Cloudy  |                  |                       |
| Gas Quality Check | Time        | %CH4                              | %CO2                       | %O2     | % Bal. Gas       |                       |
|                   | 9:23        | 52.4                              | 35.7                       | 2.8     | 9.1              |                       |
| Leak Check        | Vac.        | Time                              | Vac.                       | Time    |                  |                       |
|                   | -22         | 9:15                              | -21.5                      | 9:20    |                  |                       |
| Sample            | Sample Date | Sample Time                       | Initial Vac. (inches w.c.) | Time    | Flare Flow (cfm) | End Vac (inches w.c.) |
|                   | 9/27/2021   | 9:25                              | -21.5                      | 9:32    | 341              | -4                    |

| Sample #          | Canister #  | Barometric Pressure (inches w.c.) | Temperature (°F)           | Weather |                  |                       |
|-------------------|-------------|-----------------------------------|----------------------------|---------|------------------|-----------------------|
| #3                | 143         | 28.24                             | 65                         | Cloudy  |                  |                       |
| Gas Quality Check | Time        | %CH4                              | %CO2                       | %O2     | % Bal. Gas       |                       |
|                   | 9:48        | 52.8                              | 35.9                       | 2.7     | 8.6              |                       |
| Leak Check        | Vac.        | Time                              | Vac.                       | Time    |                  |                       |
|                   | -21.5       | 9:37                              | -21                        | 9:42    |                  |                       |
| Sample            | Sample Date | Sample Time                       | Initial Vac. (inches w.c.) | Time    | Flare Flow (cfm) | End Vac (inches w.c.) |
|                   | 9/27/2021   | 9:48                              | -21                        | 9:55    | 342              | -4                    |

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## Table 2: Waters Landfill Gas Vent Field Quality Check

Date: 27-Sep-21 Temperature: 64 degrees F

Technician Name: Andy Secord Barometric Pressure: 28.29

Instrument Used: Envision Time of Gas Quality Check: 10:00 a.m. to 11:15 a.m.

Weather Conditions: cloudy

| Gas Vent No. | CH4 % | CO2 % | O2 % | Balance Gas % | Comments                  |
|--------------|-------|-------|------|---------------|---------------------------|
| GV-1         |       |       |      |               | Ambient air               |
| GV-2         | 10.0  | 5.0   | 17.7 | 68.0          | Not suitable for sampling |
| GV-3         |       |       |      |               | Ambient air               |
| GV-4         |       |       |      |               | Ambient air               |
| GV-5         |       |       |      |               | Ambient air               |
| GV-6         |       |       |      |               | Ambient air               |
| GV-7         |       |       |      |               | Ambient air               |
| GV-8         |       |       |      |               | Ambient air               |
| GV-9         |       |       |      |               | Cap glued, no access      |
| GV-10        |       |       |      |               | Ambient air               |
| GV-11        |       |       |      |               | Ambient air               |
| GV-12        |       |       |      |               | Ambient air               |
| GV-13        |       |       |      |               | Ambient air               |
| GV-14        |       |       |      |               | Ambient air               |
| GV-15        |       |       |      |               | Ambient air               |
| GV-16        |       |       |      |               | Ambient air               |
| GV-17        |       |       |      |               | Cap glued, no access      |
| GV-18        |       |       |      |               | Ambient air               |
| GV-19        |       |       |      |               | Cap glued, no access      |
| GV-20        | 57.5  | 40.5  | 2.5  | 0.1           | Gas good for sampling     |
| GV-21        | 51.1  | 48.7  | 0.2  | 0.0           | Gas good for sampling     |

**Table 3: Waters Landfill  
September 27, 2021 Tier 2 Sampling Information - Passive Gas Vents Act 641 Area  
Frederic, Michigan**

| Vent Name | Date      | Sample Time | CH4  | CO2  | O2  | BAL | Pre-Test Tank Pressure | Post-Test Tank Pressure | Sample Canister# | Barometric Pressure | Ambient Temperature |
|-----------|-----------|-------------|------|------|-----|-----|------------------------|-------------------------|------------------|---------------------|---------------------|
| GV-20     | 9/27/2021 | 11:27:00 AM | 57.5 | 40.5 | 2.5 | 0.1 | -22                    | -4                      | 141              | 28.29               | 65                  |
| GV-21     | 9/27/2021 | 11:48:00 AM | 51.1 | 48.7 | 0.2 | 0.0 | -22                    | -4                      | 133              | 28.29               | 67                  |

**TABLE 4**  
**SUMMARY OF METHOD 25C AND METHOD 3C DATA**  
**Waters Landfill Tier 2 Test**

| Sample ID Number | Sample Location                  | Date Sampled   | CH4 (%)      | CO2 (%)      | O2 (%)      | N2 (%)       | NMOC* (ppm as carbon) | NMOC (ppm as hexane) |
|------------------|----------------------------------|----------------|--------------|--------------|-------------|--------------|-----------------------|----------------------|
| Header 1         | Flare Inlet                      | 9/27/2021      | 47.7%        | 29.9%        | 2.6%        | 19.4%        | 1794                  | 299                  |
| Header 2         | Flare Inlet                      | 9/27/2021      | 48.3%        | 30.3%        | 2.7%        | 18.4%        | 1952                  | 325                  |
| Header 3         | Flare Inlet                      | 9/27/2021      | 48.0%        | 30.1%        | 2.3%        | 19.1%        | 1869                  | 312                  |
| Probe 20         | Act 641 Area Passive Vent No. 20 | 9/27/2021      | 49.4%        | 28.0%        | 4.9%        | 17.1%        | 989                   | 165                  |
| Probe 21         | Act 641 Area Passive Vent No. 21 | 9/27/2021      | 59.0%        | 39.2%        | 0.4%        | 0.8%         | 565                   | 94                   |
|                  |                                  | <b>Average</b> | <b>50.5%</b> | <b>31.5%</b> | <b>2.6%</b> | <b>15.0%</b> | <b>1,434</b>          | <b>238.97</b>        |

CH4: methane

CO2: carbon dioxide

O2: oxygen

N2: nitrogen

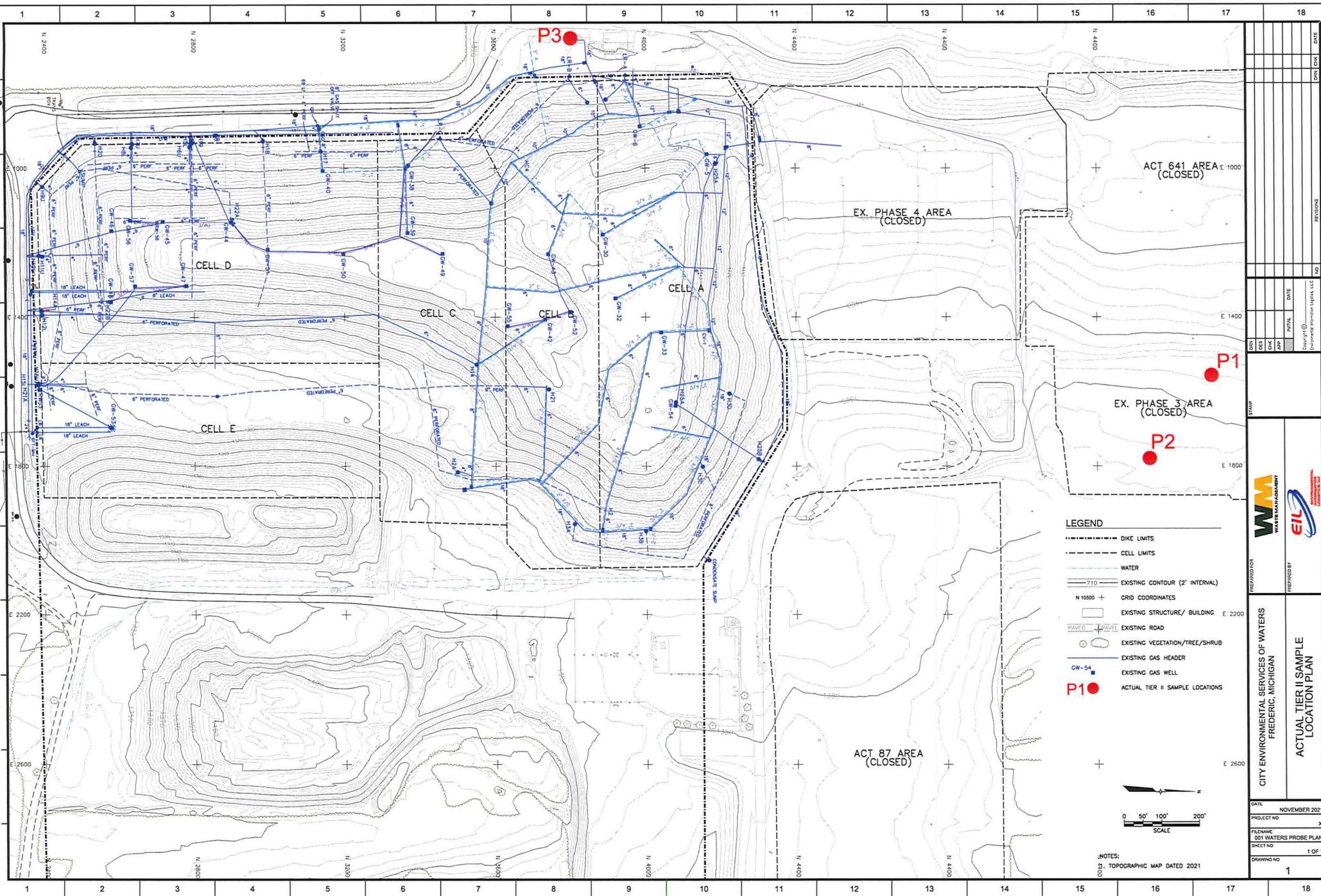
#: percent

NMOC as hexane: Non Methane Organic Compounds as hexane (NMOC as carbon divided by six)

\*NMOC values were corrected for nitrogen as required by Method 25C Section 12.

# ***FIGURES***

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|            |                       |
|------------|-----------------------|
| DATE       | NOVEMBER 2021         |
| PROJECT NO | X                     |
| FILENAME   | 501 WATERS PROBE PLAN |
| SHEET NO   | 1 OF 1                |
| DRAWING NO | 1                     |

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**WM**  
WATER MANAGEMENT

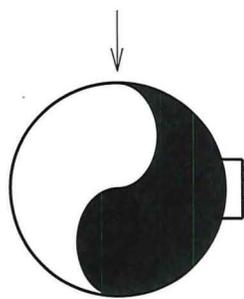
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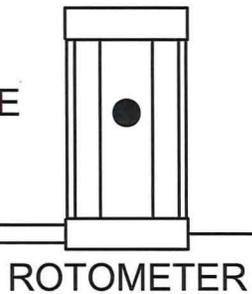
CITY ENVIRONMENTAL SERVICES OF WATERS  
FREDERIC, MICHIGAN

**ACTUAL TIER II SAMPLE  
LOCATION PLAN**

FLARE  
OR GAS  
VENT INLET



SAMPLE  
PORT



VACUUM  
GAUGE  
"Hg

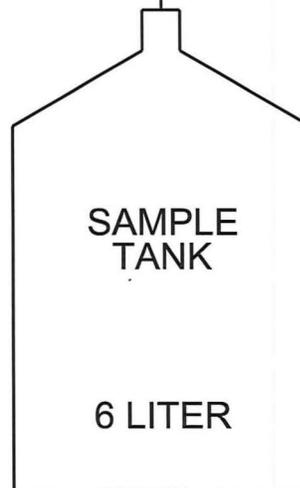


ENVISION  
METER



SAMPLE  
TANK

6 LITER



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FIGURE 2

TOTAL NON-METHANE  
ORGANIC COMPOUND SAMPLING TRAIN

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