Horn Rapids Landfill
Remedial Investigation Phase I
Push Probe Investigation

Prepared for
City of Richland Public Works Department

February 2018

Prepared by
Parametrix

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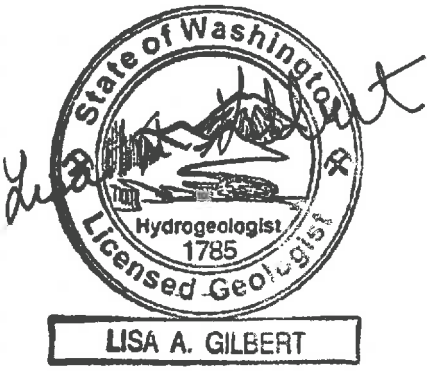
CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional hydrogeologist licensed to practice as such, is affixed below.



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ACRONYMS AND ABBREVIATIONS

BFHD	Benton-Franklin Health District
COCs	Chemicals of Concern
City	City of Richland
City Facility	275-acre permitted waste facility, including Landfill
City Property	Contiguous property owned by the City of Richland, including the City Facility (approximately 2,306 total acres)
DCA	Dichloroethane
DCE	Dichloroethene
DO	dissolved oxygen
Ecology	Washington Department of Ecology
Expansion	proposed 104-acre expansion of the Horn Rapids Landfill located within the City Facility east of the Landfill
GWQSs	groundwater quality standards (Chapter 173-200 WAC)
Landfill	46-acre permitted area where MSW has been placed within the City Facility
LFG	landfill gas
MCL	maximum contaminant level (Chapter 246-290 WAC)
MSW	municipal solid waste
MTCA	Model Toxics Control Act (Chapter 173-340 WAC)
ORP	oxidation-reduction potential
ORV	off-road vehicle
PCE	Tetrachloroethene
QAPP	Quality Assurance Project Plan
RI/FS	remedial investigation and feasibility study
SIM	Selective Ion Monitoring
TCE	Trichloroethene
TDS	Total Dissolved Solids
VC	Vinyl Chloride
VOCs	volatile organic compounds

1. INTRODUCTION

This report summarizes the results of the push probe investigation conducted at the Horn Rapids Landfill in Richland, Washington. The push probe investigation is the first of two phases of work described in the *Horn Rapids Landfill Remedial Investigation Work Plan* (Parametrix 2017d). The Work Plan was prepared as an exhibit to Agreed Order No. DE 13717 (Agreed Order) entered into between the City of Richland (City) and the Washington State Department of Ecology (Ecology) in accordance with Chapter 173-340 WAC, the Model Toxics Control Act (MTCA) and its implementing regulations. The work is being conducted to fill remaining data gaps identified by the City and Ecology to define the nature and extent of groundwater contamination at the Horn Rapids Landfill. The Phase I investigation results detailed in this report are intended to inform Phase II of the remedial investigation work: selection of a downgradient monitoring well location. The collective information of both Phase I and Phase II will form the basis for the Remedial Investigation and Feasibility Study required under the Agreed Order.

For the purposes of this report, the following terminology related to the Horn Rapids Landfill has been developed, as further described in Sections 1.2 and 1.3:

- City Facility: 275-acre permitted waste facility, including Landfill
- Landfill: 46-acre permitted area where municipal solid waste (MSW) has been and continues to be placed within the City Facility
- City Property: Contiguous property owned by the City of Richland, including the City Facility (approximately 2,306 total acres)
- Expansion: proposed 104-acre expansion of the Horn Rapids Landfill located within the City Facility east of the Landfill

1.1 Objectives

The push probe investigation work described in this report had the following objectives:

- Define the downgradient extent of contaminants in groundwater originating from the Landfill, and refine the groundwater flow direction.
- Select the location of an additional downgradient monitoring well based on push probe results to confirm that natural attenuation of VOCs in groundwater is occurring, and to monitor for future potential impacts from the existing Landfill and proposed Expansion.

1.2 Background

1.2.1 Horn Rapids Landfill Setting

The Horn Rapids Landfill is owned and operated by the City of Richland Public Works Department. It is located northwest of and within the city limits of Richland in an area bounded by Twin Bridges Road on the west, Horn Rapids Road on the north, and State Route 240 on the south. The Landfill is located within the southwest quadrant of the City Facility (see Figure 1). The Landfill includes the 46-acre existing landfill, a support facility, and a 9-acre composting facility.

As shown on Figure 1, the City Property extends to the west, south and east of the City Facility (a total of approximately 2,306 total acres), with the exception of several small privately owned parcels, two located along the southwest corner of the City Facility, and one within the northeast corner of the City Facility. East of the City Facility are circle-irrigated agricultural fields used to grow alfalfa hay, corn, and potatoes. Irrigated fields are also located west of the City Facility across State Highway 240. These fields have been in use since 1987, with irrigation occurring between the months of April and October (Shaw Environmental Inc. 2003). The remaining City Property south and southeast of the Landfill is undeveloped.

As shown on the Site Vicinity Map (Figure 2), the City Property immediately west of the City Facility has been developed as an off-road vehicle (ORV) park, which includes a road racing track and a motocross track facility.

The Site Plan (Figure 3) shows the City Facility boundary, the Landfill and other City Facility features, and monitoring locations including gas probes, groundwater monitoring wells, and lysimeters. The area within the City Facility east of the currently permitted 46 acres is the proposed Expansion.

1.2.2 Landfill Description

The Landfill began receiving MSW in 1974. The Landfill historically accepted only municipal wastes and was initially developed by placing waste into a series of north-south oriented trenches in the Phase 1 western portion of the Landfill. The Landfill (refuse) boundary is shown on Figure 3.

Phase 1 was closed in 2011, including installation of a landfill gas (LFG) collection system. MSW is currently being accepted in the Phase 2 eastern portion of the Landfill, and closure of Phase 2 is expected to occur in 2020. The proposed 104-acre Expansion is located east of the currently permitted 46 acres. Engineering plans for the proposed Expansion are presented in the Preliminary Conceptual Engineering Report (Parametrix 2017a).

1.2.3 Regulatory History and Interim Actions

The Landfill was originally permitted under Chapter 173-301 WAC, and currently operates under the Criteria for Municipal Solid Waste Landfills, Chapter 173-351 WAC and the current Solid Waste Permit (Permit) issued by the Benton-Franklin Health District (BFHD).

Monitoring wells MW-1 through MW-4 were installed in 1987, and volatile organic compounds (VOCs) were initially detected in the early 1990's. Two additional monitoring wells (MW-5 and MW-6) were installed downgradient from the Landfill in 1998, and concentrations of VOCs above MTCA cleanup levels were detected (Shannon and Wilson, Inc. 1998). An Early Notice letter was completed in March 2000, and the Landfill was placed on Ecology's Known or Suspected Contaminated Site List based on notification by the City that groundwater results were statistically elevated compared to background. The City Facility has been in assessment monitoring since that notification. The primary VOCs of concern in groundwater are chlorinated ethenes and ethanes.

In 2004 and 2005, the City performed an independent two-phased remedial investigation and a pilot study/feasibility study (RI/FS, Shaw Environmental, Inc. 2003, 2004, 2005). The RI determined that LFG is the likely source of the VOCs impacting groundwater. A LFG extraction system was designed (Parametrix 2005) based on pilot study results that showed LFG extraction would effectively remove VOCs from the subsurface, and closure including a LFG extraction system is being implemented in two phases (Parametrix 2011, 2012a, 2012b).

Between 2005 and 2010, Phase 1 of the Landfill was filled and graded to approved closure grading plans (EMCON 1999; Parametrix 2006, 2008, 2011), and was closed in 2011 (Parametrix 2011, 2012a, 2012b). The Phase 1 closure included a final cover and gas collection system consisting of in-refuse wells, collection manifold and laterals, a condensate manhole, and a flare station. The collection system has operated 24 hours a day since startup. The applied vacuum from the permanent blower/flare facility produces a pressure gradient within the MSW that causes LFG to flow into the collection field rather than migrate. Phase 2 is currently being filled to grade and closure is expected to occur in 2020.

Ongoing environmental monitoring is being conducted quarterly in accordance with Chapter 173-351 WAC and the current Permit, including annual testing for additional Appendix III parameters.

1.3 Hydrogeologic Setting

The local and regional geology and hydrogeology in the vicinity of the Landfill is detailed in reports documenting previous investigations (Hong West 1991; Shannon & Wilson 1998; Shaw Environmental Inc. 2003; Parametrix 2017c) and summarized in the following paragraphs.

Groundwater in the uppermost aquifer occurs under water table conditions in the sand, silt and gravel sediments of the middle Ringold Formation. The water table beneath the Landfill occurs at depths of approximately 75 to 105 ft below ground surface (bgs) and elevations of approximately 385 to 388 ft NAVD88, and typically fluctuates less than a foot throughout the year. Based on the geologic logs of the on-site water well and the adjacent ORV-2 well, the aquifer thickness is approximately 80 to 110 ft. The geologic logs for monitoring wells MW-4, MW-8, and MW-9, located closest to the area of investigation, indicate soils within the water bearing zone are expected to be gravel with approximately 10 to 15 percent silt.

Regionally, groundwater flow has been documented to be eastward toward the Columbia River (Shaw 2003, Liikala 1994). However, historical groundwater measurements have indicated the flow direction within the City Facility is influenced by groundwater mounding from irrigated crop circles on the City Facility's eastern boundary, resulting in a general flow direction toward the southeast with seasonal variations from east-southeast to south-southeast.

The overall groundwater gradient at the City Facility is low, approximately 0.0005 ft/ft over the past few years, and the calculated rate of groundwater flow is less than 20 ft per year.

1.4 Conceptual Site Model Summary

The Shannon & Wilson RI concluded that LFG was the primary source of the contaminants observed in groundwater. LFG interacts with moisture in the vadose zone and with groundwater in the capillary zone of the water table, where it becomes dissolved in and transported with groundwater flow. The concentrations of VOCs measured in LFG during the Shannon & Wilson RI were high enough to comprise the primary source of VOCs in groundwater. Although it is possible that some leachate may also be produced within the waste, the on-site lysimeters have demonstrated that little to no leachate is being accumulated below the waste, due to the arid conditions and the ability of the waste to store the moisture that is generated.

Groundwater with concentrations above GWQSs has moved beyond the City Facility boundary onto adjacent and downgradient City Property, and natural attenuation is expected to occur prior to movement off City Property due to the low groundwater flow rate. There are no current or anticipated risks to human health or the environment based on the data obtained to date. The presumptive remedy

is to continue removing LFG and leachate sources through the system already in progress and to enhance removal through the second phase of landfill closure. A more thorough discussion of the conceptual site model will be included in the Remedial Investigation and Feasibility Study Report required under the Agreed Order.

1.4.1 Preliminary Chemicals of Concern

Based on the measured concentrations at the City Facility boundary, the VOCs listed in Table 1 are present in concentrations greater than GWQSs and are considered to be the preliminary chemicals of concern (COCs) for the Landfill.

Table 1. Preliminary Chemicals of Concern, Horn Rapids Landfill

Parameter	Units	GWQS	MCL	Highest 2017 Concentration Observed at City Facility Boundary (Parametrix 2018)	Monitoring Well
Bromodichloromethane	µg/L	0.3	80	0.83	MW-8
Chloroform	µg/L	7	80	11	MW-8
1,1-Dichloroethane (1,1-DCA)	µg/L	1	NA	4.0	MW-4
Tetrachloroethene (PCE)	µg/L	0.8	5	12	MW-9
Trichloroethene (TCE)	µg/L	3	5	5.8	MW-9
Vinyl Chloride (VC)	µg/L	0.02	2	0.053	MW-9

Groundwater quality data collected from other monitoring wells within the City Facility, including upgradient wells MW-1 and MW-11, former upgradient well MW-7, and cross gradient well MW-2, indicate that upgradient sources are contributing to area-wide background concentrations of inorganic compounds, including TDS, chloride, nitrate, and cations.

1.4.2 Distribution of Chemicals and Rationale for Selecting Push Probe Locations

The push probe locations proposed in the Work Plan were selected based on the distribution of VOCs measured in City Facility monitoring wells during 2015. Since the groundwater flow direction is generally toward the southeast, but varies seasonally from east-southeast to south-southeast, the impacted area downgradient from the Landfill is expected to extend from south of MW-9 to east-southeast of MW-4. The contaminant distribution indicated that concentrations exceeding GWQSs were expected to be limited to an estimated distance of approximately 500 ft from the City Facility boundary. This area was explored by push probe (PP) locations PP-2 through PP-5 on City Property.

Gas probe data have indicated that LFG is present only in close proximity to the Landfill and only in gas probes GP-2, GP-9, and GP-12. Groundwater impacted by LFG in this area would generally flow toward existing wells MW-8 and MW-9. However, due to groundwater impacts observed in MW-1, and lack of deeper screened gas probes in the southwestern portion of the City Facility, the push probe investigation was also planned to evaluate potential LFG impacts to groundwater in the area near the southwestern City Facility boundary at location PP-1 and downgradient of this area on City Property at location PP-4.

2. PHASE 1 WORK CONDUCTED – DIRECT PUSH PROBES

This section provides a summary of the push probe field investigation and the results of the laboratory analyses. The Phase 1 investigation consisted of the following sequence of activities:

- Five push-probe installations were completed until groundwater was encountered to approximate depths of 100 ft.
- Groundwater samples were collected from each push probe at total depth using a portable bladder pump.
- The groundwater samples were tested for VOCs and natural attenuation parameters.

Detailed field notes are presented in Appendix A. Photographs of each probe and groundwater sampling procedures are presented in Appendix B.

The final locations of the five push probes are shown on Figure 4.

2.1 Push Probe Installation Procedures

The push probes were installed by Atkins (formerly EnergySolutions, Inc.) with oversight by a Parametrix hydrogeologist. Construction information and depth to groundwater measurements for the push probes are presented in Table 2. A variance from WAC 173-160-451(d) was obtained from Ecology (provided in Appendix A) because the probes exceeded the maximum allowed depth of 30 ft.

Atkins collected groundwater samples using direct push technology (EPA 2005) at five locations downgradient of the Landfill. One location (PP-1) was in the City Facility and four of the locations (PP-2 through PP-5) were on City Property. Atkins employed their hydraulic hammer probe driving unit that is mounted on a backhoe tractor. Atkins' Single String system driving and sampling system is deployed on 4-ft long 2.5-in. OD x 1.75-in. ID push rods, and features a 2.625-in removable tip design. The direct push tooling method for the Horn Rapids Landfill investigation project was as follows.

- Drive down to target depth.
- Knock out drive tip (drive tip remains in the hole) and pull back a few inches to ensure tip is free.
- Run in a standard stainless steel well screen on tubing and place on the bottom of hole.
- Pull back direct push tubing approximately 5 ft.
- Run sampling pump and collect groundwater sample.
- Remove screen and tubing.
- Decommission push hole by introducing grout as drive tubing is removed.

Groundwater elevations at each of the proposed locations were estimated in advance based on projections from the calculated potentiometric groundwater surface using measurements from nearby groundwater monitoring wells. The tooling was driven to a targeted depth approximately 10 ft deeper than the anticipated groundwater depth.

Table 2. Push Probe Construction and Groundwater Level Information, Horn Rapids Landfill

Push Probe	Northing	Easting	Installation Date	Ground Surface Elevation (ft NAVD88)	Total Depth (ft bgs)	Depth of Screened Interval (ft bgs)	Final Depth to Groundwater (ft bgs)	Final Groundwater Elevation (ft NAVD88)
PP-1	370136.48	1932732.48	11/15/17	485.83	116	103-113	98.84	386.99
PP-2	369722.92	1933633.14	11/07/17	486.54	111	100.4-110.4	101.68	384.86
PP-3	369779.73	1934183.53	11/09/17	474.80	108	90.5-100.5	90.60	384.20
PP-4	369636.95	1933012.80	11/13/17	481.26	105.4	95-105	95.72	385.54
PP-5	370047.88	1934744.04	11/16/17	453.60	89.3	79-89	67.80	385.80

A 10-ft temporary standard stainless steel screen was installed into each probe prior to groundwater sample collection. The purpose of the screen was to ensure that the hole remained open and to filter some particulates to reduce turbidity since the formation was expected to contain approximately 10 to 15 percent fine-grained sand and/or silt. The slot size of the screen was 20 slot (0.2 inch) based on the anticipated sediment size in the screened zone. The screen was decontaminated between push probe installations using the procedures described in the Quality Assurance Project Plan (QAPP; Parametrix 2017b).

2.2 Phasing and Selection of Push Probe Locations

The push probe locations were selected to fill data gaps in the southwest portion of the City Facility (PP-1) and on City Property further downgradient from existing monitoring well locations (PP-2 through PP-5). The objective of the investigation was to define the downgradient extent of contaminants in groundwater originating from the Landfill and to document decreases in measured VOC concentrations with distance from the Landfill to demonstrate that natural attenuation is occurring.

The first two push probes were installed at the PP-2 and PP-3 pre-selected locations, hydraulically downgradient from monitoring wells MW-9 and MW-8, respectively. Prior to confirming the third push probe location, laboratory data from PP-2 and PP-3 were reviewed and Ecology was consulted. The PP-2 results showed lower VOC concentrations than those observed in MW-9, consistent with expectations based on the 2015 isoconcentration maps. Specifically, the PP-2 concentration of 1,1-DCA was only slightly above the GWQS, PCE and TCE were not detected, and VC was below the GWQS. The observed concentrations at PP-3 were similar to the results from PP-2 and also consistent with expectations based on the 2015 isoconcentration maps.

The PP-1 location within the City Facility had to be adjusted from the original planned location due to the presence of water lines, and it was decided to install the third push probe at the PP-4 location while waiting for utility clearance and consultation with Ecology to confirm the final placement of PP-1 at the fourth location.

Following completion of PP-1, it became clear that budgetary and time constraints would limit the investigation to five probes instead of the maximum six probes proposed in the Work Plan since the dense nature of the sediment required greater than anticipated time to install each probe. This was communicated to Ecology, and after reviewing the data for PP-1, the fifth push probe was selected at the PP-5 location in consultation with Ecology. The objective of PP-5 was to confirm VOC concentrations downgradient from MW-4. Since the observed concentrations at previous push probes PP-2, PP-3, and PP-4 showed only low concentrations of VOCs, it was decided that this location for PP-5 would provide more information toward the project objectives than the alternate proposed location that was further downgradient from PP-2 and PP-3.

2.3 Groundwater Sampling Procedures

Groundwater samples were collected at each probe location using a 0.75-inch diameter portable bladder pump. Stainless steel weights were attached to the bottom of the pump to facilitate introduction to the bottom of the hole. Although full development of the probe was not possible, the portable bladder pump was used to purge some water prior to sampling to reduce the amounts of fines. However, the low pumping rate of the small diameter pump (approximately 20 to 25 ml/min) only allowed a small quantity of water to be purged prior to sampling. The portable bladder pump was decontaminated between push probe locations using the procedures described in the QAPP.

Groundwater sampling was conducted using low-flow purging techniques as detailed in SOPs presented in the QAPP. The rate of flow during purging and sampling was approximately 20 to 25 ml/min, lower than typical purge rates of 300 to 500 ml/min described in the QAPP. Field parameters (conductivity, pH, temperature, dissolved oxygen [DO], and oxidation-reduction potential [ORP]) were measured during sampling using a flow through cell.

Some of the groundwater samples were observed to have significant turbidity as detailed in the field notes in Appendix A. The observed turbidity was likely related to the pulverized sediment that was removed from the casing at the bottom of each probe prior to introducing the screen. Turbidity present within the samples is not expected to cause significant bias in concentrations of VOCs or dissolved gases (EPA 2005, see Table 3.1).

2.4 Groundwater Analyses

Groundwater samples collected from the push probe were hand delivered to a local analytical laboratory, Energy Northwest, located in Richland, WA, and tested for VOCs (EPA Method 8260C and 8260C SIM for selected VOCs with low GWQSs) with a 24-hour turnaround so that the results could be used to confirm the location of subsequent push probes. Laboratory procedures and analytical methods are presented in the QAPP.

In addition, groundwater samples were tested for the natural attenuation parameters methane, ethane, and ethene (Method RSK 175). Energy Northwest subcontracted these analyses to ALS Environmental.

In accordance with the QAPP, duplicate samples collected at selected locations were analyzed as shown on Table 3 to evaluate the quality and reproducibility of the data. Duplicate samples were analyzed by Energy Northwest, and also by TestAmerica, the lab that conducts the routine quarterly groundwater monitoring well sample analyses. The TestAmerica samples were hand delivered to the lab in Tacoma, WA, along with the Fourth Quarter 2017 monitoring well samples that were collected on November 14 and 15, 2017.

Specific conductivity, pH, temperature, DO, and ORP were measured in the field.

Table 3. Push Probe Groundwater Laboratory Duplicate Analyses, Horn Rapids Landfill

		VOCs	Natural Attenuation Parameters (methane, ethane, ethene)	
Push Probe Location	**Sample Date**	**TestAmerica**	**Energy Northwest**	**TestAmerica**
PP-1	11-15-17	x	x	
PP-2	11-07-17			
PP-3	11-09-17	x		x
PP-4	11-13-17	x		
PP-5	11-16-17			

3. RESULTS

3.1 Groundwater Quality Data

Laboratory reports for the push probes samples are presented in Appendix C. The groundwater quality results are summarized in Tables D-1 (VOCs), D-2 (natural attenuation parameters), and D-3 (field data) in Appendix D. Table D-4 presents a summary of the 2017 groundwater monitoring well results including the Fourth Quarter monitoring conducted on November 14 and 15 for comparison with the push probe results (samples collected between November 7 and 16).

The laboratory data were reviewed in accordance with data validation procedures outlined in the QAPP, including a review of the laboratory blanks and control standards, and selected sample results were compared with the results for their associated field duplicate. The results of the data review are presented in memoranda in Appendix C.

For PP-1, although the concentrations reported by Energy Northwest for vinyl chloride using Method 8260 (less than 0.5 µg/L) and 8260 SIM (0.35 µg/L) were internally consistent, the 8260 SIM result was much higher than the Method 8260 result reported by TestAmerica (less than 0.02 µg/L). Although Energy Northwest's 8260 SIM result of 0.35 µg/L for PP-1 was used to prepare the isoconcentration map discussed in Section 3.3, this value and associated interpretation are considered an estimate that is potentially biased high.

3.1.1 VOCs

VOC results are presented in Table D-1. Concentrations of 1,1-DCA, TCE, PCE, and VC were above the GWQS at PP-1, located in the southwestern portion of the City Facility. The concentrations observed at PP-1 were generally in the range of typical concentrations observed at MW-9 in routine and periodic groundwater monitoring performed at the Landfill over the past few years.

The only concentration above a GWQS detected in any of the push probes outside the City Facility boundary on City Property was 1,1-DCA in the sample from PP-2 at a concentration of 1.1 µg/L, slightly above the GWQS of 1.0 µg/L.

The chemical acrylonitrile was also detected in the samples from PP-2, PP-3, and PP-5, with the concentration at PP-5 (0.0705 µg/L) slightly above the GWQS (0.07 µg/L). Routine analyses from the monitoring wells on the City Facility for acrylonitrile have not shown detections, although the reporting limit during routine monitoring is higher (5.0 µg/L compared to 0.02 µg/L for the push probe investigation) because the selective ion monitoring (SIM) method is not used.

Acetone was detected in all five push probe samples, and the concentrations in PP-2 (46 µg/L), PP-4 (39 µg/L), and PP-5 (11 µg/L) were higher than the range of concentrations measured in Landfill monitoring wells (2.3 to 9.0 µg/L). The duplicate samples tested at PP-1 (5.0 compared to 4.5 µg/L) and PP-3 (32 compared to 39 µg/L) indicated the acetone results were generally reproducible between both laboratories, although the concentration measured at PP-3 (8.8 µg/L) was not confirmed by its duplicate result of less than 2 µg/L.

Low concentrations of acetone could potentially be attributed to its presence as a trace contaminant associated with products employed during drilling operations. However, acetone is not identified as a component of any of the materials used during the field portion of this investigation. During the push probe installation, pipe lubricant (Jet Lube's Well Guard) was used for the threading on the drill rods, and sealant (RTV Red High Temp Silicon Sealant) was used to secure the knock out tips. Prior to

deployment, the tooling (pipe, etc) was first cleaned with Simple Green then steam cleaned. The rig was also steam cleaned before deployment. And, although not introduced into the borehole, grease (Redtac grease and Lagermeister 3000 Plus) was used to lubricate the pulley system and the drive hammer. Detergent (ALCONOX) was used to clean the screen. Safety Data Sheets for these materials are included in Appendix A.

Acetone in trace concentrations is also sometimes present as a contaminant in preservatives added to sample vials, and acetone is also a contaminant that can be introduced during laboratory sample preparation and analysis. For this project, the vials used were certified to be free of acetone above a quantitation limit of 2 µg /L (see certification presented in Appendix A). No acetone was detected in any of the trip blanks, method blanks, or matrix spikes/matrix spike duplicates.

In conclusion, although it is not possible to identify any specific source that introduced acetone as a contaminant, higher acetone concentrations in push probe samples compared to well samples suggest there could be a possible source related to some aspect of this specific investigation. No GWQS has been established for acetone, and the acetone results are not believed to impact the other results of this study since the COC concentrations are consistent with expectations based on the monitoring well data.

3.1.2 Natural Attenuation Parameters

Natural attenuation parameter (methane, ethane, and ethene) results are presented in Table D-2. Methane was detected at low concentrations in all the push probes at concentrations ranging from 2.6 to 19 µg/L (23 µg/L in PP-3 duplicate). Methane is routinely detected at concentrations between 1,000 and 5,000 µg/L in monitoring wells along the downgradient edge of the Landfill (MW-5, MW-6, and MW-10) and sporadically at concentrations less than 5 µg/L in monitoring wells along the City Facility boundary (MW-8 and MW-9).

Ethane (0.68 to 7.3 µg/L) and ethene (1.2 to 5.7 µg/L) were also detected in the push probe groundwater samples. Ethane and ethene have not been detected during routine groundwater monitoring, although the reporting limits for this push probe investigation were lower (1.0 µg/L compared to 10 µg/L during the routine groundwater well monitoring). These detections support the occurrence of natural attenuation that would be expected to result in production of ethene and ethane.

3.1.3 Field Data

The field data are presented in Table D-3. The specific conductivity data are generally consistent with expectations based on typical results in the monitoring wells. The specific conductivity measured at PP-1 (1,100 µmhos/cm) was slightly above typical ranges observed in upgradient monitoring well MW-1 and in monitoring wells MW-8 and MW-9 located downgradient of the Landfill along the City Facility boundary. Lower specific conductivity measurements (370 to 551 µmhos/cm) were observed in push probes PP-2 through PP-5 located within City Property outside the City Facility boundary; these specific conductivity measurements are comparable with monitoring well MW-4, which is further from the Landfill and not impacted by area-wide background influences.

DO and ORP measurements in push probe samples were more difficult to interpret compared to the routine monitoring well data. The DO results for the push probe samples ranged from 0.36 to 3.11 mg/L and were lower than or generally consistent with the DO typically observed at MW-9 near the City Facility boundary. ORP results were all negative and lower than typically observed in monitoring wells and did not show any clear pattern.

3.2 Groundwater Elevations

Potentiometric surface maps calculated for the four quarters of 2017 using data collected at the City Facility monitoring wells are presented in Appendix F. The flow directions are consistent with past results and indicate flow generally toward the southeast with seasonal variations from east-southeast to south-southeast. Groundwater elevations calculated at each push probe using final depth to water measurements (presented on Table 2) are generally consistent with what would be expected based on the elevations measured in nearby monitoring wells. The push probe water level data were not included when preparing the Fourth Quarter potentiometric surface map since they were measured immediately following probe installation and may not reflect complete equilibration at the time of measurement.

3.3 Distribution of Contaminants

Isoconcentration maps of the maximum concentrations of VOCs detected in 2015 (1,1-DCA, PCE, TCE, cis 1,2-DCE, and VC) were previously presented in the Work Plan. These maps have been updated using data collected during the push probe investigation (November 7 through 16, 2017) and Fourth Quarter 2017 data collected at the groundwater monitoring wells (November 14 and 15, 2017). Data used to prepare the isoconcentration maps are presented in Table D-5, the updated isoconcentration maps are presented in Appendix E.

Areas estimated to be impacted by VOCs extend to the southeast of the Landfill in a direction generally consistent with the direction of flow indicated by recent groundwater flow contours. The isoconcentration maps include estimated contours of concentrations equal to GWQSs ("GWQS isocontours"). Areas with concentrations above GWQSs are limited to approximately 500 feet beyond the City Facility boundary. The downgradient limits of concentrations above GWQSs have been defined for PCE, TCE, and VC. The VC isoconcentration map uses the higher of the two measured concentrations for PP-1 and is considered a conservative estimate; the actual area where VC concentrations are above the GWQS may be less extensive than shown.

For 1,1-DCA, the isoconcentration contours suggest that concentrations likely decrease to below the GWQS just beyond the location of PP-2. 1,1-DCA was detected at PP-2 at a concentration of 1.1 µg/L, only slightly above the GWQS of 1.0 µg/L

The detections of VOCs above GWQSs at PP-1 are consistent with its location downgradient from the southwestern corner of the Landfill and near gas probes GP-2, GP-9, and GP-12 where subsurface LFG has routinely been detected. GWQS isocontours have been estimated west of PP-1 using data from well MW-1 and further downgradient PP-4, and suggest that concentrations in the southwesternmost corner of the City Facility are likely below GWQSs. This area is not downgradient of the Landfill and LFG has not routinely been detected in gas probes along the southwestern City Facility boundary (GP-3, GP,4, GP-8, and GP-10).

Based on the overall flow direction toward the southeast, the data from the push probes and monitoring wells can generally be considered to fall along one of four predicted general flow paths extending downgradient from the Landfill onto adjacent City Property, as detailed in Table 4. The COC concentrations measured along each of these groundwater flow paths show consistent decreases with distance from the Landfill, demonstrating that natural attenuation is occurring as groundwater flows away from the Landfill.

Table 4. November 2017 Concentrations of COCs (µg/L) with Distance from the Landfill along Groundwater Flow Paths, Horn Rapids Landfill

Flow Path	Monitoring Well or Probe	Approximate Distance from Landfill (ft)	1-1 DCA (GWQS 1.0)	TCE (GWQS 3.0)	PCE (GWQS 0.8)	VC (GWQS 0.02)
1	PP-1*	450	4.8	4.9	4.1	0.35[1]
	PP-4	950	<0.5	<0.5	<0.5	<0.005
2	MW-9*	500	3.9	4.8	9.6	<0.02
	PP-2	950	1.1	<0.5	<0.5	0.005
3	MW-6*	50	4.5	13	24	3.3
	MW-8*	900	<0.2	<0.2	<0.5	<0.02
	PP-3	1250	0.74	<0.5	<0.5	0.009
4	MW-10*	50	9.4	3.1	5.8	1.0
	MW-5*	50	7.7	5.1	11	4.5
	MW-4*	1250	4.0	<0.2	<0.5	<0.02
	PP-5	1600	<0.5	<0.5	<0.5	<0.02

* Within City Facility

[1] Estimated concentration; result for duplicate samples was less than 0.02 µg/L

Shading indicates concentration exceeds GWQS

4. CONCLUSIONS AND RECOMMENDATIONS

This section summarizes the conclusions of the Phase 1 investigation and presents recommendations for the Phase 2 investigation.

4.1 Phase 1 Conclusions

As shown on isoconcentration maps presented in Appendix E, the areal extent of groundwater downgradient from the Landfill where COC concentrations exceed GWQSs is limited to a distance of approximately 500 ft from the City Facility boundary. Concentrations below GWQSs have been delineated for PCE, TCE, and VC. For 1,1-DCA the area exceeding the GWQS is expected to be limited to just beyond the location of PP-2, but not beyond the other areas explored in this investigation.

The presence of low levels of methane, ethane, and ethene in the push probe groundwater samples indicates that natural attenuation is likely occurring, and indicates further that conditions in groundwater are consistent and favorable for biodegradation of chlorinated hydrocarbons.

Approximate groundwater elevations measured at the push probes are consistent with the expected flow direction as measured in the City Facility monitoring wells. The areas impacted by VOCs extend to the southeast of the Landfill in a direction generally consistent with the direction of flow indicated by recent groundwater flow contours, and the measured concentrations show attenuation with distance from the Landfill along four general groundwater flow paths as shown on Table 4.

4.2 Phase 2 Recommendations for Groundwater Monitoring Well

The conclusions of the push probe investigation support installing one downgradient monitoring well on City Property southeast of the Horn Rapids Landfill at the approximate location shown on Figure 4.

The proposed location of the monitoring well was selected with a data quality objective to confirm the absence of contamination downgradient from the Landfill, at a distance from the downgradient edge of City Property that is sufficient to allow additional actions to be taken in the event that contaminants are identified. Any contaminants identified at the proposed location (greater than 1,000 ft from the City Property boundary) would not move beyond the City Property for over 50 years at the calculated flow rate of approximately 20 ft per year.

The location is downgradient from the approximate center of the contaminant plume and the area outside the City Facility that has been defined by the push probe investigation to have VOC concentrations above GWQSs as shown on isoconcentration maps (Appendix E). It is downgradient from push probe PP-2 where 1,1-DCA was detected at a concentration slightly above the GWQS. The new well will be used as a sentinel well to identify potential contamination releases from the existing Landfill. It is also downgradient from the Expansion Area and can be used as an uncontaminated well for detection monitoring. The City will confirm the location with Ecology prior to installation.

The following activities will be conducted:

- One groundwater monitoring well will be installed into uppermost groundwater, to a total depth of approximately 100 ft using the air rotary method.
- The groundwater monitoring well will be 2-in diameter Schedule 80 PVC, with a 15-ft screened interval. The top of the screen will be set at a depth approximately 5 ft above the water table encountered during drilling. Construction of the monitoring well will follow the specification previously developed for well MW-11 (see Appendix G).
- Groundwater samples will be collected and tested for WAC 173-351 Appendix I and II parameters using existing procedures described in the QAPP.

5. REFERENCES

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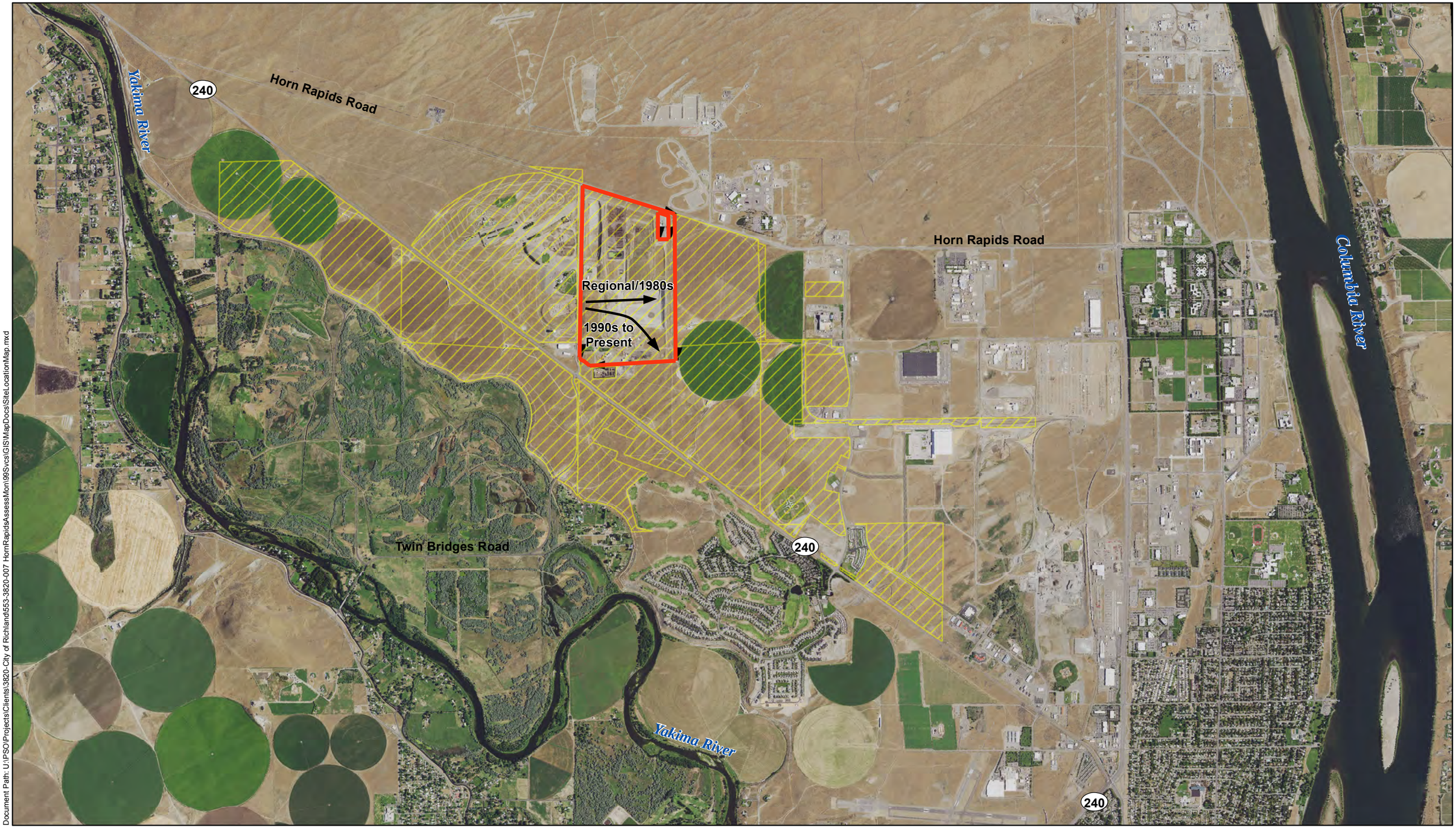
Shaw EMCON/OWT, Inc. 2005. Results of Pilot-Scale Landfill Gas Extraction Test, Horn Rapids Landfill, Richland, Washington. Prepared for Mr. Steve McNutt, Horn Rapids Landfill, May 25, 2005.

Figures



Document Path: U:\PSO\Projects\Clients\3820-City of Richland\553-3820-007 HornRapidsAssessMon\99Svcs\GIS\MapDocs\SiteLocationMap.mxd

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

Miles
0 0.25 0.5 0.75 1

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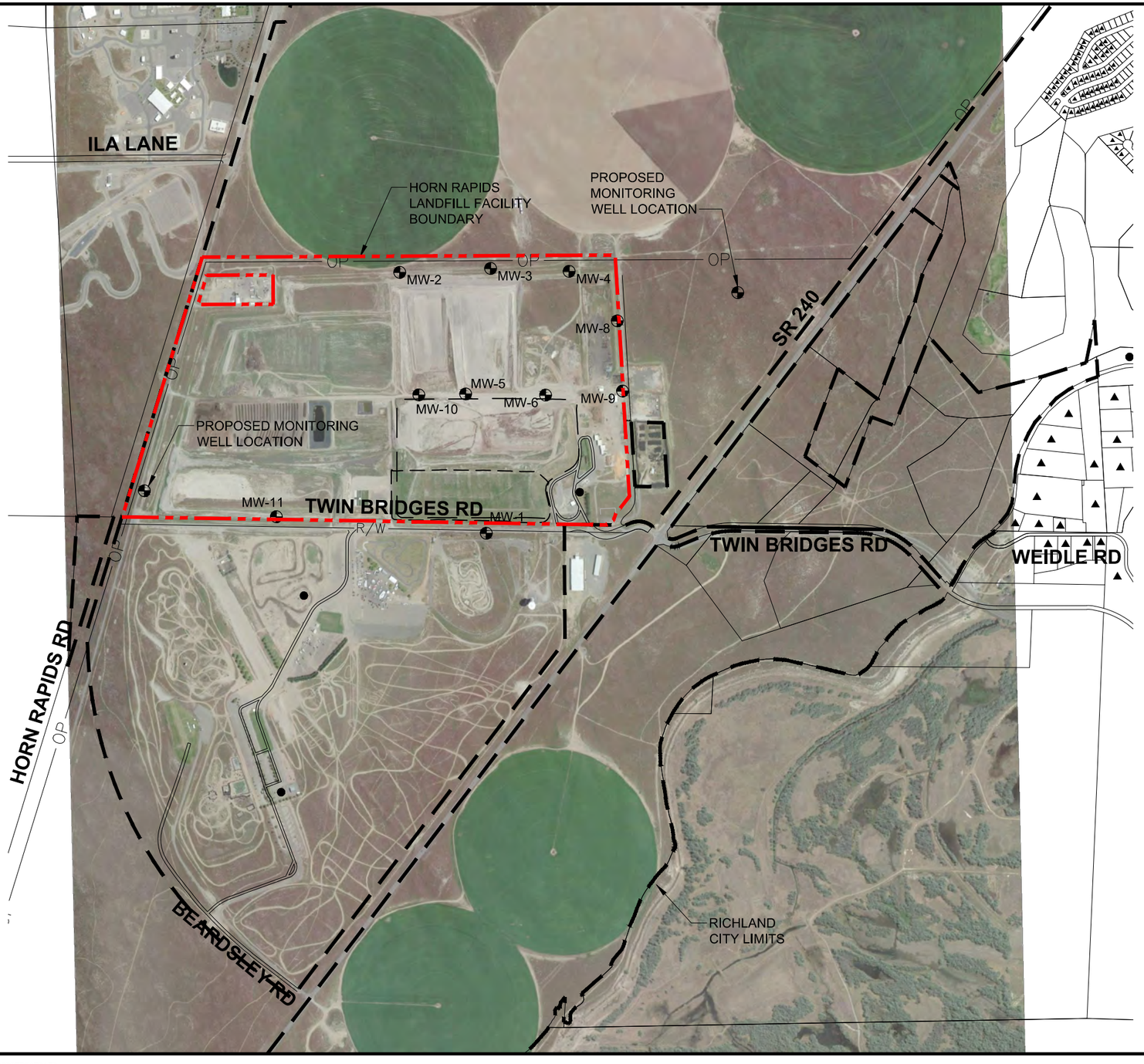
Image Source: NAIP (2015 Imagery)

Legend

- Facility Boundary
- City Owned Property
- Approximate Groundwater Flow Direction

FIGURE 1
Horn Rapids Landfill
Site Location Map



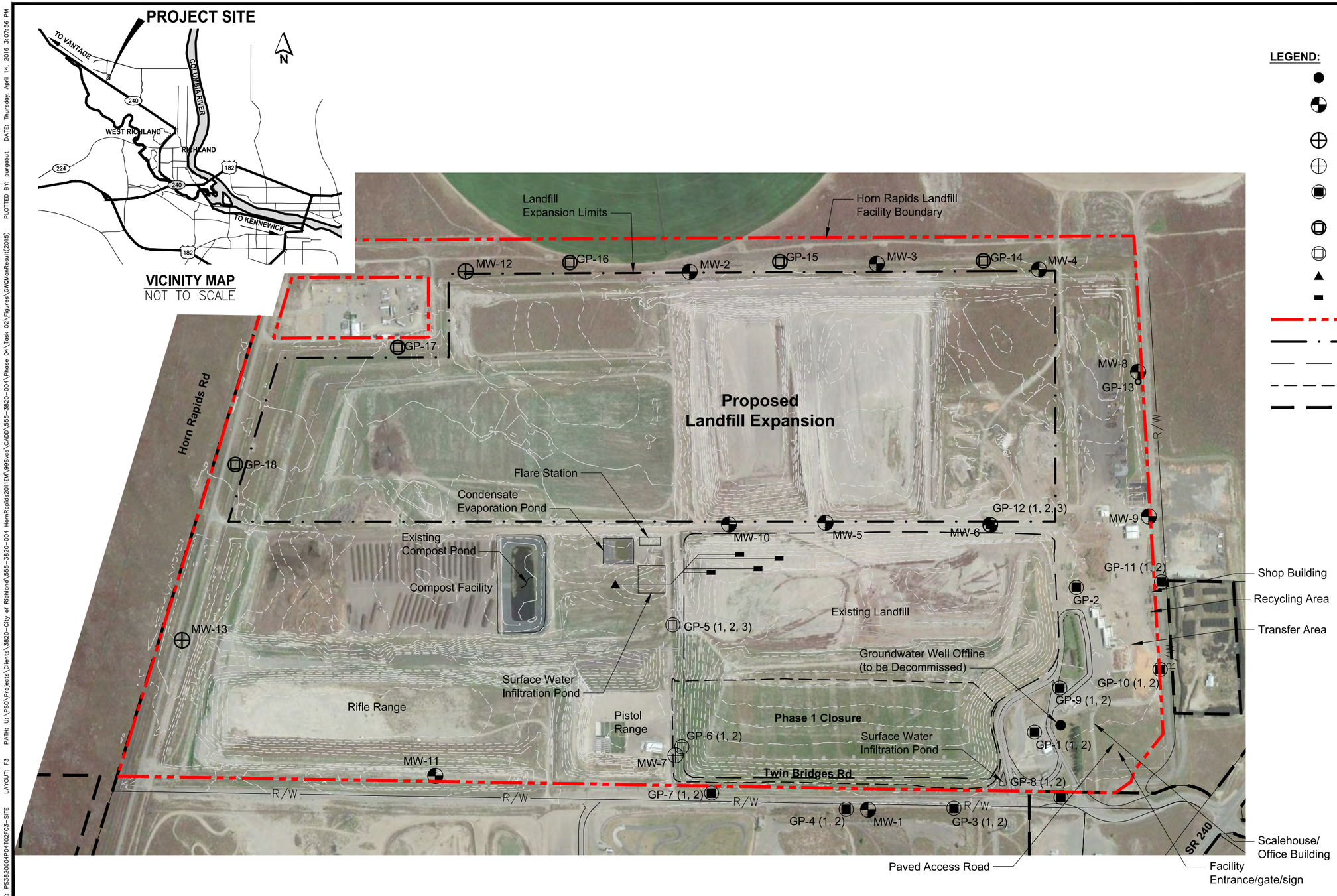
LEGEND:

- WATER SUPPLY WELLS
- RESIDENCES
- MW-1 MONITORING WELLS
- FACILITY BOUNDARY
- REFUSE BOUNDARY
- PHASE 1 BOUNDARY
- CITY OF RICHLAND PROPERTY LINE

Parametrix DATE: April 14, 2016 FILE: BL3820007P01T01F2

0 N 1200
SCALE IN FEET

Figure 2
Horn Rapids Landfill
Vicinity Plan



LEGEND:

- WATER SUPPLY WELL LOCATION
- EXISTING GROUNDWATER WELL LOCATION
- PROPOSED GROUNDWATER WELL (APPROXIMATE LOCATION)
- DECOMMISSIONED
- EXISTING GAS PROBE (1,2,3) WITH VARIABLE–DEPTH
- PROPOSED GAS PROBE (APPROXIMATE LOCATION)
- DECOMMISSIONED
- LYSIMETER PORT
- LYSIMETER
- FACILITY BOUNDARY
- LANDFILL EXPANSION BOUNDARY
- REFUSE BOUNDARY
- PHASE 1 BOUNDARY
- CITY OF RICHLAND PROPERTY LINE

Parametrix DATE: April 14, 2016 FILE: PS3820004P04T02F03-SITE

0 N 500
SCALE IN FEET

Figure 3
Horn Rapids Landfill
Site Plan

Horn Rapids
Landfill Facility Boundary

OP

MW-2
MW-3
MW-4
MW-8
MW-9
MW-10
MW-5
MW-6
MW-7
MW-11
MW-1

PP-5
PP-3
PP-2
PP-4
PP-1

Approximate Proposed
Monitoring Well Location

GP-12 (1, 2, 3)
GP-11 (1, 2)
GP-2 (1,2)
GP-10 (1, 2)
GP-9 (1, 2)
GP-1 (1,2)
GP-8 (1, 2)
GP-5
GP-6
GP-7 (1, 2)
GP-4 (1, 2)
GP-3 (1, 2)

R/W

SR 240

TWIN BRIDGES RD

Parametrix DATE: January 25, 2018 FILE: BL3820007P01T01F4

0 N 500
SCALE IN FEET

Legend:

- Water Supply Wells
- Monitoring Wells
- Gas Probes
- Push Probe Locations
- Facility Boundary
- City of Richland Property Line
- Approximate Groundwater Flow Contours
- Groundwater Flow Direction
- Refuse Boundary
- Phase 1 Boundary

Figure 4
Push Probe Locations and Proposed Monitoring Well Horn Rapids Landfill

Appendix A

Field Data

Horn Rapids Investigation Field Summary

PP-1

Drilling at location PP-1 began on 11/13/2017 and was completed on 11/15/2017. PP-1 was drilled to a maximum depth of 116 feet below ground surface (bgs). Approximately two feet of pulverized material was cleared out of inside of casing. Initial depth to water (dtw) was 102.75 feet bgs. After the screen was installed from 103 to 113 feet bgs and the outer casing was pulled up to 103 feet bgs, the dtw decreased to 98.84 feet prior to sampling. PP-1 was purged at a rate between 20 and 25 ml/min from 8:18 am to 9:10 am on 11/15/17. Initial turbidity of purge water was significant; final turbidity at time of sampling was less than initial observation but still considerable. The groundwater sample was collected from PP-1 at 9:15 am. Duplicate sample 111517-DUP was also collected at PP-1.

PP-2

Drilling at location PP-2 began on 11/5/2017 and was completed on 11/7/2017. Drilling was extremely hard to approximately 60 feet bgs. PP-2 was drilled to a maximum depth of 111 feet bgs. Approximately two feet of pulverized material was cleared out of inside of casing. Initial dtw was 101.68 feet bgs. The screen was installed from approximately 100.4 feet to 110.4 feet bgs with the outer casing pulled up to 100 feet bgs. PP-2 was purged at a rate of approximately 30 ml/min from 14:40 pm to 15:26 pm on 11/7/17. Turbidity of purge water waslow. The groundwater sample was collected from PP-2 at 15:29 pm.

PP-3

Drilling at location PP-3 began on 11/8/2017 and was completed on 11/9/2017. PP-3 was drilled to a maximum depth of 108 feet bgs. Approximately four feet of pulverized material was cleared out of inside of casing. Initial dtw was 90.6 feet bgs. The screen was installed from approximately 90.5 feet to 100.5 feet bgs with the outer casing pulled up to 90 feet bgs. PP-3 was purged at a rate between 20 and 25 ml/min from 10:45 am to 11:51 am on 11/9/17. Turbidity of purge water was very significant. The groundwater sample was collected from PP-3 at 11:55 am. Duplicate sample 110917-DUP was also collected at PP-3.

PP-4

Drilling at location PP-4 began on 11/10/2017 and was completed on 11/13/2017. PP-4 was drilled to a maximum depth of 105.4 feet bgs. Approximately one to two feet of pulverized material was cleared out of inside of casing. Initial dtw was 99.32 feet bgs. The screen was installed from approximately 95 feet to 105 feet bgs with the outer casing pulled up to 95 feet bgs. DTW prior to the start of purging was 95.72 feet bgs. PP-4 was purged at a rate between 20 and 25 ml/min from 9:06 am to 10:12 am on 11/13/17. Turbidity of purge water initially considerable but cleared up considerably for sampling. The groundwater sample was collected from PP-4 at 10:15 am. Duplicate sample 111317-DUP was also collected at PP-4.

PP-5

Drilling at location PP-5 began on 11/15/2017 and was completed on 11/16/2017. Drilling at this location was easier than all prior locations. PP-5 was drilled to a maximum depth of 89.3 feet below ground surface (bgs). Approximately one foot of pulverized material was cleared out of inside of casing. Initial depth to water (dtw) was 76.31 feet bgs. After the screen was installed from 79 to 89 feet bgs and the outer casing was pulled up to 79 feet bgs, the dtw decreased to 67.80 feet prior to sampling. PP-5 was purged at a rate between 20 and 25 ml/min from 8:56 am to 9:43 am on 11/16/17. Initial turbidity of purge water was significant; final turbidity at time of sampling was less than initial observation but still considerable. The groundwater sample was collected from PP-5 at 9:55 am. Duplicate sample 111617-DUP was also collected at PP-5.

ATKINS
Member of the SNC-Lavalin Group

Atkins
2345 Stevens Drive, Suite 240
Richland, WA 99354
www.atkinsglobal.com/energy

December 13, 2017 LT- 005218R

Ms. Lisa Gilbert
Senior Hydrologist
Parametrix
719 2nd Avenue, Suite 200
Seattle WA 98104

Subject: Transmittal of Project Documents

Dear Ms. Gilbert,

It was a pleasure working with you and your team in providing the direct push services for the investigation at the City of Richland Horn Rapids Landfill. I hope the ground water data acquired meets the goals and expectations of the project.

I will be submitting an invoice this week. I have been waiting for some vendor invoices to clear our system. I am invoicing for some expendable items we took out of our inventory. These have been priced based on current vendor pricing and I have provided the PO for the replacement of these items as a backup for the charges. If this is not acceptable, I will submit a revised invoice once we have received the items. These were long lead items that I chose to use out of our inventory as I was not certain on quantity we would expend. Let me know if you have any questions on the invoice after you have had time to review.

I am providing you with the following project documentation we generated in support of the project:

- Washington Department of Ecology (WDOE) Notice of Intent to Construct an Environmental Investigation Well
- WDOE Notice of Intent to Decommission a Well
- WDOE Variance Request
- WDOE Letter granting the Variance
- WDOE Well Reports
- Atkins Daily Field Job Tickets
- Atkins Daily Work Records

Should you require other documentation not included, please let me know.

ATKINS
Member of the SNC-Lavalin Group

Atkins
2345 Stevens Drive, Suite 240
Richland, WA 99354
www.atkinsglobal.com/energy

We look forward to the possibility of working with you in the future. If you have any questions, please contact my office 509-420-5571, my cell 509-942-4244, or at Marty.Gardner@atkinsglobal.com.

Sincerely,

Martin Gardner
Project Director
Atkins Energy Americas Division

MGG/jil

Attachments:

1) NOI to Construct
2) NOI To Decommission
3) Variance Request
4) Variance Approval from Ecology
5) Well Reports PP1-PP5
6) Atkins Daily Field Job Tickets
7) Atkins Daily Work Records

cc: Eric Straalsund
Paul Cavanah
Erin Peters
Richland Document Control

ATTACHMENT 1

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Intent to Construct an Environmental Investigation Well

Notification Number
EE06902

This form and required fees **MUST BE RECEIVED** by the Department of Ecology **72 HOURS BEFORE** you construct a well.

Submit one completed form for each job site and required fee (check or money order only) to:
Department of Ecology Cashiering Unit, P.O. Box 47611, Olympia, WA 98504-7611

NOTE: Please print. Processing your Notice of Intent may be delayed if all fields are not filled in completely.

1. Property Owner: City Of Richland		Phone Number: (509) 942-7500	
Mailing Address: 505 Swift Blvd	City: Richland	State: WA	Zip Code: 99352
2. Agent (if different from above): Parametrix		Phone Number: (206) 394-3700	
Mailing Address: 719 2nd Ave Ste 200	City: Seattle	State: WA	Zip Code: 98104

3. Well Location

Tax Parcel Number, Township, Range, Section, ¼, and ¼ ¼ are Required. Latitude and longitude (if available).

County Name: Benton - 3					
Well Site Street Address: 3102 Twin Bridges Rd.			City: Richland	State: WA	Zip Code: 99354
Tax parcel number	Township: 10N	Range: 28E	Section: 20	¼ (within 160 acres): NW	¼ -¼ (within 40 acres): NE
Latitude Degrees	Latitude Time: min	sec	Horizontal Collection Method		
Longitude Degrees	Longitude Time: min	sec			

4. Estimated Start Date: 11/6/2017 Project Name

5. Professional's License Number

6. Well Drilling Company Name: ENERGY SOLUTIONS INC		Phone Number: (509) 420-5571	
7. Well Driller Name: MARTIN GARDNER		Driller License Number: 1584	

10. **Send the entire form.**

Please copy the notification number (located in the upper and lower right corners) and keep in a safe place. Use this reference number when communicating with the Department of Ecology.

Total Number of wells to be constructed 6

Site Fee (1-4 wells) $ 40.00

This notification number must be provided to your driller:
EE06902

Total Number of wells exceeding 4 = 2 x $ 10 each = $ 20

Total Due and Amount Enclosed $60.00

Your validation will be sent to the e-mail address you provided: marty.gardner@atkinsglobal.com

ATTACHMENT 2

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Intent to Decommission a Well

Notification Number **AE45893**

This form and required fees **MUST BE RECEIVED** by the Department of Ecology **72 HOURS BEFORE** you construct a well.

Submit one completed form for each job site and required fee (check or money order only) to:
Department of Ecology Cashiering Unit, P.O. Box 47611, Olympia, WA 98504-7611

NOTE: Please print. Processing your Notice of Intent may be delayed if all fields are not filled in completely.

1. Property Owner: City Of Richland			Phone Number: (509) 942-7500
Mailing Address: 505 Swift Blvd	City: Richland	State: WA	Zip Code: 99352
2. Agent (if different from above): Parametrix			Phone Number: (206) 394-3700
Mailing Address: 719 2nd Ave Ste 200	City: Seattle	State: WA	Zip Code: 98104

3. Well Location

Tax Parcel Number, Township, Range, Section, ¼, and ¼ ¼ are Required. Latitude and longitude (if available).

County Name: Benton - 3					
Well Site Street Address: 3102 Twin Bridges Rd.			City: Richland	State: WA	Zip Code: 99354
Tax Parcel Number	Township: 10N	Range: 28E	Section: 20	¼ (within 160 acres): NW	¼ -¼ (within 40 acres): NE
Latitude Degrees	Latitude Time: min	sec	Horizontal Collection Method		
Longitude Degrees	Longitude Time: min	sec			

4. Notice of Intent Number of well being decomissioned: EE06902
Unique Well Tag Number of well being decomissioned (if applicable)

5. Well Type to Decommission: Environmental Protection Well - No Fee — How Many? 6

6. Estimated Decommission Start Date: 11/6/2017 — Project Name

7. Professional's License Number

8. Well Drilling Company Name: ENERGY SOLUTIONS INC	Phone Number: (509) 420-5571
9. Well Driller Name: MARTIN GARDNER	Driller License Number: 1584

10. **Send the entire form.**

Please copy the notification number (located in the upper and lower right corners) and keep in a safe place. Use this reference number when communicating with the Department of Ecology.

Water Well :	$50.00
Soil Sampling, Dewatering, Environmental investigation wells:	No Fee
All other wells:	$20.00 each
Amount Enclosed $	$0.00

This notification number must be provided to your driller:

AE45893

Your validation will be sent to the e-mail address you provided: marty.gardner@atkinsglobal.com

DEPARTMENT OF ECOLOGY
State of Washington

Water Resources Program
Variance Request- Minimum Standards for Well Construction

WAC173-160-106(1) allows you to request a variance from the Department of Ecology when strict compliance with state well construction standards is impractical. The variance request must propose comparable alternative specifications that will provide equal or greater human health and resource protection than the minimum standards. You must apply for a variance in writing and receive approval before constructing or decommissioning the well. (All fields must be completed.)

Requested by: Martin Gardner

Mailing Address: 2345 Stevens Dr., Ste 240 City Richland State WA Zip 99354

Daytime Phone: 509-942-4244 Date: October 26, 2107

Property Owner (if different): City of Richland

Site Location: NW ¼ NE ¼ Section 20 Township 10N Range28E ☐E or ☒WWM

Tax Parcel Number

Well Address: 3102 Twin Bridges Rd, Richland, WA 99354

Well Driller/Company (if known): Atkins Energy, Lyle Amos #1224, Martin Gardner #1584

Check one: ☐ Water Well ☒ Resource Protection Well ☐ Dewatering Well

What construction standard cannot be met? WAC 173-160-451

Reason why standard cannot be met. Include site map and distances from all known potential sources of contamination if setback variance is being requested. THE DIRECT PUSH ENVIRONMENTAL INVESTIGATION WELLS WILL BE DRIVEN TO A TOTAL DEPTH OF 110 TO 125 FT. BGS, EXCEEDING THE 30 FT. DEPTH LIMIT REQUIRING A VARIANCE. SUBMITTED NOI # EE06902

NOTE - RECEIVED VERBAL CONCURRENCE FROM AVERY RICHARDSON 10-26-2017.

Alternative construction method that will provide equal or greater protections than those provided by the minimum standard. N/A

(Attach additional pages if necessary.) Complete and return with your site map to the appropriate regional office:

Northwest Regional Office	Southwest Regional Office	Eastern Regional Office	Central Regional Office
ATTN: Noel Philip	ATTN: John Pearch	ATTN: Mark Ader	ATTN: Avery Richardson
3190 160th Avenue SE	PO Box 47775	N 4601 Monroe	15 W Yakima Ave #200
Bellevue, WA 98008	Olympia, WA 98504	Spokane, WA 99205	Yakima, WA 98902
425-649-7044	360-407-0297	509-329-3544	509-575-2639
Fax: 425-649-7098	Fax: 360-407-0284	Fax: 509-329-3529	Fax: 509-454-7830
nphi461@ecy.wa.gov	jope461@ecy.wa.gov	made461@ecy.wa.gov	aric461@ecy.wa.gov

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
1250 W Alder St • Union Gap, WA 98903-0009 • (509) 575-2490

December 11, 2017

City of Richland
505 Swift Blvd.
Richland, WA 99352

RE: Direct-Push Environmental Investigation Boring Variance (WAC 173-160-451 (d))

Dear Mr. Jay Marlow:

This letter is in response to your request for a variance from the well construction standards contained in Washington Administrative Code (WAC) 173-160, *Minimum Standards for the Construction and Maintenance of Wells.*

This variance request is for the construction of five direct push environmental investigation borings that exceed the 30 foot limitation outlined in WAC 173-160-451(d).

The variance is necessary due to the depth of material at the site overlying the zone targeted for sampling. Direct push technology has advanced rapidly in the last few years, and the 2006 WAC language does not address the current state of technology. Therefore, the Department of Ecology is comfortable issuing this variance.

A variance is hereby granted from WAC 173-160-451(d), which states, in part, "Direct push wells shall not be greater than thirty feet in depth".

This variance is subject to the provisions below:

1. This variance is for five environmental investigation borings located in the NW¼ of the NE¼ of Section 20, Township 10 N., Range 28 E.W.M. The associated Benton County site address is 3102 Twin Bridges Rd., Richland, WA.
2. The work shall be done by a licensed driller as set forth by WAC 173-162-040.

If you have any questions concerning this variance please contact Avery Richardson at 509-575-2639.

Avery A. Richardson, LHG
Well Construction Coordinator

Trevor Hutton, Section Manager
Water Resources Program
Central Regional Office

TH:AR:SS/171219

Enclosure: Your Right to Be Heard

By certified mail: 91 7199 9991 7037 1622 4349

cc: Scott Malone, Dept. of Ecology, Water Resources Program HQ (ecc)
Trevor Hutton, Dept. of Ecology, Water Resources Program CRO (ecc)

YOUR RIGHT TO APPEAL

You have a right to appeal this Decision to the Pollution Control Hearings Board (PCHB) within 30 days of the date of receipt of this Decision. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2).

To appeal you must do all of the following within 30 days of the date of receipt of this Decision:

- File your appeal and a copy of this Decision with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this Decision on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey WA 98503	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia WA 98504-7608
Pollution Control Hearings Board 1111 Israel Road SW, Suite 301 Tumwater WA 98501	**Pollution Control Hearings Board** PO Box 40903 Olympia WA 98504-0903

For additional information visit the Environmental Hearings Office Website: http://www.eho.wa.gov
To find laws and agency rules visit the Washington State Legislature Website: http://www.leg.wa.gov/CodeReviser

DEPARTMENT OF ECOLOGY State of Washington

Water Resources Program
Well Construction and Licensing

Step 7 of 8 - View Summary of Wells for Group 4 of 5

Well Report Summary

1. Review your information.
2. To make changes use the "Back to Start of Form" button at the bottom of the page.
3. To submit and view your completed well report click the "Submit Well Report" button at the bottom of the page.

General Information

Property Owner Name	City Of Richland
Property Owner Mailing Address	505 Swift Blvd, Richland, WA 99352
Type of Well	Environmental Investigation - Water Sampling
Notice of Intent Number	EE06902
Decommissioning Notice of Intent Number	AE45893
Number of Wells in Group 4	1
Well Tag Number	N/A
Water Right Permit Number	None
Variance	Yes
Well Use	NA
Type of Work	New
Method	DirectPush
Drilling Start Date	11/13/2017
Completion Date	11/15/2017

Location Information

Well Street Address	3102 Twin Bridges Rd.
City/State/Zip	Richland, WA 99354
County	Benton
Tax Parcel Number	
TRS Q / Q	Twn 10N R 28E Sec 20 in the NE ¼ of the NW ¼
Lat/Long	46.20328 / 119.2033
Horizontal Collection Method / Datum	Unknown / World Geodetic System of 1984
Vertical Collection Method / Datum	GPS carrier phase (survey grade unit) / World Geodetic System of 1984
Well Head Elevation	485 ft

Section:20

Work Details

Borehole Diameter before decommissioning	2.88 in
Depth of well before decommissioning	116 ft 0 in
Drilled To Depth	116 ft

Individual Well Details - Well Group 4 of 5

Well	Your Identifier	Water Level	Decommission Sealing Materials
1	PP-1	Static Level at: 102 ft 9 in	Bentonite

Lithology

No lithology information collected

Your Comments

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Driller Information

Driller Name **License Number**
MARTIN GARDNER 1584

Drilling Company
ATKINS ENERGY FEDERAL EPC INC.

By clicking the "Submit" button below you are creating a digital signature verifying that you are MARTIN GARDNER.

Back to Start of Form | Submit Well Report

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Construction

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 4: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/13/2017
Drilling Completion Date: 11/15/2017
Received by Ecology: 12/5/2017 3:32 PM

Dimensions:
Borehole Diameter: 2.88 in
Depth of completed well: 116 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 4 of 5)

Well	Driller's Identifier	Water Level
1	PP-1	Static Level at: 102 ft 9 in

Additional Well Construction Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 4 of 5

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:
Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 485 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20328 Longitude (DD): 119.2033
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

ATTACHMENT 5

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Decommissioning

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 4: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/13/2017
Drilling Completion Date: 11/15/2017
Received by Ecology: 12/5/2017 3:32 PM

Dimensions:

Diameter of borehole before decommissioning: 2.88 in
Well depth before decommissiong: 116 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 4 of 5)

Well	Driller's Identifier	Decom Sealing Materials
1	PP-1	Bentonite

Additional Well Decommissioning Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 4 of 5 for Decommissioning

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:

Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 485 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20328 Longitude (DD): 119.2033
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

DEPARTMENT OF ECOLOGY State of Washington

Water Resources Program
Well Construction and Licensing

Step 7 of 8 - View Summary of Wells for Group 1 of 5

Well Report Summary

1. Review your information.
2. To make changes use the "Back to Start of Form" button at the bottom of the page.
3. To submit and view your completed well report click the "Submit Well Report" button at the bottom of the page.

General Information

Property Owner Name	City Of Richland
Property Owner Mailing Address	505 Swift Blvd, Richland, WA 99352
Type of Well	Environmental Investigation - Water Sampling
Notice of Intent Number	EE06902
Decommissioning Notice of Intent Number	AE45893
Number of Wells in Group 1	1
Well Tag Number	N/A
Water Right Permit Number	None
Variance	Yes
Well Use	NA
Type of Work	New
Method	DirectPush
Drilling Start Date	11/6/2017
Completion Date	11/8/2017

Location Information

Well Street Address	3102 Twin Bridges Rd.
City/State/Zip	Richland, WA 99354
County	Benton
Tax Parcel Number	
TRS Q / Q	Twn 10N R 28E Sec 20 in the NE ¼ of the NW ¼
Lat/Long	46.20287 / 119.202
Horizontal Collection Method / Datum	Unknown / World Geodetic System of 1984
Vertical Collection Method / Datum	GPS carrier phase (survey grade unit) / World Geodetic System of 1984
Well Head Elevation	486 ft

Section:20

Work Details

Borehole Diameter before decommissioning	2.88 in
Depth of well before decommissioning	110 ft 4 in
Drilled To Depth	110 ft

Individual Well Details - Well Group 1 of 5

Well	Your Identifier	Water Level	Decommission Sealing Materials
1	PP-2	Static Level at: 101 ft 8.4 in	Bentonite

Lithology

No lithology information collected

Your Comments

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Driller Information

Driller Name **License Number**
MARTIN GARDNER 1584

Drilling Company
ATKINS ENERGY FEDERAL EPC INC.

By clicking the "Submit" button below you are creating a digital signature verifying that you are MARTIN GARDNER.

Back to Start of Form | Submit Well Report

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Construction

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 1: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/6/2017
Drilling Completion Date: 11/8/2017
Received by Ecology: 12/5/2017 2:38 PM

Dimensions:
Borehole Diameter: 2.88 in
Depth of completed well: 110 ft 4 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 1 of 5)

Well	Driller's Identifier	Water Level
1	PP-2	Static Level at: 101 ft 8.4 in

Additional Well Construction Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 1 of 5

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:
Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 486 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20287 Longitude (DD): 119.202
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

ATTACHMENT 5

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Decommissioning

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 1: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/6/2017
Drilling Completion Date: 11/8/2017
Received by Ecology: 12/5/2017 2:38 PM

Dimensions:

Diameter of borehole before decommissioning: 2.88 in
Well depth before decommissiong: 110 ft 4 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 1 of 5)

Well	Driller's Identifier	Decom Sealing Materials
1	PP-2	Bentonite

Additional Well Decommissioning Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 1 of 5 for Decommissioning

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:

Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 486 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20287 Longitude (DD): 119.202
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

DEPARTMENT OF ECOLOGY State of Washington

Water Resources Program
Well Construction and Licensing

Step 7 of 8 - View Summary of Wells for Group 2 of 5

Well Report Summary

1. Review your information.
2. To make changes use the "Back to Start of Form" button at the bottom of the page.
3. To submit and view your completed well report click the "Submit Well Report" button at the bottom of the page.

General Information

Property Owner Name	City Of Richland
Property Owner Mailing Address	505 Swift Blvd, Richland, WA 99352
Type of Well	Environmental Investigation - Water Sampling
Notice of Intent Number	EE06902
Decommissioning Notice of Intent Number	AE45893
Number of Wells in Group 2	1
Well Tag Number	N/A
Water Right Permit Number	None
Variance	Yes
Well Use	NA
Type of Work	New
Method	DirectPush
Drilling Start Date	11/8/2017
Completion Date	11/9/2017

Location Information

Well Street Address	3102 Twin Bridges Rd.
City/State/Zip	Richland, WA 99354
County	Benton
Tax Parcel Number	
TRS Q / Q	Twn 10N R 28E Sec 20 in the NE ¼ of the NW ¼
Lat/Long	46.20291 / 119.2012
Horizontal Collection Method / Datum	Unknown / World Geodetic System of 1984
Vertical Collection Method / Datum	GPS carrier phase (survey grade unit) / World Geodetic System of 1984
Well Head Elevation	474 ft

Section:20

Work Details

Borehole Diameter before decommissioning	2.88 in
Depth of well before decommissioning	108 ft 0 in
Drilled To Depth	108 ft

Individual Well Details - Well Group 2 of 5

Well	Your Identifier	Water Level	Decommission Sealing Materials
1	PP-3	Static Level at: 90 ft 7.2 in	Bentonite

Lithology

No lithology information collected

Your Comments

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Driller Information

Driller Name **License Number**
MARTIN GARDNER 1584

Drilling Company
ATKINS ENERGY FEDERAL EPC INC.

By clicking the "Submit" button below you are creating a digital signature verifying that you are MARTIN GARDNER.

Back to Start of Form | Submit Well Report

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Construction

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 2: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/8/2017
Drilling Completion Date: 11/9/2017
Received by Ecology: 12/5/2017 3:04 PM

Dimensions:
Borehole Diameter: 2.88 in
Depth of completed well: 108 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 2 of 5)

Well	Driller's Identifier	Water Level
1	PP-3	Static Level at: 90 ft 7.2 in

Additional Well Construction Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 2 of 5

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:
Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 474 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20291 Longitude (DD): 119.201
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

ATTACHMENT 5

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Decommissioning

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 2: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/8/2017
Drilling Completion Date: 11/9/2017
Received by Ecology: 12/5/2017 3:04 PM

Dimensions:

Diameter of borehole before decommissioning: 2.88 in
Well depth before decommissiong: 108 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 2 of 5)

Well	Driller's Identifier	Decom Sealing Materials
1	PP-3	Bentonite

Additional Well Decommissioning Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 2 of 5 for Decommissioning

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:

Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 474 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20291 Longitude (DD): 119.201
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

DEPARTMENT OF ECOLOGY State of Washington

Water Resources Program
Well Construction and Licensing

Step 7 of 8 - View Summary of Wells for Group 3 of 5

Well Report Summary

1. Review your information.
2. To make changes use the "Back to Start of Form" button at the bottom of the page.
3. To submit and view your completed well report click the "Submit Well Report" button at the bottom of the page.

General Information

Property Owner Name	City Of Richland
Property Owner Mailing Address	505 Swift Blvd, Richland, WA 99352
Type of Well	Environmental Investigation - Water Sampling
Notice of Intent Number	EE06902
Decommissioning Notice of Intent Number	AE45893
Number of Wells in Group 3	1
Well Tag Number	N/A
Water Right Permit Number	None
Variance	Yes
Well Use	NA
Type of Work	New
Method	DirectPush
Drilling Start Date	11/9/2017
Completion Date	11/13/2017

Location Information

Well Street Address	3102 Twin Bridges Rd.
City/State/Zip	Richland, WA 99354
County	Benton
Tax Parcel Number	
TRS Q / Q	Twn 10N R 28E Sec 20 in the NE ¼ of the NW ¼
Lat/Long	46.20278 / 119.202
Horizontal Collection Method / Datum	Unknown / World Geodetic System of 1984
Vertical Collection Method / Datum	GPS carrier phase (survey grade unit) / World Geodetic System of 1984
Well Head Elevation	481 ft

Section:20

Work Details

Borehole Diameter before decommissioning	2.88 in
Depth of well before decommissioning	105 ft 0 in
Drilled To Depth	105 ft

Individual Well Details - Well Group 3 of 5

Well	Your Identifier	Water Level	Decommission Sealing Materials
1	PP-4	Static Level at: 90 ft 7.2 in	Bentonite

Lithology

No lithology information collected

Your Comments

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Driller Information

Driller Name **License Number**
MARTIN GARDNER 1584

Drilling Company
ATKINS ENERGY FEDERAL EPC INC.

By clicking the "Submit" button below you are creating a digital signature verifying that you are MARTIN GARDNER.

Back to Start of Form | Submit Well Report

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Construction

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 3: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/10/2017
Drilling Completion Date: 11/13/2017
Received by Ecology: 12/5/2017 3:23 PM

Dimensions:
Borehole Diameter: 2.88 in
Depth of completed well: 105 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 3 of 5)

Well	Driller's Identifier	Water Level
1	PP-4	Static Level at: 95 ft 8.64 in

Additional Well Construction Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 3 of 5

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:
Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 481 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20278 Longitude (DD): 119.2029
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Decommissioning

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 3: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/10/2017
Drilling Completion Date: 11/13/2017
Received by Ecology: 12/5/2017 3:23 PM

Dimensions:

Diameter of borehole before decommissioning: 2.88 in
Well depth before decommissiong: 105 ft 0 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 3 of 5)

Well	Driller's Identifier	Decom Sealing Materials
1	PP-4	Bentonite

Additional Well Decommissioning Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 3 of 5 for Decommissioning

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:

Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 481 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20278 Longitude (DD): 119.2029
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

DEPARTMENT OF ECOLOGY State of Washington

Water Resources Program
Well Construction and Licensing

Step 7 of 8 - View Summary of Wells for Group 5 of 5

Well Report Summary

1. **Review your information.**
2. **To make changes use the "Back to Start of Form" button at the bottom of the page.**
3. **To submit and view your completed well report click the "Submit Well Report" button at the bottom of the page.**

General Information

Property Owner Name	City Of Richland
Property Owner Mailing Address	505 Swift Blvd, Richland, WA 99352
Type of Well	Environmental Investigation - Water Sampling
Notice of Intent Number	EE06902
Decommissioning Notice of Intent Number	AE45893
Number of Wells in Group 5	1
Well Tag Number	N/A
Water Right Permit Number	None
Variance	Yes
Well Use	NA
Type of Work	New
Method	DirectPush
Drilling Start Date	11/15/2017
Completion Date	11/16/2017

Location Information

Well Street Address	3102 Twin Bridges Rd.
City/State/Zip	Richland, WA 99354
County	Benton
Tax Parcel Number	
TRS Q / Q	Twn 10N R 28E Sec 20 in the NE ¼ of the NW ¼
Lat/Long	46.20316 / 119.2004
Horizontal Collection Method / Datum	Unknown / World Geodetic System of 1984
Vertical Collection Method / Datum	GPS carrier phase (survey grade unit) / World Geodetic System of 1984
Well Head Elevation	453 ft

Section:20

Work Details

Borehole Diameter before decommissioning	2.88 in
Depth of well before decommissioning	89 ft 3 in
Drilled To Depth	89 ft

Individual Well Details - Well Group 5 of 5

Well	Your Identifier	Water Level	Decommission Sealing Materials
1	PP-5	Static Level at: 67 ft 9.6 in	Bentonite

Lithology

No lithology information collected

Your Comments

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Driller Information

Driller Name **License Number**
MARTIN GARDNER 1584

Drilling Company
ATKINS ENERGY FEDERAL EPC INC.

By clicking the "Submit" button below you are creating a digital signature verifying that you are MARTIN GARDNER.

Back to Start of Form | Submit Well Report

ATTACHMENT 5

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Construction

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 5: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/15/2017
Drilling Completion Date: 11/16/2017
Received by Ecology: 12/5/2017 3:41 PM

Dimensions:
Borehole Diameter: 2.88 in
Depth of completed well: 89 ft 3 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 5 of 5)

Well	Driller's Identifier	Water Level
1	PP-5	Static Level at: 67 ft 9.6 in

Additional Well Construction Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 5 of 5

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:
Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 453 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20316 Longitude (DD): 119.2004
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

RESOURCE PROTECTION WELL REPORT

This is a report of the activities of a licensed Washington well driller and serves as the official record of work done within the borehole and casing and describes the amount of water encountered.

Decommissioning

Type of Well: Environmental Investigation - Water Sampling
Number of Wells in Group 5: 1 well
Type of Work: New
Method: DirectPush
Drilling Start Date: 11/15/2017
Drilling Completion Date: 11/16/2017
Received by Ecology: 12/5/2017 3:41 PM

Dimensions:

Diameter of borehole before decommissioning: 2.88 in
Well depth before decommissiong: 89 ft 3 in

Construction Details

Casings:

From Depth	To Depth	Type	Diameter	Stickup
N/A				

Perforations:

Type	Size	Total Perforations	From Depth	To Depth
N/A				

Screens:

Manufacturer	Type	Dia-meter	Slot Size	From Depth	To Depth
N/A					

Sand/Gravel Packings:

Material	From Depth	To Depth
N/A		

Individual Well Details (Group 5 of 5)

Well	Driller's Identifier	Decom Sealing Materials
1	PP-5	Bentonite

Additional Well Decommissioning Information

Drove push tubing to total depth, knocked out drive point, installed temporary SS wire wrapped 20 slot screen to bottom, back pulled drive tubing 10 ft. Installed small diameter bladder pump and collected water samples. Removed pump and well screen. Decommissioned push hole by placing Benseal granular bentonite down tubing from TD to surface as the push tubing was back pulled.

Well Group 5 of 5 for Decommissioning

Construction Notice of Intent Number: EE06902
Decommissioning Notice of Intent Number: AE45893
Unique Ecology Well ID Tag Number: N/A
Property Owner Name: City Of Richland
Property Owner Address: 505 Swift Blvd, Richland, WA 99352

Well Location:

Well Street Address: 3102 Twin Bridges Rd.
City, State, Zip: Richland, WA , 99354
County: Benton
Township: 10N Range: 28E Section: 20 in the NE 1/4 of the NW 1/4

Well Head Elevation: 453 ft
Elevation Datum: WGS84
Elevation Method: GPS carrier phase (survey grade unit)
Latitude (DD): 46.20316 Longitude (DD): 119.2004
Datum: WGS84
Horizontal Coordinate Collection Method: Unknown
Tax parcel No.:

Lithology

Layer: Describe by color, character, size of material and structure, and the kind and nature of the material in each layer penetrated, with at least one entry for each change of information.

From	To	Material

Well Construction Certification: I constructed and/or accept responsibility for construction of this well and its compliance with all Washington well construction standards. Material used and information reported above are true to the best of my knowledge and belief.

Driller/Engineer/Trainee Printed Name: MARTIN GARDNER	Drilling Company: ROM EMICK
Driller or trainee License Number: 1584	Address:
If trainee, Driller's License Number:	City, State, Zip:

ATKINS

ATKINS ENERGY FEDERAL EPC
2345 STEVENS DRIVE RICHLAND, WA 99354
FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-6-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA	1	2 3/8 Drive head	1
2	Direct Push Drilling	HR	6.5	Lynch Pins	10
3	Decommissioning	HR	0	Tip Holder	1
4	Water Sample Collection	HR	0		
5	Demobilization	EA	0		
10	Standby	HR	0		

Comments

Pre job kick off meeting. First location is PP-2.
Safety Topic - JHA and general work around the HHU.

Work Summary

Drove to a depth of 51.4 ft. Extremely hard driving.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
Olin Amos	10	Rory Z Steffler / R.S. Steffler
Nicki Weakley	10	
Rory Steffler	10	
Kelly Olson	10	Client Print/Sign
Marty Gardner	4	Adam Romney
Jack Koch	2	
Josh Sundeman / A. Hughes	2	

Client Comments:

ATKINS

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FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-7-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		Expendable Tip	1
2	Direct Push Drilling	HR	5.5	Rivits	4
3	Decommissioning	HR		Lynch Pins	6
4	Water Sample Collection	HR	4	Nylatron Washer	1
5	Demobilization	EA			
10	Standby	HR			

Comments

Work Summary

Pushed from 51.4' to 116.2' TOC which is 4.8' stick up. Cleared plug in pipe, set screen, set pump and sampled. Pulled pump.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
Olin Amos	10	Rory Z Steffler / R.Z. Steffler
Rory Steffler	10	
Kelly Olsen	10	Client Print/Sign
Mike Weakley	10	Adam Romney
Marty Gardner	2	

Client Comments:

ATKINS

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DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-8-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ CAT #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA	—	Granular bentonite	5 cks
2	Direct Push Drilling	HR	8.0	2 5/8 Drive head	1
3	Decommissioning	HR	1.75	Nylatron washer	1
4	Water Sample Collection	HR	—	Lynch Pins.	8
5	Demobilization	EA	—		
10	Standby	HR	—		

Comments

Work Summary

Decommissioned PP-2 and moved over to PP-3 and set up and began pushing. Pushed to 108'.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
Olin Amos	10	Rory Z Steffler / R.Z. Steffler
Kelly Olson	10	
Mike Weakley	10	
Marty Gardner	10	Client Print/Sign
John Koch	2	Adam Rowey

Client Comments:

ATKINS

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FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-9-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		1 Expendable Tip	1
2	Direct Push Drilling	HR	2.5	Nylatron Washer	1
3	Decommissioning	HR	1.25	Bentonite (Bags)	4.25
4	Water Sample Collection	HR	2.75	Rivits	4
5	Demobilization	EA			
10	Standby	HR			

Comments

Space relocation and set up was late in the day it was decided not to start driving. This will allow the silicon to set up overnight.

Work Summary

Knocked out ≈ 4' of blockage in PP-3.
Sampled PP-3
Decommissioned PP-3
Relocated and set up on PP-4

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
Rory Z Steffler	10	Rory Z Steffler / R.Z. Steffler
Olyn Amos	10	
Kelly Olsen	10	
Mike Weakley	10	Client Print/Sign
Marty Gardner	1	Adam Bowey

Client Comments:

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DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-10-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	Cat Rig ~~XL~~ #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		2 5/8 Drive head	1
2	Direct Push Drilling	HR	9	Nylatron washer	1
3	Decommissioning	HR		Drive Pin	1
4	Water Sample Collection	HR		Lynch Pins	8
5	Demobilization	EA			
10	Standby	HR			

Comments

Hard, slow driving.

Work Summary

Began pushing on PP-4. Target depth - 105'
Made it to 100 ft.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
RZ Steffler	10	Rory Z Steffler / R.Z. Steffler
Olin Amos	~~10~~ 9	
Mike Weakley	10	
Marty Gardner	1	Client Print/Sign
		Adam Romney

Client Comments:

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DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-13-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA	—	Bags of Bentonite	5
2	Direct Push Drilling	HR	4	Exp. Tip	1
3	Decommissioning	HR	1.5	Lynch Pins	6
4	Water Sample Collection	HR	3.25	2 5/8" drive head	1
5	Demobilization	EA	—	Rivits	4
10	Standby	HR			

Comments

Work Summary

Finished driving to depth on PP-4. Knocked out tip and blockage, set pump and sampled PP-4. Decommissioned PP-4. Relocated and set up on PPT-1. Drove tubing to 29 ft.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
RZ Steffler	10	~~Rory~~ Rory Z Steffler / R.Z. Steffler
Olin Amos	10	
Mike Weakley	10	
Kelly Olsen	10	Client Print/Sign
Marty Gardner	2	Adam Bowen

Client Comments:

ATKINS

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FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-14-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	CAT #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		2 5/8 drive head	1
2	Direct Push Drilling	HR	8.5	Expendable Tip	1
3	Decommissioning	HR		Nylatron washers	2
4	Water Sample Collection	HR	1.25	Lynch Pins	14
5	Demobilization	EA		Rivits	4
10	Standby	HR			

Comments

Work Summary

Finished driving on PP-1, to depth. Knocked out tip and attempted to place screen. Removed screen to inspect. Still OK. Something blocking the tip holder.

Atkins Personnel	Hrs
RZ Steffler	10
Olin Amos	10
Mike Weakley	10
Kelly Olson	10
Josh Bonderman	5
John Koch	5
Marty Gardner	2

Atkins Supervisor Print/Sign: Rory Z Steffler / R.Z. Steffler

Client Print/Sign: Adam Ramey

Client/Comments:

ATKINS

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FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-15-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		Bags Bentonite	5
2	Direct Push Drilling	HR	4.5	0 2 5/8 drive head	1
3	Decommissioning	HR	1.5	Lynch Pins	5
4	Water Sample Collection	HR	2.5		
5	Demobilization	EA			
10	Standby	HR			

Comments

Work Summary

Cleared blockage on PP-1 and landed screen. Sampled PP-1.
Deconed piping + screen. Mobed to PP-5
Drove tubing on PP-5 from 65 to 69 ft.

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
Rory Z Steffler	10	Rory Z Steffler / R.Z. Steffler
Olly Amos	10	
Mike Weakly	10	
Kelly Olson	10	Client Print/Sign
Maddy Gardner	1	Adam Romney

Client Comments:

ATKINS

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2345 STEVENS DRIVE RICHLAND, WA 99354
FIELD SERVICES GROUP (509) 420-5571

DAILY FIELD JOB TICKET

Date	Contract/Task No.	Project Title		
11-16-17	553-3820-007	Horn Rapids Assessment Monitoring		
Location		Driller/Supervisor	Rig No.	Rig Type
Richland Horn Rapids Landfill		Lyle Amos	~~XL~~ Cat #2	DPT

Pay Items				Equipment/Consumables	
Item #	Item Description	Unit	Qty	Description	Qty
1	Mobilization	EA		Expendable Tip	1
2	Direct Push Drilling	HR	1.5	Bags of Bentonite	4
3	Decommissioning	HR	1	Rivits	4
4	Water Sample Collection	HR	2		
5	Demobilization	EA	1		
10	Standby	HR			

Comments

Work Summary

Finish driving to depth on PP-5.
Sampled PP-5
Decommissioned PP-5

Atkins Personnel	Hrs	Atkins Supervisor Print/Sign
RZ Steffler	10	Rory Z Steffler / R.Z. Steffler
Olin Amos	10	
Josh Benderman	10	
John Koch	2	Client Print/Sign
Mike Weakley	10	Adam Rowe
Marty Gardner	2	

Client Comments:

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Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 51.4 ft.	**LOCATION:** Richland Landfill	**DATE:** 11-6-17	**Report #:** 1
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-2 Tubing (2 5/8) @ ~~50.2~~ 51.4 ft bgs; S.U. 2.8

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY

NA

TIME	WORK SUMMARY
0730	Pre job kick off meeting.
0825	Set up and began pushing on Richland Landfill site #2.
1017	Test bladder pump. Pumps 500ml in 7minutes at 6 cpm.
1100	Lunch. Pushed to a depth of ≈ 23.0 ft, on PP-2.
1200	Resumed pushing. Extremely slow.
1345	Replaced broken 2 5/8 drive head. Broke at ≈ 36 ft.
1600	Done pushing for the day. At ≈ 51.5 ft on PP-2

OPERATOR/LICENSE: 1224

PERSONNEL: Olin Amos, Mike Weakley, RZ Steffler, Kelly Olson

WEATHER/DOWNTIME: Clear, minimal breeze, ≈ 45 degrees

DISCARDED ITEMS: (11) 2 5/8 Drive Head. (10) Lynch Pins

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler
TITLE : TEAM COGNIZANT PERSON
SIGNATURE: RZ Steffler

REVIEWED BY: Kelly Olson
TITLE: ATKINS TECHNICAL REVIEWER
SIGNATURE: Kelly Olson

ATKINS

ATKINS FEDERAL EPC, INC

Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 60 ft.	**LOCATION:** Richland Landfill	**DATE:** 11-7-17	**Report #:** 2
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: N/A	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-2 Tubing (HC, 2 5/8) @ 116.2 ft bgs; S.U. 4.8

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY

PP-2

(11) 40 ml vials

(2) Trip blanks, 40 ml VOAs

TIME	WORK SUMMARY
0630	Tool gate meeting. Slippery surfaces, safety topic
0650	Resumed pushing on PP-2. Depth at 51.4 ft.
0715	Paused to allow head to cool.
0740	Geologist measured the air at the top of tubing. No positive readings. Resumed driving tubing. Driving much easier.
0818	Purse to allow head to cool. Depth ≈ 90 ft.
0843	Resumed driving on PP-2.
0928	Reached depth of 116.2 to top of casing. 4.8 ft of stick up.
0942	May have lost the tip. Unable to detect water and theres soil on the tip of the detector. Approximately 3 ft. of soil in tubing.
0952	Run inner rod in to knock out soil plug. Plug cleared
1110	Geologist tagged PP-2. Water at 104.9 ft. Bottom was at 110.37'
1115	Lunch.
1213	Began placing the screen. Screen is 11.1 ft. in length.
1243	Screen placed.
1440	Pump placed in PP-2. Several attempts were made. Had to use 3 stainless steel weights to get the pump to the bottom due to the tubing friction. Started pump.
1454	Water to surface.
1529	Began sampling.
1604	Sampling complete. End of shift.

OPERATOR/LICENSE: 1224

PERSONNEL: Olin Amos, RZ Steffler, Mike Weakley, Kelly Olson

WEATHER/DOWNTIME: 21° - Clear

DISCARDED ITEMS: (1) Exp. Tip. (4) Rivits (6) Lynch Pin (1) Nylatron Washer

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler

TITLE: TEAM COGNIZANT PERSON

SIGNATURE: RZ Steffler

REVIEWED BY: Kelly Olson

TITLE: ATKINS TECHNICAL REVIEWER

SIGNATURE: Kelly Olson

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Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 108'	**LOCATION:** Richland land fill	**DATE:** 11-8-17	**Report #:** 3
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** / **HHU XL #3**	**HHU CAT #2** / **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-2 Tubing (2 5/8) @ 104' ft bgs; S.U. 0'

Borehole # PP-3 Tubing (2 5/8) @ 108 ft bgs; S.U. 2'

Borehole # _____ Tubing ( ) @ ft bgs; S.U.

SAMPLING SUMMARY: NA

TIME	WORK SUMMARY
0630	Tailgate safety meeting, cold weather gear & tripping hazards, safety topic
0700	Pulling out well screen and inner rod
0730	Back-pull 2 5/8" tubing 104' to 0', added 5 sacks bentonite
0845	Fold up rig, begin moving to PP-3 De-con screen and pipe
1000	Begin driving PP-3, Drove 2 5/8" tubing 0' to 40' b.g.s.
1105	Lunch
1140	Brought fuel and pipe to rig
1200	Resumed driving at PP-3
1415	Replaced broken 2 5/8" drive head (broke at 80')
1595	Drove to 108' b.g.s.
1610	off load equipment secure site

OPERATOR/LICENSE: 1224

PERSONNEL: Olin Amos, Kelly Olson, Mike Weckley, John Koch

WEATHER/DOWNTIME: cloudy 40°

DISCARDED ITEMS:
- 5 sacks granular bentonite
- 1 2 5/8 drive head
- 1 nylatrol washer
- 8 lynch pins

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: Kelly Olson
TITLE: TEAM COGNIZANT PERSON
SIGNATURE: Kelly Olson

REVIEWED BY: Roy Z Stoffler
TITLE: ATKINS TECHNICAL REVIEWER
SIGNATURE: R.Z. Stoffler

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: None	**LOCATION:** Richland Landfill	**DATE:** 11-9-17	**Report #:** 4
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**(HHU CAT #2)** **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-3 Tubing (2 5/8) @ 108 ft bgs; S.U. 0

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY

PP-3 (15) 40 ml VOAs
110917 Dup (3) 40 ml VOAs
Trip blank (2) 40 ml VOAs

TIME	WORK SUMMARY
0630	Tailgate meeting. Inclement weather and path forward on PP-3.
0650	Deployed inner rod and began tripping it in to dislodge ≈ 4' of blockage.
0753	Pump decegned and deconed.
0830	Completed two trips in with the inner rod. Unable to clear blockage.
0841	Removed (1) 4' section and tripping in inner rod to try 3rd attempt to clear blockage.
0915	Blockage knocked out. Water level @ 90.6 ft.
0950	Tripping in screen.
1010	Screen landed on bottom. Removed 3 sections of 2 5/8 tubing.
1031	Raised screen until bottom was at 100.5'.
1044	Landed pump on bottom and started pump.
1122	Water to surface.
1152	Began sampling.
1232	Sampling complete.
1240	Began decommissioning PP-3.
1355	Decommissioning of PP-3 complete. Used 4 1/4 bags of bentonite.
1520	After decoming pipe + screen, silicoming drive tip and repairing the jaws, we set up on PP-4.

OPERATOR/LICENSE: 1224 **PERSONNEL:** Olin Amos, Kelly Olson, Mike Weakley, Rory Stefflre	**WEATHER/DOWNTIME:** Overcast / Breezy / ≈ 38°	**DISCARDED ITEMS:** 4 1/4 bags bentonite 1 Exp. Tip. (4) Rivits 1 Nylatron washer.

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Stefflre	**REVIEWED BY:** Kelly Olson
TITLE : TEAM COGNIZANT PERSON	**TITLE:** ATKINS TECHNICAL REVIEWER
SIGNATURE: R.Z. Stefflre	**SIGNATURE:** Kelly Olson

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 100'	**LOCATION:** Richland Landfill	**DATE:** 11-10-17	**Report #:** 5
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-4 Tubing (2 5/8) @ 100 ft bgs; S.U. 2'

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY

NA

TIME	WORK SUMMARY
0640	Tailgate meeting. Path forward on PP-4 and pinch points discussed.
0652	All signed HHU and rod and began driving.
0722	Paused to let the drive head adapter cool.
0742	Resumed pushing.
0800	Paused for cooling
0815	Resumed.
0825	Paused for cooling. Extremely slow pushing. Can drive ≈ 2 ft. before having to stop to let the head cool. Cooling cycles much longer than push cycles.
1007	Depth ≈ 30 ft. 10:42 - Depth ≈ 36 ft. 11:15 - Depth ≈ 38 ft.
1115	Lunch
1158	Resumed driving.
1213	Depth - ≈ 42 ft. 12:43 - ≈ 49 ft.
1320	Broke a drive head. At ≈ 56 ft. 14:30 - Depth ≈ 80'.
1520	Extremely slow pushing at ≈ 85 ft.
1530	Cool down period. Depth ≈ 88 ft.
1545	Resumed pushing.
1600	Cool down. Depth ≈ 92 ft.
1615	Resumed pushing.
1638	Done for the day. PP-4 at ≈ 100 ft.

OPERATOR/LICENSE: 1224 **PERSONNEL:** Olin Amos, RZ Stoffler, Mike Weakley	**WEATHER/DOWNTIME:** ≈ 40°, Raining	**DISCARDED ITEMS:** (1) 2 5/8 drive head, (1) Nylatron washer, (1) Drive Pin, (8) Lynch Pins

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Stoffler **TITLE :** TEAM COGNIZANT PERSON **SIGNATURE:** R.Z. Stoffler	**REVIEWED BY:** Kelly Olson **TITLE:** ATKINS TECHNICAL REVIEWER **SIGNATURE:** Kelly Olson

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: PP-4 5 ft PP-1 29 ft.	**LOCATION:** Richland Landfill	**DATE:** 11-13-17	**Report #:** 6
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-4 Tubing (2 5/8) @ 105 ft bgs; S.U. 0

Borehole # PP-1 Tubing (2 5/8) @ 29 ft bgs; S.U. 5'

Borehole # Tubing ( ) @ ft bgs; S.U.

SAMPLING SUMMARY

PP-4
(22) 40ml VOA's

TIME	WORK SUMMARY
0640	Tailgate meeting. Driving in foggy conditions. Need to resume pushing to 104' before back pulling and dislodging blockage.
0655	Resumed pushing on PP-4.
0712	Reached target depth of 104'. Tagged PP-4. Approximately 1 ft. of blockage that needs to be knocked out.
0720	Began running in inner rod to dislodge blockage and tip.
0751	Blockage dislodged. Setting screen on bottom.
0815	Tagged well. Water at 99.3'. Will re-tag water after back pulling rod to expose screen.
0820	Pump deconed and tested.
0847	Removed (2) 4' outer rod.
0850	Geologist tested the air inside the rod. No positive readings.
0853	Geologist retagged H2O. Its now at 95.72. Bottom of screen at 105.
0905	Pump placed. Started pump.
0923	Water to surface.
1015	Began Sampling
1104	Sampling complete. Lunch.
1145	Began decommissioning PP-4
1310	Decommissioning complete.
1340	HHU Cat # 2 set up on PP-1
1415	Tip refurbished, piping + screen deconed.
1427	Began driving on PP-1. 1448 - Paused for head cooling. ≈ 15'.
1510	Resumed driving. 15:23 - Paused for cooling @ ≈ 20'. 15:43 - Resumed.
1552	Paused for cooling @ 24'. 16:14 - Resumed. 16:25 Done for day. Broke the drive head

OPERATOR/LICENSE: 12204
PERSONNEL: Olin Amos, Mike Weakley, Kelly Olson, RZ Steffler

WEATHER/DOWNTIME: Overcast / ≈ 40°

DISCARDED ITEMS:
(5) Bags bentonite etc
(1) Exp. Tip, (1) 2 5/8 drive head
(6) Lynch pins (4) Rivits

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler
TITLE : TEAM COGNIZANT PERSON
SIGNATURE: RZ Steffler

REVIEWED BY: Kelly Olson
TITLE: ATKINS TECHNICAL REVIEWER
SIGNATURE: Kelly Olson

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 87'	**LOCATION:** Richland Landfill	**DATE:** 11-14-17	**Report #:** 7
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # / Interval: / Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** / **HHU XL #3**	**HHU CAT #2** (circled) / **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-1 Tubing (2 5/8) @ 116 ft bgs; S.U. 2

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY: NA

TIME	WORK SUMMARY
0630	Tailgate meeting. Safety topic - vector control. Continue driving on PP-1 from 29 ft.
0649	Resumed driving on PP-1 ft from 29'.
0712	Pause to allow drive head and sub to cool. Depth - ≈ 38'. 0728 - Resumed.
0740	Pause for cooling. Depth - ≈ 43'. 0755 - Resumed. 0810 - Paused - Depth ≈ 47'
0827	Resumed driving. 0837 - Pause. Depth ≈ 51'. 0858 - Resumed. 0909 - Paused ≈ 54'.
0932	Resumed driving. 0945 - Paused @ 60' for cooling. 10:06 - Resumed. 10:14 - Paused @ 67'.
1042	Resumed driving. Broke a drive head. 11:03 Paused for cooling + lunch, at 72'
1144	Resumed driving. 1159 - Paused for cooling @ 77'. 1220 - Resumed. 1233 - Paused.
1253	Resumed driving. 1305 - Paused for cooling at 92'. 13:22 - Resumed.
1335	Paused for cooling @ 97'. 1400 - Resumed.
1420	Reached depth of 116'.
1430	Tripped in inner rod and knocked out disposable tip.
1437	Pump deconed and tested.
1510	Inner knock out rod removed.
1515	Began placing screen.
1534	Screen placed on bottom. Removing 3 sections of outer piping.
1600	Experiencing difficulties getting the screen down through the tip holder. When removing outer piping, the screen also wants to come up.
1603	Removing the screen.
1624	Screen out. Still in good shape. Dirt on bottom.

OPERATOR/LICENSE: 1224
PERSONNEL: Olin Amos RZ Steffler, Mike Weakley, Kelly Olson, John Kosh, Josh Bonderman

WEATHER/DOWNTIME: ≈ 48°, Clear, Windy

DISCARDED ITEMS: 2 5/8 drive head. Exp. tip, (14) Lynch Pins (2) Nylatron washers

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler
TITLE : TEAM COGNIZANT PERSON
SIGNATURE: RZ Steffler

REVIEWED BY: Kelly Olson
TITLE: ATKINS TECHNICAL REVIEWER
SIGNATURE: Kelly Olson

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: 69	**LOCATION:** Richland Landfill	**DATE:** 11-15-17	**Report #:** 8
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-1 Tubing (2 5/8) @ 0 ft bgs; S.U. 0

Borehole # PP-5 Tubing (2 5/8) @ 69 ft bgs; S.U. 2

Borehole # Tubing ( ) @ ft bgs; S.U.

SAMPLING SUMMARY

PP-1 (18) 40 ml VOAs

TIME	WORK SUMMARY
0635	Began tripping in inner string to clear blockage for screen placement.
0709	Blockage presumably cleared. Removing inner string.
0732	Inner string out. Geologist tagged the borehole. 102.75' to water. 110.8' to bottom.
0738	Began tripping in screen again.
0757	Screen landed. Extracting and removing 3 sections of outer string.
0818	Pump on bottom. Start pump.
0838	Water to surface.
0911	Began sampling.
0942	Sampling complete.
1115	Decommissioning of PP-1 complete.
1130	Lunch.
1225	Decon + Applying new tip complete. Mob to PP-5
1245	Set up on PP-5
1254	Began driving to depth on PP-5.
1324	Paused to allow head to cool @ 25 ft. 13:43 - Resumed driving.
1402	Paused for cooling @ 44 ft. 1424 - Resumed driving.
1640	Paused at 56'. 1502 - Resumed driving. 1510 - Paused. Broken drive head.
1525	Resumed driving. 1545 - Paused at 65 ft. 1600 - Resumed.
1610	Paused at 69 ft. Done for day.

OPERATOR/LICENSE: 1224

PERSONNEL: Olin Amos, Kelly Olson, Mike Weakley, Rory Steffler

WEATHER/DOWNTIME: Partly cloudy, ≈ 50°, Breezy

DISCARDED ITEMS: 5 bags bentonite, 2 5/8 drive head, (5) Lynch Pins

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler

TITLE: TEAM COGNIZANT PERSON

SIGNATURE: RZ Steffler

REVIEWED BY: Kelly Olson

TITLE: ATKINS TECHNICAL REVIEWER

SIGNATURE: Kelly Olson

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Direct Push and GW Sampling for Horn Rapids Assessment Monitoring

SHIFT FOOTAGE: ≈ 20.25	**LOCATION:** Richland Landfill	**DATE:** 11-16-17	**Report #:** 9
START CARD NO. EE06902	**DECOMMISSION NO.** AE45893	**RWP:** N/A NA	**AHA:** NA
GEOPHYSICAL LOGGING Boring # Interval: Type: NA	**DAN-** NA **/U-DIG NO.** NA	**HHU CASE #1** **HHU XL #3**	**HHU CAT #2** (circled) **HHU CAT #4**

BOREHOLE SUMMARY END OF SHIFT

Borehole # PP-5 Tubing (2⅝) @ 0 ft bgs; S.U. 0

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

Borehole # _____ Tubing ( ) @ ft bgs; S.U. _____

SAMPLING SUMMARY

PP-5 (18) 40 ml VOAs

TIME	WORK SUMMARY
0640	Resumed driving on PP-5 from 69 ft.
0715	Completed driving to depth. 88 ft.
0730	Pump deconed and tested.
0744	Ran in inner string and knocked out expendable tip.
0807	Inner rod tripped out. Geologist tagged the borehole. Water at 76.31 ft. Bottom tagged at 89.28 ft.
0816	Began placing screen. 0830 - Screen landed. Water at 67.8'.
0844	Removed 3 sections to expose screen.
0855	Pump placed on bottom. Pump On
0906	Water to surface
0945	Started sampling
1019	Sampling complete. 18 VOAs.
1116	PP-5 decommissioned.
1130	Lunch.
1220	Rode HHU Cat # 2 to ENW.
1410	HHU at ENW.
1616	Equipment back to ENW.

OPERATOR/LICENSE: 1224 **PERSONNEL:** RZ Steffler, Olin Amos, Josh Bonderman, Michael Weakley	**WEATHER/DOWNTIME:** Clear / Breezy / 42°	**DISCARDED ITEMS:** Exp. Tip, (4) Bags Bentonite, (4) Rivits

REFERENCE/CONTRACT INFORMATION: Parametrix Contract # 553-3820-007

REPORT BY: RZ Steffler	**REVIEWED BY:** Kelly Olson
TITLE : TEAM COGNIZANT PERSON	**TITLE:** ATKINS TECHNICAL REVIEWER
SIGNATURE: R. Z. Steffler	**SIGNATURE:** Kelly Olson

Safety Data Sheet

according to 1907/2006/EC (REACH), 1272/2008/EC (CLP), and GHS

Effective date: 11/20/2014 **Revision:** 05/12/2015

ALCONOX

1 Identification of the Substance/mixture and of the Company/Undertaking

1.1 Product identifier
Trade name: ALCONOX
Application of the substance / the preparation: Cleaning material/ Detergent

1.2 Relevant identified uses of the substance or mixture and uses advised against:
No additional information available.

1.3 Details of the supplier of the Safety Data Sheet
Manufacturer/Supplier:
Alconox, Inc.
30 Glenn St., Suite 309
White Plains, NY 10603
Phone: 914-948-4040

Further information obtainable from: Product Safety Department

1.4 Emergencytelephone number:
ChemTel Inc.: (800)255-3924, +1 (813)248-0585

2 Hazards Identification

2.1 Classification of the substance or mixture Classification according to Regulation (EC) No 1272/2008:

Eye Irrit. 2B; H320: Causes eye irritation.

Information concerning particular hazards for human and environment:
The product has to be labelled due to the calculation procedure of the "General Classification guideline for preparations of the EU" in the latest valid version.
Classificationsystem:
The classification is according to the latest editions of the EU-lists, and extended by company and literature data

2.2 Label elements
Labelling according to Regulation (EC) No 1272/2008:
The product is classified and labelled according to the CLP regulation.

Hazard pictograms:

Signal word: Warning

Hazard-determining components of labelling:
Sodium Alkylbenzene Sulfonate
Hazard statements:
H320: Causes eye irritation.

Precautionary statements:
P280 Wear protective gloves/protective clothing/eye protection/face protection.
P264: Wash thoroughly after handling.
P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses,if present and easy to do. Continue rinsing.
P337+P313: If eye irritation persists: Get medical advice/attention.

Other Hazard description:
WHMIS-classification and symbols:
D2B - Toxic material causing other toxic effects

NFPA ratings (scale 0 - 4)

Health = 1
Fire = 0
Reactivity = 0

HMIS-ratings (scale 0 - 4)

HEALTH	1	
FIRE	0	
REACTIVITY	0	

Health = 1
Fire = 0
Reactivity = 0

2.3 Other hazards
Results of PBT and vPvB assessment
PBT: Not applicable.
vPvB: Not applicable.

3 Composition/Information on Ingredients

3.2 Chemical characterization: Mixture
Description: Hazardous ingredients of mixture listed below.

Identifying Nos.	Description	Wt. %
CAS: 68081-81-2	Sodium Alkylbenzene Sulfonate	10 - 25%
CAS: 497-19-8	Sodium Carbonate	5-15%
CAS: 7722-88-5	Tetrasodium pyrophosphate	5-15%
CAS: N/A	Proprietary (non-classified)	40-60%

Additional information: For the wording of the listed risk phrases refer to section 16.

4 First Aid Measures

4.1 Description of first aid measures
General information:
Contaminated individuals of chemical exposure must be taken for medical attention if any adverse effect occurs. Rescuers should be taken for medical attention, if necessary. Take copy of label and SDS to health professional with contaminated individual.
After inhalation:
Supply fresh air; consult doctor in case of complaints.
After skin contact:
Immediately wash with water and soap and rinse thoroughly. If skin irritation continues, consult a doctor.

After eye contact:
Remove contact lenses if worn. Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.

After swallowing:
Rinse out mouth and then drink plenty of water. Do not induce vomiting; call for medical help immediately.

4.2 Most important symptoms and effects, both acute and delayed:
No additional information available.

4.3 Indication of any immediate medical attention and special treatment needed:
No additional information available.

5 Firefighting Measures

5.1 Extinguishing media:
Suitable extinguishing agents:
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.

5.2 Special hazards arising from the substance or mixture:
No additional information available.

5.3 Advice for firefighters:
Protective equipment:
Wear self-contained respiratory protective device.
Wear fully protective suit.

6 Accidental Release Measures

6.1 Personal precautions, protective equipment and emergency procedures:
Product forms slippery surface when combined with water.

6.2 Environmental precautions:
Do not allow product to reach sewage system or any water course.

6.3 Methods and material for containment and cleaning up:
Pick up mechanically.
Clean the affected area carefully; suitable cleaners are: Warm water

6.4 Reference to other sections:
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information

7 Handling and Storage

7.1 Precautions for safe handling:
Ensure good ventilation/exhaustion at the workplace.
Keep receptacles tightly sealed.
Prevent formation of dust.
Information about fire - and explosion protection: No special measures required.

7.2 Conditions for safe storage, including any incompatibilities:
Storage:
Requirements to be met by storerooms and receptacles: No special requirements.
Information about storage in one common storage facility: None required.
Further information about storage conditions: Protect from humidity and water.

7.3 Specific end use(s): No additional information available.

8 Exposure Controls/Personal Protection

8.1 Control parameters

Ingredients with limit values that require monitoring at the workplace: Not required.

Additional information: The lists valid during the making were used as basis.

8.2 Exposure controls:

Personal protective equipment:

General protective and hygienic measures:

Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Avoid contact with the skin.
Avoid contact with the eyes and skin.

Respiratory protection:

Not required under normal conditions of use.
In case of brief exposure or low pollution use respiratory filter device.
In case of intensive or longer exposure use self-contained respiratory protective device.

Protection of hands:


Protective gloves

The glove material has to be impermeable and resistant to the product. Selection of the glove material should be based on the penetration time, rates of diffusion and the degradation of the glove material.

Material of gloves:

The selection of a suitable gloves does not only depend on the material, but also on the quality, and varies from manufacturer to manufacturer.

Penetration time of glove material:

The exact break through time has to be determined by the manufacturer of the protective gloves. DO NOT exceed the breakthrough time set by the Manufacturer.

For long term contact, gloves made of the following materials are considered suitable:

Butyl rubber, BR
Nitrile rubber, NBR
Natural rubber (NR)
Neoprene gloves

Eye protection:


Safety glasses

Body protection: Protective work clothing

9 Physical and Chemical Properties

9.1 Information on basic physical and chemical properties:

General Information:	
Appearance:	
Form:	Powder
Color:	White
Odor:	Odorless
Odor threshold:	Not determined.
pH-value (10 g/l) at 20°C:	9.5 (NA for Powder form)
Change in condition:	
Melting point/Melting range:	Not determined.
Boiling point/Boiling range:	Not determined.

Flash point:	Not applicable.
Flammability (solid, gaseous):	Not determined.
Ignition temperature:	Not determined.
Decomposition temperature:	Not determined.
Self-igniting:	Product is not selfigniting.
Danger of explosion:	Product does not present an explosion hazard.
Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
Vapor pressure:	Not applicable.
Density at 20°C:	1,1 g/cm³
Relative density:	Not determined.
Vapor density:	Not applicable.
Evaporation rate:	Not applicable.
Solubility in / Miscibility with water:	Soluble.
Segregation coefficient (n-octanol/water):	Not determined.
Viscosity:	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
Solvent content:	
Organic solvents:	0.0 %
Solids content:	100 %
9.2 Other information:	No additional information available.

10 Stability and Reactivity

10.1 Reactivity:
10.2 Chemical stability:
Thermal decomposition / conditions to be avoided:
No decomposition if used according to specifications.
10.3 Possibility of hazardous reactions:
Reacts with acids.
Reacts with strong alkali.
Reacts with strong oxidizing agents.
10.4 Conditions to avoid:
No additional information available.
10.5 Incompatible materials:
No additional information available.
10.6 Hazardous decomposition products:
Carbon monoxide and carbon dioxide
Phosphorus compounds
Sulphur oxides (SOx)

11 Toxicological Information

11.1 Information on toxicological effects:
Toxicity data: No additional information available.
Primary irritant effect:
On the skin: Irritating to skin and mucous membranes.
On the eye: Strong irritant with the danger of severe eye injury.
Sensitization: No sensitizing effects known.

Additional toxicological information:
The product shows the following dangers according to the calculation method of the General EU Classification Guidelines for Preparations as issued in the latest version: Irritant.
Swallowing will lead to a strong caustic effect on mouth and throat and to the danger of perforation ofesophagus and stomach.

12 Ecological Information

12.1 Toxicity:
Aquatic toxicity: No additional information available.
12.2 Persistence and degradability: No additional information available.
12.3 Bioaccumulative potential: Not worth-mentioning accumulating in organisms.
12.4 Mobility in soil: No additional information available.
Ecotoxical effects:
Remark: Harmful to fish
Additional ecological information:
General notes:
Water hazard class 2 (German Regulation) (Self-assessment): hazardous for water.
Do not allow product to reach ground water, water course or sewage system.
Danger to drinking water if even small quantities leak into the ground.
12.5 Results of PBT and vPvB assessment:
PBT: Not applicable.
vPvB: Not applicable.
12.6 Other adverse effects: No additional information available.

13 Disposal Considerations

13.1 Waste treatment methods:
Recommendation:
Smaller quantities can be disposed of with household waste.
Small amounts may be diluted with plenty of water and washed away. Dispose of bigger amounts in accordance with Local Authority requirements.
The surfactant used in this product complies with the biodegradability criteria as laid down in Regulation (EC) No. 648/2004 on detergents. Data to support this assertion are held at the disposal of the competent authorities of the Member States and will be made available to them, at their direct request or at the request of a detergent manufacturer.
Uncleaned packaging:
Recommendation: Disposal must be made according to official regulations.
Recommended cleansing agents: Water, together with cleansing agents, if necessary.

14 Transport Information

14.1 UN-Number:
DOT, ADR, ADN, IMDG, IATA: Not Regulated

14.2 UN proper shipping name:
DOT, ADR, IMDG, IATA: Not Regulated

14.3 Transport hazard class(es):
DOT, ADR, IMDG, IATA:
Class: Not Regulated
Label: -

14.4 Packing group:
DOT, ADR, IMDG, IATA: Not Regulated

14.5 Environmentalhazards:
Marine pollutant: No

14.6 Special precautions for user: Not applicable.

14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code: Not applicable.

UN "Model Regulation": Not Regulated

15 Regulatory Information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:
United States (USA):
SARA:
Section 355 (extremely hazardous substances): None of the ingredient is listed.
Section 313 (Specific toxic chemical listings): None of the ingredient is listed.
TSCA(Toxic Substances Control Act): All ingredients are listed.

Proposition 65 (California):
Chemicals known to cause cancer: None of the ingredient is listed.
Chemicals known to cause reproductive toxicity for females: None of the ingredient is listed.
Chemicals known to cause reproductive toxicity for males: None of the ingredient is listed.
Chemicals known to cause developmental toxicity: None of the ingredient is listed.

CarcinogenicCategories:
EPA (Environmental Protection Agency): None of the ingredient is listed.
TLV (Threshold Limit Value established by ACGIH): None of the ingredient is listed.
NIOSH-Ca (National Institute for Occupational Safety and Health): None of the ingredient is listed.
OSHA-Ca (Occupational Safety & Health Administration): None of the ingredient is listed.

Canadá:
Canadian Domestic Substances List (DSL): All ingredients are listed.
Canadian Ingredient Disclosure list (limit 0.1%): None of the ingredient is listed.
Canadian Ingredient Disclosure list (limit 1%):

497-19-8	Sodium Carbonate
7722-88-5	Tetrasodium pyrophosphate
151-21-3	Sodium dodecylsulphate

15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

16 Other Information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

Relevantphrases:

H320: Causes eye irritation.

Abbreviations and Acronyms:

ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road.
IMDG: International Maritime Code for Dangerous Goods.
DOT: US Department of Transportation.
IATA: International Air Transport Association.
GHS: Globally Harmonized System of Classification and Labelling of Chemicals.
ACGIH: American Conference of Governmental Industrial Hygienists.
NFPA: National Fire Protection Association (USA).
HMIS: Hazardous Materials Identification System (USA).
WHMIS: Workplace Hazardous Materials Information System (Canada).
VOC: Volatile Organic Compounds (USA, EU).
LC50: Lethal concentration, 50 percent.
LD50: Lethal dose, 50 percent.

SDS Created by:

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JET-LUBE®
A CSW Industrials Company

SAFETY DATA SHEET

Issuing Date 02-Jun-2015 **Revision Date** 15-Mar-2017 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND THE COMPANY/UNDERTAKING

GHS product identifier

Product Name **WELL-GUARD®**

Other means of identification

Product Code(s) **185**

Synonyms JET-LUBEÒ WELL-GUARDÒ

Recommended use of the chemical and restrictions on use

Recommended Use Lubricants, Greases and Release Products

Uses advised against No information available

Supplier's details

Manufacturer Address
Jet-Lube, LLC
930 Whitmore Dr.
Rockwall, Texas 75087
TEL: 972-771-1000
Toll Free: 1-800-669-6318

Emergency telephone number

Emergency Telephone Number CHEMTREC: +1-703-527-3887 (INTERNATIONAL)
1-800-424-9300 (NORTH AMERICA)

2. HAZARDS IDENTIFICATION

Classification

This chemical is not considered hazardous according to the OSHA Hazard Communication Standard 2012 (29 CFR 1910.1200).

GHS Label elements, including precautionary statements

Emergency Overview

Signal Word **None**

The product contains no substances which at their given concentration are considered to be hazardous to health

Appearance Beige **Physical State** Semi-Solid, Paste. **Odor** Seed oil smell (slight)

Precautionary Statements
Prevention
• None

General Advice
• None

Storage
• None

Disposal
• None

Hazard Not Otherwise Classified (HNOC)

Not applicable

Other information
93.5% of the mixture consists of ingredient(s) of unknown toxicity.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms JET-LUBEÒ WELL-GUARDÒ

Chemical Name	CAS-No	Weight %	Trade secret
Mica	12001-26-2	15-20	*
Limestone	1317-65-3	15-20	*
Titanium dioxide	13463-67-7	0-1	*

**The exact percentage (concentration) of composition has been withheld as a trade secret.*

4. FIRST AID MEASURES

Description of necessary first-aid measures

Eye Contact Rinse thoroughly with plenty of water, also under the eyelids. If symptoms persist, call a physician.

Skin Contact Wash skin with soap and water. If skin irritation persists, call a physician.

Inhalation Move to fresh air.

Ingestion Do NOT induce vomiting. Drink plenty of water. Never give anything by mouth to an unconscious person. Consult a physician if necessary

Most important symptoms/effects, acute and delayed

Most Important Symptoms/Effects No information available.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media No information available.

Specific Hazards Arising from the Chemical
No information available.

Explosion Data
Sensitivity to Mechanical Impact None.
Sensitivity to Static Discharge None.

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Avoid contact with the skin and the eyes. Refer to Section 8 for personal protective equipment.

Environmental Precautions

Environmental Precautions Do not allow material to contaminate ground water system. See Section 12 for additional Ecological Information.

Methods and materials for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Dam up. Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin and eyes.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from oxidizing materials.

Incompatible Products Strong oxidizing agents.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Mica 12001-26-2	TWA: 3 mg/m³	TWA: 20 mppcf (<1% crystalline silica) 3 mg/m³ (vacated)	IDLH: 1500 mg/m³ containing <1% quartz TWA: 3 mg/m³ respirable dust
Limestone 1317-65-3	-	TWA: 15 mg/m³ TWA: 5 mg/m³ (vacated) TWA: 15 mg/m³ (vacated) TWA: 5 mg/m³	TWA: 5 mg/m³ respirable dust TWA: 10 mg/m³ total dust
Titanium dioxide 13463-67-7	TWA: 10 mg/m³	TWA: 15 mg/m³ total dust (vacated) TWA: 10 mg/m³ total dust	IDLH: 5000 mg/m³

Immediately Dangerous to Life or Health. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH:

Other Exposure Guidelines Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Appropriate engineering controls

Engineering Measures	Showers Eyewash stations Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection	If splashes are likely to occur, wear: Safety glasses with side-shields.
Skin and Body Protection	Protective gloves.
Respiratory Protection	No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Semi-Solid, Paste.	**Appearance**	Beige.
Odor	Seed oil smell (slight).	**Odor Threshold**	No information available.

Property	Values	Remarks/ - Method
pH	Neutral	None known
Melting Point/Range	> 260 °C	None known
Boiling Point/Boiling Range	> 300 °C	None known
Flash Point	> 280 °C	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
upper flammability limit	No data available	
lower flammability limit	No data available	
Vapor Pressure	No data available	None known
Vapor Density	No data available	None known
Specific Gravity	1.35	None known
Water Solubility	Insoluble	None known
Solubility in other solvents	Largely.	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition Temperature	No data available	None known
Decomposition Temperature	No data available	None known
Viscosity	No data available	None known

Flammable Properties	Not flammable
Explosive Properties	No data available
Oxidizing Properties	No data available

Other information

VOC Content (%)	No data available

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

None under normal processing.

Hazardous Polymerization

Hazardous polymerization does not occur.

Conditions to avoid

Incompatible products.

Incompatible materials

Strong oxidizing agents.

Hazardous decomposition products

None known based on information supplied.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation	None under normal use condtions
Eye Contact	Contact with eyes may cause irritation.
Skin Contact	Prolonged or repeated contact may dry skin and cause irritation.
Ingestion	May be harmful if swallowed. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Titanium dioxide	> 10000 mg/kg (Rat)	-	> 6820 mg/m³

Symptoms related to the physical, chemical and toxicological characteristics

Symptoms No information available.

Delayed and immediate effects and also chronic effects from short and long term exposure

Sensitization	No information available.
Mutagenic Effects	No information available.
Carcinogenicity	The table below indicates whether each agency has listed any ingredient as a carcinogen. This product contains titanium dioxide in a non-respirable form. Inhalation of titanium dioxide is unlikely to occur from exposure to this product.

Chemical Name	ACGIH	IARC	NTP	OSHA
Titanium dioxide		Group 2B		X

IARC: (International Agency for Research on Cancer)
Group 2B - Possibly Carcinogenic to Humans

OSHA: (Occupational Safety & Health Administration)
X - Present

Reproductive Toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Chronic Toxicity	Titanium dioxide has been classified by the International Agency for Research on Cancer (IARC) as possibly carcinogenic to humans (Group 2B) by inhalation. This product contains titanium dioxide in a non-respirable form. Inhalation of titanium dioxide is unlikely to occur from exposure to this product.
Aspiration Hazard	No information available.

Numerical measures of toxicity - Product

Acute Toxicity	93.5% of the mixture consists of ingredient(s) of unknown toxicity.

The following values are calculated based on chapter 3.1 of the GHS document:

LD50 Oral	2500 mg/kg; Acute toxicity estimate
Inhalation	
gas	4500
dust/mist	12.7 mg/L; Acute toxicity estimate

12. ECOLOGICAL INFORMATION

Ecotoxicity
The environmental impact of this product has not been fully investigated.

Persistence and Degradability	No information available.
Bioaccumulation	No information available.

Other Adverse Effects
No information available.

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	Dispose of in accordance with federal, state, and local regulations
Contaminated Packaging	Do not re-use empty containers.

14. TRANSPORT INFORMATION

DOT	Not regulated

15. REGULATORY INFORMATION

International Inventories

DSL	All components are listed either on the DSL or NDSL.

Legend
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals:

Chemical Name	CAS-No	California Prop. 65
Titanium dioxide	13463-67-7	Carcinogen

U.S. State Right-to-Know Regulations

"X" designates that the ingredients are listed on the state right to know list.

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Illinois	Rhode Island
Mica	X	X	X		X
Limestone	X	X	X		X
Ptfe			X		X

U.S. EPA Label Information

EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

NFPA	**Health Hazard** 1	**Flammability** 1	**Instability** 0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard** 1	**Flammability** 1	**Physical Hazard** 0	**Personal Protection** X

Prepared By
Product Stewardship
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Latham, NY 12110
1-800-572-6501

Issuing Date 02-Jun-2015
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Revision Note Updated company information.

General Disclaimer

The information provided on this SDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of Safety Data Sheet

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Name of product LAGERMEISTER 3000 PLUS

1.2. Relevant identified uses of the substance or mixture and uses advised against

Recommended intended purpose(s)
Lubricating grease

1.3. Details of the supplier of the safety data sheet

Manufacturer/distributor
FUCHS LUBRITECH GMBH
Werner-Heisenberg-Straße 1, D-67661 Kaiserslautern/Germany
Phone +49 (0) 6301 3206 - 0, Fax +49 (0) 6301 3206 - 940
E-Mail reach@fuchs-lubritech.de
Internet www.fuchs-lubritech.com

Advice
Product Safety Management
Phone +49 (0) 6301 3206 - 0
Fax +49 (0) 6301 3206 - 940
E-mail (competent person):
reach@fuchs-lubritech.de

1.4. Emergency telephone number

Emergency advice
+49 (0)171 / 4632154
Phone 06301/3206-808
This number is only available at office times.

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification according to 67/548/EEC or 1999/45/EC

R52/53

R-phrases

52/53 Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]

Hazard classes and Hazard categories	Hazard Statements	Classification procedure
Aquatic Chronic 3	**H412**	

2.2. Label elements

Labelling according to Regulation (EC) No 1272/2008 [CLP/GHS]

Hazard Statements

H412 Harmful to aquatic life with long lasting effects.

Precautionary Statements

P273 Avoid release to the environment.

2.3. Other hazards

Information pertaining to special dangers for human and environment
none at appropriate handling and storage

SECTION 3: Composition/ information on ingredients

3.1. Substances

not applicable

3.2. Mixtures

Description
Thickening system and additives in highly refined mineral oil

Hazardous ingredients

CAS No	EC No	Name	[% weight]	Classification according to 67/548/EEC
	205-251-1	Zn-Octoat	0,1 - 1	Xi; R38 N; R51/53
	234-409-2	Zinc compound	0,1 - 1	Xi; R38; N; R50/53
	204-881-4	phenol. Antioxidans	0,1 - 1	N; R50/53
	247-810-2	ZnDTP	0,1 - 1	Xi, N; R 41-51/53

CAS No	EC No	Name	[% weight]	Classification according to Regulation (EC) No 1272/2008 [CLP/GHS]
	205-251-1	Zn-Octoat	0,1 - 1	Skin Irrit. 2, H315 / Aquatic Chronic 2, H411
	234-409-2	Zinc compound	0,1 - 1	Aquatic Chronic 1, H410 / Aquatic Acute 1, H400 / Skin Irrit. 2, H315
	204-881-4	phenol. Antioxidans	0,1 - 1	Aquatic Chronic 1, H410 / Aquatic Acute 1, H400
	247-810-2	ZnDTP	0,1 - 1	Eye Dam. 1, H318 / Aquatic Chronic 2, H411

REACH

CAS No	Name	REACH registration number
	phenol. Antioxidans	01-2119565113-46
	ZnDTP	01-2119937239-30

Additional advice
We do not know of adverse reactions at storage and handling of the product in accordance with the prescribed procedures.

SECTION 4: First aid measures

4.1. Description of first aid measures
General information
Remove contaminated soaked clothing immediately, don`t leave to dry.

In case of inhalation
Ensure of fresh air.
In the event of symptoms refer for medical treatment.
(may be relevant for vapours of superheated product)

In case of skin contact
In case of contact with skin wash off with soap and water.

In case of eye contact
In case of contact with eyes rinse with plenty of water carefully. In the event of persistent symptoms seek medical treatment.

In case of ingestion
Call doctor in case of indisposition

4.2. Most important symptoms and effects, both acute and delayed
Physician's information / possible symptoms
No symptoms known so far.

4.3. Indication of any immediate medical attention and special treatment needed
Treatment (Advice to doctor)
Treat symptoms.

SECTION 5: Firefighting measures

5.1. Extinguishing media
Suitable extinguishing media
Alcohol-resistant foam
Dry powder
Carbon dioxide
Water spray jet

Unsuitable extinguishing media
Full water jet

5.2. Special hazards arising from the substance or mixture
Fire gas of organic material has to be classed invariably as respiratory poison.

5.3. Advice for firefighters
Special protective equipment for fire-fighters
Use breathing apparatus with independent air supply.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
For non-emergency personnel
none at appropriate handling and storage

For emergency responders
no special dangers known

6.2. Environmental precautions
Do not discharge into the drains/surface waters/groundwater.

6.3. Methods and material for containment and cleaning up
Disposal according to regulations.
Take up mechanically and send for disposal.

Additional Information
Informations for disposal see chapter 13.
No dangerous substances are released

6.4. Reference to other sections
Safe handling: see section 7
Disposal: see section 13
Personal protection equipment: see section 8
Emergency telephone number: see section 1

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Advice on safe handling
none at appropriate handling and storage

General protective measures
Avoid contact with eyes and skin

Hygiene measures
Cloths contaminated with product should not be kept in trouser pockets.
Follow general rules of industrial hygiene for safe handling of chemical products
Use barrier skin cream.

Advice on protection against fire and explosion
No special measures necessary.

7.2. Conditions for safe storage, including any incompatibilities
Requirements for storage rooms and vessels
Prevent penetration into the ground.

Advice on storage compatibility
Do not store together with food.

Further information on storage conditions
Keep container tightly closed, store at cool and aired place, open and handle carefully.

Information on storage stability
See technical information about storage of lubricants

Storage group 11

7.3. Specific end use(s)
Recommendation(s) for intended use
see Product information

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Ingredients with occupational exposure limits to be monitored

CAS No	Name	Code	[mg/m3]	[ppm]		Remark
128-37-0	2,6-Di-tert-butyl-p-kresol	8 hours	10 E		4(II)	DFG, Y, 11

Additional advice
As basis for this information served the valid references.

8.2. Exposure controls

Respiratory protection
Not required at determined application

Hand protection
Protective gloves

Eye protection
tightly fitting goggles, in case of splashing

Other protection measures
Usual working clothes for chemical industries

Appropriate engineering controls
Care for good room ventilation, exhaust system at workshop place if necessary

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance	Colour	Odour
pasty	light green	characteristic

Odour threshold
not determined

Important health, safety and environmental information

	Value	Temperature	at	Method	Remark
pH value					not applicable
boiling range					not applicable
melting range					not determined
Flash point					not applicable
Vapourisation rate	not determined				
Flammable (solid)	not determined				
Flammability (gas)	not determined				
Ignition temperature	not determined				
Self ignition temperature					not self-igniting
Lower explosion limit	not determined				
Upper explosion limit	not determined				
Vapour pressure	not determined				
Relative density	ca. 0,9 g/cm3	25 °C		DIN 51757	
Vapour density	not determined				
Solubility in water					more or less insoluble
Solubility/other	not determined				

	Value	Temperature	at	Method	Remark
Partition coefficient n-octanol/water (log P O/W)	not determined				
Decomposition temperature	not determined				
Viscosity					NLGI 2

Oxidising properties
No information available.

Explosive properties
The product as such is not explosive.

9.2. Other information
No information available.

SECTION 10: Stability and reactivity

10.1. Reactivity
No information available.

10.2. Chemical stability
No information available.

10.3. Possibility of hazardous reactions
No information available.

10.4. Conditions to avoid
none at appropriate handling and storage

10.5. Incompatible materials
Materials to avoid
none at appropriate handling and storage

10.6. Hazardous decomposition products
No hazardous decomposition products known.

Thermal decomposition

Remark No decomposition if used as directed.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity/Irritability/Sensitization

	Value/Validation	Species	Method	Remark
LD50 acute oral				not determined
Irritability skin	no irritating effects known			
Irritability eye	no irritating effects known			
Skin sensitization	No sensitizing effect known			

Experiences made from practice
no harmful effects at appropriate handling and determined usage

Additional information
No toxical dates available.
The product was classified on the basis of the calculation procedure of the directive 67/548/EEC (conventional method).

SECTION 12: Ecological information

12.1. Toxicity

Ecotoxicological effects

Value	Species	Method	Validation
Fish			not determined

12.2. Persistence and degradability

Biological degradability not determined

12.3. Bioaccumulative potential

No information available.

12.4. Mobility in soil

No information available.

12.5. Results of PBT and vPvB assessment

No information available.

12.6. Other adverse effects

Behaviour in sewage plant

Product swims on (waste-) water surface

General regulation

Ecological dates are not available.
Do not allow uncontrolled leakage of product into the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Recommendations for the product

Waste disposal in accordance with the relevant regulations.

Recommendations for packaging

Uncontaminated packaging may be taken for recycling.
Contaminated packaging should be emptied as far as possible and after appropriate cleansing may be taken fot reuse.

General information

Ultimately responsible for correct classification is the waste producer, as the EWC names different codes for different origins of same waste

SECTION 14: Transport information

	ADR/RID	IMDG	IATA-DGR
14.1. UN number	-	-	-
14.2. UN proper shipping name	-	-	-
14.3. Transport hazard class(es)	-	-	-
14.4. Packing group	-	-	-
14.5. Environmental hazards	-	-	-

14.6. Special precautions for user

No information available.

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

No information available.

Land and inland navigation transport ADR/RID

No dangerous goods as defined by these transport regulations.

Marine transport IMDG

No hazardous goods as defined by prescriptions

Air transport ICAO/IATA-DGR

No hazardous goods as defined by prescriptions

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

VOC standard

VOC content	0 %	
National regulations		
Water hazard class	1	Mixture-WGK according to VwVwS (GER)

15.2. Chemical Safety Assessment

Chemical Safety Assessments for mixtures is not required.

! SECTION 16: Other information

Training advice

Use information in this MSDS

Further information

All the raw materials in this product are listed in TSCA.
All the raw materials in this product are listed in DSL.
Refer to product information paper.
The information contained herein is based on the state of our knowledge. It characterizes the product with regard to the appropriate safety precautions. It does not represent a guarantee of the properties of the product.

Indication of changes: "!" = Data changed compared with the previous version. Previous version: 1.8

Sources of key data used

Material Safety Data Sheets of raw materials

Wording of the R/H-phrases specified in chapter 3 (not the classification of the mixture!)

R 38 Irritating to skin.
R 41 Risk of serious damage to eyes.
R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

H315	Causes skin irritation.
H318	Causes serious eye damage.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
H411	Toxic to aquatic life with long lasting effects.
H412	Harmful to aquatic life with long lasting effects.

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200)

SECTION 1: Identification

Product Identifier	**Redtac® Grease**
Other means of identification	Phillips 66 Redtac® Grease #0 Phillips 66 Redtac® Grease #1 Phillips 66 Redtac® Grease #2
SDS Number	**LBPH721570**
Relevant identified uses	Lubricating Grease
Uses advised against	All others
24 Hour Emergency Phone Number	CHEMTREC 1-800-424-9300 CHEMTREC Mexico 01-800-681-9531

Manufacturer/Supplier	**SDS Information**
Phillips 66 Company	Phone: 800-762-0942
P.O. Box 4428	Email: SDS@P66.com
Houston, Texas 77210	URL: www.Phillips66.com

SECTION 2: Hazard identification

Classified Hazards

This material is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29CFR 1910.1200.

Hazards Not Otherwise Classified (HNOC)

PHNOC: None known

HHNOC: None known

Label Elements

No classified hazards

SECTION 3: Composition/information on ingredients

Chemical Name	CASRN	Concentration[1]
Lubricant Base Oil (Petroleum)	VARIOUS	>80

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician. (see Note to Physician)

Inhalation: First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion: First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: Prolonged or repeated contact may dry skin and cause irritation. Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea.

Notes to Physician: When using high-pressure equipment, injection of product under the skin can occur. In this case, the casualty should be sent immediately to the hospital. Do not wait for symptoms to develop. High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. These injuries often require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury. Early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

SECTION 5: Firefighting measures

NFPA 704 Hazard Class

Health: 0 **Flammability:** 1 **Instability:** 0

0 (Minimal)
1 (Slight)
2 (Moderate)
3 (Serious)
4 (Severe)

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

Special protective actions for firefighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate the hazard area and deny entry to unnecessary and unprotected personnel Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

SECTION 7: Handling and storage

Precautions for safe handling: Keep away from flames and hot surfaces. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). Spills will produce very slippery surfaces. High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing of high pressure hydraulic oil equipment.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: Exposure controls/personal protection

Chemical Name	ACGIH	OSHA	Phillips 66
Lubricant Base Oil (Petroleum)	---	---	TWA: 5 mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye/face protection is not normally required; however, good industrial hygiene practice suggests the use of eye protection that meets or exceeds ANSI Z.87.1 whenever working with chemicals.

Skin/Hand Protection: The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals. Suggested protective materials: Nitrile

Respiratory Protection: Respiratory protection is not normally required under intended conditions of use. Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

SECTION 9: Physical and chemical properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance: Red
Physical Form: Semi-Solid
Odor: Petroleum
Odor Threshold: No data
pH: Not applicable
Vapor Density (air=1): >1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): <1
Particle Size: Not applicable
Percent Volatile: Negligible
Flammability (solid, gas): Not applicable

Flash Point: > 390 °F / > 199 °C
Test Method: Cleveland Open Cup (COC), ASTM D92
Initial Boiling Point/Range: No data
Vapor Pressure: <0.1 mm Hg
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: No data
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 0.9 @ 60°F (15.6°C)
Bulk Density: 7.5 lbs/gal
Viscosity: No data
Solubility in Water: Negligible

SECTION 10: Stability and reactivity

Reactivity: Not chemically reactive.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Extended exposure to high temperatures can cause decomposition. Avoid all possible sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous decomposition products: Not anticipated under normal conditions of use.

SECTION 11: Toxicological information

Information on Toxicological Effects

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Aspiration Hazard: Not an aspiration hazard.

Skin Corrosion/Irritation: Not expected to be irritating. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Not expected to be irritating.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Specific Target Organ Toxicity (Repeated Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Carcinogenicity: No information available on the mixture, however none of the components have been classified for carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Information on Toxicological Effects of Components

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

SECTION 12: Ecological information

GHS Classification:
No classified hazards

Toxicity: All acute aquatic toxicity studies on samples of lubricant base oils show acute toxicity values greater than 100 mg/L for invertebrates, algae and fish. These tests were carried out on water accommodated fractions and the results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material are greater than 5.3, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

Mobility in Soil: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of the hydrocarbon constituents in soil and sediment.

Other adverse effects: None anticipated.

SECTION 13: Disposal considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.This material under most intended uses would become "Used Oil" due to contamination by physical or chemical impurities. Whenever possible, Recycle used oil in accordance with applicable federal and state or local regulations. Container contents should be completely used and containers should be emptied prior to discard.

SECTION 14: Transport information

U.S. Department of Transportation (DOT)
UN Number: Not regulated
UN proper shipping name: None
Transport hazard class(es): None
Packing Group: None
Environmental Hazards: This product does not meet the DOT/UN/IMDG/IMO criteria of a marine pollutant
Special precautions for user: If shipped by land in a packaging having a capacity of 3,500 gallons or more, the provisions of 49 CFR, Part 130 apply. (Contains oil)
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable

SECTION 15: Regulatory information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds):
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)

Acute Health Hazard:	No
Chronic Health Hazard:	No
Fire Hazard:	No
Pressure Hazard:	No
Reactive Hazard:	No

CERCLA/SARA - Section 313 and 40 CFR 372:
This material contains the following chemicals subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR 372:

Chemical Name	Concentration[1]	de minimis
Zinc Compound(s)	1.5	1.0%

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

EPA (CERCLA) Reportable Quantity (in pounds):
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65:
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Hazard Classification

Canada:
This product has been classified in accordance with the hazard criteria of the Hazardous Products Regulations (SOR/2015-17) and the SDS contains all the information required by the Regulations.

International Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

U.S. Export Control Classification Number: EAR99

SECTION 16: Other information

Issue Date:	Previous Issue Date:	SDS Number	Status:
22-Jun-2016	24-May-2016	LBPH721570	FINAL

Revised Sections or Basis for Revision:
New SDS

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them

shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Revision Number: 006.0

Issue date: 08/01/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name: LOCTITE® SUPERFLEX® RED HIGH TEMP RTV V Silicone Adhesive Sealant Silicone Adhesive Sealant

IDH number: 198817

Product type: Silicone

Item number: 59675

Restriction of Use: None identified

Region: United States

Company address:
Henkel Corporation
One Henkel Way
Rocky Hill, Connecticut 06067

Contact information:
Telephone: (860) 571-5100
MEDICAL EMERGENCY Phone: Poison Control Center
1-877-671-4608 (toll free) or 1-303-592-1711
TRANSPORT EMERGENCY Phone: CHEMTREC
1-800-424-9300 (toll free) or 1-703-527-3887
Internet: www.henkelna.com

2. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW	
WARNING:	CAUSES SKIN IRRITATION. MAY CAUSE AN ALLERGIC SKIN REACTION. CAUSES SERIOUS EYE IRRITATION.

HAZARD CLASS	HAZARD CATEGORY
SKIN IRRITATION	2
EYE IRRITATION	2A
SKIN SENSITIZATION	1

PICTOGRAM(S)

Precautionary Statements

Prevention: Avoid breathing vapors, mist, or spray. Wash thoroughly after handling. Contaminated work clothing should not be allowed out of the workplace. Wear eye and face protection. Wear protective gloves.

Response: IF ON SKIN: Wash with plenty of soap and water. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to remove. Continue rinsing. If skin irritation or rash occurs: Get medical attention. If eye irritation persists: Get medical attention. Take off contaminated clothing.

Storage: Not prescribed

Disposal: Dispose of contents and/or container according to Federal, State/Provincial and local governmental regulations.

Classification complies with OSHA Hazard Communication Standard (29 CFR 1910.1200) and is consistent with the provisions of the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

See Section 11 for additional toxicological information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Component(s)	CAS Number	Percentage*
Distillates (petroleum), hydrotreated middle	64742-46-7	5 - 10
Silicon dioxide	7631-86-9	5 - 10
Silicone Resin	Proprietary	1 - 5
Diiron trioxide	1309-37-1	1 - 5
Substituted Silane	Proprietary	1 - 5
Acetic acid	64-19-7	0.1 - 1
Substituted silane	Proprietary	0.1 - 1

* Exact percentage is a trade secret. Concentration range is provided to assist users in providing appropriate protections.

4. FIRST AID MEASURES

Inhalation: Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. If symptoms develop and persist, get medical attention.

Skin contact: Wipe off paste with paper towel or cloth. Wash with soap and water. If skin irritation persists, call a physician.

Eye contact: Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If eye irritation persists, consult a specialist.

Ingestion: Do not induce vomiting. If a person feels unwell or symptoms of skin irritation appear, consult a physician.

Symptoms: See Section 11.

Notes to physician: Treat symptomatically.

5. FIRE FIGHTING MEASURES

Extinguishing media: Foam, dry chemical or carbon dioxide.

Special firefighting procedures: None

Unusual fire or explosion hazards: None

Hazardous combustion products: Silica mist. Formaldehyde. Acrid smoke and fumes.

6. ACCIDENTAL RELEASE MEASURES

Use personal protection recommended in Section 8, isolate the hazard area and deny entry to unnecessary and unprotected personnel.

Environmental precautions: Do not allow product to enter sewer or waterways.

Clean-up methods: Maintain good ventilation for large spills. Store in a partly filled, closed container until disposal. Spilled material will solidify. Scrape up as much material as possible.

7. HANDLING AND STORAGE

Handling: Prevent contact with eyes, skin and clothing. Do not breathe vapor and mist. Wash thoroughly after handling.

Storage: Keep container closed. Store in a dry area below 90° F.

For information on product shelf life contact Henkel Customer Service at (800) 243-4874.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Employers should complete an assessment of all workplaces to determine the need for, and selection of, proper exposure controls and protective equipment for each task performed.

Hazardous Component(s)	ACGIH TLV	OSHA PEL	AIHA WEEL	OTHER
Distillates (petroleum), hydrotreated middle	None	5 mg/m3 PEL Mist.	None	None
Silicon dioxide	6 mg/m3 TWA	20 MPPCF TWA 0.8 mg/m3 TWA	None	3 mg/m3 TWA Respirable fraction.
Silicone Resin	None	None	None	None
Diiron trioxide	5 mg/m3 TWA Respirable fraction.	10 mg/m3 PEL Fume.	None	None
Substituted Silane	None	None	None	None
Acetic acid	15 ppm STEL 10 ppm TWA	10 ppm (25 mg/m3) PEL	None	None
Substituted silane	None	None	None	None

Engineering controls: Use only with adequate ventilation.

Respiratory protection: Use NIOSH approved respirator if there is potential to exceed exposure limit(s).

Eye/face protection: Safety goggles or safety glasses with side shields. Full face protection should be used if the potential for splashing or spraying of product exists.

Skin protection: Use impermeable gloves and protective clothing as necessary to prevent skin contact.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state: Liquid, Paste
Color: Red
Odor: Acetic acid
Odor threshold: Not available.
pH: Not available.
Vapor pressure: < 10 mm hg (68 °F (20°C))
Boiling point/range: Not available.
Melting point/ range: Not available.
Specific gravity: 1.01 at 20 °C (68°F)
Vapor density: Heavier than air.
Flash point: > 93 °C (> 199.4 °F)
Flammable/Explosive limits - lower: 4 % (acetic acid)
Flammable/Explosive limits - upper: 19.9 % (acetic acid)
Autoignition temperature: Not available.
Evaporation rate: Not available.
Solubility in water: Not soluble. Polymerizes in presence of water.
Partition coefficient (n-octanol/water): Not available.
VOC content: 3.08 %; 32 g/l
Viscosity: Not available.
Decomposition temperature: Not available.

10. STABILITY AND REACTIVITY

Stability: Stable

Hazardous reactions: Will not occur.

Hazardous decomposition products: Acetic acid is liberated slowly upon contact with moisture. Formaldehyde.

Incompatible materials: Acids. Water Bases. Oxidizing agents.

Reactivity: Not available.

Conditions to avoid: Exposure to moisture. Prolonged heating at temperatures above 150 °C.

11. TOXICOLOGICAL INFORMATION

Relevant routes of exposure: Skin, Inhalation, Eyes

Potential Health Effects/Symptoms

Inhalation: Acetic acid produced during cure may irritate eyes, nose and throat. When heated to temperatures exceeding 300° F (150° C) in the presence of air, silicones may form formaldehyde vapors. Formaldehyde is a potential cancer hazard and a known skin and respiratory sensitizer. Vapors irritate the eyes, nose and throat. Safe handling conditions may be maintained by keeping formaldehyde vapor concentrations below the OSHA permissible limit.

Skin contact: Causes skin irritation. May cause allergic skin reaction.

Eye contact: Causes serious eye irritation.

Ingestion: Not expected to be harmful by ingestion.

Hazardous Component(s)	LD50s and LC50s	Immediate and Delayed Health Effects
Distillates (petroleum), hydrotreated middle	None	Irritant
Silicon dioxide	Oral LD50 (RAT) = > 22,500 mg/kg	Nuisance dust
Silicone Resin	None	Irritant
Diiron trioxide	None	Allergen, Cardiac, Central nervous system, Irritant, Kidney, Liver, Lung
Substituted Silane	None	Irritant, Allergen
Acetic acid	Oral LD50 (RABBIT) = 1,200 mg/kg Oral LD50 (RAT) = 3.53 g/kg Oral LD50 (RAT) = 3.31 g/kg Dermal LD50 (RABBIT) = 1,060 mg/kg Inhalation LC50 (RAT, 4 h) = 11.4 mg/l	Allergen, Corrosive, Eyes, Gastrointestinal, Immune system, Irritant, Kidney
Substituted silane	None	Allergen, Irritant

Hazardous Component(s)	NTP Carcinogen	IARC Carcinogen	OSHA Carcinogen (Specifically Regulated)
Distillates (petroleum), hydrotreated middle	No	No	No
Silicon dioxide	No	No	No
Silicone Resin	No	No	No
Diiron trioxide	No	No	No
Substituted Silane	No	No	No
Acetic acid	No	No	No
Substituted silane	No	No	No

12. ECOLOGICAL INFORMATION

Ecological information: Not available.

13. DISPOSAL CONSIDERATIONS

Information provided is for unused product only.

Recommended method of disposal:	Follow all local, state, federal and provincial regulations for disposal. Cured rubber can be incinerated or landfilled following EPA and local regulations.
Hazardous waste number:	Not a RCRA hazardous waste.

14. TRANSPORT INFORMATION

The transport information provided in this section only applies to the material/formulation itself, and is not specific to any package/configuration.

U.S. Department of Transportation Ground (49 CFR)

Proper shipping name:	Not regulated
Hazard class or division:	None
Identification number:	None
Packing group:	None

International Air Transportation (ICAO/IATA)

Proper shipping name:	Not regulated
Hazard class or division:	None
Identification number:	None
Packing group:	None

Water Transportation (IMO/IMDG)

Proper shipping name:	Not regulated
Hazard class or division:	None
Identification number:	None
Packing group:	None

15. REGULATORY INFORMATION

United States Regulatory Information

TSCA 8 (b) Inventory Status:	All components are listed or are exempt from listing on the Toxic Substances Control Act Inventory.
TSCA 12 (b) Export Notification:	None above reporting de minimis
CERCLA/SARA Section 302 EHS:	None above reporting de minimis
CERCLA/SARA Section 311/312:	Immediate Health
CERCLA/SARA Section 313:	None above reporting de minimis
California Proposition 65:	This product contains a chemical known in the State of California to cause cancer. This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

Canada Regulatory Information

CEPA DSL/NDSL Status:	All components are listed on or are exempt from listing on the Canadian Domestic Substances List.

16. OTHER INFORMATION

This safety data sheet contains changes from the previous version in sections: New Safety Data Sheet format.

Prepared by: Catherine Bimler, Regulatory Affairs Specialist

Issue date: 08/01/2014

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Safety Data Sheet: **Simple Green® All-Purpose Cleaner** ★

Version No. 13000-14B Issue Date: September 13, 2014 Supersedes Date: January 7, 2014 *OSHA HCS-2012 / GHS*

Section 1: IDENTIFICATION

Product Name: Simple Green® All-Purpose Cleaner
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 • 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not classified as hazardous under 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200).

OSHA HCS 2012
Label Elements
Signal Word: None

Hazard Symbol(s)/Pictogram(s): None required

Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 84.8%*
Ethoxylated Alcohol	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Tetrasodium *N,N*-bis(carboxymethyl)-L-glutamate	51981-21-6	< 1%*
Sodium Carbonate	497-19-8	< 1%*
Citric Acid	77-92-9	< 1%*
Isothiazolinone mixture	55965-84-9	< 0.2%*
Fragrance	Proprietary Mixture	< 1%*
Colorant	Proprietary Mixture	< 1%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

See section 16 for NFPA rating.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Green Liquid
Odor: Added sassafras odor
Odor Threshold: Not determined
pH ASTM D-1293: 8.5 – 9.5
Freezing Point ASTM D-1177: 0-3.33°C (32-38°F)
Boiling Point & Range ASTM D-1120: 101°C (213.8°F)
Flash Point ASTM D-93: > 212°F
Evaporation Rate ASTM D-1901: ½ Butyl Acetate @ 25°C
Flammability (solid, gas): Not applicable
Upper/Lower Flammability or Explosive Limits: Not applicable
Vapor Pressure ASTM D-323: 0.60 PSI @77°F, 2.05 PSI @100°F
Vapor Density: Not determined

Partition Coefficient: n-octanol/water: Not determined
Autoignition Temperature: Non-flammable
Decomposition Temperature: 109°F
Viscosity: Like water
Specific Gravity ASTM D-891: 1.01 – 1.03
VOCs: ***Water & fragrance exemption in calculation*

SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
CARB Method 310**:	2.5 g/L	0.021 lb/gal	0.25%
SCAQMD Method 313:	Not tested		

VOC Composite Partial Pressure: Not determined
Relative Density ASTM D-4017: 8.34 – 8.42 lb/gal
Solubility: 100% in water

Section 10: STABILITY AND REACTIVITY

Reactivity:	Non-reactive.
Chemical Stability:	Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions:	None known.
Conditions to Avoid:	Excessive heat or cold.
Incompatible Materials:	Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products:	Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:	Inhalation -	Overexposure may cause headache.
	Skin Contact -	Not expected to cause irritation, repeated contact may cause dry skin.
	Eye Contact -	Not expected to cause irritation.
	Ingestion -	May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:	Oral LD_{50} (rat)	> 5 g/kg body weight
	Dermal LD_{50} (rabbit)	> 5 g/kg body weight

Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation:	Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation:	Minimal irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity:	Mixture does not classify under this category.
Carcinogenicity:	Mixture does not classify under this category.
Reproductive Toxicity:	Mixture does not classify under this category.
STOT-Single Exposure:	Mixture does not classify under this category.
STOT-Repeated Exposure:	Mixture does not classify under this category.
Aspiration Hazard:	Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity:	Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic:	Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial:	Not tested on finished formulation.

Persistence and Degradability:	Readily Biodegradable per OCED 301D, Closed Bottle Test
Bioaccumulative Potential:	No data available.
Mobility in Soil:	No data available.
Other Adverse Effects:	No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number:	Not applicable	**U.N. Proper Shipping Name:**	Cleaning Compound, Liquid NOI
Transport Hazard Class(es):	Not applicable	**NMFC Number:**	48580-3
Packing Group:	Not applicable	**Class:**	55
Environmental Hazards:	Marine Pollutant - NO		

Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG:	Not Regulated for shipping.	**ICAO/ IATA:**	Not classified as Hazardous
IMO / IDMG:	Not classified as Hazardous	**ADR/RID:**	Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed
Texas ESL:

Ethoxylated Alcohol	68439-46-3	60 µg/m^3 long term	600 µg/m^3 short term
Sodium Citrate	68-04-2	5 µg/m^3 long term	50 µg/m^3 short term
Sodium Carbonate	497-19-8	5 µg/m^3 long term	50 µg/m^3 short term
Citric Acid	77-92-9	10 µg/m^3 long term	100 µg/m^3 short term

Section 16: OTHER INFORMATION

Size	UPC	Size	UPC
2 oz. Pump	043318130366	1 Gallon w/ Dilution Bottle	043318000669
2 oz. Pump	043318131035	1 Gallon	043318000799
4 oz. Pump	043318130014	1 Gallon w/ Dilution Bottle	043318001383
16 oz. Trigger	043318130021	1 Gallon w/ Dilution Bottle	043318002021
22 oz. Trigger	043318130229	1 Gallon	043318130052
24 oz. Trigger, 12 per case	043318000034	1 Gallon w/ Dilution Bottle, 112 per case	043318480140
24 oz. Trigger	043318000300	1 Gallon w/ Dilution Bottle, 4 per case	043318480416
24 oz. Trigger	043318130137	1 Gallon w/ Dilution Bottle, 24 per case	043318480492
32 oz. Trigger	043318000652	1 Gallon w/ laundry	043318002052
32 oz. Trigger	043318130335	1 Gallon w/ towel	043318001222
67.6 oz	043318000393	140 oz.	043318001390
67.6 oz.	043318130144	140 oz., 168 per case	043318561405
1 Gallon w/ Dilution Bottle	043318000539	140 oz. w/ Dilution Bottle	043318001468
1 Gallon w/ Dilution Bottle	043318000645		

USA items listed only. Not all items listed. USA items may not be valid for international sale.

Section 16: OTHER INFORMATION - continued

NFPA:

Health – None
Flammability – Non-flammable
Stability – Stable
Special - None

Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

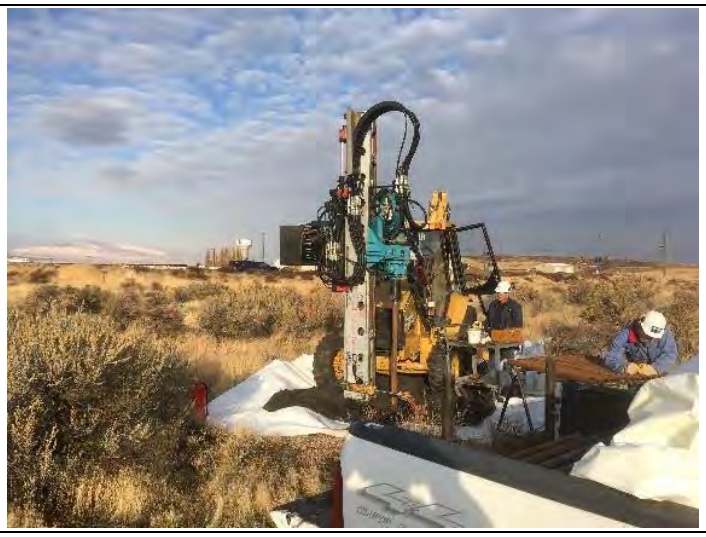
Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Revised SDS layout

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

Appendix B

Photographs

PP-1 View toward North



Rig at PP-2 View toward Northwest

PP-2 Rig and Drill Pipe View toward South

Knock off tip

Groundwater sampling pump and tubing at PP-2

Groundwater sampling pump with weights at PP-2

Pump controller

Groundwater sampling at PP-2

PP-2 Decommissioning

PP-2 View toward Northwest

PP-3 Vew toward North

PP-4 View toward West

PP-5 View toward Southeast

PP-5 View toward West

Appendix C

Laboratory Reports

Energy Northwest

Report of Analysis

For: **Parametrix**

Horn Rapids Landfill

Attn: Lisa Gilbert

Authorized Signature: 09-Nov-17

Project ID: 5533820007

Client Sample ID: PP-2

Lab Sample ID: 180518 180518-01

Site: Horn Rapids Landfill

Collection Date: 11/7/2017 3:29 PM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/8/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/8/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/8/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/8/2017
1,1-Dichloroethane	75-34-3	1.1	µg/L	EPA 8260C	0.5	0.0567	11/8/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/8/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/8/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/8/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/8/2017
1,2,4-Trichlorobenzene	120-82-1	< 0.5	µg/L	EPA 8260C	0.5	0.0214	11/8/2017
1,2,4-Trimethylbenzene	95-63-6	< 0.5	µg/L	EPA 8260C	0.5	0.0374	11/8/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/8/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/8/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/8/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/8/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/8/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-2 **Lab Sample ID:** 180518 180518-01

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017 3:29 PM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,3,5-Trimethylbenzene	108-67-8	< 0.5	µg/L	EPA 8260C	0.5	0.0404	11/8/2017
1,3-Dichlorobenzene	541-73-1	< 0.5	µg/L	EPA 8260C	0.5	0.0423	11/8/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/8/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/8/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/8/2017
2-Butanone (MEK)	78-93-3	6.9	µg/L	EPA 8260C	4	0.9116	11/8/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/8/2017
2-Hexanone	591-78-6	< 4	µg/L	EPA 8260C	4	1.3377	11/8/2017
4-Chlorotoluene	106-43-4	< 0.5	µg/L	EPA 8260C	0.5	0.0482	11/8/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	< 4	µg/L	EPA 8260C	4	0.6029	11/8/2017
Acetone	67-64-1	46	µg/L	EPA 8260C	4	0.5408	11/8/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/8/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/8/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/8/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/8/2017
Benzene	71-43-2	0.53	µg/L	EPA 8260C	0.5	0.0609	11/8/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/8/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/8/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/8/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/8/2017
Bromomethane	74-83-9	m.N.D.	µg/L	EPA 8260C	0.5	0.0785	11/8/2017
Carbon disulfide	75-15-0	< 0.5	µg/L	EPA 8260C	0.5	0.0627	11/8/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/8/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/8/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/8/2017
Chloroform	67-66-3	< 0.5	µg/L	EPA 8260C	0.5	0.0703	11/8/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-2 **Lab Sample ID:** 180518 180518-01

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017 3:29 PM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/8/2017
Chloroprene	126-99-8	N.D.	µg/L	EPA 8260C	1	0.941	11/8/2017
cis-1,2-Dichloroethene	156-59-2	< 0.5	µg/L	EPA 8260C	0.5	0.107	11/8/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/8/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/8/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/8/2017
Dichlorodifluoromethane	75-71-8	0.88	µg/L	EPA 8260C	0.5	0.0458	11/8/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/8/2017
Ethylbenzene	100-41-4	< 0.5	µg/L	EPA 8260C	0.5	0.0533	11/8/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/8/2017
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/8/2017
Isobutyl alcohol	78-83-1	m.N.D.	µg/L	EPA 8260C	20	8.2052	11/8/2017
Isopropylbenzene	98-82-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0526	11/8/2017
m- & p-Xylene	1330-20-7	< 0.5	µg/L	EPA 8260C	0.5	0.1001	11/8/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/8/2017
Methyl methacrylate	80-62-6	m.N.D.	µg/L	EPA 8260C	0.5	0.093	11/8/2017
Methylene chloride	75-09-2	< 0.5	µg/L	EPA 8260C	0.5	0.0563	11/8/2017
Methyl-t-butyl ether	1634-04-4	m.N.D.	µg/L	EPA 8260C	0.5	0.032	11/8/2017
Naphthalene	91-20-3	0.70	µg/L	EPA 8260C	0.5	0.0309	11/8/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/8/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/8/2017
o-Xylene	95-47-6	< 0.5	µg/L	EPA 8260C	0.5	0.0476	11/8/2017
p-isopropyltoluene	99-87-6	< 0.5	µg/L	EPA 8260C	0.5	0.0338	11/8/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/8/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/8/2017
Styrene	100-42-5	< 0.5	µg/L	EPA 8260C	0.5	0.0678	11/8/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-2 **Lab Sample ID:** 180518 180518-01

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017 3:29 PM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/8/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/8/2017
Toluene	108-88-3	< 0.5	µg/L	EPA 8260C	0.5	0.0768	11/8/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/8/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/8/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/8/2017
Trichloroethene	79-01-6	m.N.D.	µg/L	EPA 8260C	0.5	0.0642	11/8/2017
Trichlorofluoromethane	75-69-4	< 0.5	µg/L	EPA 8260C	0.5	0.1286	11/8/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/8/2017
Vinyl chloride	75-01-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0979	11/8/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/8/2017
1,2-Dibromoethane	106-93-4	0.0033	µg/L	EPA 8260C SIM	0.001	0.001	11/8/2017
Acrylonitrile	107-13-1	0.0207	µg/L	EPA 8260C SIM	0.02	0.02	11/8/2017
Vinyl chloride	75-01-4	0.0052	µg/L	EPA 8260C SIM	0.005	0.005	11/8/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180518-01	1,2-Dichloroethane-d4	EPA 8260C	100 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	97.5 %	70 -130
	Dibromofluoromethane	EPA 8260C	95.4 %	70 -130
	Toluene-d8	EPA 8260C	96.5 %	70 -130

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180518 180518-02

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/8/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/8/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/8/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/8/2017
1,1-Dichloroethane	75-34-3	N.D.	µg/L	EPA 8260C	0.5	0.0567	11/8/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/8/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/8/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/8/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/8/2017
1,2,4-Trichlorobenzene	120-82-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0214	11/8/2017
1,2,4-Trimethylbenzene	95-63-6	m.N.D.	µg/L	EPA 8260C	0.5	0.0374	11/8/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/8/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/8/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/8/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/8/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/8/2017
1,3,5-Trimethylbenzene	108-67-8	N.D.	µg/L	EPA 8260C	0.5	0.0404	11/8/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/8/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/8/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/8/2017
2,2-Dichloropropane	594-20-7	m.N.D.	µg/L	EPA 8260C	0.5	0.0609	11/8/2017
2-Butanone (MEK)	78-93-3	N.D.	µg/L	EPA 8260C	4	0.9116	11/8/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/8/2017
2-Hexanone	591-78-6	N.D.	µg/L	EPA 8260C	4	1.3377	11/8/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/8/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/8/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180518 180518-02

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Acetone	67-64-1	< 4	µg/L	EPA 8260C	4	0.5408	11/8/2017
Acetonitrile	75-05-8	N.D.	µg/L	EPA 8260C	20	2.7799	11/8/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/8/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/8/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/8/2017
Benzene	71-43-2	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/8/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/8/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/8/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/8/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/8/2017
Bromomethane	74-83-9	m.N.D.	µg/L	EPA 8260C	0.5	0.0785	11/8/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/8/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/8/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/8/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/8/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/8/2017
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/8/2017
Chloroprene	126-99-8	N.D.	µg/L	EPA 8260C	1	0.941	11/8/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/8/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/8/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/8/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/8/2017
Dichlorodifluoromethane	75-71-8	N.D.	µg/L	EPA 8260C	0.5	0.0458	11/8/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/8/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/8/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/8/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180518 180518-02

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/8/2017
Isobutyl alcohol	78-83-1	m.N.D.	µg/L	EPA 8260C	20	8.2052	11/8/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/8/2017
m- & p-Xylene	1330-20-7	N.D.	µg/L	EPA 8260C	0.5	0.1001	11/8/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/8/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/8/2017
Methylene chloride	75-09-2	N.D.	µg/L	EPA 8260C	0.5	0.0563	11/8/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/8/2017
Naphthalene	91-20-3	N.D.	µg/L	EPA 8260C	0.5	0.0309	11/8/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/8/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/8/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/8/2017
p-isopropyltoluene	99-87-6	< 0.5	µg/L	EPA 8260C	0.5	0.0338	11/8/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/8/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/8/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/8/2017
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/8/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/8/2017
Toluene	108-88-3	N.D.	µg/L	EPA 8260C	0.5	0.0768	11/8/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/8/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/8/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/8/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/8/2017
Trichlorofluoromethane	75-69-4	N.D.	µg/L	EPA 8260C	0.5	0.1286	11/8/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/8/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/8/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180518 180518-02

Site: Horn Rapids Landfill **Collection Date:** 11/7/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/8/2017
1,2-Dibromoethane	106-93-4	0.0033	µg/L	EPA 8260C SIM	0.001	0.001	11/8/2017
Acrylonitrile	107-13-1	< 0.02	µg/L	EPA 8260C SIM	0.02	0.02	11/8/2017
Vinyl chloride	75-01-4	< 0.005	µg/L	EPA 8260C SIM	0.005	0.005	11/8/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180518-02	1,2-Dichloroethane-d4	EPA 8260C	99.9 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	93.9 %	70 -130
	Dibromofluoromethane	EPA 8260C	92 %	70 -130
	Toluene-d8	EPA 8260C	95.4 %	70 -130

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Report of Analysis

For: **Parametrix**

Horn Rapids Landfill

Attn: Lisa Gilbert

Authorized Signature: Dirpan Peters 10-Nov-17

Project ID: 5533820007

Client Sample ID: PP-3

Lab Sample ID: 180535 180535-01

Site: Horn Rapids Landfill

Collection Date: 11/9/2017 11:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/10/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/10/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/10/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/10/2017
1,1-Dichloroethane	75-34-3	0.74	µg/L	EPA 8260C	0.5	0.0567	11/10/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/10/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/10/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/10/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/10/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/10/2017
1,2,4-Trimethylbenzene	95-63-6	< 0.5	µg/L	EPA 8260C	0.5	0.0374	11/10/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/10/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/10/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/10/2017
1,2-Dichloroethane	107-06-2	m.N.D.	µg/L	EPA 8260C	0.5	0.0822	11/10/2017
1,2-Dichloropropane	78-87-5	m.N.D.	µg/L	EPA 8260C	0.5	0.0295	11/10/2017

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350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-3 **Lab Sample ID:** 180535 180535-01

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017 11:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,3,5-Trimethylbenzene	108-67-8	< 0.5	µg/L	EPA 8260C	0.5	0.0404	11/10/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/10/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/10/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/10/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/10/2017
2-Butanone (MEK)	78-93-3	< 4	µg/L	EPA 8260C	4	0.9116	11/10/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/10/2017
2-Hexanone	591-78-6	m.N.D.	µg/L	EPA 8260C	4	1.3377	11/10/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/10/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/10/2017
Acetone	67-64-1	8.8	µg/L	EPA 8260C	4	0.5408	11/10/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/10/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/10/2017
Acrylonitrile	107-13-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0978	11/10/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/10/2017
Benzene	71-43-2	< 0.5	µg/L	EPA 8260C	0.5	0.0609	11/10/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/10/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/10/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/10/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/10/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/10/2017
Carbon disulfide	75-15-0	< 0.5	µg/L	EPA 8260C	0.5	0.0627	11/10/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/10/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/10/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/10/2017
Chloroform	67-66-3	< 0.5	µg/L	EPA 8260C	0.5	0.0703	11/10/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-3 **Lab Sample ID:** 180535 180535-01

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017 11:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/10/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/10/2017
cis-1,2-Dichloroethene	156-59-2	0.67	µg/L	EPA 8260C	0.5	0.107	11/10/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/10/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/10/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/10/2017
Dichlorodifluoromethane	75-71-8	0.68	µg/L	EPA 8260C	0.5	0.0458	11/10/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/10/2017
Ethylbenzene	100-41-4	< 0.5	µg/L	EPA 8260C	0.5	0.0533	11/10/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/10/2017
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/10/2017
Isobutyl alcohol	78-83-1	m.N.D.	µg/L	EPA 8260C	20	8.2052	11/10/2017
Isopropylbenzene	98-82-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0526	11/10/2017
m- & p-Xylene	1330-20-7	< 0.5	µg/L	EPA 8260C	0.5	0.1001	11/10/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/10/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/10/2017
Methylene chloride	75-09-2	< 0.5	µg/L	EPA 8260C	0.5	0.0563	11/10/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/10/2017
Naphthalene	91-20-3	< 0.5	µg/L	EPA 8260C	0.5	0.0309	11/10/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/10/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/10/2017
o-Xylene	95-47-6	< 0.5	µg/L	EPA 8260C	0.5	0.0476	11/10/2017
p-isopropyltoluene	99-87-6	< 0.5	µg/L	EPA 8260C	0.5	0.0338	11/10/2017
Propionitrile	107-12-0	m.N.D.	µg/L	EPA 8260C	2	0.4026	11/10/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/10/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/10/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-3 **Lab Sample ID:** 180535 180535-01

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017 11:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/10/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/10/2017
Toluene	108-88-3	< 0.5	µg/L	EPA 8260C	0.5	0.0768	11/10/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/10/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/10/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/10/2017
Trichloroethene	79-01-6	< 0.5	µg/L	EPA 8260C	0.5	0.0642	11/10/2017
Trichlorofluoromethane	75-69-4	< 0.5	µg/L	EPA 8260C	0.5	0.1286	11/10/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/10/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/10/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/10/2017
1,2-Dibromoethane	106-93-4	0.0023	µg/L	EPA 8260C SIM	0.001	0.001	11/10/2017
Acrylonitrile	107-13-1	0.0438	µg/L	EPA 8260C SIM	0.02	0.02	11/10/2017
Vinyl chloride	75-01-4	0.0087	µg/L	EPA 8260C SIM	0.005	0.005	11/10/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180535-01	1,2-Dichloroethane-d4	EPA 8260C	99.7 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	93.4 %	70 -130
	Dibromofluoromethane	EPA 8260C	93.5 %	70 -130
	Toluene-d8	EPA 8260C	95.6 %	70 -130

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180535 180535-03

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/10/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/10/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/10/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/10/2017
1,1-Dichloroethane	75-34-3	N.D.	µg/L	EPA 8260C	0.5	0.0567	11/10/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/10/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/10/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/10/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/10/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/10/2017
1,2,4-Trimethylbenzene	95-63-6	N.D.	µg/L	EPA 8260C	0.5	0.0374	11/10/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/10/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/10/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/10/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/10/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/10/2017
1,3,5-Trimethylbenzene	108-67-8	N.D.	µg/L	EPA 8260C	0.5	0.0404	11/10/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/10/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/10/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/10/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/10/2017
2-Butanone (MEK)	78-93-3	N.D.	µg/L	EPA 8260C	4	0.9116	11/10/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/10/2017
2-Hexanone	591-78-6	N.D.	µg/L	EPA 8260C	4	1.3377	11/10/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/10/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/10/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180535 180535-03

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Acetone	67-64-1	< 4	µg/L	EPA 8260C	4	0.5408	11/10/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/10/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/10/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/10/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/10/2017
Benzene	71-43-2	m.N.D.	µg/L	EPA 8260C	0.5	0.0609	11/10/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/10/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/10/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/10/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/10/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/10/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/10/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/10/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/10/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/10/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/10/2017
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/10/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/10/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/10/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/10/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/10/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/10/2017
Dichlorodifluoromethane	75-71-8	N.D.	µg/L	EPA 8260C	0.5	0.0458	11/10/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/10/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/10/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/10/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180535 180535-03

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/10/2017
Isobutyl alcohol	78-83-1	m.N.D.	µg/L	EPA 8260C	20	8.2052	11/10/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/10/2017
m- & p-Xylene	1330-20-7	N.D.	µg/L	EPA 8260C	0.5	0.1001	11/10/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/10/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/10/2017
Methylene chloride	75-09-2	N.D.	µg/L	EPA 8260C	0.5	0.0563	11/10/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/10/2017
Naphthalene	91-20-3	N.D.	µg/L	EPA 8260C	0.5	0.0309	11/10/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/10/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/10/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/10/2017
p-isopropyltoluene	99-87-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/10/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/10/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/10/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/10/2017
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/10/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/10/2017
Toluene	108-88-3	N.D.	µg/L	EPA 8260C	0.5	0.0768	11/10/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/10/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/10/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/10/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/10/2017
Trichlorofluoromethane	75-69-4	N.D.	µg/L	EPA 8260C	0.5	0.1286	11/10/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/10/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/10/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180535 180535-03

Site: Horn Rapids Landfill **Collection Date:** 11/9/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/10/2017
1,2-Dibromoethane	106-93-4	0.0020	µg/L	EPA 8260C SIM	0.001	0.001	11/10/2017
Acrylonitrile	107-13-1	< 0.02	µg/L	EPA 8260C SIM	0.02	0.02	11/10/2017
Vinyl chloride	75-01-4	< 0.005	µg/L	EPA 8260C SIM	0.005	0.005	11/10/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180535-03	1,2-Dichloroethane-d4	EPA 8260C	99.8 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	94.4 %	70 -130
	Dibromofluoromethane	EPA 8260C	91.2 %	70 -130
	Toluene-d8	EPA 8260C	96.1 %	70 -130

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Report of Analysis

For: **Parametrix**

Horn Rapids Landfill

Attn: Lisa Gilbert

Authorized Signature: Dilyan Petrov 14-Nov-17

Project ID: 5533820007

Client Sample ID: PP-4 **Lab Sample ID:** 180544 180544-01

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017 10:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/14/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/14/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/14/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/14/2017
1,1-Dichloroethane	75-34-3	< 0.5	µg/L	EPA 8260C	0.5	0.0567	11/14/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/14/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/14/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/14/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/14/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/14/2017
1,2,4-Trimethylbenzene	95-63-6	< 0.5	µg/L	EPA 8260C	0.5	0.0374	11/14/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/14/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/14/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/14/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/14/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/14/2017

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350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-4 **Lab Sample ID:** 180544 180544-01

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017 10:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,3,5-Trimethylbenzene	108-67-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0404	11/14/2017
1,3-Dichlorobenzene	541-73-1	N.D.	µg/L	EPA 8260C	0.5	0.0423	11/14/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/14/2017
1,4-Dichlorobenzene	106-46-7	N.D.	µg/L	EPA 8260C	0.5	0.0541	11/14/2017
2,2-Dichloropropane	594-20-7	m.N.D.	µg/L	EPA 8260C	0.5	0.0609	11/14/2017
2-Butanone (MEK)	78-93-3	7.8	µg/L	EPA 8260C	4	0.9116	11/14/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/14/2017
2-Hexanone	591-78-6	< 4	µg/L	EPA 8260C	4	1.3377	11/14/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/14/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	< 4	µg/L	EPA 8260C	4	0.6029	11/14/2017
Acetone	67-64-1	39	µg/L	EPA 8260C	4	0.5408	11/14/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/14/2017
Acrolein	107-02-8	< 10	µg/L	EPA 8260C	10	2.9355	11/14/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/14/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/14/2017
Benzene	71-43-2	< 0.5	µg/L	EPA 8260C	0.5	0.0609	11/14/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/14/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/14/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/14/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/14/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/14/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/14/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/14/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/14/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/14/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/14/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-4 **Lab Sample ID:** 180544 180544-01

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017 10:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/14/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/14/2017
cis-1,2-Dichloroethene	156-59-2	< 0.5	µg/L	EPA 8260C	0.5	0.107	11/14/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/14/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/14/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/14/2017
Dichlorodifluoromethane	75-71-8	0.53	µg/L	EPA 8260C	0.5	0.0458	11/14/2017
Ethyl methacrylate	97-63-2	m.N.D.	µg/L	EPA 8260C	0.5	0.085	11/14/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/14/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/14/2017
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/14/2017
Isobutyl alcohol	78-83-1	m.N.D.	µg/L	EPA 8260C	20	8.2052	11/14/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/14/2017
m- & p-Xylene	1330-20-7	< 0.5	µg/L	EPA 8260C	0.5	0.1001	11/14/2017
Methacrylonitrile	126-98-7	N.D.	µg/L	EPA 8260C	2	0.2056	11/14/2017
Methyl methacrylate	80-62-6	m.N.D.	µg/L	EPA 8260C	0.5	0.093	11/14/2017
Methylene chloride	75-09-2	< 0.5	µg/L	EPA 8260C	0.5	0.0563	11/14/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/14/2017
Naphthalene	91-20-3	< 0.5	µg/L	EPA 8260C	0.5	0.0309	11/14/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/14/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/14/2017
o-Xylene	95-47-6	< 0.5	µg/L	EPA 8260C	0.5	0.0476	11/14/2017
p-isopropyltoluene	99-87-6	< 0.5	µg/L	EPA 8260C	0.5	0.0338	11/14/2017
Propionitrile	107-12-0	m.N.D.	µg/L	EPA 8260C	2	0.4026	11/14/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/14/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/14/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-4 **Lab Sample ID:** 180544 180544-01

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017 10:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/14/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/14/2017
Toluene	108-88-3	< 0.5	µg/L	EPA 8260C	0.5	0.0768	11/14/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/14/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/14/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/14/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/14/2017
Trichlorofluoromethane	75-69-4	< 0.5	µg/L	EPA 8260C	0.5	0.1286	11/14/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/14/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/14/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/14/2017
1,2-Dibromoethane	106-93-4	0.0020*	µg/L	EPA 8260C SIM	0.001	0.001	11/14/2017
Acrylonitrile	107-13-1	< 0.02	µg/L	EPA 8260C SIM	0.02	0.02	11/14/2017
Vinyl chloride	75-01-4	< 0.005	µg/L	EPA 8260C SIM	0.005	0.005	11/14/2017

* 1,2-Dibromoethane detected in the method blank at 0.0018 µg/L

Lab ID	Surrogate	Method	Recovery	Control Limits
180544-01	1,2-Dichloroethane-d4	EPA 8260C	99.8 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	94 %	70 -130
	Dibromofluoromethane	EPA 8260C	95.5 %	70 -130
	Toluene-d8	EPA 8260C	94.5 %	70 -130

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180544 180544-03

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/14/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/14/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/14/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/14/2017
1,1-Dichloroethane	75-34-3	N.D.	µg/L	EPA 8260C	0.5	0.0567	11/14/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/14/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/14/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/14/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/14/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/14/2017
1,2,4-Trimethylbenzene	95-63-6	N.D.	µg/L	EPA 8260C	0.5	0.0374	11/14/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/14/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/14/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/14/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/14/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/14/2017
1,3,5-Trimethylbenzene	108-67-8	N.D.	µg/L	EPA 8260C	0.5	0.0404	11/14/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/14/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/14/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/14/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/14/2017
2-Butanone (MEK)	78-93-3	N.D.	µg/L	EPA 8260C	4	0.9116	11/14/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/14/2017
2-Hexanone	591-78-6	N.D.	µg/L	EPA 8260C	4	1.3377	11/14/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/14/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/14/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180544 180544-03

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Acetone	67-64-1	< 4	µg/L	EPA 8260C	4	0.5408	11/14/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/14/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/14/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/14/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/14/2017
Benzene	71-43-2	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/14/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/14/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/14/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/14/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/14/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/14/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/14/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/14/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/14/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/14/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/14/2017
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/14/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/14/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/14/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/14/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/14/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/14/2017
Dichlorodifluoromethane	75-71-8	N.D.	µg/L	EPA 8260C	0.5	0.0458	11/14/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/14/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/14/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/14/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180544 180544-03

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/14/2017
Isobutyl alcohol	78-83-1	N.D.	µg/L	EPA 8260C	20	8.2052	11/14/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/14/2017
m- & p-Xylene	1330-20-7	N.D.	µg/L	EPA 8260C	0.5	0.1001	11/14/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/14/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/14/2017
Methylene chloride	75-09-2	N.D.	µg/L	EPA 8260C	0.5	0.0563	11/14/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/14/2017
Naphthalene	91-20-3	N.D.	µg/L	EPA 8260C	0.5	0.0309	11/14/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/14/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/14/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/14/2017
p-isopropyltoluene	99-87-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/14/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/14/2017
sec-Butylbenzene	135-98-8	N.D.	µg/L	EPA 8260C	0.5	0.0549	11/14/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/14/2017
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/14/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/14/2017
Toluene	108-88-3	N.D.	µg/L	EPA 8260C	0.5	0.0768	11/14/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/14/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/14/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/14/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/14/2017
Trichlorofluoromethane	75-69-4	N.D.	µg/L	EPA 8260C	0.5	0.1286	11/14/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/14/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/14/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180544 180544-03

Site: Horn Rapids Landfill **Collection Date:** 11/13/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.05	11/14/2017
1,2-Dibromoethane	106-93-4	0.0017*	µg/L	EPA 8260C SIM	0.001	0.001	11/14/2017
Acrylonitrile	107-13-1	< 0.02	µg/L	EPA 8260C SIM	0.02	0.02	11/14/2017
Vinyl chloride	75-01-4	< 0.005	µg/L	EPA 8260C SIM	0.005	0.005	11/14/2017

* 1,2-Dibromoethane detected in the method blank at 0.0018 µg/L

Lab ID	Surrogate	Method	Recovery	Control Limits
180544-03	1,2-Dichloroethane-d4	EPA 8260C	100.6 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	93.1 %	70 -130
	Dibromofluoromethane	EPA 8260C	90.9 %	70 -130
	Toluene-d8	EPA 8260C	95.7 %	70 -130

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Report of Analysis

For: **Parametrix**

Horn Rapids Landfill

Attn: Lisa Gilbert

Authorized Signature: 17-Nov-17

Project ID: 5533820007

Client Sample ID: PP-1

Lab Sample ID: 180550 180550-01

Site: Horn Rapids Landfill

Collection Date: 11/15/2017 9:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/16/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/16/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/16/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/16/2017
1,1-Dichloroethane	75-34-3	4.8	µg/L	EPA 8260C	0.5	0.0567	11/16/2017
1,1-Dichloroethene	75-35-4	< 0.5	µg/L	EPA 8260C	0.5	0.1039	11/16/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/16/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/16/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/16/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/16/2017
1,2,4-Trimethylbenzene	95-63-6	< 0.5	µg/L	EPA 8260C	0.5	0.0374	11/16/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/16/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/16/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/16/2017
1,2-Dichloroethane	107-06-2	< 0.5	µg/L	EPA 8260C	0.5	0.0822	11/16/2017
1,2-Dichloropropane	78-87-5	< 0.5	µg/L	EPA 8260C	0.5	0.0295	11/16/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-1 **Lab Sample ID:** 180550 180550-01

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017 9:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,3,5-Trimethylbenzene	108-67-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0404	11/16/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/16/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/16/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/16/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/16/2017
2-Butanone (MEK)	78-93-3	< 4	µg/L	EPA 8260C	4	0.9116	11/16/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/16/2017
2-Hexanone	591-78-6	m.N.D.	µg/L	EPA 8260C	4	1.3377	11/16/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/16/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/16/2017
Acetone	67-64-1	4.5	µg/L	EPA 8260C	4	0.5408	11/16/2017
Acetonitrile	75-05-8	m.N.D.	µg/L	EPA 8260C	20	2.7799	11/16/2017
Acrolein	107-02-8	< 10	µg/L	EPA 8260C	10	2.9355	11/16/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/16/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/16/2017
Benzene	71-43-2	< 0.5	µg/L	EPA 8260C	0.5	0.0609	11/16/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/16/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/16/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/16/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/16/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/16/2017
Carbon disulfide	75-15-0	< 0.5	µg/L	EPA 8260C	0.5	0.0627	11/16/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/16/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/16/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/16/2017
Chloroform	67-66-3	< 0.5	µg/L	EPA 8260C	0.5	0.0703	11/16/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-1 **Lab Sample ID:** 180550 180550-01

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017 9:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/16/2017
Chloroprene	126-99-8	N.D.	µg/L	EPA 8260C	1	0.941	11/16/2017
cis-1,2-Dichloroethene	156-59-2	28	µg/L	EPA 8260C	0.5	0.107	11/16/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/16/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/16/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/16/2017
Dichlorodifluoromethane	75-71-8	< 0.5	µg/L	EPA 8260C	0.5	0.0458	11/16/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/16/2017
Ethylbenzene	100-41-4	< 0.5	µg/L	EPA 8260C	0.5	0.0533	11/16/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/16/2017
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/16/2017
Isobutyl alcohol	78-83-1	N.D.	µg/L	EPA 8260C	20	8.2052	11/16/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/16/2017
m- & p-Xylene	1330-20-7	< 0.5	µg/L	EPA 8260C	0.5	0.1001	11/16/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/16/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/16/2017
Methylene chloride	75-09-2	< 0.5	µg/L	EPA 8260C	0.5	0.0563	11/16/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/16/2017
Naphthalene	91-20-3	< 0.5	µg/L	EPA 8260C	0.5	0.0309	11/16/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/16/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/16/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/16/2017
p-isopropyltoluene	99-87-6	< 0.5	µg/L	EPA 8260C	0.5	0.0338	11/16/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/16/2017
sec-Butylbenzene	135-98-8	N.D.	µg/L	EPA 8260C	0.5	0.0549	11/16/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/16/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-1 **Lab Sample ID:** 180550 180550-01

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017 9:15 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/16/2017
Tetrachloroethene	127-18-4	4.1	µg/L	EPA 8260C	0.5	0.0864	11/16/2017
Toluene	108-88-3	< 0.5	µg/L	EPA 8260C	0.5	0.0768	11/16/2017
trans-1,2-Dichloroethene	156-60-5	0.95	µg/L	EPA 8260C	0.5	0.0655	11/16/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/16/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/16/2017
Trichloroethene	79-01-6	4.9	µg/L	EPA 8260C	0.5	0.0642	11/16/2017
Trichlorofluoromethane	75-69-4	< 0.5	µg/L	EPA 8260C	0.5	0.1286	11/16/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/16/2017
Vinyl chloride	75-01-4	< 0.5	µg/L	EPA 8260C	0.5	0.0979	11/16/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.0095	11/16/2017
1,2-Dibromoethane	106-93-4	< 0.001	µg/L	EPA 8260C SIM	0.001	0.0006	11/16/2017
Acrylonitrile	107-13-1	< 0.02	µg/L	EPA 8260C SIM	0.02	0.0018	11/16/2017
Vinyl chloride	75-01-4	0.3481	µg/L	EPA 8260C SIM	0.02	0.006	11/16/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180550-01	1,2-Dichloroethane-d4	EPA 8260C	100.2 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	96 %	70 -130
	Dibromofluoromethane	EPA 8260C	97.7 %	70 -130
	Toluene-d8	EPA 8260C	95.6 %	70 -130

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180550 180550-02

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/16/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/16/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/16/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/16/2017
1,1-Dichloroethane	75-34-3	N.D.	µg/L	EPA 8260C	0.5	0.0567	11/16/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/16/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/16/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/16/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/16/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/16/2017
1,2,4-Trimethylbenzene	95-63-6	N.D.	µg/L	EPA 8260C	0.5	0.0374	11/16/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/16/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/16/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/16/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/16/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/16/2017
1,3,5-Trimethylbenzene	108-67-8	N.D.	µg/L	EPA 8260C	0.5	0.0404	11/16/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/16/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/16/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/16/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/16/2017
2-Butanone (MEK)	78-93-3	N.D.	µg/L	EPA 8260C	4	0.9116	11/16/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/16/2017
2-Hexanone	591-78-6	N.D.	µg/L	EPA 8260C	4	1.3377	11/16/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/16/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/16/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180550 180550-02

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Acetone	67-64-1	< 4	µg/L	EPA 8260C	4	0.5408	11/16/2017
Acetonitrile	75-05-8	N.D.	µg/L	EPA 8260C	20	2.7799	11/16/2017
Acrolein	107-02-8	N.D.	µg/L	EPA 8260C	10	2.9355	11/16/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/16/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/16/2017
Benzene	71-43-2	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/16/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/16/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/16/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/16/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/16/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/16/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/16/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/16/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/16/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/16/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/16/2017
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/16/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/16/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/16/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/16/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/16/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/16/2017
Dichlorodifluoromethane	75-71-8	N.D.	µg/L	EPA 8260C	0.5	0.0458	11/16/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/16/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/16/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/16/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180550 180550-02

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/16/2017
Isobutyl alcohol	78-83-1	N.D.	µg/L	EPA 8260C	20	8.2052	11/16/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/16/2017
m- & p-Xylene	1330-20-7	N.D.	µg/L	EPA 8260C	0.5	0.1001	11/16/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/16/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/16/2017
Methylene chloride	75-09-2	N.D.	µg/L	EPA 8260C	0.5	0.0563	11/16/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/16/2017
Naphthalene	91-20-3	N.D.	µg/L	EPA 8260C	0.5	0.0309	11/16/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/16/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/16/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/16/2017
p-isopropyltoluene	99-87-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/16/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/16/2017
sec-Butylbenzene	135-98-8	N.D.	µg/L	EPA 8260C	0.5	0.0549	11/16/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/16/2017
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/16/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/16/2017
Toluene	108-88-3	N.D.	µg/L	EPA 8260C	0.5	0.0768	11/16/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/16/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/16/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/16/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/16/2017
Trichlorofluoromethane	75-69-4	N.D.	µg/L	EPA 8260C	0.5	0.1286	11/16/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/16/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/16/2017

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ISO 14001

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180550 180550-02

Site: Horn Rapids Landfill **Collection Date:** 11/15/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.0095	11/16/2017
1,2-Dibromoethane	106-93-4	< 0.001	µg/L	EPA 8260C SIM	0.001	0.0006	11/16/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C SIM	0.02	0.0018	11/16/2017
Vinyl chloride	75-01-4	< 0.02	µg/L	EPA 8260C SIM	0.02	0.006	11/16/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180550-02	1,2-Dichloroethane-d4	EPA 8260C	100.7 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	93.3 %	70 -130
	Dibromofluoromethane	EPA 8260C	90.2 %	70 -130
	Toluene-d8	EPA 8260C	95.1 %	70 -130

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Report of Analysis

For: **Parametrix**

Horn Rapids Landfill

Attn: Lisa Gilbert

Authorized Signature: Alyssa Peters 20-Nov-17

Project ID: 5533820007

Client Sample ID: PP-5

Lab Sample ID: 180562 180562-01

Site: Horn Rapids Landfill

Collection Date: 11/16/2017 9:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/17/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/17/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/17/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/17/2017
1,1-Dichloroethane	75-34-3	< 0.5	µg/L	EPA 8260C	0.5	0.0567	11/17/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/17/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/17/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/17/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/17/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/17/2017
1,2,4-Trimethylbenzene	95-63-6	< 0.5	µg/L	EPA 8260C	0.5	0.0374	11/17/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/17/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/17/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/17/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/17/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/17/2017

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350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-5 **Lab Sample ID:** 180562 180562-01

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017 9:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,3,5-Trimethylbenzene	108-67-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0404	11/17/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/17/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/17/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/17/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/17/2017
2-Butanone (MEK)	78-93-3	< 4	µg/L	EPA 8260C	4	0.9116	11/17/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/17/2017
2-Hexanone	591-78-6	< 4	µg/L	EPA 8260C	4	1.3377	11/17/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/17/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/17/2017
Acetone	67-64-1	11	µg/L	EPA 8260C	4	0.5408	11/17/2017
Acetonitrile	75-05-8	< 20	µg/L	EPA 8260C	20	2.7799	11/17/2017
Acrolein	107-02-8	m.N.D.	µg/L	EPA 8260C	10	2.9355	11/17/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/17/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/17/2017
Benzene	71-43-2	< 0.5	µg/L	EPA 8260C	0.5	0.0609	11/17/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/17/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.3	0.0546	11/17/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.5	0.0329	11/17/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/17/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/17/2017
Carbon disulfide	75-15-0	< 0.5	µg/L	EPA 8260C	0.5	0.0627	11/17/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/17/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/17/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/17/2017
Chloroform	67-66-3	m.N.D.	µg/L	EPA 8260C	0.5	0.0703	11/17/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-5 **Lab Sample ID:** 180562 180562-01

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017 9:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/17/2017
Chloroprene	126-99-8	m.N.D.	µg/L	EPA 8260C	1	0.941	11/17/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/17/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/17/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/17/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/17/2017
Dichlorodifluoromethane	75-71-8	1.0	µg/L	EPA 8260C	0.5	0.0458	11/17/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/17/2017
Ethylbenzene	100-41-4	< 0.5	µg/L	EPA 8260C	0.5	0.0533	11/17/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/17/2017
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/17/2017
Isobutyl alcohol	78-83-1	N.D.	µg/L	EPA 8260C	20	8.2052	11/17/2017
Isopropylbenzene	98-82-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0526	11/17/2017
m- & p-Xylene	1330-20-7	< 0.5	µg/L	EPA 8260C	0.5	0.1001	11/17/2017
Methacrylonitrile	126-98-7	N.D.	µg/L	EPA 8260C	2	0.2056	11/17/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/17/2017
Methylene chloride	75-09-2	< 0.5	µg/L	EPA 8260C	0.5	0.0563	11/17/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/17/2017
Naphthalene	91-20-3	< 0.5	µg/L	EPA 8260C	0.5	0.0309	11/17/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/17/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/17/2017
o-Xylene	95-47-6	< 0.5	µg/L	EPA 8260C	0.5	0.0476	11/17/2017
p-isopropyltoluene	99-87-6	m.N.D.	µg/L	EPA 8260C	0.5	0.0338	11/17/2017
Propionitrile	107-12-0	< 2	µg/L	EPA 8260C	2	0.4026	11/17/2017
sec-Butylbenzene	135-98-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0549	11/17/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/17/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: PP-5 **Lab Sample ID:** 180562 180562-01

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017 9:55 AM

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/17/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/17/2017
Toluene	108-88-3	< 0.5	µg/L	EPA 8260C	0.5	0.0768	11/17/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/17/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/17/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/17/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/17/2017
Trichlorofluoromethane	75-69-4	< 0.5	µg/L	EPA 8260C	0.5	0.1286	11/17/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/17/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/17/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.0095	11/16/2017
1,2-Dibromoethane	106-93-4	< 0.001	µg/L	EPA 8260C SIM	0.001	0.0006	11/16/2017
Acrylonitrile	107-13-1	0.0705	µg/L	EPA 8260C SIM	0.02	0.0018	11/16/2017
Vinyl chloride	75-01-4	< 0.02	µg/L	EPA 8260C SIM	0.02	0.006	11/16/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180562-01	1,2-Dichloroethane-d4	EPA 8260C	96.7 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	97 %	70 -130
	Dibromofluoromethane	EPA 8260C	95.8 %	70 -130
	Toluene-d8	EPA 8260C	94.6 %	70 -130

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180562 180562-02

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,1,1,2-Tetrachloroethane	630-20-6	N.D.	µg/L	EPA 8260C	0.5	0.0624	11/17/2017
1,1,1-Trichloroethane	71-55-6	N.D.	µg/L	EPA 8260C	0.5	0.1051	11/17/2017
1,1,2,2-Tetrachloroethane	79-34-5	N.D.	µg/L	EPA 8260C	0.5	0.036	11/17/2017
1,1,2-Trichloroethane	79-00-5	N.D.	µg/L	EPA 8260C	0.5	0.0531	11/17/2017
1,1-Dichloroethane	75-34-3	N.D.	µg/L	EPA 8260C	0.5	0.0567	11/17/2017
1,1-Dichloroethene	75-35-4	N.D.	µg/L	EPA 8260C	0.5	0.1039	11/17/2017
1,1-Dichloropropene	563-58-6	N.D.	µg/L	EPA 8260C	0.5	0.1073	11/17/2017
1,2,3-Trichlorobenzene	87-61-6	N.D.	µg/L	EPA 8260C	0.5	0.0281	11/17/2017
1,2,3-Trichloropropane	96-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0743	11/17/2017
1,2,4-Trichlorobenzene	120-82-1	N.D.	µg/L	EPA 8260C	0.5	0.0214	11/17/2017
1,2,4-Trimethylbenzene	95-63-6	N.D.	µg/L	EPA 8260C	0.5	0.0374	11/17/2017
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C	0.5	0.285	11/17/2017
1,2-Dibromoethane	106-93-4	N.D.	µg/L	EPA 8260C	0.5	0.0381	11/17/2017
1,2-Dichlorobenzene	95-50-1	N.D.	µg/L	EPA 8260C	0.5	0.0474	11/17/2017
1,2-Dichloroethane	107-06-2	N.D.	µg/L	EPA 8260C	0.5	0.0822	11/17/2017
1,2-Dichloropropane	78-87-5	N.D.	µg/L	EPA 8260C	0.5	0.0295	11/17/2017
1,3,5-Trimethylbenzene	108-67-8	N.D.	µg/L	EPA 8260C	0.5	0.0404	11/17/2017
1,3-Dichlorobenzene	541-73-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0423	11/17/2017
1,3-Dichloropropane	142-28-9	N.D.	µg/L	EPA 8260C	0.5	0.0335	11/17/2017
1,4-Dichlorobenzene	106-46-7	< 0.5	µg/L	EPA 8260C	0.5	0.0541	11/17/2017
2,2-Dichloropropane	594-20-7	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/17/2017
2-Butanone (MEK)	78-93-3	N.D.	µg/L	EPA 8260C	4	0.9116	11/17/2017
2-Chlorotoluene	95-49-8	m.N.D.	µg/L	EPA 8260C	0.5	0.0446	11/17/2017
2-Hexanone	591-78-6	N.D.	µg/L	EPA 8260C	4	1.3377	11/17/2017
4-Chlorotoluene	106-43-4	m.N.D.	µg/L	EPA 8260C	0.5	0.0482	11/17/2017
4-Methyl-2-pentanone (MIBK)	108-10-1	m.N.D.	µg/L	EPA 8260C	4	0.6029	11/17/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180562 180562-02

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Acetone	67-64-1	< 4	µg/L	EPA 8260C	4	0.5408	11/17/2017
Acetonitrile	75-05-8	N.D.	µg/L	EPA 8260C	20	2.7799	11/17/2017
Acrolein	107-02-8	N.D.	µg/L	EPA 8260C	10	2.9355	11/17/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C	0.5	0.0978	11/17/2017
Allyl chloride	107-05-1	m.N.D.	µg/L	EPA 8260C	0.5	0.1962	11/17/2017
Benzene	71-43-2	N.D.	µg/L	EPA 8260C	0.5	0.0609	11/17/2017
Bromobenzene	108-86-1	N.D.	µg/L	EPA 8260C	0.5	0.0579	11/17/2017
Bromochloromethane	74-97-5	N.D.	µg/L	EPA 8260C	0.5	0.0546	11/17/2017
Bromodichloromethane	75-27-4	N.D.	µg/L	EPA 8260C	0.3	0.0329	11/17/2017
Bromoform	75-25-2	N.D.	µg/L	EPA 8260C	0.5	0.052	11/17/2017
Bromomethane	74-83-9	< 0.5	µg/L	EPA 8260C	0.5	0.0785	11/17/2017
Carbon disulfide	75-15-0	m.N.D.	µg/L	EPA 8260C	0.5	0.0627	11/17/2017
Carbon tetrachloride	56-23-5	N.D.	µg/L	EPA 8260C	0.3	0.1029	11/17/2017
Chlorobenzene	108-90-7	N.D.	µg/L	EPA 8260C	0.5	0.054	11/17/2017
Chloroethane	75-00-3	m.N.D.	µg/L	EPA 8260C	0.5	0.1823	11/17/2017
Chloroform	67-66-3	N.D.	µg/L	EPA 8260C	0.5	0.0703	11/17/2017
Chloromethane	74-87-3	< 0.5	µg/L	EPA 8260C	0.5	0.1447	11/17/2017
Chloroprene	126-99-8	N.D.	µg/L	EPA 8260C	1	0.941	11/17/2017
cis-1,2-Dichloroethene	156-59-2	N.D.	µg/L	EPA 8260C	0.5	0.107	11/17/2017
cis-1,3-Dichloropropene	10061-01-5	N.D.	µg/L	EPA 8260C	0.5	0.0352	11/17/2017
Dibromochloromethane	124-48-1	N.D.	µg/L	EPA 8260C	0.5	0.0392	11/17/2017
Dibromomethane	74-95-3	N.D.	µg/L	EPA 8260C	0.5	0.0553	11/17/2017
Dichlorodifluoromethane	75-71-8	N.D.	µg/L	EPA 8260C	0.5	0.0458	11/17/2017
Ethyl methacrylate	97-63-2	N.D.	µg/L	EPA 8260C	0.5	0.085	11/17/2017
Ethylbenzene	100-41-4	N.D.	µg/L	EPA 8260C	0.5	0.0533	11/17/2017
Hexachlorobutadiene	87-68-3	N.D.	µg/L	EPA 8260C	0.5	0.0896	11/17/2017

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ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180562 180562-02

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
Iodomethane	74-88-4	< 4	µg/L	EPA 8260C	4	0.3555	11/17/2017
Isobutyl alcohol	78-83-1	N.D.	µg/L	EPA 8260C	20	8.2052	11/17/2017
Isopropylbenzene	98-82-8	N.D.	µg/L	EPA 8260C	0.5	0.0526	11/17/2017
m- & p-Xylene	1330-20-7	N.D.	µg/L	EPA 8260C	0.5	0.1001	11/17/2017
Methacrylonitrile	126-98-7	m.N.D.	µg/L	EPA 8260C	2	0.2056	11/17/2017
Methyl methacrylate	80-62-6	N.D.	µg/L	EPA 8260C	0.5	0.093	11/17/2017
Methylene chloride	75-09-2	N.D.	µg/L	EPA 8260C	0.5	0.0563	11/17/2017
Methyl-t-butyl ether	1634-04-4	N.D.	µg/L	EPA 8260C	0.5	0.032	11/17/2017
Naphthalene	91-20-3	N.D.	µg/L	EPA 8260C	0.5	0.0309	11/17/2017
n-Butylbenzene	104-51-8	< 0.5	µg/L	EPA 8260C	0.5	0.039	11/17/2017
n-Propylbenzene	103-65-1	m.N.D.	µg/L	EPA 8260C	0.5	0.0484	11/17/2017
o-Xylene	95-47-6	N.D.	µg/L	EPA 8260C	0.5	0.0476	11/17/2017
p-isopropyltoluene	99-87-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/17/2017
Propionitrile	107-12-0	N.D.	µg/L	EPA 8260C	2	0.4026	11/17/2017
sec-Butylbenzene	135-98-8	N.D.	µg/L	EPA 8260C	0.5	0.0549	11/17/2017
Styrene	100-42-5	N.D.	µg/L	EPA 8260C	0.5	0.0678	11/17/2017
tert-Butylbenzene	98-06-6	N.D.	µg/L	EPA 8260C	0.5	0.0338	11/17/2017
Tetrachloroethene	127-18-4	N.D.	µg/L	EPA 8260C	0.5	0.0864	11/17/2017
Toluene	108-88-3	N.D.	µg/L	EPA 8260C	0.5	0.0768	11/17/2017
trans-1,2-Dichloroethene	156-60-5	N.D.	µg/L	EPA 8260C	0.5	0.0655	11/17/2017
trans-1,3-Dichloropropene	10061-02-6	N.D.	µg/L	EPA 8260C	0.5	0.0421	11/17/2017
trans-1,4-Dichloro-2-butene	110-57-6	N.D.	µg/L	EPA 8260C	0.5	0.1599	11/17/2017
Trichloroethene	79-01-6	N.D.	µg/L	EPA 8260C	0.5	0.0642	11/17/2017
Trichlorofluoromethane	75-69-4	N.D.	µg/L	EPA 8260C	0.5	0.1286	11/17/2017
Vinyl acetate	108-05-4	N.D.	µg/L	EPA 8260C	2	0.5418	11/17/2017
Vinyl chloride	75-01-4	N.D.	µg/L	EPA 8260C	0.5	0.0979	11/17/2017

PQL = Practical Quantitation Limit, MDL = Method Detection Limit, ND = Not Detected, m = Manual integration or deletion

ENERGY NORTHWEST
350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058

Client Sample ID: Trip Blank **Lab Sample ID:** 180562 180562-02

Site: Horn Rapids Landfill **Collection Date:** 11/16/2017

Analyte	CAS #	Sample Result		Method	PQL	MDL	Analysis Date
1,2-Dibromo-3-chloropropane	96-12-8	N.D.	µg/L	EPA 8260C SIM	0.05	0.0095	11/16/2017
1,2-Dibromoethane	106-93-4	< 0.001	µg/L	EPA 8260C SIM	0.001	0.0006	11/16/2017
Acrylonitrile	107-13-1	N.D.	µg/L	EPA 8260C SIM	0.02	0.0018	11/16/2017
Vinyl chloride	75-01-4	< 0.02	µg/L	EPA 8260C SIM	0.02	0.006	11/16/2017

Lab ID	Surrogate	Method	Recovery	Control Limits
180562-02	1,2-Dichloroethane-d4	EPA 8260C	97 %	70 -130
	4-Bromofluorobenzene	EPA 8260C	89.9 %	70 -130
	Dibromofluoromethane	EPA 8260C	90.7 %	70 -130
	Toluene-d8	EPA 8260C	94.8 %	70 -130

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ENERGY NORTHWEST
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LABORATORY REPORT

November 28, 2017

Alyssa Petersen
Energy Northwest
350 Hills Street, Suite 107
Richland, WA 99354-5511

RE: Horn Rapids Landfill

Dear Alyssa:

Enclosed are the results of the sample submitted to our laboratory on November 10, 2017. For your reference, these analyses have been assigned our service request number P1705679.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Kate Kaneko

By Kate Kaneko at 3:21 pm, 11/28/17

Kate Kaneko
Project Manager

2655 Park Center Dr., Suite A
Simi Valley, CA 93065
T: +1 805 526 7161
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Client: Energy Northwest
Project: Horn Rapids Landfill

Service Request No: P1705679

CASE NARRATIVE

The sample was received intact under chain of custody on November 10, 2017 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time of sample receipt.

Methane, Ethene and Ethane Analysis

The sample was analyzed for methane, ethene and ethane using a gas chromatograph equipped with a flame ionization detector (FID). A known amount of liquid was displaced by injecting 8.0 milliliters of helium creating a headspace in the sample vial. Each sample vial was agitated using a sonic disrupter for fifteen minutes and then allowed to equilibrate for at least two hours. A volume of the headspace was withdrawn using a gas-tight syringe and analyzed using a manual injection technique. The amount of dissolved gases (methane, ethene and ethane) in the original sample was calculated using Henry's Law. This method was performed with guidance from RSK 175. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the laboratory's NELAP or DoD-ELAP accreditation.

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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Arizona DHS	http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home	AZ0694
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Louisiana DEQ (NELAP)	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	05071
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2016036
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	1177034
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	4068-004
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
PJLA (DoD ELAP)	http://www.pjlabs.com/search-accredited-labs	65818 (Testing)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-17-8
Utah DOH (NELAP)	http://health.utah.gov/lab/environmental-lab-certification/	CA016272017-8
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: Energy Northwest
Project ID: Horn Rapids Landfill
Service Request: P1705679

Date Received: 11/10/2017
Time Received: 09:30

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	RSK 175 - Gases
180518-01	P1705679-001	Water	11/7/2017	15:29	X

P1705679

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058 Fax: (509) 377-8464

ALS's Sample Routing Sheet

11/9/2017

ENERGY NORTHWEST
People · Vision · Solutions

Sample ID	Customer ID	Site	Sample Location	Matrix	Date/Time Coll'd	Preservative	Parameters	Method
180518-01	PP-2	Horn Rapids Landfill		Water/Waste Water	11/7/2017 15:29	HCl, ship	Ethylene	RSK-175
						HCl, ship	Methane	RSK-175
						HCl, ship	Ethane	RSK-175

Relinquished By: [signature] Date/Time: 11/09/17 1445

Received By: [signature] 11-10-17 0930

3°C ice packs

ALS Environmental
Sample Acceptance Check Form

Client: Energy Northwest Work order: P1705679

Project: Horn Rapids Landfill

Sample(s) received on: 11/10/17 Date opened: 11/10/17 by: ADAVID

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: 2° C Blank Temperature: ° C **Gel Packs**			
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☒	☐	☐
	Is there a client indication that the submitted samples are **pH** preserved?	☒	☐	☐
	Were **VOA vials** checked for presence/absence of air bubbles?	☒	☐	☐
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1705679-001.01	40ml VOA HCL		1		A	MC 11/13/2017
P1705679-001.02	40ml VOA HCL				A	
P1705679-001.03	40ml VOA HCL				A	

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180518-01**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705679
ALS Sample ID: P1705679-001

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/7/17
Date Received: 11/10/17
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**8.1**	1.3	
74-85-1	Ethene	**2.6**	1.0	
74-84-0	Ethane	**2.2**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **Method Control Sample** ALS Project ID: P1705679
Client Project ID: **Horn Rapids Landfill** ALS Sample ID: P171113-MB

Test Code: RSK 175 Date Collected: NA
Instrument ID: HP5890A/GC10/FID Date Received: NA
Analyst: Mike Conejo Date Analyzed: 11/13/17
Sample Type: Water Volume(s) Analyzed: 0.10 ml(s)
Test Notes:

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	ND	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	ND	0.60	

The Method Control Sample is laboratory water carried through the entire analytical process.
ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Client: **Energy Northwest**
Client Sample ID: **Duplicate Lab Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705679
ALS Sample ID: P171113-LCS
P171113-DLCS

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Spike Amount LCS / DLCS µg/L	Result$_1$ LCS µg/L	Result$_1$ DLCS µg/L	% Recovery LCS	% Recovery DLCS	ALS Acceptance Limits	RPD	RPD Limit	Data Qualifier
74-82-8	Methane	2.50	2.45	2.36	**98**	**94**	80-114	4	12	
74-85-1	Ethene	4.37	4.84	4.69	**111**	**107**	90-135	4	7	
74-84-0	Ethane	4.69	4.73	4.59	**101**	**98**	89-115	3	6	

$_1$ = The concentration shown includes a subtraction of the Method Control Sample value, even if the result is less than the MRL.

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www.alsglobal.com

LABORATORY REPORT

November 28, 2017

Alyssa Petersen
Energy Northwest
350 Hills Street, Suite 107
Richland, WA 99354-5511

RE: Horn Rapids Landfill

Dear Alyssa:

Enclosed are the results of the samples submitted to our laboratory on November 10, 2017. For your reference, these analyses have been assigned our service request number P1705680.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Kate Kaneko
By Kate Kaneko at 3:21 pm, 11/28/17

Kate Kaneko
Project Manager

2655 Park Center Dr., Suite A
Simi Valley, CA 93065
T: +1 805 526 7161
F: +1 805 526 7270
www.alsglobal.com

Client: Energy Northwest
Project: Horn Rapids Landfill

Service Request No: P1705680

CASE NARRATIVE

The samples were received intact under chain of custody on November 10, 2017 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the samples at the time of sample receipt.

Methane, Ethene and Ethane Analysis

The samples were analyzed for methane, ethene and ethane using a gas chromatograph equipped with a flame ionization detector (FID). A known amount of liquid was displaced by injecting 8.0 milliliters of helium creating a headspace in the sample vial. Each sample vial was agitated using a sonic disrupter for fifteen minutes and then allowed to equilibrate for at least two hours. A volume of the headspace was withdrawn using a gas-tight syringe and analyzed using a manual injection technique. The amount of dissolved gases (methane, ethene and ethane) in the original sample was calculated using Henry's Law. This method was performed with guidance from RSK 175. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the laboratory's NELAP or DoD-ELAP accreditation.

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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Arizona DHS	http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home	AZ0694
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Louisiana DEQ (NELAP)	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	05071
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2016036
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	1177034
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	4068-004
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
PJLA (DoD ELAP)	http://www.pjlabs.com/search-accredited-labs	65818 (Testing)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-17-8
Utah DOH (NELAP)	http://health.utah.gov/lab/environmental-lab-certification/	CA016272017-8
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: Energy Northwest
Service Request: P1705680
Project ID: Horn Rapids Landfill

Date Received: 11/10/2017
Time Received: 09:30

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	RSK 175 - Gases
180535-01	P1705680-001	Water	11/9/2017	11:55	X
180535-02	P1705680-002	Water	11/9/2017	12:00	X

P1705680

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058 Fax: (509) 377-8464

ALS's Sample Routing Sheet

11/9/2017

ENERGY NORTHWEST
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Sample ID	Customer ID	Site	Sample Location	Matrix	Date/Time Coll'd	Preservative	Parameters	Method
180535-01	PP-3	Horn Rapids Landfill		Water/Waste Water	11/9/2017 11:55	HCl, ship	Ethylene	RSK-175
						HCl, ship	Methane	RSK-175
						HCl, ship	Ethane	RSK-175
180535-02	110917-DUP	Horn Rapids Landfill		Water/Waste Water	11/9/2017 12:00	HCl, ship	Ethylene	RSK-175
						HCl, ship	Ethane	RSK-175
						HCl, ship	Methane	RSK-175

Relinquished By: Michael Hay Date/Time: 11/09/17 1445

Received By: [signature] 11-10-17 0930

3°C Ice Packs

ALS Environmental
Sample Acceptance Check Form

Client: Energy Northwest Work order: P1705680

Project: Horn Rapids Landfill

Sample(s) received on: 11/10/17 Date opened: 11/10/17 by: ADAVID

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: 2° C Blank Temperature: ° C **Gel Packs**			
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☒	☐	☐
	Is there a client indication that the submitted samples are **pH** preserved?	☒	☐	☐
	Were **VOA vials** checked for presence/absence of air bubbles?	☒	☐	☐
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1705680-001.01	40ml VOA HCL		1		A	MC 11/13/2017
P1705680-001.02	40ml VOA HCL				A	
P1705680-001.03	40ml VOA HCL				A	
P1705680-002.01	40ml VOA HCL		1		A	MC 11/13/2017
P1705680-002.02	40ml VOA HCL				A	
P1705680-002.03	40ml VOA HCL				A	

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180535-01**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705680
ALS Sample ID: P1705680-001

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/9/17
Date Received: 11/10/17
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**19**	1.3	
74-85-1	Ethene	**4.9**	1.0	
74-84-0	Ethane	**6.1**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180535-02**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705680
ALS Sample ID: P1705680-002

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/9/17
Date Received: 11/10/17
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**23**	1.3	
74-85-1	Ethene	**5.7**	1.0	
74-84-0	Ethane	**7.3**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **Method Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705680
ALS Sample ID: P171113-MB

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	ND	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	ND	0.60	

The Method Control Sample is laboratory water carried through the entire analytical process.
ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Client: **Energy Northwest**
Client Sample ID: **Duplicate Lab Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705680
ALS Sample ID: P171113-LCS
P171113-DLCS

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/13/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Spike Amount LCS / DLCS µg/L	Result$_1$ LCS µg/L	Result$_1$ DLCS µg/L	% Recovery LCS	% Recovery DLCS	ALS Acceptance Limits	RPD	RPD Limit	Data Qualifier
74-82-8	Methane	2.50	2.45	2.36	**98**	**94**	80-114	4	12	
74-85-1	Ethene	4.37	4.84	4.69	**111**	**107**	90-135	4	7	
74-84-0	Ethane	4.69	4.73	4.59	**101**	**98**	89-115	3	6	

$_1$ = The concentration shown includes a subtraction of the Method Control Sample value, even if the result is less than the MRL.

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www.alsglobal.com

LABORATORY REPORT

December 4, 2017

Alyssa Petersen
Energy Northwest
350 Hills Street, Suite 107
Richland, WA 99354-5511

RE: Horn Rapids Landfill

Dear Alyssa:

Enclosed are the results of the sample submitted to our laboratory on November 16, 2017. For your reference, these analyses have been assigned our service request number P1705799.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Kate Kaneko
By Kate Kaneko at 3:45 pm, 12/04/17

Kate Kaneko
Project Manager

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Simi Valley, CA 93065
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F: +1 805 526 7270
www.alsglobal.com

Client: Energy Northwest
Project: Horn Rapids Landfill

Service Request No: P1705799

CASE NARRATIVE

The sample was received intact under chain of custody on November 16, 2017 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time of sample receipt.

Methane, Ethene and Ethane Analysis

The sample was analyzed for methane, ethene and ethane using a gas chromatograph equipped with a flame ionization detector (FID). A known amount of liquid was displaced by injecting 8.0 milliliters of helium creating a headspace in the sample vial. Each sample vial was agitated using a sonic disrupter for fifteen minutes and then allowed to equilibrate for at least two hours. A volume of the headspace was withdrawn using a gas-tight syringe and analyzed using a manual injection technique. The amount of dissolved gases (methane, ethene and ethane) in the original sample was calculated using Henry's Law. This method was performed with guidance from RSK 175. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the laboratory's NELAP or DoD-ELAP accreditation.

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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Arizona DHS	http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home	AZ0694
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Louisiana DEQ (NELAP)	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	05071
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2016036
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	1177034
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	4068-004
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
PJLA (DoD ELAP)	http://www.pjlabs.com/search-accredited-labs	65818 (Testing)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-17-8
Utah DOH (NELAP)	http://health.utah.gov/lab/environmental-lab-certification/	CA016272017-8
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: Energy Northwest
Service Request: P1705799
Project ID: Horn Rapids Landfill

Date Received: 11/16/2017
Time Received: 09:30

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	RSK 175 - Gases
180544-01	P1705799-001	Water	11/13/2017	10:15	X

P1705799

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058 Fax: (509) 377-8464

ALS's Sample Routing Sheet

11/13/2017

ENERGY NORTHWEST
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Sample ID	Customer ID	Site	Sample Location	Matrix	Date/Time Coll'd	Preservative	Parameters	Method
180544-01	PP-4	Horn Rapids Landfill		Water/Waste Water	11/13/2017 10:15	HCl, ship	Ethylene	RSK-175
						HCl, ship	Methane	RSK-175
						HCl, ship	Ethane	RSK-175
~~180544-02~~	~~111317-DUP~~	~~Horn Rapids Landfill~~		~~Water/Waste Water~~	~~11/13/2017 10:20~~	~~HCl, ship~~	~~Ethylene~~	~~RSK-175~~
						~~HCl, ship~~	~~Ethane~~	~~RSK-175~~
						~~HCl, ship~~	~~Methane~~	~~RSK-175~~

maH 11/13/17

Email results to EnviroLab@energy-northwest.com

Relinquished By: Date/Time: 11/15/17 1400

Received By: Date/Time: 11/16/17 0930 Cooler 2°

ALS Environmental
Sample Acceptance Check Form

Client: Energy Northwest Work order: P1705799

Project: Horn Rapids Landfill

Sample(s) received on: 11/16/17 Date opened: 11/16/17 by: E.PEREZ

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: 3° C Blank Temperature: ° C **Gel Packs**			
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☐	☐	☒
	Is there a client indication that the submitted samples are **pH** preserved?	☐	☒	☐
	Were **VOA vials** checked for presence/absence of air bubbles?	☒	☐	☐
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☐	☒
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1705799-001.01	40ml VOA HCL		1		A	MC 11/20/2017
P1705799-001.02	40ml VOA HCL				A	
P1705799-001.03	40ml VOA HCL				A	

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180544-01**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705799
ALS Sample ID: P1705799-001

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/13/17
Date Received: 11/16/17
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**4.0**	1.3	
74-85-1	Ethene	**1.2**	1.0	
74-84-0	Ethane	**1.3**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **Method Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705799
ALS Sample ID: P171120-MB

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	ND	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	ND	0.60	

The Method Control Sample is laboratory water carried through the entire analytical process.
ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Client: **Energy Northwest**
Client Sample ID: **Duplicate Lab Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705799
ALS Sample ID: P171120-LCS
P171120-DLCS

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Spike Amount LCS / DLCS µg/L	Result$_1$ LCS µg/L	Result$_1$ DLCS µg/L	% Recovery LCS	% Recovery DLCS	ALS Acceptance Limits	RPD	RPD Limit	Data Qualifier
74-82-8	Methane	2.50	2.52	2.39	**101**	**96**	80-114	5	12	
74-85-1	Ethene	4.37	4.65	4.58	**106**	**105**	90-135	0.9	7	
74-84-0	Ethane	4.69	4.63	4.45	**99**	**95**	89-115	4	6	

$_1$ = The concentration shown includes a subtraction of the Method Control Sample value, even if the result is less than the MRL.

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LABORATORY REPORT

December 4, 2017

Alyssa Petersen
Energy Northwest
350 Hills Street, Suite 107
Richland, WA 99354-5511

RE: Horn Rapids Landfill

Dear Alyssa:

Enclosed are the results of the sample submitted to our laboratory on November 16, 2017. For your reference, this analysis has been assigned our service request number P1705797.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Kate Kaneko
By Kate Kaneko at 3:45 pm, 12/04/17

Kate Kaneko
Project Manager

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Simi Valley, CA 93065
T: +1 805 526 7161
F: +1 805 526 7270
www.alsglobal.com

Client: Energy Northwest
Project: Horn Rapids Landfill

Service Request No: P1705797

CASE NARRATIVE

The sample was received intact under chain of custody on November 16, 2017 and was stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time of sample receipt.

Methane, Ethene and Ethane Analysis

The sample was analyzed for methane, ethene and ethane using a gas chromatograph equipped with a flame ionization detector (FID). A known amount of liquid was displaced by injecting 8.0 milliliters of helium creating a headspace in the sample vial. Each sample vial was agitated using a sonic disrupter for fifteen minutes and then allowed to equilibrate for at least two hours. A volume of the headspace was withdrawn using a gas-tight syringe and analyzed using a manual injection technique. The amount of dissolved gases (methane, ethene and ethane) in the original sample was calculated using Henry's Law. This method was performed with guidance from RSK 175. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the laboratory's NELAP or DoD-ELAP accreditation.

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www.alsglobal.com

ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Arizona DHS	http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home	AZ0694
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Louisiana DEQ (NELAP)	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	05071
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2016036
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	1177034
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	4068-004
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
PJLA (DoD ELAP)	http://www.pjlabs.com/search-accredited-labs	65818 (Testing)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-17-8
Utah DOH (NELAP)	http://health.utah.gov/lab/environmental-lab-certification/	CA016272017-8
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: Energy Northwest
Project ID: Horn Rapids Landfill
Service Request: P1705797

Date Received: 11/16/2017
Time Received: 09:30

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	RSK 175 - Gases
180550-01	P1705797-001	Water	11/15/2017	09:15	X

P1705797

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058 Fax: (509) 377-8464

ALS's Sample Routing Sheet

11/15/2017

ENERGY NORTHWEST
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Sample ID	Customer ID	Site	Sample Location	Matrix	Date/Time Coll'd	Preservative	Parameters	Method
180550-01	PP-1	Horn Rapids Landfill		Water/Waste Water	11/15/2017 9:15	HCl, ship	Ethylene	RSK-175
						HCl, ship	Methane	RSK-175
						HCl, ship	Ethane	RSK-175

Email results to EnviroLab@energy-northwest.com

Relinquished By: Michael Hase Date/Time: 11/15/17 1400

Received By: Henry Rapp Date/Time: 11/16/17 0930 Cooler 3°

ALS Environmental
Sample Acceptance Check Form

Client: Energy Northwest Work order: P1705797

Project: Horn Rapids Landfill

Sample(s) received on: 11/16/17 Date opened: 11/16/17 by: E.PEREZ

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: 3° C Blank Temperature: ° C **Gel Packs**			
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☒	☐	☐
	Is there a client indication that the submitted samples are **pH** preserved?	☒	☐	☐
	Were **VOA vials** checked for presence/absence of air bubbles?	☒	☐	☐
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☒	☐
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1705797-001.01	40ml VOA HCL		1		A	MC 11/20/2017
P1705797-001.02	40ml VOA HCL				A	
P1705797-001.03	40ml VOA HCL				A	

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180550-01**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705797
ALS Sample ID: P1705797-001

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/15/17
Date Received: 11/16/17
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**2.6**	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	**0.68**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **Method Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705797
ALS Sample ID: P171120-MB

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	ND	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	ND	0.60	

The Method Control Sample is laboratory water carried through the entire analytical process.
ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Client: **Energy Northwest**
Client Sample ID: **Duplicate Lab Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705797
ALS Sample ID: P171120-LCS
P171120-DLCS

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/20/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Spike Amount LCS / DLCS µg/L	Result$_1$ LCS µg/L	Result$_1$ DLCS µg/L	% Recovery LCS	% Recovery DLCS	ALS Acceptance Limits	RPD	RPD Limit	Data Qualifier
74-82-8	Methane	2.50	2.52	2.39	**101**	**96**	80-114	5	12	
74-85-1	Ethene	4.37	4.65	4.58	**106**	**105**	90-135	0.9	7	
74-84-0	Ethane	4.69	4.63	4.45	**99**	**95**	89-115	4	6	

$_1$ = The concentration shown includes a subtraction of the Method Control Sample value, even if the result is less than the MRL.

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LABORATORY REPORT

December 8, 2017

Alyssa Petersen
Energy Northwest
350 Hills Street, Suite 107
Richland, WA 99354-5511

RE: Horn Rapids Landfill

Dear Alyssa:

Enclosed are the results of the sample submitted to our laboratory on November 22, 2017. For your reference, this analysis has been assigned our service request number P1705885.

All analyses were performed according to our laboratory's NELAP and DoD-ELAP-approved quality assurance program. The test results meet requirements of the current NELAP and DoD-ELAP standards, where applicable, and except as noted in the laboratory case narrative provided. For a specific list of NELAP and DoD-ELAP-accredited analytes, refer to the certifications section at www.alsglobal.com. Results are intended to be considered in their entirety and apply only to the samples analyzed and reported herein.

If you have any questions, please call me at (805) 526-7161.

Respectfully submitted,

ALS | Environmental

Kate Kaneko
By Kate Kaneko at 11:03 am, 12/08/17

Kate Kaneko
Project Manager

2655 Park Center Dr., Suite A
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F: +1 805 526 7270
www.alsglobal.com

Client: Energy Northwest
Project: Horn Rapids Landfill

Service Request No: P1705885

CASE NARRATIVE

The sample was received intact under chain of custody on November 22, 2017 and were stored in accordance with the analytical method requirements. Please refer to the sample acceptance check form for additional information. The results reported herein are applicable only to the condition of the sample at the time of sample receipt.

Methane, Ethene and Ethane Analysis

The sample was analyzed for methane, ethene and ethane using a gas chromatograph equipped with a flame ionization detector (FID). A known amount of liquid was displaced by injecting 8.0 milliliters of helium creating a headspace in the sample vial. Each sample vial was agitated using a sonic disrupter for fifteen minutes and then allowed to equilibrate for at least two hours. A volume of the headspace was withdrawn using a gas-tight syringe and analyzed using a manual injection technique. The amount of dissolved gases (methane, ethene and ethane) in the original sample was calculated using Henry's Law. This method was performed with guidance from RSK 175. This method is included on the laboratory's NELAP and DoD-ELAP scope of accreditation. Any analytes flagged with an X are not included on the laboratory's NELAP or DoD-ELAP accreditation.

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ALS Environmental – Simi Valley

CERTIFICATIONS, ACCREDITATIONS, AND REGISTRATIONS

Agency	Web Site	Number
Arizona DHS	http://www.azdhs.gov/preparedness/state-laboratory/lab-licensure-certification/index.php#laboratory-licensure-home	AZ0694
Florida DOH (NELAP)	http://www.doh.state.fl.us/lab/EnvLabCert/WaterCert.htm	E871020
Louisiana DEQ (NELAP)	http://www.deq.louisiana.gov/portal/DIVISIONS/PublicParticipationandPermitSupport/LouisianaLaboratoryAccreditationProgram.aspx	05071
Maine DHHS	http://www.maine.gov/dhhs/mecdc/environmental-health/water/dwp-services/labcert/labcert.htm	2016036
Minnesota DOH (NELAP)	http://www.health.state.mn.us/accreditation	1177034
New Jersey DEP (NELAP)	http://www.nj.gov/dep/oqa/	CA009
New York DOH (NELAP)	http://www.wadsworth.org/labcert/elap/elap.html	11221
Oregon PHD (NELAP)	http://public.health.oregon.gov/LaboratoryServices/EnvironmentalLaboratoryAccreditation/Pages/index.aspx	4068-004
Pennsylvania DEP	http://www.depweb.state.pa.us/labs	68-03307 (Registration)
PJLA (DoD ELAP)	http://www.pjlabs.com/search-accredited-labs	65818 (Testing)
Texas CEQ (NELAP)	http://www.tceq.texas.gov/field/qa/env_lab_accreditation.html	T104704413-17-8
Utah DOH (NELAP)	http://health.utah.gov/lab/environmental-lab-certification/	CA016272017-8
Washington DOE	http://www.ecy.wa.gov/programs/eap/labs/lab-accreditation.html	C946

Analyses were performed according to our laboratory's NELAP and DoD-ELAP approved quality assurance program. A complete listing of specific NELAP and DoD-ELAP certified analytes can be found in the certifications section at www.alsglobal.com, or at the accreditation body's website.

Each of the certifications listed above have an explicit Scope of Accreditation that applies to specific matrices/methods/analytes; therefore, please contact the laboratory for information corresponding to a particular certification.

ALS ENVIRONMENTAL

DETAIL SUMMARY REPORT

Client: Energy Northwest
Service Request: P1705885
Project ID: Horn Rapids Landfill

Date Received: 11/22/2017
Time Received: 09:30

Client Sample ID	Lab Code	Matrix	Date Collected	Time Collected	RSK 175 - Gases
180562-01	P1705885-001	Water	11/16/2017	09:55	X

350 Hills Street, Suite 107
Richland, WA 99354-5511
(509) 377-8058 Fax: (509) 377-8464

ALS's Sample Routing Sheet

11/21/2017

ENERGY NORTHWEST
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Sample ID	Customer ID	Site	Sample Location	Matrix	Date/Time Coll'd	Preservative	Parameters	Method
180562-01	PP-5	Horn Rapids Landfill		Water/Waste Water	11/16/2017 9:55	HCl, ship	Ethylene	RSK-175
						HCl, ship	Methane	RSK-175
						HCl, ship	Ethane	RSK-175

Email results to envirolab@energy-northwest.com

Thank You.

Relinquished By: Michael Hare Date/Time: 11/21/17 1400

RECEIVED BY: 11-22-17 0930

4 PAGES

ALS Environmental
Sample Acceptance Check Form

Client: Energy Northwest Work order: P1705885

Project: Horn Rapids Landfill

Sample(s) received on: 11/22/17 Date opened: 11/22/17 by: ADAVID

Note: This form is used for all samples received by ALS. The use of this form for custody seals is strictly meant to indicate presence/absence and not as an indication of compliance or nonconformity. Thermal preservation and pH will only be evaluated either at the request of the client and/or as required by the method/SOP.

		Yes	No	N/A
1	Were **sample containers** properly marked with client sample ID?	☒	☐	☐
2	Did **sample containers** arrive in good condition?	☒	☐	☐
3	Were **chain-of-custody** papers used and filled out?	☒	☐	☐
4	Did **sample container labels** and/or tags agree with custody papers?	☒	☐	☐
5	Was **sample volume** received adequate for analysis?	☒	☐	☐
6	Are samples within specified holding times?	☒	☐	☐
7	Was proper **temperature** (thermal preservation) of cooler at receipt adhered to?	☒	☐	☐
	Cooler Temperature: 4° C Blank Temperature: ° C **Gel Packs**			
8	Were **custody seals** on outside of cooler/Box/Container?	☐	☒	☐
	Location of seal(s)? _____ Sealing Lid?	☐	☐	☒
	Were signature and date included?	☐	☐	☒
	Were seals intact?	☐	☐	☒
9	Do containers have appropriate **preservation**, according to method/SOP or Client specified information?	☒	☐	☐
	Is there a client indication that the submitted samples are **pH** preserved?	☒	☐	☐
	Were **VOA vials** checked for presence/absence of air bubbles?	☒	☐	☐
	Does the client/method/SOP require that the analyst check the sample pH and if necessary alter it?	☐	☒	☐
10	**Tubes:** Are the tubes capped and intact?	☐	☐	☒
11	**Badges:** Are the badges properly capped and intact?	☐	☐	☒
	Are dual bed badges separated and individually capped and intact?	☐	☐	☒

Lab Sample ID	Container Description	Required pH *	Received pH	Adjusted pH	VOA Headspace (Presence/Absence)	Receipt / Preservation Comments
P1705885-001.01	40ml VOA HCL		1		A	MC 11/29/2017
P1705885-001.02	40ml VOA HCL				A	
P1705885-001.03	40ml VOA HCL				A	

Explain any discrepancies: (include lab sample ID numbers): _____

RSK - MEEPP, HCL (pH<2); RSK - CO2, (pH 5-8); Sulfur (pH>4)

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **180562-01**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705885
ALS Sample ID: P1705885-001

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: 11/16/17
Date Received: 11/22/17
Date Analyzed: 11/29/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	**13**	1.3	
74-85-1	Ethene	**3.0**	1.0	
74-84-0	Ethane	**3.4**	0.60	

ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

RESULTS OF ANALYSIS

Client: **Energy Northwest**
Client Sample ID: **Method Control Sample** ALS Project ID: P1705885
Client Project ID: **Horn Rapids Landfill** ALS Sample ID: P171129-MB

Test Code: RSK 175 Date Collected: NA
Instrument ID: HP5890A/GC10/FID Date Received: NA
Analyst: Mike Conejo Date Analyzed: 11/29/17
Sample Type: Water Volume(s) Analyzed: 0.10 ml(s)
Test Notes:

CAS #	Compound	Result µg/L	MRL µg/L	Data Qualifier
74-82-8	Methane	ND	1.3	
74-85-1	Ethene	ND	1.0	
74-84-0	Ethane	ND	0.60	

The Method Control Sample is laboratory water carried through the entire analytical process.
ND = Compound was analyzed for, but not detected above the laboratory reporting limit.
MRL = Method Reporting Limit - The minimum quantity of a target analyte that can be confidently determined by the referenced method.

ALS ENVIRONMENTAL

LABORATORY CONTROL SAMPLE / DUPLICATE LABORATORY CONTROL SAMPLE SUMMARY

Client: **Energy Northwest**
Client Sample ID: **Duplicate Lab Control Sample**
Client Project ID: **Horn Rapids Landfill**

ALS Project ID: P1705885
ALS Sample ID: P171129-LCS
P171129-DLCS

Test Code: RSK 175
Instrument ID: HP5890A/GC10/FID
Analyst: Mike Conejo
Sample Type: Water
Test Notes:

Date Collected: NA
Date Received: NA
Date Analyzed: 11/29/17
Volume(s) Analyzed: 0.10 ml(s)

CAS #	Compound	Spike Amount LCS / DLCS µg/L	Result$_1$ LCS µg/L	Result$_1$ DLCS µg/L	% Recovery LCS	% Recovery DLCS	ALS Acceptance Limits	RPD	RPD Limit	Data Qualifier
74-82-8	Methane	2.50	2.55	2.43	**102**	**97**	80-114	5	12	
74-85-1	Ethene	4.37	4.82	4.81	**110**	**110**	90-135	0	7	
74-84-0	Ethane	4.69	4.77	4.65	**102**	**99**	89-115	3	6	

$_1$ = The concentration shown includes a subtraction of the Method Control Sample value, even if the result is less than the MRL.

Matrix Spike/Duplicate Recover and RPD Summary Report

Agilent Technologies

Batch Name D:\MassHunter\GCMS\1\data\110717\QuantResults\110717.batch.bin
Last Calib Update 11/7/2017 10:39:24 AM
Method File
Data Path D:\MassHunter\GCMS\1\data\110717

Sample Name	Sample Type	Matrix Spike Group	Acq. Date Time
180518-01 MS	Matrix		11/8/2017 5:09:19 AM
180518-01 DMS	Matrix Dup		11/8/2017 5:38:21 AM
180518-01	Non Spike		11/8/2017 8:32:29 AM

Compound	Sample Conc	Spike Amt	Spike Res	Dup Res	Spike Rec	Dup Rec	RPD	QC RPD	Limits %Rec
Dichlorodifluoromethane	0.883	10.000	9.324	8.330	93.24	83.30	10.24	30	29 - 149
Chloromethane	0.013	10.000	9.897	8.622	98.97	86.22	13.75	30	50 - 136
Vinyl Chloride	0.000	10.000	8.925	8.344	89.25	83.44	6.73	30	58 - 137
Bromomethane	0.000	10.000	8.129	7.916	81.29	79.16	2.65	30	53 - 143
Chloroethane	0.000	10.000	8.574	8.312	85.74	83.12	3.11	30	59 - 139
Trichlorofluoromethane	0.093	10.000	9.210	8.492	92.10	84.92	8.03	30	65 - 141
1,1-Dichloroethene	0.000	10.000	10.787	9.962	107.87	99.62	7.95	30	71 - 131
Acetone	46.485	50.000	36.559	40.901	73.12	81.80	5.10	30	39 - 160
Carbon disulfide	0.062	20.000	17.626	16.519	88.13	82.59	6.46	30	63 - 132
Methylene Chloride	0.057	10.000	9.702	9.433	97.02	94.33	2.79	30	70 - 128
Acrylonitrile	0.000	10.000	9.681	9.632	96.81	96.32	0.51	30	63 - 135
trans-1,2-Dichloroethene	0.000	10.000	10.256	9.911	102.56	99.11	3.43	30	75 - 124
Methyl tert-Butyl Ether	0.000	10.000	9.851	10.026	98.51	100.26	1.76	30	73 - 125
1,1-Dichloroethane	1.100	10.000	10.067	9.684	100.67	96.84	3.49	30	77 - 125
2,2-Dichloropropane	0.000	10.000	11.939	11.064	119.39	110.64	7.61	30	60 - 139
cis-1,2-Dichloroethene	0.361	10.000	9.890	9.431	98.90	94.31	4.58	30	77 - 123
2-Butanone	6.886	50.000	47.293	49.418	94.59	98.84	3.85	30	56 - 143
Bromochloromethane	0.000	10.000	10.501	10.363	105.01	103.63	1.33	30	78 - 123
Chloroform	0.038	10.000	10.064	9.663	100.64	96.63	4.05	30	78 - 123
1,1,1-Trichloroethane	0.000	10.000	10.448	9.918	104.48	99.18	5.20	30	74 - 131
Carbon Tetrachloride	0.000	10.000	9.280	8.997	92.80	89.97	3.10	30	70 - 135
1,1-Dichloropropene	0.000	10.000	10.240	9.527	102.40	95.27	7.21	30	79 - 125
Benzene	0.532	10.000	9.316	8.913	93.16	89.13	4.18	30	79 - 120
1,2-Dichloroethane	0.000	10.000	9.935	9.685	99.35	96.85	2.54	30	73 - 128
Trichloroethene	0.000	10.000	10.168	9.746	101.68	97.46	4.24	30	79 - 123
1,2-Dichloropropane	0.000	10.000	10.149	9.997	101.49	99.97	1.51	30	78 - 122
Dibromomethane	0.000	10.000	10.461	10.327	104.61	103.27	1.28	30	78 - 125
Bromodichloromethane	0.000	10.000	8.917	8.727	89.17	87.27	2.15	30	79 - 125
cis-1,3-Dichloropropene	0.000	10.000	8.402	8.294	84.02	82.94	1.29	30	74 - 126
4-Methyl-2-pentanone (MIBK)	0.189	50.000	50.080	52.905	100.16	105.81	5.47	30	67 - 130
Toluene	0.213	10.000	9.927	9.385	99.27	93.85	5.49	30	80 - 121
trans-1,3-Dichloropropene	0.000	10.000	8.476	8.498	84.76	84.98	0.25	30	73 - 127
1,1,2-Trichloroethane	0.000	10.000	10.242	10.133	102.42	101.33	1.07	30	80 - 119
Tetrachloroethene	0.000	10.000	10.839	9.756	108.39	97.56	10.52	30	74 - 129
1,3-Dichloropropane	0.000	10.000	10.040	10.087	100.40	100.87	0.47	30	80 - 119
2-Hexanone	0.879	50.000	45.999	47.202	92.00	94.40	2.53	30	57 - 139
Dibromochloromethane	0.000	10.000	8.437	8.308	84.37	83.08	1.54	30	74 - 126
1,2-Dibromoethane	0.000	10.000	10.717	10.987	107.17	109.87	2.49	30	77 - 121
Chlorobenzene	0.000	10.000	9.809	9.524	98.09	95.24	2.95	30	79 - 120
1,1,1,2-Tetrachloroethane	0.000	10.000	8.724	8.634	87.24	86.34	1.04	30	78 - 124
Ethylbenzene	0.051	10.000	10.380	9.732	103.80	97.32	6.41	30	76 - 122
m,p-Xylene	0.164	20.000	21.087	19.923	105.43	99.62	5.63	30	77 - 124
o-Xylene	0.078	10.000	10.398	9.990	103.98	99.90	3.96	30	77 - 123
Styrene	0.029	10.000	10.824	10.150	108.24	101.50	6.41	30	78 - 123

Bromoform	0.000	10.000	9.453	9.358	94.53	93.58	1.02	30	66 - 130
Isopropylbenzene	0.000	10.000	10.295	9.801	102.95	98.01	4.92	30	68 - 134
Bromobenzene	0.000	10.000	10.112	9.930	101.12	99.30	1.82	30	80 - 120
1,1,2,2-Tetrachloroethane	0.000	10.000	10.159	10.327	101.59	103.27	1.64	30	72 - 121
1,2,3-Trichloropropane	0.000	10.000	9.978	10.228	99.78	102.28	2.47	30	73 - 122
n-Propylbenzene	0.000	10.000	10.734	10.004	107.34	100.04	7.05	30	73 - 125
2-Chlorotoluene	0.000	10.000	10.147	9.772	101.47	97.72	3.77	30	78 - 122
4-Chlorotoluene	0.029	10.000	10.073	9.494	100.73	94.94	5.90	30	78 - 122
1,3,5-Trimethylbenzene	0.025	10.000	10.739	10.133	107.39	101.33	5.80	30	75 - 124
tert-Butylbenzene	0.000	10.000	10.728	10.247	107.28	102.47	4.58	30	78 - 124
1,2,4-Trimethylbenzene	0.076	10.000	10.696	10.150	106.96	101.50	5.21	30	76 - 124
sec-Butylbenzene	0.000	10.000	11.204	10.437	112.04	104.37	7.09	30	73 - 125
1,3-Dichlorobenzene	0.027	10.000	10.134	9.698	101.34	96.98	4.39	30	80 - 119
p-Isopropyltoluene	0.028	10.000	11.137	10.260	111.37	102.60	8.18	30	73 - 127
1,4-Dichlorobenzene	0.035	10.000	10.047	9.581	100.47	95.81	4.73	30	79 - 118
1,2-Dichlorobenzene	0.000	10.000	10.192	9.893	101.92	98.93	2.97	30	80 - 119
n-Butylbenzene	0.055	10.000	12.041	10.937	120.41	109.37	9.56	30	70 - 128
1,2-dibromo-3-chloropropane	0.000	10.000	9.378	10.240	93.78	102.40	8.78	30	62 - 128
1,2,4-Trichlorobenzene	0.045	10.000	10.852	9.962	108.52	99.62	8.52	30	69 - 130
Hexachlorobutadiene	0.000	10.000	11.235	10.579	112.35	105.79	6.02	30	61 - 135
Naphthalene	0.699	10.000	10.033	10.182	100.33	101.82	1.38	30	62 - 129
1,2,3-Trichlorobenzene	0.000	10.000	10.957	10.629	109.57	106.29	3.04	30	69 - 129

(#) = out of Range

Matrix Spike/Duplicate Recover and RPD Summary Report

Agilent Technologies

Batch Name	D:\MassHunter\GCMS\1\data\110717\QuantResults\110717AP.batch.bin
Last Calib Update	11/8/2017 3:19:47 AM
Method File	D:\MassHunter\GCMS\1\methods\8260WAP110517.m
Data Path	D:\MassHunter\GCMS\1\data\110717

Sample Name	Sample Type	Matrix Spike Group	Acq. Date Time
180518-01 AP MS	Matrix		11/8/2017 3:37:25 AM
180518-01 AP DMS	Matrix Dup		11/8/2017 4:06:20 AM
180518-01	Non Spike		11/8/2017 8:32:29 AM

Compound	Sample Conc	Spike Amt	Spike Res	Dup Res	Spike Rec	Dup Rec	RPD	QC RPD	Limits %Rec
Acrolein	0.000	100.000	32.679	31.216	32.68 #	31.22 #	4.58	30	39 - 155
Iodomethane	0.101	30.000	33.470	34.013	111.57	113.38	1.61	30	69 - 131
Acetonitrile	0.000	300.000	344.766	350.726	114.92	116.91	1.71	30	50 - 142
Allyl Chloride	0.000	30.000	35.536	33.847	118.45	112.82	4.87	30	68 - 130
Vinyl Acetate	0.000	30.000	30.381	32.307	101.27	107.69	6.14	30	54 - 146
Chloroprene	0.000	30.000	30.105	28.318	100.35	94.39	6.12	30	65 - 135
Propionitrile	0.000	30.000	28.621	30.216	95.40	100.72	5.42	30	64 - 136
Methacrylonitrile	0.000	30.000	30.147	32.619	100.49	108.73	7.88	30	63 - 133
Isobutyl Alcohol	0.000	300.000	223.086	256.540	74.36	85.51	13.95	30	63 - 133
Methyl Methacrylate	0.000	30.000	27.667	31.092	92.22	103.64	11.66	30	67 - 128
Ethyl Methacrylate	0.000	30.000	30.594	33.769	101.98	112.56	9.87	30	72 - 126
trans-1,4-Dichloro-2-butene	0.000	30.000	26.929	27.654	89.76	92.18	2.66	30	43 - 140

(#) = out of Range

Acrolein RPD ok; Result indicative of matrix interferent.

Generated at 9:08 AM on 11/8/2017

TestAmerica

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THE LEADER IN ENVIRONMENTAL TESTING

ANALYTICAL REPORT

TestAmerica Laboratories, Inc.
TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Tel: (253)922-2310

TestAmerica Job ID: 580-72948-1
Client Project/Site: Horn Rapids Investigation

For:
Parametrix, Inc.
719 2nd Avenue
Suite 200
Seattle, Washington 98104

Attn: Lisa Gilbert

Authorized for release by:
11/30/2017 3:26:44 PM

Cathy Gamble, Project Manager I
(253)922-2310
cathy.gamble@testamericainc.com

Table of Contents

Job ID: 580-72948-1

Laboratory: TestAmerica Seattle

Narrative

Receipt
The samples were received on 11/16/2017 9:40 AM; the samples arrived in good condition, properly preserved and, where required, on ice. The temperature of the cooler at receipt was 0.7º C.

Receipt Exceptions
Per the client, "Please run the 8260 and hold the RSK for the sample 111317-DUP, consistent with what is noted on the COC." PP-3 (580-72948-1), 111317-DUP (580-72948-2), 111517-DUP (580-72948-3) and Trip Blank (580-72948-4)

GC/MS VOA
Method(s) 8260C: The method blank for preparation batch 580-261611 contained Methylene Chloride above the reporting limit (RL). None of the samples associated with this method blank contained the target compound; therefore, re-extraction and/or re-analysis of samples were not performed.

Method(s) 8260C: The following analyte(s) recovered outside control limits for the LCSD associated with analytical batch 580-261611: Tetrachloroethene. This is not indicative of a systematic control problem because these were random marginal exceedances. Qualified results have been reported.

Method(s) 8260C: The continuing calibration verification (CCV) associated with batch 580-261611 recovered outside acceptance criteria, low biased, for 2,2-Dichloropropane, vinyl acetate and trans-1,4-Dichloro-2-butene. A reporting limit (RL) standard was analyzed, and the target analyte was detected. Since the associated samples were non-detect for this analyte, the data have been reported.

Method(s) 8260C: The continuing calibration verification (CCV) associated with batch 580-261611 recovered above the upper control limit for 2-Hexanone, Acrylonitrile and 4-Methyl-2-pentanone. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported. The following samples are impacted: PP-3 (580-72948-1), 111317-DUP (580-72948-2), 111517-DUP (580-72948-3), Trip Blank (580-72948-4) and (CCVIS 580-261611/3).

Method(s) 8260C: The following sample was reanalyzed due to high biased QC for 2-Hexanone in the initial batch. 111317-DUP (580-72948-2)

No additional analytical or quality issues were noted, other than those described above or in the Definitions/Glossary page.

GC VOA
No analytical or quality issues were noted, other than those described in the Definitions/Glossary page.

Qualifiers

GC/MS VOA

Qualifier	Qualifier Description
*	LCS or LCSD is outside acceptance limits.

Glossary

Abbreviation	These commonly used abbreviations may or may not be present in this report.
¤	Listed under the "D" column to designate that the result is reported on a dry weight basis
%R	Percent Recovery
CFL	Contains Free Liquid
CNF	Contains No Free Liquid
DER	Duplicate Error Ratio (normalized absolute difference)
Dil Fac	Dilution Factor
DL	Detection Limit (DoD/DOE)
DL, RA, RE, IN	Indicates a Dilution, Re-analysis, Re-extraction, or additional Initial metals/anion analysis of the sample
DLC	Decision Level Concentration (Radiochemistry)
EDL	Estimated Detection Limit (Dioxin)
LOD	Limit of Detection (DoD/DOE)
LOQ	Limit of Quantitation (DoD/DOE)
MDA	Minimum Detectable Activity (Radiochemistry)
MDC	Minimum Detectable Concentration (Radiochemistry)
MDL	Method Detection Limit
ML	Minimum Level (Dioxin)
NC	Not Calculated
ND	Not Detected at the reporting limit (or MDL or EDL if shown)
PQL	Practical Quantitation Limit
QC	Quality Control
RER	Relative Error Ratio (Radiochemistry)
RL	Reporting Limit or Requested Limit (Radiochemistry)
RPD	Relative Percent Difference, a measure of the relative difference between two points
TEF	Toxicity Equivalent Factor (Dioxin)
TEQ	Toxicity Equivalent Quotient (Dioxin)

Client Sample ID: PP-3
Date Collected: 11/09/17 11:55
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-1
Matrix: Water

Method: 8260C - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 06:21	1
1,1,1-Trichloroethane	ND		0.20		ug/L			11/18/17 06:21	1
1,1,2,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 06:21	1
1,1,2-Trichloroethane	ND		0.20		ug/L			11/18/17 06:21	1
1,1-Dichloroethane	**0.85**		0.20		ug/L			11/18/17 06:21	1
1,1-Dichloroethene	ND		0.10		ug/L			11/18/17 06:21	1
1,2,3-Trichloropropane	ND		0.20		ug/L			11/18/17 06:21	1
1,2-Dibromo-3-Chloropropane	ND		2.0		ug/L			11/18/17 06:21	1
1,2-Dibromoethane	ND		0.10		ug/L			11/18/17 06:21	1
1,2-Dichlorobenzene	ND		0.30		ug/L			11/18/17 06:21	1
1,2-Dichloroethane	ND		0.20		ug/L			11/18/17 06:21	1
1,2-Dichloropropane	ND		0.20		ug/L			11/18/17 06:21	1
1,4-Dichlorobenzene	ND		0.30		ug/L			11/18/17 06:21	1
2-Butanone	ND		15		ug/L			11/18/17 06:21	1
2-Hexanone	ND		2.0		ug/L			11/18/17 06:21	1
4-Methyl-2-pentanone	ND		5.0		ug/L			11/18/17 06:21	1
Acetone	ND		2.0		ug/L			11/18/17 06:21	1
Acrylonitrile	ND		5.0		ug/L			11/18/17 06:21	1
Benzene	**0.25**		0.20		ug/L			11/18/17 06:21	1
Bromochloromethane	ND		0.20		ug/L			11/18/17 06:21	1
Bromodichloromethane	ND		0.20		ug/L			11/18/17 06:21	1
Bromoform	ND		0.50		ug/L			11/18/17 06:21	1
Bromomethane	ND		1.0		ug/L			11/18/17 06:21	1
Carbon disulfide	**0.53**		0.20		ug/L			11/18/17 06:21	1
Carbon tetrachloride	ND		0.20		ug/L			11/18/17 06:21	1
Chlorobenzene	ND		0.20		ug/L			11/18/17 06:21	1
Chloroethane	ND		0.50		ug/L			11/18/17 06:21	1
Chloroform	**0.41**		0.20		ug/L			11/18/17 06:21	1
Chloromethane	ND		0.30		ug/L			11/18/17 06:21	1
cis-1,2-Dichloroethene	**0.70**		0.20		ug/L			11/18/17 06:21	1
cis-1,3-Dichloropropene	ND		0.50		ug/L			11/18/17 06:21	1
Dibromochloromethane	ND		0.20		ug/L			11/18/17 06:21	1
Dibromomethane	ND		0.20		ug/L			11/18/17 06:21	1
Ethylbenzene	ND		0.20		ug/L			11/18/17 06:21	1
Iodomethane	ND		0.50		ug/L			11/18/17 06:21	1
Methylene Chloride	ND		0.50		ug/L			11/18/17 06:21	1
m-Xylene & p-Xylene	ND		0.50		ug/L			11/18/17 06:21	1
o-Xylene	ND		0.50		ug/L			11/18/17 06:21	1
Styrene	ND		0.50		ug/L			11/18/17 06:21	1
Tetrachloroethene	ND	*	0.50		ug/L			11/18/17 06:21	1
Toluene	**0.22**		0.20		ug/L			11/18/17 06:21	1
trans-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 06:21	1
trans-1,3-Dichloropropene	ND		0.20		ug/L			11/18/17 06:21	1
trans-1,4-Dichloro-2-butene	ND		2.0		ug/L			11/18/17 06:21	1
Trichloroethene	ND		0.20		ug/L			11/18/17 06:21	1
Trichlorofluoromethane	ND		0.50		ug/L			11/18/17 06:21	1
Vinyl acetate	ND		1.0		ug/L			11/18/17 06:21	1
Vinyl chloride	ND		0.020		ug/L			11/18/17 06:21	1
Xylenes, Total	ND		0.50		ug/L			11/18/17 06:21	1

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Client Sample ID: PP-3
Date Collected: 11/09/17 11:55
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-1
Matrix: Water

Surrogate	%Recovery	Qualifier	Limits	Prepared	Analyzed	Dil Fac
1,2-Dichloroethane-d4 (Surr)	107		46 - 150		11/18/17 06:21	1
4-Bromofluorobenzene (Surr)	91		81 - 120		11/18/17 06:21	1
Dibromofluoromethane (Surr)	95		42 - 132		11/18/17 06:21	1
Toluene-d8 (Surr)	106		75 - 125		11/18/17 06:21	1
Trifluorotoluene (Surr)	101		74 - 118		11/18/17 06:21	1

Client Sample ID: 111317-DUP
Date Collected: 11/13/17 10:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-2
Matrix: Water

Method: 8260C - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 06:47	1
1,1,1-Trichloroethane	ND		0.20		ug/L			11/18/17 06:47	1
1,1,2,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 06:47	1
1,1,2-Trichloroethane	ND		0.20		ug/L			11/18/17 06:47	1
1,1-Dichloroethane	**0.35**		0.20		ug/L			11/18/17 06:47	1
1,1-Dichloroethene	ND		0.10		ug/L			11/18/17 06:47	1
1,2,3-Trichloropropane	ND		0.20		ug/L			11/18/17 06:47	1
1,2-Dibromo-3-Chloropropane	ND		2.0		ug/L			11/18/17 06:47	1
1,2-Dibromoethane	ND		0.10		ug/L			11/18/17 06:47	1
1,2-Dichlorobenzene	ND		0.30		ug/L			11/18/17 06:47	1
1,2-Dichloroethane	ND		0.20		ug/L			11/18/17 06:47	1
1,2-Dichloropropane	ND		0.20		ug/L			11/18/17 06:47	1
1,4-Dichlorobenzene	ND		0.30		ug/L			11/18/17 06:47	1
2-Butanone	ND		15		ug/L			11/18/17 06:47	1
4-Methyl-2-pentanone	ND		5.0		ug/L			11/18/17 06:47	1
Acetone	**32**		2.0		ug/L			11/18/17 06:47	1
Acrylonitrile	ND		5.0		ug/L			11/18/17 06:47	1
Benzene	ND		0.20		ug/L			11/18/17 06:47	1
Bromochloromethane	ND		0.20		ug/L			11/18/17 06:47	1
Bromodichloromethane	ND		0.20		ug/L			11/18/17 06:47	1
Bromoform	ND		0.50		ug/L			11/18/17 06:47	1
Bromomethane	ND		1.0		ug/L			11/18/17 06:47	1
Carbon disulfide	ND		0.20		ug/L			11/18/17 06:47	1
Carbon tetrachloride	ND		0.20		ug/L			11/18/17 06:47	1
Chlorobenzene	ND		0.20		ug/L			11/18/17 06:47	1
Chloroethane	ND		0.50		ug/L			11/18/17 06:47	1
Chloroform	ND		0.20		ug/L			11/18/17 06:47	1
Chloromethane	ND		0.30		ug/L			11/18/17 06:47	1
cis-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 06:47	1
cis-1,3-Dichloropropene	ND		0.50		ug/L			11/18/17 06:47	1
Dibromochloromethane	ND		0.20		ug/L			11/18/17 06:47	1
Dibromomethane	ND		0.20		ug/L			11/18/17 06:47	1
Ethylbenzene	ND		0.20		ug/L			11/18/17 06:47	1
Iodomethane	ND		0.50		ug/L			11/18/17 06:47	1
Methylene Chloride	ND		0.50		ug/L			11/18/17 06:47	1
m-Xylene & p-Xylene	ND		0.50		ug/L			11/18/17 06:47	1
o-Xylene	ND		0.50		ug/L			11/18/17 06:47	1
Styrene	ND		0.50		ug/L			11/18/17 06:47	1
Tetrachloroethene	ND	*	0.50		ug/L			11/18/17 06:47	1
Toluene	ND		0.20		ug/L			11/18/17 06:47	1
trans-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 06:47	1
trans-1,3-Dichloropropene	ND		0.20		ug/L			11/18/17 06:47	1
trans-1,4-Dichloro-2-butene	ND		2.0		ug/L			11/18/17 06:47	1
Trichloroethene	ND		0.20		ug/L			11/18/17 06:47	1
Trichlorofluoromethane	ND		0.50		ug/L			11/18/17 06:47	1
Vinyl acetate	ND		1.0		ug/L			11/18/17 06:47	1
Vinyl chloride	ND		0.020		ug/L			11/18/17 06:47	1
Xylenes, Total	ND		0.50		ug/L			11/18/17 06:47	1

Client Sample ID: 111317-DUP

Date Collected: 11/13/17 10:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-2

Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*110*		*46 - 150*		*11/18/17 06:47*	*1*
4-Bromofluorobenzene (Surr)	*90*		*81 - 120*		*11/18/17 06:47*	*1*
Dibromofluoromethane (Surr)	*96*		*42 - 132*		*11/18/17 06:47*	*1*
Toluene-d8 (Surr)	*108*		*75 - 125*		*11/18/17 06:47*	*1*
Trifluorotoluene (Surr)	*102*		*74 - 118*		*11/18/17 06:47*	*1*

Method: 8260C - Volatile Organic Compounds (GC/MS) - RA

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND		2.0		ug/L			11/22/17 22:55	1

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*99*		*46 - 150*		*11/22/17 22:55*	*1*
4-Bromofluorobenzene (Surr)	*100*		*81 - 120*		*11/22/17 22:55*	*1*
Dibromofluoromethane (Surr)	*96*		*42 - 132*		*11/22/17 22:55*	*1*
Toluene-d8 (Surr)	*103*		*75 - 125*		*11/22/17 22:55*	*1*
Trifluorotoluene (Surr)	*101*		*74 - 118*		*11/22/17 22:55*	*1*

Client Sample ID: 111517-DUP
Date Collected: 11/15/17 09:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-3
Matrix: Water

Method: 8260C - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 07:13	1
1,1,1-Trichloroethane	ND		0.20		ug/L			11/18/17 07:13	1
1,1,2,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 07:13	1
1,1,2-Trichloroethane	ND		0.20		ug/L			11/18/17 07:13	1
1,1-Dichloroethane	**5.3**		0.20		ug/L			11/18/17 07:13	1
1,1-Dichloroethene	ND		0.10		ug/L			11/18/17 07:13	1
1,2,3-Trichloropropane	ND		0.20		ug/L			11/18/17 07:13	1
1,2-Dibromo-3-Chloropropane	ND		2.0		ug/L			11/18/17 07:13	1
1,2-Dibromoethane	ND		0.10		ug/L			11/18/17 07:13	1
1,2-Dichlorobenzene	ND		0.30		ug/L			11/18/17 07:13	1
1,2-Dichloroethane	ND		0.20		ug/L			11/18/17 07:13	1
1,2-Dichloropropane	**0.20**		0.20		ug/L			11/18/17 07:13	1
1,4-Dichlorobenzene	ND		0.30		ug/L			11/18/17 07:13	1
2-Butanone	ND		15		ug/L			11/18/17 07:13	1
2-Hexanone	ND		2.0		ug/L			11/18/17 07:13	1
4-Methyl-2-pentanone	ND		5.0		ug/L			11/18/17 07:13	1
Acetone	**5.0**		2.0		ug/L			11/18/17 07:13	1
Acrylonitrile	ND		5.0		ug/L			11/18/17 07:13	1
Benzene	ND		0.20		ug/L			11/18/17 07:13	1
Bromochloromethane	ND		0.20		ug/L			11/18/17 07:13	1
Bromodichloromethane	ND		0.20		ug/L			11/18/17 07:13	1
Bromoform	ND		0.50		ug/L			11/18/17 07:13	1
Bromomethane	ND		1.0		ug/L			11/18/17 07:13	1
Carbon disulfide	**0.20**		0.20		ug/L			11/18/17 07:13	1
Carbon tetrachloride	ND		0.20		ug/L			11/18/17 07:13	1
Chlorobenzene	ND		0.20		ug/L			11/18/17 07:13	1
Chloroethane	ND		0.50		ug/L			11/18/17 07:13	1
Chloroform	ND		0.20		ug/L			11/18/17 07:13	1
Chloromethane	ND		0.30		ug/L			11/18/17 07:13	1
cis-1,2-Dichloroethene	**26**		0.20		ug/L			11/18/17 07:13	1
cis-1,3-Dichloropropene	ND		0.50		ug/L			11/18/17 07:13	1
Dibromochloromethane	ND		0.20		ug/L			11/18/17 07:13	1
Dibromomethane	ND		0.20		ug/L			11/18/17 07:13	1
Ethylbenzene	ND		0.20		ug/L			11/18/17 07:13	1
Iodomethane	ND		0.50		ug/L			11/18/17 07:13	1
Methylene Chloride	ND		0.50		ug/L			11/18/17 07:13	1
m-Xylene & p-Xylene	ND		0.50		ug/L			11/18/17 07:13	1
o-Xylene	ND		0.50		ug/L			11/18/17 07:13	1
Styrene	ND		0.50		ug/L			11/18/17 07:13	1
Tetrachloroethene	**6.2**	*	0.50		ug/L			11/18/17 07:13	1
Toluene	ND		0.20		ug/L			11/18/17 07:13	1
trans-1,2-Dichloroethene	**0.86**		0.20		ug/L			11/18/17 07:13	1
trans-1,3-Dichloropropene	ND		0.20		ug/L			11/18/17 07:13	1
trans-1,4-Dichloro-2-butene	ND		2.0		ug/L			11/18/17 07:13	1
Trichloroethene	**5.0**		0.20		ug/L			11/18/17 07:13	1
Trichlorofluoromethane	ND		0.50		ug/L			11/18/17 07:13	1
Vinyl acetate	ND		1.0		ug/L			11/18/17 07:13	1
Vinyl chloride	ND		0.020		ug/L			11/18/17 07:13	1
Xylenes, Total	ND		0.50		ug/L			11/18/17 07:13	1

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Client Sample ID: 111517-DUP
Date Collected: 11/15/17 09:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-3
Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*111*		*46 - 150*		*11/18/17 07:13*	*1*
4-Bromofluorobenzene (Surr)	*90*		*81 - 120*		*11/18/17 07:13*	*1*
Dibromofluoromethane (Surr)	*97*		*42 - 132*		*11/18/17 07:13*	*1*
Toluene-d8 (Surr)	*105*		*75 - 125*		*11/18/17 07:13*	*1*
Trifluorotoluene (Surr)	*101*		*74 - 118*		*11/18/17 07:13*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		10		ug/L			11/24/17 11:21	1
Ethylene	ND		10		ug/L			11/24/17 11:21	1
Methane	**7.5**		1.2		ug/L			11/24/17 11:21	1

Client Sample ID: Trip Blank
Date Collected: 11/09/17 00:01
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-4
Matrix: Water

Method: 8260C - Volatile Organic Compounds (GC/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,1,1-Trichloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,1,2,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,1,2-Trichloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,1-Dichloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,1-Dichloroethene	ND		0.10		ug/L			11/18/17 02:49	1
1,2,3-Trichloropropane	ND		0.20		ug/L			11/18/17 02:49	1
1,2-Dibromo-3-Chloropropane	ND		2.0		ug/L			11/18/17 02:49	1
1,2-Dibromoethane	ND		0.10		ug/L			11/18/17 02:49	1
1,2-Dichlorobenzene	ND		0.30		ug/L			11/18/17 02:49	1
1,2-Dichloroethane	ND		0.20		ug/L			11/18/17 02:49	1
1,2-Dichloropropane	ND		0.20		ug/L			11/18/17 02:49	1
1,4-Dichlorobenzene	ND		0.30		ug/L			11/18/17 02:49	1
2-Butanone	ND		15		ug/L			11/18/17 02:49	1
2-Hexanone	ND		2.0		ug/L			11/18/17 02:49	1
4-Methyl-2-pentanone	ND		5.0		ug/L			11/18/17 02:49	1
Acetone	ND		2.0		ug/L			11/18/17 02:49	1
Acrylonitrile	ND		5.0		ug/L			11/18/17 02:49	1
Benzene	ND		0.20		ug/L			11/18/17 02:49	1
Bromochloromethane	ND		0.20		ug/L			11/18/17 02:49	1
Bromodichloromethane	ND		0.20		ug/L			11/18/17 02:49	1
Bromoform	ND		0.50		ug/L			11/18/17 02:49	1
Bromomethane	ND		1.0		ug/L			11/18/17 02:49	1
Carbon disulfide	ND		0.20		ug/L			11/18/17 02:49	1
Carbon tetrachloride	ND		0.20		ug/L			11/18/17 02:49	1
Chlorobenzene	ND		0.20		ug/L			11/18/17 02:49	1
Chloroethane	ND		0.50		ug/L			11/18/17 02:49	1
Chloroform	ND		0.20		ug/L			11/18/17 02:49	1
Chloromethane	ND		0.30		ug/L			11/18/17 02:49	1
cis-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 02:49	1
cis-1,3-Dichloropropene	ND		0.50		ug/L			11/18/17 02:49	1
Dibromochloromethane	ND		0.20		ug/L			11/18/17 02:49	1
Dibromomethane	ND		0.20		ug/L			11/18/17 02:49	1
Ethylbenzene	ND		0.20		ug/L			11/18/17 02:49	1
Iodomethane	ND		0.50		ug/L			11/18/17 02:49	1
Methylene Chloride	ND		0.50		ug/L			11/18/17 02:49	1
m-Xylene & p-Xylene	ND		0.50		ug/L			11/18/17 02:49	1
o-Xylene	ND		0.50		ug/L			11/18/17 02:49	1
Styrene	ND		0.50		ug/L			11/18/17 02:49	1
Tetrachloroethene	ND	*	0.50		ug/L			11/18/17 02:49	1
Toluene	ND		0.20		ug/L			11/18/17 02:49	1
trans-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 02:49	1
trans-1,3-Dichloropropene	ND		0.20		ug/L			11/18/17 02:49	1
trans-1,4-Dichloro-2-butene	ND		2.0		ug/L			11/18/17 02:49	1
Trichloroethene	ND		0.20		ug/L			11/18/17 02:49	1
Trichlorofluoromethane	ND		0.50		ug/L			11/18/17 02:49	1
Vinyl acetate	ND		1.0		ug/L			11/18/17 02:49	1
Vinyl chloride	ND		0.020		ug/L			11/18/17 02:49	1
Xylenes, Total	ND		0.50		ug/L			11/18/17 02:49	1

Client Sample ID: Trip Blank

Date Collected: 11/09/17 00:01
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-4
Matrix: Water

Surrogate	*%Recovery*	*Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*107*		*46 - 150*		*11/18/17 02:49*	*1*
4-Bromofluorobenzene (Surr)	*91*		*81 - 120*		*11/18/17 02:49*	*1*
Dibromofluoromethane (Surr)	*96*		*42 - 132*		*11/18/17 02:49*	*1*
Toluene-d8 (Surr)	*109*		*75 - 125*		*11/18/17 02:49*	*1*
Trifluorotoluene (Surr)	*104*		*74 - 118*		*11/18/17 02:49*	*1*

Method: RSK-175 - Dissolved Gases (GC)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Ethane	ND		10		ug/L			11/21/17 11:44	1
Ethylene	ND		10		ug/L			11/21/17 11:44	1
Methane	ND		1.2		ug/L			11/21/17 11:44	1

Method: 8260C - Volatile Organic Compounds (GC/MS)

Lab Sample ID: MB 580-261611/5
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
1,1,1,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,1,1-Trichloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,1,2,2-Tetrachloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,1,2-Trichloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,1-Dichloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,1-Dichloroethene	ND		0.10		ug/L			11/18/17 01:60	1
1,2,6-Trichloropropane	ND		0.20		ug/L			11/18/17 01:60	1
1,2-Dibromo-6-Chloropropane	ND		2.0		ug/L			11/18/17 01:60	1
1,2-Dibromoethane	ND		0.10		ug/L			11/18/17 01:60	1
1,2-Dichloroben3ene	ND		0.60		ug/L			11/18/17 01:60	1
1,2-Dichloroethane	ND		0.20		ug/L			11/18/17 01:60	1
1,2-Dichloropropane	ND		0.20		ug/L			11/18/17 01:60	1
1,4-Dichloroben3ene	ND		0.60		ug/L			11/18/17 01:60	1
2-z utanone	ND		15		ug/L			11/18/17 01:60	1
2-Hexanone	ND		2.0		ug/L			11/18/17 01:60	1
4-B ethM-2-pentanone	ND		5.0		ug/L			11/18/17 01:60	1
Acetone	ND		2.0		ug/L			11/18/17 01:60	1
AcrMonitrile	ND		5.0		ug/L			11/18/17 01:60	1
z en3ene	ND		0.20		ug/L			11/18/17 01:60	1
z romochloromethane	ND		0.20		ug/L			11/18/17 01:60	1
z romodichloromethane	ND		0.20		ug/L			11/18/17 01:60	1
z romoyorm	ND		0.50		ug/L			11/18/17 01:60	1
z romomethane	ND		1.0		ug/L			11/18/17 01:60	1
Carbon disulyide	ND		0.20		ug/L			11/18/17 01:60	1
Carbon tetrachloride	ND		0.20		ug/L			11/18/17 01:60	1
Chloroben3ene	ND		0.20		ug/L			11/18/17 01:60	1
Chloroethane	ND		0.50		ug/L			11/18/17 01:60	1
Chloroyorm	ND		0.20		ug/L			11/18/17 01:60	1
Chloromethane	ND		0.60		ug/L			11/18/17 01:60	1
cis-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 01:60	1
cis-1,6-Dichloropropene	ND		0.50		ug/L			11/18/17 01:60	1
Dibromochloromethane	ND		0.20		ug/L			11/18/17 01:60	1
Dibromomethane	ND		0.20		ug/L			11/18/17 01:60	1
f thMben3ene	ND		0.20		ug/L			11/18/17 01:60	1
Iodomethane	ND		0.50		ug/L			11/18/17 01:60	1
B ethMene Chloride	2.66		0.50		ug/L			11/18/17 01:60	1
m-EMene X p-EMene	ND		0.50		ug/L			11/18/17 01:60	1
o-EMene	ND		0.50		ug/L			11/18/17 01:60	1
StMene	ND		0.50		ug/L			11/18/17 01:60	1
Tetrachloroethene	ND		0.50		ug/L			11/18/17 01:60	1
Toluene	ND		0.20		ug/L			11/18/17 01:60	1
trans-1,2-Dichloroethene	ND		0.20		ug/L			11/18/17 01:60	1
trans-1,6-Dichloropropene	ND		0.20		ug/L			11/18/17 01:60	1
trans-1,4-Dichloro-2-butene	ND		2.0		ug/L			11/18/17 01:60	1
Trichloroethene	ND		0.20		ug/L			11/18/17 01:60	1
Trichloroyuoromethane	ND		0.50		ug/L			11/18/17 01:60	1
&inMl acetate	ND		1.0		ug/L			11/18/17 01:60	1
&inMl chloride	ND		0.020		ug/L			11/18/17 01:60	1

Method: 8260C - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 580-261611/5
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
EMenes, Total	ND		0.50		ug/L			11/18/17 01:60	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*107*		*47 - 160*		*1151/ 518 01:B0*	*1*
4-f rob ozluoro9en3ene (Surr)	*m1*		*/ 1 - 120*		*1151/ 518 01:B0*	*1*
Di9rob ozluorob ethane (Surr)	*m6*		*42 - 1B2*		*1151/ 518 01:B0*	*1*
Toluene-d/ (Surr)	*108*		*86 - 126*		*1151/ 518 01:B0*	*1*
Trizluorotoluene (Surr)	*10B*		*84 - 11/*		*1151/ 518 01:B0*	*1*

Lab Sample ID: LCS 580-261611/6
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
1,1,1,2-Tetrachloroethane	5.00	4.06		ug/L		81	*8 - 169
1,1,1-Trichloroethane	5.00	6.85		ug/L		77	5* - 150
1,1,2,2-Tetrachloroethane	5.00	5.02		ug/L		100	*0 - 164
1,1,2-Trichloroethane	5.00	4.85		ug/L		97	*2 - 167
1,1-Dichloroethane	5.00	4.96		ug/L		99	*8 - 165
1,1-Dichloroethene	5.00	4.01		ug/L		80	*4 - 125
1,2,6-Trichloropropane	5.00	4.86		ug/L		97	45 - 150
1,2-Dibromo-6-Chloropropane	5.00	4.40		ug/L		88	64 - 150
1,2-Dibromoethane	5.00	4.72		ug/L		94	5* - 14*
1,2-Dichloroben3ene	5.00	4.65		ug/L		87	76 - 120
1,2-Dichloroethane	5.00	4.72		ug/L		94	*6 - 150
1,2-Dichloropropane	5.00	4.88		ug/L		98	72 - 120
1,4-Dichloroben3ene	5.00	4.21		ug/L		84	77 - 120
2-z utanone	25.0	24.6		ug/L		97	60 - 150
2-Hexanone	25.0	28.4		ug/L		116	25 - 150
4-B ethM-2-pentanone	25.0	28.*		ug/L		114	6* - 150
Acetone	25.0	26.8		ug/L		95	20 - 168
AcrMonitrile	50.0	57.1		ug/L		114	55 - 164
z en3ene	5.00	4.48		ug/L		90	76 - 120
z romochloromethane	5.00	4.14		ug/L		86	71 - 161
z romodichloromethane	5.00	4.40		ug/L		88	*2 - 150
z romoyorm	5.00	6.84		ug/L		77	51 - 167
z romomethane	5.00	4.18		ug/L		84	*1 - 165
Carbon disulyide	5.00	4.25		ug/L		85	*5 - 128
Carbon tetrachloride	5.00	6.*1		ug/L		72	54 - 150
Chloroben3ene	5.00	4.27		ug/L		85	74 - 114
Chloroethane	5.00	4.08		ug/L		82	58 - 160
Chloroyorm	5.00	4.60		ug/L		8*	71 - 160
Chloromethane	5.00	4.94		ug/L		99	40 - 150
cis-1,2-Dichloroethene	5.00	4.66		ug/L		87	76 - 160
cis-1,6-Dichloropropene	5.00	4.49		ug/L		90	54 - 150
Dibromochloromethane	5.00	4.1*		ug/L		86	4* - 150
Dibromomethane	5.00	6.95		ug/L		79	*5 - 167
f thMben3ene	5.00	4.51		ug/L		90	74 - 125

Method: 8260C - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCS 580-261611/6
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
Iodomethane	5.00	6.97		ug/L		79	47 - 145
B ethMene Chloride	5.00	5.18		ug/L		104	58 - 164
m-EMene X p-EMene	5.00	4.41		ug/L		88	76 - 160
o-EMene	5.00	4.5*		ug/L		91	80 - 169
StMene	5.00	4.18		ug/L		84	*8 - 16*
Tetrachloroethene	5.00	6.55		ug/L		71	*7 - 126
Toluene	5.00	4.48		ug/L		90	70 - 12*
trans-1,2-Dichloroethene	5.00	4.06		ug/L		81	*9 - 124
trans-1,6-Dichloropropene	5.00	4.40		ug/L		88	40 - 150
trans-1,4-Dichloro-2-butene	5.00	2.86		ug/L		57	20 - 150
Trichloroethene	5.00	4.2*		ug/L		85	72 - 126
Trichloroyuoromethane	5.00	6.9*		ug/L		79	*0 - 150
&inMl acetate	12.5	7.64		ug/L		59	60 - 150
&inMl chloride	5.00	4.5*		ug/L		91	59 - 140
EMenes, Total	10.0	8.97		ug/L		90	80 - 167

Surrogate	*LCS %Recovery*	*LCS Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*106*		*47 - 160*
4-f rob oduoro9en3ene (Surr)	*m0*		*/ 1 - 120*
Di9rob oduorob ethane (Surr)	*m7*		*42 - 1B2*
Toluene-d/ (Surr)	*104*		*86 - 126*
Triduorotoluene (Surr)	*101*		*84 - 11/*

Lab Sample ID: LCSD 580-261611/7
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
1,1,1,2-Tetrachloroethane	5.81	4.19		ug/L		72	*8 - 169	4	20
1,1,1-Trichloroethane	5.81	4.01		ug/L		*9	5* - 150	4	29
1,1,2,2-Tetrachloroethane	5.81	5.67		ug/L		92	*0 - 164	7	25
1,1,2-Trichloroethane	5.81	4.90		ug/L		84	*2 - 167	1	60
1,1-Dichloroethane	5.81	5.08		ug/L		87	*8 - 165	6	27
1,1-Dichloroethene	5.81	4.22		ug/L		76	*4 - 125	5	28
1,2,6-Trichloropropane	5.81	5.04		ug/L		87	45 - 150	4	20
1,2-Dibromo-6-Chloropropane	5.81	4.4*		ug/L		77	64 - 150	1	20
1,2-Dibromoethane	5.81	4.76		ug/L		81	5* - 14*	0	20
1,2-Dichloroben3ene	5.81	4.57		ug/L		79	76 - 120	5	14
1,2-Dichloroethane	5.81	4.86		ug/L		86	*6 - 150	2	29
1,2-Dichloropropane	5.81	4.99		ug/L		8*	72 - 120	2	20
1,4-Dichloroben3ene	5.81	4.4*		ug/L		77	77 - 120	*	11
2-z utanone	29.1	26.9		ug/L		82	60 - 150	2	65
2-Hexanone	29.1	29.2		ug/L		100	25 - 150	6	28
4-B ethM-2-pentanone	29.1	29.*		ug/L		102	6* - 150	6	64
Acetone	29.1	24.7		ug/L		85	20 - 168	4	65
AcrMonitrile	58.1	58.6		ug/L		100	55 - 164	2	65
z en3ene	5.81	4.*8		ug/L		81	76 - 120	4	20
z romochloromethane	5.81	4.25		ug/L		76	71 - 161	6	20

Method: 8260C - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: LCSD 580-261611/7
Matrix: Water
Analysis Batch: 261611

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
zromodichloromethane	5.81	4.42		ug/L		7*	*2 - 150	0	20
zromoyorm	5.81	4.02		ug/L		*9	51 - 167	5	20
zromomethane	5.81	4.60		ug/L		74	*1 - 165	6	61
Carbon disulyide	5.81	4.50		ug/L		77	*5 - 128	*	62
Carbon tetrachloride	5.81	6.82		ug/L		**	54 - 150	*	60
Chloroben3ene	5.81	4.42		ug/L		7*	74 - 114	6	12
Chloroethane	5.81	4.48		ug/L		77	58 - 160	9	65
Chloroyorm	5.81	4.49		ug/L		77	71 - 160	4	20
Chloromethane	5.81	5.02		ug/L		8*	40 - 150	2	61
cis-1,2-Dichloroethene	5.81	4.55		ug/L		78	76 - 160	5	20
cis-1,6-Dichloropropene	5.81	4.**		ug/L		80	54 - 150	4	28
Dibromochloromethane	5.81	4.65		ug/L		75	4* - 150	4	20
Dibromomethane	5.81	6.8*		ug/L		**	*5 - 167	2	20
f thMben3ene	5.81	4.72		ug/L		81	74 - 125	5	20
Iodomethane	5.81	4.00		ug/L		*9	47 - 145	1	65
B ethMene Chloride	5.81	5.0*		ug/L		87	58 - 164	2	29
m-EMene X p-EMene	5.81	4.*2		ug/L		79	76 - 160	5	20
o-EMene	5.81	4.80		ug/L		86	80 - 169	5	20
StMene	5.81	4.41		ug/L		7*	*8 - 16*	5	20
Tetrachloroethene	5.81	6.72	V	ug/L		*4	*7 - 126	5	20
Toluene	5.81	4.70		ug/L		81	70 - 12*	5	20
trans-1,2-Dichloroethene	5.81	4.60		ug/L		74	*9 - 124	7	27
trans-1,6-Dichloropropene	5.81	4.49		ug/L		77	40 - 150	2	60
trans-1,4-Dichloro-2-butene	5.81	6.24		ug/L		5*	20 - 150	14	20
Trichloroethene	5.81	4.1*		ug/L		72	72 - 126	2	20
Trichloroyluoromethane	5.81	4.18		ug/L		72	*0 - 150	5	61
&inMl acetate	14.5	9.15		ug/L		*6	60 - 150	22	65
&inMl chloride	5.81	4.86		ug/L		86	59 - 140	*	60
EMenes, Total	11.*	9.42		ug/L		81	80 - 167	5	20

Surrogate	*LCSD %Recovery*	*LCSD Qualifier*	*Limits*
1,2-Dichloroethane-d4 (Surr)	*106*		*47 - 160*
4-f rob ozuoro9en3ene (Surr)	*m1*		*/ 1 - 120*
Di9rob ozuorob ethane (Surr)	*m7*		*42 - 1B2*
Toluene-d/ (Surr)	*106*		*86 - 126*
Trizuorotoluene (Surr)	*101*		*84 - 11/*

Lab Sample ID: MB 580-262003/7
Matrix: Water
Analysis Batch: 262003

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
2-Hexanone	ND		2.0		ug/L			11/22/17 20:46	1

Surrogate	*MB %Recovery*	*MB Qualifier*	*Limits*	*Prepared*	*Analyzed*	*Dil Fac*
1,2-Dichloroethane-d4 (Surr)	*m7*		*47 - 160*		*115225/18 20:4B*	*1*
4-f rob ozuoro9en3ene (Surr)	*100*		*/ 1 - 120*		*115225/18 20:4B*	*1*

Method: 8260C - Volatile Organic Compounds (GC/MS) (Continued)

Lab Sample ID: MB 580-262003/7
Matrix: Water
Analysis Batch: 262003

Client Sample ID: Method Blank
Prep Type: Total/NA

Surrogate	MB %Recovery	MB Qualifier	Limits	Prepared	Analyzed	Dil Fac
Di9rob ozuorob ethane (Surr)	m6		42 - 1B2		115225/18 20:4B	1
Toluene-d/ (Surr)	10B		86 - 126		115225/18 20:4B	1
Triuorotoluene (Surr)	10B		84 - 11/		115225/18 20:4B	1

Lab Sample ID: LCS 580-262003/4
Matrix: Water
Analysis Batch: 262003

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte			Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits		
2-Hexanone			25.0	27.7		ug/L		111	25 - 150		

Surrogate	LCS %Recovery	LCS Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	mm		47 - 160
4-f rob ozuoro9en3ene (Surr)	mm		/ 1 - 120
Di9rob ozuorob ethane (Surr)	m/		42 - 1B2
Toluene-d/ (Surr)	101		86 - 126
Triuorotoluene (Surr)	101		84 - 11/

Lab Sample ID: LCSD 580-262003/5
Matrix: Water
Analysis Batch: 262003

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte			Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
2-Hexanone			25.0	2*.8		ug/L		107	25 - 150	6	28

Surrogate	LCSD %Recovery	LCSD Qualifier	Limits
1,2-Dichloroethane-d4 (Surr)	m8		47 - 160
4-f rob ozuoro9en3ene (Surr)	m/		/ 1 - 120
Di9rob ozuorob ethane (Surr)	m8		42 - 1B2
Toluene-d/ (Surr)	101		86 - 126
Triuorotoluene (Surr)	102		84 - 11/

Method: RSK-175 - Dissolved Gases (GC)

Lab Sample ID: MB 680-503465/10
Matrix: Water
Analysis Batch: 503465

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
f thane	ND		10		ug/L			11/21/17 11:16	1
f thMene	ND		10		ug/L			11/21/17 11:16	1
B ethane	ND		1.2		ug/L			11/21/17 11:16	1

Method: RSK-175 - Dissolved Gases (GC) (Continued)

Lab Sample ID: LCS 680-503465/7
Matrix: Water
Analysis Batch: 503465

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
f thane	288	617		ug/L		110	75 - 125
f thMene	2*9	299		ug/L		111	75 - 125
B ethane	154	170		ug/L		111	75 - 125

Lab Sample ID: LCSD 680-503465/8
Matrix: Water
Analysis Batch: 503465

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
f thane	288	629		ug/L		114	75 - 125	4	60
f thMene	2*9	608		ug/L		115	75 - 125	6	60
B ethane	154	177		ug/L		115	75 - 125	4	60

Lab Sample ID: MB 680-503807/10
Matrix: Water
Analysis Batch: 503807

Client Sample ID: Method Blank
Prep Type: Total/NA

Analyte	MB Result	MB Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
f thane	ND		10		ug/L			11/24/17 10:55	1
f thMene	ND		10		ug/L			11/24/17 10:55	1
B ethane	ND		1.2		ug/L			11/24/17 10:55	1

Lab Sample ID: LCS 680-503807/7
Matrix: Water
Analysis Batch: 503807

Client Sample ID: Lab Control Sample
Prep Type: Total/NA

Analyte	Spike Added	LCS Result	LCS Qualifier	Unit	D	%Rec	%Rec. Limits
f thane	288	610		ug/L		108	75 - 125
f thMene	2*9	296		ug/L		109	75 - 125
B ethane	154	1*7		ug/L		109	75 - 125

Lab Sample ID: LCSD 680-503807/8
Matrix: Water
Analysis Batch: 503807

Client Sample ID: Lab Control Sample Dup
Prep Type: Total/NA

Analyte	Spike Added	LCSD Result	LCSD Qualifier	Unit	D	%Rec	%Rec. Limits	RPD	RPD Limit
f thane	288	627		ug/L		114	75 - 125	5	60
f thMene	2*9	605		ug/L		116	75 - 125	4	60
B ethane	154	177		ug/L		115	75 - 125	*	60

Lab Chronicle

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Client Sample ID: PP-3
Date Collected: 11/09/17 11:55
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-1
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	261611	11/18/17 06:21	W1T	TAL SEA

Client Sample ID: 111317-DUP
Date Collected: 11/13/17 10:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-2
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	261611	11/18/17 06:47	W1T	TAL SEA
Total/NA	Analysis	8260C	RA	1	262003	11/22/17 22:55	TL1	TAL SEA

Client Sample ID: 111517-DUP
Date Collected: 11/15/17 09:20
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-3
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	261611	11/18/17 07:13	W1T	TAL SEA
Total/NA	Analysis	RSK-175		1	503807	11/24/17 11:21	KAB	TAL SAV

Client Sample ID: Trip Blank
Date Collected: 11/09/17 00:01
Date Received: 11/16/17 09:40

Lab Sample ID: 580-72948-4
Matrix: Water

Prep Type	Batch Type	Batch Method	Run	Dilution Factor	Batch Number	Prepared or Analyzed	Analyst	Lab
Total/NA	Analysis	8260C		1	261611	11/18/17 02:49	W1T	TAL SEA
Total/NA	Analysis	RSK-175		1	503465	11/21/17 11:44	KAB	TAL SAV

Laboratory References:

TAL SAV = TestAmerica Savannah, 5102 LaRoche Avenue, Savannah, GA 31404, TEL (912)354-7858

TAL SEA = TestAmerica Seattle, 5755 8th Street East, Tacoma, WA 98424, TEL (253)922-2310

Accreditation/Certification Summary

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Laboratory: TestAmerica Seattle

Unless otherwise noted, all analytes for this laboratory were covered under each accreditation/certification below.

Authority	Program	EPA Region	Identification Number	Expiration Date
Oregon	NELAP	10	WA100007	11-05-18

The following analytes are included in this report, but are not accredited/certified under this accreditation/certification:

Analysis Method	Prep Method	Matrix	Analyte
8260C		Water	Xylenes, Total

Washington	State Program	10	C553	02-17-18

The following analytes are included in this report, but accreditation/certification is not offered by the governing authority:

Analysis Method	Prep Method	Matrix	Analyte
8260C		Water	Xylenes, Total

Laboratory: TestAmerica Savannah

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
	AFCEE		SAVLAB	
Alabama	State Program	4	41450	06-30-18
Alaska	State Program	10		06-30-18
Alaska (UST)	State Program	10	UST-104	11-05-17 *
Arizona	State Program	9	AZ808	12-14-17 *
Arkansas DEQ	State Program	6	88-0692	02-01-18
California	State Program	9	2939	06-30-18
Colorado	State Program	8	N/A	12-31-17
Connecticut	State Program	1	PH-0161	03-31-19
Florida	NELAP	4	E87052	06-30-18
GA Dept. of Agriculture	State Program	4	N/A	06-12-18
Georgia	State Program	4	803	06-30-18
Guam	State Program	9	15-005r	04-16-18
Hawaii	State Program	9	N/A	06-30-18
Illinois	NELAP	5	200022	11-30-17 *
Indiana	State Program	5	N/A	06-30-18
Iowa	State Program	7	353	06-30-19
Kentucky (DW)	State Program	4	90084	12-31-17
Kentucky (UST)	State Program	4	18	06-30-18
Kentucky (WW)	State Program	4	90084	12-31-17
L-A-B	DoD ELAP		L2463	09-22-19
L-A-B	ISO/IEC 17025		L2463.01	09-22-19
Louisiana	NELAP	6	30690	06-30-18
Louisiana (DW)	NELAP	6	LA160019	12-31-18
Maine	State Program	1	GA00006	09-24-18
Maryland	State Program	3	250	12-31-17
Massachusetts	State Program	1	M-GA006	06-30-18
Michigan	State Program	5	9925	06-30-18
Mississippi	State Program	4	N/A	06-30-18
Nebraska	State Program	7	TestAmerica-Savannah	06-30-18
New Jersey	NELAP	2	GA769	06-30-18
New Mexico	State Program	6	N/A	06-30-18
New York	NELAP	2	10842	03-31-18
North Carolina (DW)	State Program	4	13701	07-31-18
North Carolina (WW/SW)	State Program	4	269	12-31-17
Oklahoma	State Program	6	9984	08-31-18

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Laboratory: TestAmerica Savannah (Continued)

All accreditations/certifications held by this laboratory are listed. Not all accreditations/certifications are applicable to this report.

Authority	Program	EPA Region	Identification Number	Expiration Date
Pennsylvania	NELAP	3	68-00474	06-30-18
Puerto Rico	State Program	2	GA00006	12-31-17
South Carolina	State Program	4	98001	06-30-18
Tennessee	State Program	4	TN02961	06-30-18
Texas	NELAP	6	T104704185-16-9	11-30-18
Texas	State Program	6	T104704185	06-30-18
US Fish & Wildlife	Federal		LE058448-0	07-31-18
USDA	Federal		SAV 3-04	06-14-20 *
Virginia	NELAP	3	460161	06-14-18
Washington	State Program	10	C805	06-10-18
West Virginia (DW)	State Program	3	9950C	12-31-17
West Virginia DEP	State Program	3	094	06-30-18
Wisconsin	State Program	5	999819810	08-31-18
Wyoming	State Program	8	8TMS-L	06-30-16 *

* Accreditation/Certification renewal pending - accreditation/certification considered valid.

Sample Summary

Client: Parametrix, Inc.
Project/Site: Horn Rapids Investigation

TestAmerica Job ID: 580-72948-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
580-72948-1	PP-3	Water	11/09/17 11:55	11/16/17 09:40
580-72948-2	111317-DUP	Water	11/13/17 10:20	11/16/17 09:40
580-72948-3	111517-DUP	Water	11/15/17 09:20	11/16/17 09:40
580-72948-4	Trip Blank	Water	11/09/17 00:01	11/16/17 09:40

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Loc: 580
72948

TestAmerica Seattle
5755 8th Street E.
Tacoma, WA 98424
Tel. 253-922-2310
Fax 253-922-5047
www.testamericainc.com

☐ Rush
☐ Short Hold

Chain of Custody Record

Client	Client Contact	Date	Chain of Custody Number
PARAMETRIX	LISA GILBERT	11/15/17	31449
Address: 719 2nd AVE, SUITE 206	Telephone Number (Area Code)/Fax Number: 206 394 3667	Lab Number	Page ___ of ___
City: SEATTLE; State: WA; Zip Code: 98104	Sampler: A. Romey; Lab Contact		
Project Name and Location (State): HORN RAPIDS INVESTIGATION	Billing Contact		
Contract/Purchase Order/Quote No.: 553 3820 007			

Analysis (Attach list if more space is needed)

Special Instructions/ Conditions of Receipt

Sample I.D. and Location/Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	8260C-VOCs	RSK-175
PP-3	11/9/17	1155		X						4			X	
111317-DUP	11/13/17	1020		X						11			X	
111517-DUP	11/15/17	0920		X						7			X	X
TRIP BLANK	–	–		X						2			X	

580-72948 Chain of Custody

Therm. ID FR4 Cor 0.7 Unc 0.9
Cooler Dsc Lrs Blue @Lab
Wet/Packs Packing card.
Cl: No
Custody Seal: Yes ___ No ✗

Cooler: ☐ Yes ☐ No Cooler Temp: ____

Possible Hazard Identification: ☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal: ☐ Return To Client ☑ Disposal By Lab ☐ Archive For ____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required (business days): ☐ 24 Hours ☐ 48 Hours ☐ 5 Days ☐ 10 Days ☐ 15 Days ☐ Other STD

QC Requirements (Specify)

1. Relinquished By Sign/Print	Date	Time	1. Received By Sign/Print	Date	Time
[signature]	11/16/17	9:40	[signature] B. Gall SEA TA	11/16/17	0940
2. Relinquished By Sign/Print	Date	Time	2. Received By Sign/Print	Date	Time
3. Relinquished By Sign/Print	Date	Time	3. Received By Sign/Print	Date	Time

Comments

DISTRIBUTION: WHITE – Stays with the Samples; CANARY – Returned to Client with Report; PINK – Field Copy

TAL-8274-580 (0210)

TestAmerica Seattle
5755 8th Street East
Tacoma, WA 98424
Phone (253) 922-2310 Fax (253) 922-5047

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Client Information (Sub Contract Lab)	Sampler:	Lab PM: Gamble, Cathy L	Carrier Tracking No(s):	COC No: 580-51400.1
Client Contact: Shipping/Receiving	Phone:	E-Mail: cathy.gamble@testamericainc.com	State of Origin: Washington	Page: Page 1 of 1
Company: TestAmerica Laboratories, Inc.		Accreditations Required (See note): NELAP - Oregon; State Program - Washington		Job #: 580-72948-1
Address: 5102 LaRoche Avenue,	Due Date Requested: 11/27/2017			
City: Savannah	TAT Requested (days):			
State, Zip: GA, 31404				
Phone: 912-354-7858(Tel) 912-352-0165(Fax)	PO #:			
Email:	WO #:			
Project Name: Horn Rapids Landfill	Project #: 58002179			
Site: Horn Rapids Landfill	SSOW#:			

Analysis Requested

Preservation Codes:

A - HCL	M - Hexane
B - NaOH	N - None
C - Zn Acetate	O - AsNaO2
D - Nitric Acid	P - Na2O4S
E - NaHSO4	Q - Na2SO3
F - MeOH	R - Na2S2O3
G - Amchlor	S - H2SO4
H - Ascorbic Acid	T - TSP Dodecahydrate
I - Ice	U - Acetone
J - DI Water	V - MCAA
K - EDTA	W - pH 4-5
L - EDA	Z - other (specify)

Other:

Sample Identification - Client ID (Lab ID)	Sample Date	Sample Time	Sample Type (C=comp, G=grab)	Matrix (W=water, S=solid, O=waste/oil, BT=Tissue, A=Air)	Field Filtered Sample (Yes or No)	Perform MS/MSD (Yes or No)	RSK_175/ (MOD) Methane, Ethane, & Ethene (Hold)	RSK_175/ (MOD) Methane, Ethane, & Ethene	Total Number of containers	Special Instructions/Note:
			Preservation Code:							
111317-DUP (580-72948-2)	11/13/17	10:20 Pacific		Water			X		4	
111517-DUP (580-72948-3)	11/15/17	09:20 Pacific		Water				X	3	
Trip Blank (580-72948-4)	11/9/17	00:01 Pacific		Water				X	1	

Note: Since laboratory accreditations are subject to change, TestAmerica Laboratories, Inc. places the ownership of method, analyte & accreditation compliance upon out subcontract laboratories. This sample shipment is forwarded under chain-of-custody. If the laboratory does not currently maintain accreditation in the State of Origin listed above for analysis/tests/matrix being analyzed, the samples must be shipped back to the TestAmerica laboratory or other instructions will be provided. Any changes to accreditation status should be brought to TestAmerica Laboratories, Inc. attention immediately. If all requested accreditations are current to date, return the signed Chain of Custody attesting to said complicance to TestAmerica Laboratories, Inc.

Possible Hazard Identification	Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
Unconfirmed	☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months
Deliverable Requested: I, II, III, IV, Other (specify) Primary Deliverable Rank: 2	Special Instructions/QC Requirements:

Empty Kit Relinquished by:	Date:	Time:	Method of Shipment:

Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
[signature]	11-17-17 1330	TAS	[signature]	11/18/17 0910	TA SAV
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:
Relinquished by:	Date/Time:	Company:	Received by:	Date/Time:	Company:

Custody Seals Intact: Δ Yes Δ No	Custody Seal No.:	Cooler Temperature(s) °C and Other Remarks: 2.1

Ver: 09/20/2016

11/30/2017

Login Sample Receipt Checklist

Client: Parametrix, Inc.

Job Number: 580-72948-1

Login Number: 72948
List Number: 1
Creator: Gall, Brandon A

List Source: TestAmerica Seattle

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	Lab does not accept radioactive samples.
The cooler's custody seal, if present, is intact.	N/A	Not present
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	True	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	True	Preservation labels on samples match COC
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	N/A	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Login Sample Receipt Checklist

Client: Parametrix, Inc.

Job Number: 580-72948-1

Login Number: 72948
List Number: 2
Creator: Kirkland, Bernard C

List Source: TestAmerica Savannah
List Creation: 11/18/17 02:30 PM

Question	Answer	Comment
Radioactivity wasn't checked or is </= background as measured by a survey meter.	N/A	
The cooler's custody seal, if present, is intact.	True	
Sample custody seals, if present, are intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
Is the Field Sampler's name present on COC?	N/A	
There are no discrepancies between the containers received and the COC.	True	
Samples are received within Holding Time (excluding tests with immediate HTs)	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
Sample Preservation Verified.	N/A	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
Containers requiring zero headspace have no headspace or bubble is <6mm (1/4").	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	
Residual Chlorine Checked.	N/A	

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

719 2ND AVENUE, SUITE 200 | SEATTLE, WA 98104 | P 206.394.3700

MEMORANDUM

DATE: February 15, 2018
TO: Project File
FROM: Lisa Gilbert
SUBJECT: Push Probe Investigation Data Validation
CC:
PROJECT NUMBER: 553-3820-007
PROJECT NAME: Horn Rapids Landfill

Data validation for the Remedial Investigation Phase I Push Probe Investigation at the Horn Rapids Landfill determined that the data required qualification as noted below. The samples were analyzed by Energy Northwest and TestAmerica, Inc. The data were qualified in accordance with the *National Functional Guidelines for Superfund Organic Methods Data Review* (EPA 2016).

The chemical 1,2-dibromoethane was detected by Energy Northwest using the SIM method in the samples from PP-2 (0.0033 ug/L), PP-3 (0.0023 ug/L), and PP-4 (0.0020 ug/L) at concentrations slightly above the GWQS of 0.001 µg/L. However, 1,2-dibromoethane was also detected in the trip blanks associated with these three samples at similar concentrations (0.0033 ug/L, 0.0020 ug/L, and 0.0017 ug/L, respectively), and in the method blank associated with PP-4 at a concentration of 0.0018 µg/L. In accordance with EPA guidance, the results for PP-2, PP-3, and PP-4 were reported as <0.001.

Detected results for tetrachloroethene analyzed by TestAmerica were qualified "J" as estimated due to low recovery in the laboratory control sample duplicate.

The following results were qualified "J" as estimated due to variability between the sample analyzed by Energy Northwest and field duplicate analyzed by TestAmerica: acetone in PP-3; vinyl chloride, tetrachloroethene, and methane in PP-1.

Reference:

EPA 2016. National Functional Guidelines for Superfund Organic Methods Data Review. EPA 540-R-2016-002.

Data Validation — Push Probe Investigation
Horn Rapids 553-3820-007

QA/QC completed by: Lisa Gilbert — 1/15/2018
Sample number: PP-1 through PP-5
Sample Date: November 7 through 16, 2017

Parameter	sample	duplicate	avg	diff	rpd	=/<25%	RL	w/in RL?
	PP-1	PP-1 (111517-DUP)						
	ENW	TA						
VOCs (ug/L)								
Vinyl chloride ENW SIM	**0.3481**	**<0.02**	**0.3481**	**#VALUE!**	**#VALUE!**		**0.02/0.02**	**N**
Vinyl chloride	<0.5	<0.02	#DIV/0!	#VALUE!	#VALUE!		0.5/0.02	Y
Acetone	4.5	5	4.75	-0.5	10.5	Y	4/2	
carbon disulfide	<0.5	0.2	0.2	#VALUE!	#VALUE!		0.5/0.2	Y
1,1-dichloroethane	4.8	5.3	5.05	-0.5	9.9		0.5/0.2	
1,2-dichloropropane	<0.5	0.2	0.2	#VALUE!	#VALUE!		0.5/0.2	Y
cis-1,2-dichloroethene	28	26	27	2	7.4	Y	0.5/0.2	
trichloroethene	4.9	5	4.95	-0.1	2.0	Y	0.5/0.2	
trans-1,2 dichloroethene	0.95	0.86	0.905	0.09	9.9	Y	0.5/0.2	
tetrachloroethene	**4.1**	**6.2**	**5.15**	**-2.1**	**40.8**	**N**	0.5/0.2	**N**
RSK (mg/L)	ENW	TA						
methane	**2.6**	**7.5**	**5.05**	**-4.9**	**97.0**	**N**	1/1.3	**N**
ethane	0.68	<10	0.68	#VALUE!	#VALUE!		0.6/10	Y
ethene	<1	>10	#DIV/0!	#VALUE!	#VALUE!		1/10	Y
	PP-4	PP-4 (111317-DUP)						
	ENW	TA						
VOCs (ug/L)								
1,1-dichloroethane	<0.5	0.35	0.35	#VALUE!	#VALUE!		0.5/0.2	Y
Acetone	39	32	35.5	7	19.7	Y	4/2	
2-butanone	7.8	<15	7.8	#VALUE!	#VALUE!		4/15	Y

Data Validation — Push Probe Investigation
Horn Rapids 553-3820-007

QA/QC completed by: Lisa Gilbert — 1/15/2018

Sample number: PP-1 through PP-5

Sample Date: November 7 through 16, 2017

Parameter	sample	duplicate	avg	diff	rpd	=/<25%	RL	w/in RL?
	PP-3	PP-3						
	ENW	TA						
VOCs (ug/L)								
1,1-dichloroethane	0.74	0.85	0.795	-0.11	13.8	Y	0.5/0.2	
Vinyl chloride	0.0087	<0.02	0.0087	#VALUE!	#VALUE!		0.005/0.02	Y
Acetone	**8.8**	**<2.0**	**8.8**	**#VALUE!**	**#VALUE!**		**4/2**	**N**
benzene	<0.5	0.25	0.25	#VALUE!	#VALUE!		0.5/0.2	Y
carbon disulfide	<0.5	0.53	0.53	#VALUE!	#VALUE!		0.5/0.2	Y
cis-1,2-dichloroethene	0.67	0.7	0.685	-0.03	4.4	Y	0.5/0.2	
chloroform	<0.5	0.41	0.41	#VALUE!	#VALUE!		0.5/0.2	Y
toluene	<0.5	0.22	0.22	#VALUE!	#VALUE!		0.5/0.2	Y
acrylonitrile	0.0438	<5	0.0438	#VALUE!	#VALUE!		0.02/5	Y
RSK (mg/L)	ENW	ENW						
methane	19	23	21	-4	19.0	Y	1/1.3	
ethane	6.1	7.3	6.7	-1.2	17.9	Y	0.6/10	
ethene	4.9	5.7	5.3	-0.8	15.1	Y	1/10	

Comparison of BOLDED samples with their field duplicate indicated a high degree of variability. These data will be qualified "J" as estimated.

Data Validation	Push Probe Investigation Horn Rapids 553-3820-007
QA/QC completed by: Lisa Gilbert	
Sample number:	PP-1 through PP-5
Sample Date:	November 7 through 16, 2017 TestAmerica
Holding Times:	All within limits
Chain vs Data:	All compounds indicated on COC were analyzed
Blanks:	(List any compounds detected) MB Methylene chloride 2.33 Not detected in samples. Trip None
MS/MSD:	All within limits
Lab Control Sample:	All within limits, except as noted below.
Surrogate:	All within limits
Lab Comments:	**Laboratory Narrative:** Temps for cooler 0.7 degrees C (recommended maximum 6.0 degrees C) VOCs %Recovery of LCSD outside control limits HIGH for tetrachloroethane in 261611. Results flagged "*" qualifed because not believed to represent a systemic problem. CCV LOW biased for 2,2-dichloropropane, vinyl acetate and trans-1,4-dichloro-2-butene. All samples ND. CCV HIGH biased for 2-hexanone, 4-methyl-2-pentanone, and acrylonitrile. All samples ND.
Parametrix Comments:	Qualify results for tetrachloroethene "J" as estimated due to LCSD recovery outside criteria.

Data Validation	Push Probe Investigation Horn Rapids 553-3820-007
QA/QC completed by: Lisa Gilbert	
Sample number:	PP-1 through PP-5
Sample Date:	November 7 through 16, 2017 Energy Northwest
Holding Times:	All within limits
Chain vs Data:	All compounds indicated on COC were analyzed
Blanks:	(List any compounds detected) MB 1,2-Dibromoethane 0.0018 ug/L (PP-4) Trip 1,2-Dibromoethane 0.0033 ug/L (PP-2), 0.0020 ug/L (PP-3), 0.0017 ug/L (PP-4)
MS/MSD:	NA
Lab Control Sample:	NA
Surrogate:	NA
Lab Comments:	NA
Parametrix Comments:	Report results for 1,2-dibromoethane as <0.001 ug/L due to detection in Trip blank and method blank

PRECLEANED CERTIFIED

Certificate of Compliance

The enclosed containers have been chemically cleaned by using the specified USEPA cleaning procedures for low level chemical analysis. Representative containers have been tested by independent certified laboratories for their appropriate use. ESS containers meet and exceed the required detection limits established by the USEPA in SPECIFICATIONS AND GUIDANCE FOR CONTAMINANT-FREE SAMPLE CONTAINERS (OSWER Directive #9240.0-05A).

EXTRACTABLE ORGANIC COMPOUNDS (PROCEDURE 1)

Analyte	Quantitation Limit (ug/L)
PESTICIDES/PCB'S	
Alpha-BHC	<0.005
Beta-BHC	<0.005
Delta-BHC	<0.005
Gamma-BHC (Lindane)	<0.005
Heptachlor	<0.005
Aldrin	<0.005
Heptachlor Epoxide	<0.005
Endosulfan I	<0.005
Dieldrin	<0.005
4,4'-DDE	<0.005
Endrin	<0.005
Endosulfan II	<0.005
4,4'-DDD	<0.005
Endosulfan Sulfate	<0.005
4,4'-DDT	<0.005
Methoxychlor	<0.005
Endrin Ketone	<0.005
Endrin Aldehyde	<0.005
Alpha-Chlordane	<0.005
Gamma-Chlordane	<0.005
Toxaphene	<0.005
Aroclor-1016	<0.2
Aroclor-1221	<0.2
Aroclor-1232	<0.2
Aroclor-1242	<0.2
Aroclor-1248	<0.2
Aroclor-1254	<0.2
Aroclor-1260	<0.2
Aroclor-1262	<0.2
Aroclor-1268	<0.2
SEMIVOLATILES	
Phenol	<1
bis-(2-Chloroethyl) ether	<1
bis-(2-Chloroisopropyl) ether	<1
2-Chlorophenol	<1
2-Methylphenol	<1
2,2'-Oxybis-(1-Chloropropane)	<1
4-Methylphenol	<1
N-Nitroso-di-n-propylamine	<1
Hexachloroethane	<1
Nitrobenzene	<1
Isophorone	<1
2-Nitrophenol	<1
2,4-Dimethylphenol	<1
bis-(2-Chloroethoxy) methane	<1
2,4-Dichlorophenol	<1
1,2,4-Trichlorobenzene	<1
Naphthalene	<0.2
4-Chloroaniline	<1
Hexachlorobutadiene	<1
4-Chloro-3-Methylphenol	<1
2-Methylnaphthalene	<0.2
Hexachlorocyclopentadiene	<1
2,4,6-Tricholrophenol	<1
2,4,5-Tricholrophenol	<1
1,2-Diphenylhydrazene	<1
Carbazole	<1
2-Chloronaphthalene	<0.15
2-Nitroaniline	<1
Dimethylphthalate	<1
Acenaphthylene	<0.2
2,6-Dinitrotoluene	<1
3-Nitroaniline	<1
Acenaphthene	<0.2
2,4-Dinitrophenol	<5
4-Nitrophenol	<5
Dibenzofuran	<1
2,4-Dinitrotoluene	<1
Diethylphthalate	<1
4-Chlorophenyl-Phenylether	<1
Flourene	<0.15
4-Nitroaniline	<1.5
4,6-Dinitro-2-Methyphenol	<1
N-Nitrosodiphenylamine	<1
N-Nitrosodimethylamine	<1
4-Bromophenyl-Phenylether	<1
Hexachlorobenzene	<1
Pentachlorophenol	<1
Phenanthrene	<0.2
Anthracene	<0.1
Di-n-Butylphthalate	<0.2
Fluoroanthene	<0.1
Pyrene	<0.15
Butylbenzylphthalate	<1
1,2'-Dichlorobenzene	<1
1,3'-Dichlorobenzene	<1
1,4'-Dichlorobenzene	<1
3,3'-Dichlorobenzidine	<1
Benzo[a]anthracene	<0.15
Chyrsene	<0.1
bis-(2-Ethylhexyl) Phthalate	<1
Di-n-Octylphthalate	<1
Benzo[b]flouranthene	<0.2
Benzo[k]flouranthene	<0.15
Benzo[a]pyrene	<0.15
Indeno(1,2,3-cd)pyrene	<0.2
Dibenzo[a,h]anthracene	<0.15
Benzo[g,h,i]perylene	<0.15
Benzoic Acid	<5
Benzyl Alcohol	<1
TPH Diesel	**<50.00**

PURGEABLE VOLATILE ORGANIC COMPOUNDS (PROCEDURE 2)

Analyte	Quantitation Limit (ug/L)
Acetone	<2.0
Benzene	<0.1
Bromoform	<0.1
Bromobenzene	<0.1
Bromochloromethane	<0.1
Bromodichloromethane	<0.1
Bromomethane	<0.1
z-Butylbenzene	<0.1
n-Butylbenzene	<0.1
sec-Butylbenzene	<0.1
tert-Butylbenzene	<0.1
Carbon Tetrachloride	<0.1
Carbon Disulfide	<0.1
Chlorobenzene	<0.1
Chloroethane	<0.1
Chloromethane	<0.1
2-Chlorotoluene	<0.1
4-Chlorotoluene	<0.1
2,4-Chlorotoluene	<0.2
Chloroform	<0.1
Dibromomethane	<0.1
1,2-Dibro 3-Chloropropane	<0.1
Dibromochloromethane	<0.1
1,2-Dibromoethane (EDB)	<0.1
1,2-Dichlorobenzene	<0.1
1,3-Dichlorobenzene	<0.1
1,4-Dichlorobenzene	<0.1
Dichlorodifluoromethane	<0.1
1,1-Dichloroethane	<0.1
1,2-Dichloroethane	<0.1
1,1-Dichloroethene	<0.1
cis-1,2-Dichloroethene	<0.1
trans-1,2-Dichloroethene	<0.1
1,2-Dichloropropane	<0.1
1,3-Dichloropropane	<0.1
2,2-Dichloropropane	<0.1
1,1-Dichloropropene	<0.1
cis-1,3-Dichloropropene	<0.1
trans-1,3-Dichloropropene	<0.1
Ethylbenzene	<0.1
2-Hexanone	<0.5
Hexachlorobutadiene	<0.1
Isopropylbenzene	<0.1
4-Isopropyltoluene	<0.1
Methylene Chloride	<0.5
Napthalene	<0.5
Propylbenzene	<0.1
Styrene	<0.1
1,1,1,2-Tetrachloroethane	<0.1
1,1,2,2-Tetrachloroethane	<0.1
Tetrachloroethene	<0.1
Toluene	<0.1
1,2,3-Trichlorobenzene	<0.1
1,2,4-Trichlorobenzene	<0.1
1,1,1-Trichloroethane	<0.1
1,1,2-Trichloroethane	<0.1
Trichloroethene	<0.1
Trichlorofluoromethane	<0.1
Trichlorotrifluoroethane	<0.1
1,2,3-Trichloropropane	<0.1
1,2,3-Trimethylbenzene	<0.1
1,2,4-Trimethylbenzene	<0.1
1,3,5-Trimethylbenzene	<0.1
Vinyl Acetate	<0.5
Vinyl Chloride	<0.1
Methyl-Tert-Butyl-Ether	<0.1
4-Methyl-2-pentanone	<0.5
ethyl-tert-butylether	<0.1
tert-amylmethylether	<0.1
diisopropylether	<0.1
tert-butanol	<0.1
o-xylene	<0.1
m-xylene(1)	<0.2
p-xylene(1)	<0.2
TPH as Gasoline	**<50.00**

METALS, FLOURIDE, NITRATE & NITRITE COMPOUNDS (PROCEDURE 3)

Analyte	Detection Limit (ug/L)
Aluminum	<0.5
Antimony	<0.03
Arsenic	<0.01
Barium	<0.03
Beryllium	<0.01
Cadmium	<0.03
Chromium	<0.06
Copper	<0.08
Iron	<3
Lead	<0.05
Magnesium	<4
Manganese	<0.1
Mercury	<0.2
Molybdenum	<0.5
Nickel	<0.05
Potassium	<50
Selenium	<0.5
Silver	<0.02
Sodium	<6
Thallium	<0.09
Zinc	<0.3
Flouride	<1
Nitrate + Nitrite	<1

This certificate only applies to the enclosed containers and not to any added preservative (except HCL vials). ESS uses only Analytical Grade chemicals. All ESS PrePreserved® containers include a case label with the reagent manufacturer and their lot number. Chemical C of A's can be found online using their lot number. For additional assistance or questions, call 800 233-8424 or email at: essorders@essvial.com.

ON-TIME PRODUCTS FOR ENVIRONMENTAL SAMPLING & ANALYSIS

ENVIRONMENTAL SAMPLING SUPPLY

For more information on our cleaning & monitoring procedures, please call

1-800-233-8425

www.essvial.com

041117

Appendix D

Data Summary Tables

Table D-1. Push Probe Monitoring Results, Volatile Organic Compounds, Horn Rapids Landfill

				Push Probe Samples								Trip Blanks					
Analyte	Units	GWQS	MCL	PP-1 Energy Northwest 11/15/2017	PP-1 Test America 11/15/2017	PP-2 Energy Northwest 11/7/2017	PP-3 Energy Northwest 11/9/2017	PP-3 Test America 11/9/2017	PP-4 Energy Northwest 11/13/2017	PP-4 Test America 11/13/2017	PP-5 Energy Northwest 11/16/2017	PP-1 TB Energy Northwest 11/15/2017	PP-2 TB Energy Northwest 11/7/2017	PP-3 TB Energy Northwest 11/9/2017	PP-4 TB Energy Northwest 11/13/2017	PP-5 TB Energy Northwest 11/16/2017	Test America 11/9/2017
1,1,1,2-Tetrachloroethane	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,1,1-Trichloroethane	µg/L	200 *	200 *	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,1,2,2-Tetrachloroethane	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,1,2-Trichloroethane	µg/L		5 *	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,1-Dichloroethane	µg/L	1 ***		**4.8**	**5.3**	**1.1**	0.74	0.85	<0.5	0.35	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,1-Dichloroethene	µg/L		7 *	<0.5	<0.10	<0.5	<0.5	<0.10	<0.5	<0.10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.10
1,1-Dichloropropene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,2,3-Trichlorobenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,2,3-Trichloropropane	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,2,4-Trichlorobenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,2,4-Trimethylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,2-Dibromo-3-Chloropropane	µg/L		0.2 *	<0.5	<2.0	<0.5	<0.5	<2.0	<0.5	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2.0
1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.5	<0.10	<0.5	<0.5	<0.10	<0.5	<0.10	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.10
1,2-Dichlorobenzene	µg/L		600 *	<0.5	<0.30	<0.5	<0.5	<0.30	<0.5	<0.30	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.30
1,2-Dichloroethane	µg/L	0.5 ***	5 *	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,2-Dichloropropane	µg/L	0.6 ***	5 *	<0.5	0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
1,3,5-Trimethylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,3-Dichlorobenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,3-Dichloropropane	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
1,4-Dichlorobenzene	µg/L	4 ***	75 *	<0.5	<0.30	<0.5	<0.5	<0.30	<0.5	<0.30	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.30
2,2-Dichloropropane	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
2-Butanone (MEK)	µg/L			<4	<15	6.9	<4	<15	7.8	<15	<4	<4	<4	<4	<4	<4	<15
2-Chlorotoluene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
2-Hexanone	µg/L			<4	<2.0	<4	<4	<2.0	<4	<2.0	<4	<4	<4	<4	<4	<4	<2.0
4-Chlorotoluene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
4-Methyl-2-pentanone (MIBK)	µg/L			<4	<5.0	<4	<4	<5.0	<4	<5.0	<4	<4	<4	<4	<4	<4	<5.0
Acetone	µg/L			4.5	5.0	46	8.8 J	<2.0 J	39	32	11	<4	<4	<4	<4	<4	<2.0
Acetonitrile	µg/L			<20	NA	<20	<20	NA	<20	NA	<20	<20	<20	<20	<20	<20	NA
Acrolein	µg/L			<10	NA	<10	<10	NA	<10	NA	<10	<10	<10	<10	<10	<10	NA
Acrylonitrile	µg/L	0.07 ***		<0.5	<5.0	<0.5	<0.5	<5.0	<0.5	<5.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<5.0
Allyl chloride	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Benzene	µg/L	1 ***	5 *	<0.5	<0.20	0.53	<0.5	0.25	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Bromobenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Bromochloromethane	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.3	<0.5	<0.5	<0.5	<0.5	<0.3	<0.20
Bromodichloromethane	µg/L	0.3 ***	80 * THM	<0.3	<0.20	<0.3	<0.3	<0.20	<0.3	<0.20	<0.5	<0.3	<0.3	<0.3	<0.3	<0.5	<0.20

Table D-1. Push Probe Monitoring Results, Volatile Organic Compounds, Horn Rapids Landfill

				Push Probe Samples								Trip Blanks					
Analyte	Units	GWQS	MCL	PP-1 Energy Northwest 11/15/2017	PP-1 Test America 11/15/2017	PP-2 Energy Northwest 11/7/2017	PP-3 Energy Northwest 11/9/2017	PP-3 Test America 11/9/2017	PP-4 Energy Northwest 11/13/2017	PP-4 Test America 11/13/2017	PP-5 Energy Northwest 11/16/2017	PP-1 TB Energy Northwest 11/15/2017	PP-2 TB Energy Northwest 11/7/2017	PP-3 TB Energy Northwest 11/9/2017	PP-4 TB Energy Northwest 11/13/2017	PP-5 TB Energy Northwest 11/16/2017	Test America 11/9/2017
Bromoform	µg/L	5 ***	80 * THM	<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Bromomethane	µg/L			<0.5	<1.0	<0.5	<0.5	<1.0	<0.5	<1.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<1.0
Carbon Disulfide	µg/L			<0.5	0.20	<0.5	<0.5	0.53	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Carbon Tetrachloride	µg/L	0.3 ***	5 *	<0.3	<0.20	<0.3	<0.3	<0.20	<0.3	<0.20	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.20
Chlorobenzene	µg/L		100 *	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Chloroethane	µg/L			<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Chloroform	µg/L	7 ***	80 * THM	<0.5	<0.20	<0.5	<0.5	0.41	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Chloromethane	µg/L			<0.5	<0.30	<0.5	<0.5	<0.30	<0.5	<0.30	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.30
Chloroprene	µg/L			<1	NA	<1	<1	NA	<1	NA	<1	<1	<1	<1	<1	<1	NA
cis-1,2-Dichloroethene	µg/L		70 *	28	26	<0.5	0.67	0.7	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
cis-1,3-Dichloropropene	µg/L			<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Dibromochloromethane	µg/L		80 * THM	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Dibromomethane	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Dichlorodifluoromethane	µg/L			<0.5	NA	0.88	0.68	NA	0.53	NA	1.0	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Ethyl methacrylate	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Ethylbenzene	µg/L		700 *	<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Hexachlorobutadiene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Iodomethane	µg/L			<4	<0.50	<4	<4	<0.50	<4	<0.50	<4	<4	<4	<4	<4	<4	<0.50
Isobutyl alcohol	µg/L			<20	NA	<20	<20	NA	<20	NA	<20	<20	<20	<20	<20	<20	NA
Isopropylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
m,p-Xylene	µg/L			<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Methacrylonitrile	µg/L			<2	NA	<2	<2	NA	<2	NA	<2	<2	<2	<2	<2	<2	NA
Methyl methacrylate	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Methylene Chloride	µg/L	5 ***	5 *	<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Methyl-t-butyl ether	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Naphthalene	µg/L			<0.5	NA	0.70	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
n-Butylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
n-Propylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
o-Xylene	µg/L			<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
p-isopropyltoluene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Propionitrile	µg/L			<2	NA	<2	<2	NA	<2	NA	<2	<2	<2	<2	<2	<2	NA
sec-Butylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Styrene	µg/L		100 *	<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
tert-Butylbenzene	µg/L			<0.5	NA	<0.5	<0.5	NA	<0.5	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	NA
Tetrachloroethene	µg/L	0.8 ***	5 *	**4.1 J**	**6.2 J**	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50

Table D-1. Push Probe Monitoring Results, Volatile Organic Compounds, Horn Rapids Landfill

				Push Probe Samples								Trip Blanks					
Analyte	**Units**	**GWQS**	**MCL**	**PP-1 Energy Northwest 11/15/2017**	**PP-1 Test America 11/15/2017**	**PP-2 Energy Northwest 11/7/2017**	**PP-3 Energy Northwest 11/9/2017**	**PP-3 Test America 11/9/2017**	**PP-4 Energy Northwest 11/13/2017**	**PP-4 Test America 11/13/2017**	**PP-5 Energy Northwest 11/16/2017**	**PP-1 TB Energy Northwest 11/15/2017**	**PP-2 TB Energy Northwest 11/7/2017**	**PP-3 TB Energy Northwest 11/9/2017**	**PP-4 TB Energy Northwest 11/13/2017**	**PP-5 TB Energy Northwest 11/16/2017**	**Test America 11/9/2017**
Toluene	µg/L		1000 *	<0.5	<0.20	<0.5	<0.5	0.22	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
trans-1,2-Dichloroethene	µg/L		100 *	0.95	0.86	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
trans-1,3-Dichloropropene	µg/L			<0.5	<0.20	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
trans-1,4-Dichloro-2-butene	µg/L			<0.5	<2.0	<0.5	<0.5	<2.0	<0.5	<2.0	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<2.0
Trichloroethene	µg/L	3 ***	5 *	**4.9**	**5.0**	<0.5	<0.5	<0.20	<0.5	<0.20	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.20
Trichlorofluoromethane	µg/L			<0.5	<0.50	<0.5	<0.5	<0.50	<0.5	<0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.50
Vinyl Acetate	µg/L			<2	<1.0	<2	<2	<1.0	<2	<1.0	<2	<2	<2	<2	<2	<2	<1.0
Vinyl Chloride	µg/L	0.02 ***	2 *	<0.5	<0.020	<0.5	<0.5	<0.020	<0.5	<0.020	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.020
1,2-Dibromo-3-chloropropane	µg/L			<0.05	NA	<0.05	<0.05	NA	<0.05	NA	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	NA
1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.001	NA	<0.001	<0.001	NA	<0.001	NA	<0.001	<0.001	**0.0033**	**0.0020**	**0.0017**	<0.001	NA
Acrylonitrile	µg/L	0.07 ***		<0.02	NA	0.0207	0.0438	NA	<0.02	NA	**0.0705**	<0.02	<0.02	<0.02	<0.02	<0.02	NA
Vinyl chloride	µg/L	0.02 ***	2 *	**0.3481 J**	NA	0.0052	0.0087	NA	<0.005	NA	<0.02	<0.02	<0.005	<0.005	<0.005	<0.02	NA
Total Xylenes	µg/L		10000 * XYL	NA	<0.50	NA	NA	<0.50	NA	<0.50	NA	NA	NA	NA	NA	NA	<0.50

Notes:
GWQS = Water Quality Standards for Ground Waters of the State of Washington (WAC 173-200)
MCL = Maximum Contaminant Level, State Drinking Water Regulations (WAC 246-290)
* = Primary
*** = Carcinogen
*THM = Primary MCL for the sum of all trihalomethanes
*XYL = Primary MCL for the sum of all xylenes
Bold = Does not meet GWQS or MCL
NA = Not analyzed
J = Estimated concentration (See data validation memorandum)

Table D-2. Push Probe Monitoring Results, Natural Attenuation Parameters, Horn Rapids Landfill

Analyte	Units	PP-1 ALS Environmental 11/15/2017	PP-1 Test America 11/15/2017	PP-2 ALS Environmental 11/7/17	PP-3 ALS Environmental 11/9/17	PP-3 Dup ALS Environmental 11/9/17	PP-4 ALS Environmental 11/13/2017	PP-5 ALS Environmental 11/16/2017	Trip Blank Test America 11/9/2017
Methane	µg/L	2.6 J	7.5 J	8.1	19	23	4.0	13	<1.2
Ethane	µg/L	0.68	<10	2.2	6.1	7.3	1.3	3.4	<10
Ethene	µg/L	<1.0	<10	2.6	4.9	5.7	1.2	3.0	<10

Notes: J = Estimated concentration (see Data validation memorandum)

Table D-3. Push Probe Monitoring Results, Field Data, Horn Rapids Landfill

Analyte	Units	GWQS	MCL	PP-1 11/15/2017	PP-2 11/7/2017	PP-3 11/9/2017	PP-4 11/13/2017	PP-5 11/16/2017
Conductivity	µmhos/cm		700 **	**1092**	551	370	500	492
pH	units	6.5-8.5		7.02	7.58	**8.63**	8.26	8.41
Temperature	C°			11.58	10.70	10.68	9.13	10.10
Redox	mv			-59.6	-186.9	-185.9	-46.4	-199.3
Dissolved Oxygen	mg/L			2.37	1.45	0.94	3.11	0.39

Notes:
GWQS = Water Quality Standards for Ground Waters of the State of Washington (WAC 173-200)
MCL = Maximum Contaminant Level, State Drinking Water Regulations (WAC 246-290)
** = Secondary
Bold = Does not meet GWQS or MCL

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-1 2/16/2017	MW-1 5/24/2017	MW-21 (MW-1 Dup) 5/24/2017	MW-1 8/28/2017	MW-1 11/14/2017	MW-2 2/16/2017	MW-2 5/23/2017	MW-2 8/28/2017	MW-2 11/15/2017	MW-3 8/29/2017	MW-3 11/15/2017
FIELD DATA	Conductivity	µmhos/cm		700 **	**735.2 R**	**720**	NA	**1031**	546.1	**736.2 R**	484	669	517.5	544	470.1
	pH	units	6.5-8.5		7.04	7.27	NA	7.03	7.38	7.14	7.82	7.50	7.63	7.67	7.68
	Temperature	C°			16.2	21.56	NA	22.4	20.4	16.6	21.40	21.5	19.9	21.1	18.1
	Redox	mv			378.5	78.6	NA	200.9	26.3	359.4	-150.1	215.6	17.8	305.4	22.4
	Dissolved Oxygen	mg/L			5.31	4.92	NA	4.76	6.42	6.97	6.38	6.44	6.72	7.61	9.15
WATER QUALITY	Nitrate-Nitrogen	mg/L as N	10 *	10 *	0.70 R	10	10	**11 H**	7.0	0.039 R	**22**	**23**	**16**	5.9	3.6
PARAMETERS	Calcium, Dissolved	mg/L			120	120	120	120	69	74	73	79	65	69	58
	Sodium, Dissolved	mg/L			23	23 J	22	22	15	14	14	14	12	16	14
	Bicarbonate Alkalinity	mg/L as CaCO3			320	340	320	360	170	110	120	120	110	150	130
	Chloride	mg/L	250 **	250 **	30 J	32	32	33	20	27	34	33	23	36	23
	Magnesium, Dissolved	mg/L			26	23 J	25	25	14	17	15	18	13	13	10
	Potassium, Dissolved	mg/L			8.3	8.3	8.2	7.9	6.2	6.5	6.1	6.3	5.9	6.8	6.5
	Sulfate	mg/L	250 **	250 **	58	53	55	58	44	73	78	81	65	70	60
	Total Alkalinity	mg/L as CaCO3			320	340	320	360	170	110	120	120	110	150	130
	Iron, Dissolved	mg/L	0.3 **	0.3 **	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Manganese, Dissolved	mg/L	0.05 **	0.05 **	<0.020	<0.02	<0.02	<0.02	<0.02	<0.020	<0.02	<0.02	<0.02	<0.02	<0.02
	Ammonia-Nitrogen	mg/L as N			<0.20	<0.20	<0.20	<0.5	<0.50	<0.20	<0.20	<0.5	<0.50	<0.5	<0.50
	Total Organic Carbon	mg/L			2.1	1.8	2.1	1.8	1.4	1.2	1.2	1.2	1.1	1.1	1.2
	Total Dissolved Solids	mg/L	500 **	500 **	**570**	**600**	**570**	**620**	370	380	440	460	380	360	330
	Total Suspended Solids	mg/L			<2.0 H	<2.0	<2.0	<2.0	<2.0	<2.0 H	<2.0	<2.0	<2.0	24	<2.0
METALS	Antimony, Total	mg/L		6 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Arsenic, Total	mg/L	0.00005 ***	0.01 *	**0.0046**	**0.0041**	**0.0042**	**0.0041**	**0.0046**	**0.0041**	**0.0036**	**0.0035**	**0.0039**	**0.0079**	**0.0077**
	Barium, Total	mg/L	1 *	2 *	0.063	0.057	0.059	0.065	0.034	0.039	0.040	0.043	0.033	0.040	0.027
	Beryllium, Total	mg/L		0.004 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Cadmium, Total	mg/L	0.01 *	0.005 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Chromium, Total	mg/L	0.05 *	0.1 *	0.0026	0.0026	0.0028	0.0032	0.0031	0.015	0.012	0.023	0.0029	0.033	0.019
	Cobalt, Total	mg/L			0.031	0.035	0.038	0.041	0.041	<0.0004	<0.0004	<0.0004	<0.0004	0.0024	0.00045
	Copper, Total	mg/L	1 **		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.0026	<0.002
	Lead, Total	mg/L	0.05 *		<0.0004	<0.0008	<0.0008	<0.0008	<0.0008	<0.0004	<0.0008	<0.0008	<0.0008	0.0012	<0.0008
	Nickel, Total	mg/L		0.1 *	<0.003	<0.003	<0.003	<0.003	0.0033	0.0064	0.0049	0.022	<0.003	0.022	0.0084
	Selenium, Total	mg/L	0.01 *	0.05 *	0.0022	<0.008	<0.008	<0.008	<0.008	0.0017	<0.008	<0.008	<0.008	<0.008	<0.008
	Silver, Total	mg/L	0.05 *	0.1 **	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Thallium, Total	mg/L		0.002 *	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Vanadium, Total	mg/L			0.0099	0.0088	0.0089	0.0091	0.011	0.011	0.0093	0.010	0.01	0.016	0.014
	Zinc, Total	mg/L	5 **	5 **	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007
VOLATILE ORGANIC	1,1,1,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
COMPOUNDS	1,1,1-Trichloroethane	µg/L	200 *	200 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2-Trichloroethane	µg/L		5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1-Dichloroethane	µg/L	1 ***		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.84	0.48
	1,1-Dichloroethene	µg/L		7 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2,3-Trichloropropane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dibromo-3-Chloropropane	µg/L		0.2 *	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2-Dichlorobenzene	µg/L		600 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	1,2-Dichloroethane	µg/L	0.5 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dichloropropane	µg/L	0.6 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,4-Dichlorobenzene	µg/L	4 ***	75 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	2-Butanone	µg/L			<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
	2-Hexanone	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	4-Methyl-2-pentanone	µg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-4 2/15/2017	MW-4 5/24/2017	MW-4 8/28/2017	MW-4 11/15/2017	MW-5 2/16/2017	MW-21 (MW-5 Dup) 2/16/2017	MW-5 5/23/2017	MW-5 8/28/2017	MW-5 11/15/2017	MW-6 2/16/2017	MW-6 5/24/2017	MW-6 8/29/2017	MW-6 11/15/2017
FIELD DATA	Conductivity	µmhos/cm		700 **	**744.9 R**	356	470.6	482.9	**735.9 R**	NA	**883**	**1282**	**1301**	**735.4 R**	**816**	**1135**	**1062**
	pH	units	6.5-8.5		7.46	7.77	7.46	7.60	6.73	NA	6.82	6.67	6.75	6.63	6.82	6.62	6.64
	Temperature	C°			18.3	20.57	21.1	20.1	18.8	NA	24.63	24.9	23.7	21.4	25.34	27.0	25.9
	Redox	mv			280	56.1	236.4	26.2	136	NA	-210.2	121.4	-53.2	317	-92.2	293.6	2.4
	Dissolved Oxygen	mg/L			4.22	3.64	4.30	4.19	1.14	NA	0.52	0.58	0.89	0.82	0.50	0.46	0.73
WATER QUALITY	Nitrate-Nitrogen	mg/L as N	10 *	10 *	2.4	2.6	2.7	2.6 J	3.5	3.3	3.1 H	3.1	7.0	2.5	2.3	2.4	1.9 J
PARAMETERS	Calcium, Dissolved	mg/L			64	61	63	63	180	170	180	180	200	150	160	160	150
	Sodium, Dissolved	mg/L			13	13	13	13	20	20	21	21	21	21	23	22	20
	Bicarbonate Alkalinity	mg/L as CaCO3			180	190	190	200	510	510	500	530	520	500	510	520	490
	Chloride	mg/L	250 **	250 **	11	11	11	11 J	42	43	41	42	49	20	19	20	20
	Magnesium, Dissolved	mg/L			15	12	14	13	42	42	41	41	40	39	39	37	34
	Potassium, Dissolved	mg/L			6.5	6.0	6.1	6.0	12	11	12	11	12	11	12	11	11
	Sulfate	mg/L	250 **	250 **	26	25	24	27 J	63	65	65	86	94	53	50	51	49 J
	Total Alkalinity	mg/L as CaCO3			180	190	190	200	510	510	500	530	520	500	510	520	490
	Iron, Dissolved	mg/L	0.3 **	0.3 **	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Manganese, Dissolved	mg/L	0.05 **	0.05 **	<0.020	<0.02	<0.02	<0.02	**0.051**	**0.053**	**0.054**	0.046	0.031	0.035	0.039	0.047	<0.02
	Ammonia-Nitrogen	mg/L as N			<0.20	<0.20	<0.5	<0.50	<0.20	<0.20	<0.20	<0.5	<0.50	<0.20	<0.20	<0.5	<0.50
	Total Organic Carbon	mg/L			<1.0	<1.0	<1.0	<1.0	3.1	3.5	2.9	3.5	4.0	2.2	1.6	2.1	2.3
	Total Dissolved Solids	mg/L	500 **	500 **	290	310	300	320	**750**	**740**	**750**	**780**	**840**	**680**	**660**	**680**	**670**
	Total Suspended Solids	mg/L			<2.0 H	<2.0	<2.0	<2.0	<2.0 H	<2.0 H	<2.0	<2.0	<2.0	<2.0 H	<2.0	<2.0	<2.0
METALS	Antimony, Total	mg/L		6 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Arsenic, Total	mg/L	0.00005 ***	0.01 *	**0.0048**	**0.0046**	**0.0043**	**0.0042**	**0.0029**	**0.0029**	**0.0027**	**0.0023**	**0.0021**	**0.0021**	**0.0021**	**0.0017**	**0.0014**
	Barium, Total	mg/L	1 *	2 *	0.037	0.036	0.034	0.035	0.110	0.110	0.110	0.100	0.120	0.099	0.100	0.091	0.091
	Beryllium, Total	mg/L		0.004 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Cadmium, Total	mg/L	0.01 *	0.005 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Chromium, Total	mg/L	0.05 *	0.1 *	0.0016	0.0017	0.0015	0.0017	0.00091	0.00087	0.00086	0.00077	0.001	<0.0004	0.00084	0.00072	0.00071
	Cobalt, Total	mg/L			0.0024	0.0033	0.0024	0.0039	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	0.00049	0.0039	0.0091	0.0062
	Copper, Total	mg/L	1 **		0.0029	<0.002	<0.002	<0.002	0.0026	0.0033	0.0032	0.0026	0.0032	<0.002	0.002	<0.002	<0.002
	Lead, Total	mg/L	0.05 *		<0.0004	<0.0008	<0.0008	<0.0008	<0.0004	<0.0004	<0.0008	<0.0008	<0.0008	<0.0004	<0.0008	<0.0008	<0.0008
	Nickel, Total	mg/L		0.1 *	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.003	<0.003	<0.003	<0.003	0.0041	<0.003	<0.003
	Selenium, Total	mg/L	0.01 *	0.05 *	<0.001	<0.008	<0.008	<0.008	<0.001	<0.001	<0.008	<0.008	<0.008	<0.001	<0.008	<0.008	<0.008
	Silver, Total	mg/L	0.05 *	0.1 **	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Thallium, Total	mg/L		0.002 *	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Vanadium, Total	mg/L			0.012	0.012	0.011	0.011	0.0086	0.0086	0.0081	0.0075	0.0074	0.0073	0.0073	0.0067	0.0061
	Zinc, Total	mg/L	5 **	5 **	<0.007	<0.007	<0.007	<0.007	0.015	0.015	0.022	0.018	0.022	<0.007	0.011	<0.007	<0.007
VOLATILE ORGANIC	1,1,1,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
COMPOUNDS	1,1,1-Trichloroethane	µg/L	200 *	200 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2-Trichloroethane	µg/L		5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1-Dichloroethane	µg/L	1 ***		**3.5**	**3.5**	**3.8**	**4.0**	**7.4**	**7.5**	**6.9**	**8.4**	**7.7**	**4.8**	**4.5**	**5.0**	**4.5**
	1,1-Dichloroethene	µg/L		7 *	<0.10	0.12	<0.10	<0.10	0.19	0.18	0.19	0.11	0.22	0.19	0.23	0.19	0.21
	1,2,3-Trichloropropane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dibromo-3-Chloropropane	µg/L		0.2 *	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2-Dichlorobenzene	µg/L		600 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	1,2-Dichloroethane	µg/L	0.5 ***	5 *	<0.20	<0.20	<0.20	<0.20	**0.84**	**0.82**	**0.72**	**0.83**	**0.74**	**0.51**	0.48	**0.52**	0.44
	1,2-Dichloropropane	µg/L	0.6 ***	5 *	<0.20	<0.20	<0.20	<0.20	0.48	0.48	0.39	0.46	0.43	0.45	0.42	0.47	0.40
	1,4-Dichlorobenzene	µg/L	4 ***	75 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	2-Butanone	µg/L			<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
	2-Hexanone	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	4-Methyl-2-pentanone	µg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-8 2/16/2017	MW-8 5/24/2017	MW-8 8/29/2017	MW-21 (MW-8 Dup) 8/29/2017	MW-8 11/14/2017	MW-9 2/16/2017	MW-9 5/23/2017	MW-9 8/29/2017	MW-9 11/14/2017	MW-21 (MW-9 Dup) 11/14/2017	MW-10 2/16/2017	MW-10 5/23/2017	MW-10 8/29/2017	MW-10 11/14/2017
FIELD DATA	Conductivity	µmhos/cm		700 **	**755.8 R**	434	**976**	NA	650	**735.1 R**	671	**982**	**884**	NA	**736.1 R**	**996**	**1393**	**1324**
	pH	units	6.5-8.5		7.16	7.94	7.64	NA	7.48	7.03	7.11	6.99	6.88	NA	6.69	6.75	6.65	6.66
	Temperature	C°			16.0	23.17	23.1	NA	18.0	17.4	23.97	24.1	16.6	NA	18.5	26.27	23.2	25.0
	Redox	mv			370	45.4	353.0	NA	51.9	318	-154.9	334.8	40.4	NA	115	-44.9	275.3	24.3
	Dissolved Oxygen	mg/L			7.90	7.08	7.84	NA	8.95	3.50	2.69	2.74	4.34	NA	1.54	0.24	0.25	0.49
WATER QUALITY	Nitrate-Nitrogen	mg/L as N	10 *	10 *	4.3	9.6	**26**	**26**	**12**	4.4	4.4 H	4.6	3.4	3.4	4.4	4.1 H	3.6	5.2
PARAMETERS	Calcium, Dissolved	mg/L			47	74	130	120	75	130	120	130	130	120	180	200	220	200
	Sodium, Dissolved	mg/L			15	21	27	26	21	20	20	24	22	22	21	22	24	22
	Bicarbonate Alkalinity	mg/L as CaCO3			120	120	120	120	120	340	360	390	340	340	530	620	660	600
	Chloride	mg/L	250 **	250 **	27	56	170	160	70	31	33	42	35	35	29	31	36	31
	Magnesium, Dissolved	mg/L			10	15	27	24	15	30	27	31	28	26	42	43	44	41
	Potassium, Dissolved	mg/L			5.9	7.6	9.3	8.9	7.4	8.7	8.3	8.3	8.8	8.8	12	12	12	12
	Sulfate	mg/L	250 **	250 **	31	41	72	72	50	62	61	67	64	63	61	66	73	69
	Total Alkalinity	mg/L as CaCO3			120	120	120	120	120	340	360	390	340	340	530	620	660	600
	Iron, Dissolved	mg/L	0.3 **	0.3 **	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
	Manganese, Dissolved	mg/L	0.05 **	0.05 **	<0.020	<0.02	<0.02	<0.02	<0.02	<0.020	<0.02	<0.02	<0.02	<0.02	0.025	0.03	0.032	0.028
	Ammonia-Nitrogen	mg/L as N			0.32	<0.20	<0.5	<0.5	<0.50	<0.20	<0.20	<0.5	<0.50	<0.50	<0.20	<0.20	<0.5	<0.50
	Total Organic Carbon	mg/L			1.0	1.2	1.9	1.7	1.3	1.9	1.6	1.7	2.1	1.5	6.7	4.1	3.7	3.4
	Total Dissolved Solids	mg/L	500 **	500 **	260	390	**710**	**740**	450	**550**	**570**	**640**	**580**	**580**	**750**	**850**	**890**	**840**
	Total Suspended Solids	mg/L			<2.0 H	<2.0	<2.0	<2.0	<2.0	<2.0 H	<2.0	<2.0	<2.0	<2.0	<2.0 H	<2.0	<2.0	<2.0
METALS	Antimony, Total	mg/L		6 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Arsenic, Total	mg/L	0.00005 ***	0.01 *	**0.012**	**0.0098**	**0.0079**	**0.0078**	**0.0089**	**0.0024**	**0.0021**	**0.002**	**0.0019**	**0.0018**	**0.0021**	**0.0018**	**0.0016**	**0.0015**
	Barium, Total	mg/L	1 *	2 *	0.033	0.042	0.083	0.084	0.048	0.073	0.067	0.075	0.069	0.066	0.100	0.110	0.120	0.110
	Beryllium, Total	mg/L		0.004 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Cadmium, Total	mg/L	0.01 *	0.005 *	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Chromium, Total	mg/L	0.05 *	0.1 *	0.0037	0.0092	0.0042	0.0046	0.010	0.006	0.0029	0.0056	0.0032 J	0.0016 J	0.00088	0.00057	0.00081	0.0013
	Cobalt, Total	mg/L			<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Copper, Total	mg/L	1 **		<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
	Lead, Total	mg/L	0.05 *		<0.0004	<0.0008	<0.0008	<0.0008	<0.0008	<0.0004	<0.0008	<0.0008	<0.0008	<0.0008	<0.0004	<0.0008	<0.0008	<0.0008
	Nickel, Total	mg/L		0.1 *	<0.003	0.0058	<0.003	<0.003	0.0076	0.0037	<0.003	0.0034	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
	Selenium, Total	mg/L	0.01 *	0.05 *	<0.001	<0.008	<0.008	<0.008	<0.008	0.0011	<0.008	<0.008	<0.008	<0.008	<0.001	<0.008	<0.008	<0.008
	Silver, Total	mg/L	0.05 *	0.1 **	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004
	Thallium, Total	mg/L		0.002 *	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
	Vanadium, Total	mg/L			0.020	0.016	0.013	0.014	0.015	0.0081	0.0071	0.0072	0.0072	0.0071	0.0073	0.0072	0.0074	0.0073
	Zinc, Total	mg/L	5 **	5 **	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	<0.007	0.0072	0.0075	0.0072	0.0074
VOLATILE ORGANIC	1,1,1,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
COMPOUNDS	1,1,1-Trichloroethane	µg/L	200 *	200 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2-Trichloroethane	µg/L		5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1-Dichloroethane	µg/L	1 ***		<0.20	<0.20	<0.20	<0.20	<0.20	**3.7**	**3.5**	**2.9**	**3.9**	**3.9**	**7.2**	**7.5**	**11**	**9.4**
	1,1-Dichloroethene	µg/L		7 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.47	0.46	0.47	0.65
	1,2,3-Trichloropropane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dibromo-3-Chloropropane	µg/L		0.2 *	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2-Dichlorobenzene	µg/L		600 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	1,2-Dichloroethane	µg/L	0.5 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.41	0.42	**0.53**	**0.52**
	1,2-Dichloropropane	µg/L	0.6 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.21	0.21
	1,4-Dichlorobenzene	µg/L	4 ***	75 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	2-Butanone	µg/L			<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15	<15
	2-Hexanone	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	4-Methyl-2-pentanone	µg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-11 2/16/2017	MW-11 5/23/2017	MW-11 8/28/2017	MW-11 11/14/2017	Trip Blank 2/16/2017	Trip Blank 5/23/2017	Trip Blank 8/28/2017	Trip Blank 11/14/2017
FIELD DATA	Conductivity	µmhos/cm		700 **	**735.1 R**	**1354**	**1754**	249 R	NA	NA	NA	NA
	pH	units	6.5-8.5		7.20	7.49	7.38	7.30	NA	NA	NA	NA
	Temperature	C°			16.7	22.19	22.6	21.3	NA	NA	NA	NA
	Redox	mv			380	72.5	270.5	57.0	NA	NA	NA	NA
	Dissolved Oxygen	mg/L			8.21	8.79	8.34	9.39	NA	NA	NA	NA
WATER QUALITY	Nitrate-Nitrogen	mg/L as N	10 *	10 *	0.035 R	**34 H**	**36**	**35**	NA	NA	NA	NA
PARAMETERS	Calcium, Dissolved	mg/L			250	270	250	260	NA	NA	NA	NA
	Sodium, Dissolved	mg/L			21	22	20	21	NA	NA	NA	NA
	Bicarbonate Alkalinity	mg/L as CaCO3			170	170	170	190	NA	NA	NA	NA
	Chloride	mg/L	250 **	250 **	220	240	250	230	NA	NA	NA	NA
	Magnesium, Dissolved	mg/L			53	55	48	51	NA	NA	NA	NA
	Potassium, Dissolved	mg/L			12	12	11	12	NA	NA	NA	NA
	Sulfate	mg/L	250 **	250 **	**310**	**320**	**330**	**340**	NA	NA	NA	NA
	Total Alkalinity	mg/L as CaCO3			170	170	170	190	NA	NA	NA	NA
	Iron, Dissolved	mg/L	0.3 **	0.3 **	<0.5	<0.5	<0.5	<0.5	NA	NA	NA	NA
	Manganese, Dissolved	mg/L	0.05 **	0.05 **	<0.020	<0.02	<0.02	<0.02	NA	NA	NA	NA
	Ammonia-Nitrogen	mg/L as N			<0.20	<0.20	<0.5	<0.50	NA	NA	NA	NA
	Total Organic Carbon	mg/L			4.1	3.9	4.1	4.4	NA	NA	NA	NA
	Total Dissolved Solids	mg/L	500 **	500 **	**1300**	**1300**	**1300**	**1300**	NA	NA	NA	NA
	Total Suspended Solids	mg/L			<2.0 H	<2.0	<2.0	<2.0	NA	NA	NA	NA
METALS	Antimony, Total	mg/L		6 *	<0.0004	<0.0004	<0.0004	<0.0004	NA	NA	NA	NA
	Arsenic, Total	mg/L	0.00005 ***	0.01 *	**0.0057**	**0.0047**	**0.0046**	**0.0047**	NA	NA	NA	NA
	Barium, Total	mg/L	1 *	2 *	0.120	0.110	0.110	0.100	NA	NA	NA	NA
	Beryllium, Total	mg/L		0.004 *	<0.0004	<0.0004	<0.0004	<0.0004	NA	NA	NA	NA
	Cadmium, Total	mg/L	0.01 *	0.005 *	<0.0004	<0.0004	<0.0004	<0.0004	NA	NA	NA	NA
	Chromium, Total	mg/L	0.05 *	0.1 *	0.0028	0.0046	0.0056	0.0031	NA	NA	NA	NA
	Cobalt, Total	mg/L			<0.0004	<0.0004	<0.0004	<0.0004	NA	NA	NA	NA
	Copper, Total	mg/L	1 **		<0.002	<0.002	<0.002	<0.002	NA	NA	NA	NA
	Lead, Total	mg/L	0.05 *		<0.0004	<0.0008	<0.0008	<0.0008	NA	NA	NA	NA
	Nickel, Total	mg/L		0.1 *	<0.003	<0.003	<0.003	<0.003	NA	NA	NA	NA
	Selenium, Total	mg/L	0.01 *	0.05 *	0.0093	0.0082	<0.008	<0.008	NA	NA	NA	NA
	Silver, Total	mg/L	0.05 *	0.1 **	<0.0004	<0.0004	<0.0004	<0.0004	NA	NA	NA	NA
	Thallium, Total	mg/L		0.002 *	<0.001	<0.001	<0.001	<0.001	NA	NA	NA	NA
	Vanadium, Total	mg/L			0.011	0.0092	0.0097	0.0098	NA	NA	NA	NA
	Zinc, Total	mg/L	5 **	5 **	<0.007	<0.007	<0.007	<0.007	NA	NA	NA	NA
VOLATILE ORGANIC	1,1,1,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
COMPOUNDS	1,1,1-Trichloroethane	µg/L	200 *	200 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2,2-Tetrachloroethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1,2-Trichloroethane	µg/L		5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1-Dichloroethane	µg/L	1 ***		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,1-Dichloroethene	µg/L		7 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2,3-Trichloropropane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dibromo-3-Chloropropane	µg/L		0.2 *	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	1,2-Dibromoethane	µg/L	0.001 ***	0.05 *	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	1,2-Dichlorobenzene	µg/L		600 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	1,2-Dichloroethane	µg/L	0.5 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,2-Dichloropropane	µg/L	0.6 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	1,4-Dichlorobenzene	µg/L	4 ***	75 *	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	2-Butanone	µg/L			<15	<15	<15	<15	<15	<15	<15	<15
	2-Hexanone	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	4-Methyl-2-pentanone	µg/L			<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-1 2/16/2017	MW-1 5/24/2017	MW-21 (MW-1 Dup) 5/24/2017	MW-1 8/28/2017	MW-1 11/14/2017	MW-2 2/16/2017	MW-2 5/23/2017	MW-2 8/28/2017	MW-2 11/15/2017	MW-3 8/29/2017	MW-3 11/15/2017
VOLATILE ORGANIC COMPOUNDS (Cont.)	Acetone	µg/L			<2.0	<2.0	2.4	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	<2.0	2.0
	Acrylonitrile	µg/L	0.07 ***		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Benzene	µg/L	1 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromochloromethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromodichloromethane	µg/L	0.3 ***	80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromoform	µg/L	5 ***	80 * THM	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromomethane	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon Disulfide	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Carbon Tetrachloride	µg/L	0.3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chlorobenzene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloroethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Chloroform	µg/L	7 ***	80 * THM	<0.20	<0.20	<0.20	<0.20	0.27	<0.20	<0.20	<0.20	<0.20	0.63	0.90
	Chloromethane	µg/L			<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	cis-1,2-Dichloroethene	µg/L		70 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.47	0.43
	cis-1,3-Dichloropropene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane	µg/L		80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Dibromomethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Ethylbenzene	µg/L		700 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Iodomethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Methylene Chloride	µg/L	5 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	m,p-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene	µg/L		100 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethene	µg/L	0.8 ***	5 *	**5.0**	**4.1**	**4.1**	**4.7**	0.73	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Toluene	µg/L		1000 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,2-Dichloroethene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,3-Dichloropropene	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,4-Dichloro-2-butene	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Trichloroethene	µg/L	3 ***	5 *	0.34	0.27	0.28	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Trichlorofluoromethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Vinyl Acetate	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vinyl Chloride	µg/L	0.02 ***	2 *	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Total Xylenes	µg/L		10000 * XYL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NATURAL ATTENUATION PARAMETERS	Methane	µg/L			<1.2	<1.2	<1.2	<5	<1.2	<1.2	<1.2	<5	<1.2	<5	<1.2
	Ethane	µg/L			<10	<10	<10	<5	<10	<10	<10	<5	<10	<5	<10
	Ethene	µg/L			<10	<10	<10	<5	<10	<10	<10	<5	<10	<5	<10

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-4 2/15/2017	MW-4 5/24/2017	MW-4 8/28/2017	MW-4 11/15/2017	MW-5 2/16/2017	MW-21 (MW-5 Dup) 2/16/2017	MW-5 5/23/2017	MW-5 8/28/2017	MW-5 11/15/2017	MW-6 2/16/2017	MW-6 5/24/2017	MW-6 8/29/2017	MW-6 11/15/2017
VOLATILE ORGANIC COMPOUNDS (Cont.)	Acetone	µg/L			<2.0	<2.0	<2.0	2.7	<2.0	<2.0	<2.0	<2.0	3.5	<2.0	<2.0	<2.0	2.3
	Acrylonitrile	µg/L	0.07 ***		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Benzene	µg/L	1 ***	5 *	<0.20	<0.20	<0.20	<0.20	0.33	0.32	0.27	0.29	0.29	0.50	0.52	0.51	0.56
	Bromochloromethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromodichloromethane	µg/L	0.3 ***	80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromoform	µg/L	5 ***	80 * THM	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromomethane	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon Disulfide	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Carbon Tetrachloride	µg/L	0.3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chlorobenzene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloroethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Chloroform	µg/L	7 ***	80 * THM	0.58	0.51	0.46	0.48	<0.20	0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloromethane	µg/L			<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	cis-1,2-Dichloroethene	µg/L		70 *	2.7	2.9	2.6	2.7	34	35	33	34	30	57	**120 J**	55 H	55
	cis-1,3-Dichloropropene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane	µg/L		80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Dibromomethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Ethylbenzene	µg/L		700 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Iodomethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Methylene Chloride	µg/L	5 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	m,p-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene	µg/L		100 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethene	µg/L	0.8 ***	5 *	<0.50	<0.50	<0.50	<0.50	**16**	**16**	**12**	**15**	**11**	**34**	**33**	**30**	**24**
	Toluene	µg/L		1000 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,2-Dichloroethene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	0.62	0.56	0.54	0.69	0.54	1.8	1.9	1.8	1.7
	trans-1,3-Dichloropropene	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,4-Dichloro-2-butene	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Trichloroethene	µg/L	3 ***	5 *	0.22	0.23	<0.20	<0.20	**6.6**	**6.6**	**5.2**	**5.7**	**5.1**	**16**	**16**	**14**	**13**
	Trichlorofluoromethane	µg/L			0.88 J	0.87	0.95	0.88	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Vinyl Acetate	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vinyl Chloride	µg/L	0.02 ***	2 *	**0.042**	**0.043**	**0.042**	<0.020	**4.8**	**4.7**	**4.0**	**4.3**	**4.5**	**2.8**	**2.7**	**2.7**	**3.3**
	Total Xylenes	µg/L		10000 * XYL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NATURAL ATTENUATION PARAMETERS	Methane	µg/L			<1.2	<1.2	<5	<1.2	1700 J	1200 J	1300	2200	1000	3800	3300	4900	2400
	Ethane	µg/L			<10	<10	<5	<10	<10	<10	<10	<5	<10	<10	<10	<5	<10
	Ethene	µg/L			<10	<10	<5	<10	<10	<10	<10	<5	<10	<10	<10	<5	<10

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-8 2/16/2017	MW-8 5/24/2017	MW-8 8/29/2017	MW-21 (MW-8 Dup) 8/29/2017	MW-8 11/14/2017	MW-9 2/16/2017	MW-9 5/23/2017	MW-9 8/29/2017	MW-9 11/14/2017	MW-21 (MW-9 Dup) 11/14/2017	MW-10 2/16/2017	MW-10 5/23/2017	MW-10 8/29/2017	MW-10 11/14/2017
VOLATILE ORGANIC COMPOUNDS (Cont.)	Acetone	µg/L			<2.0	2.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	17	<2.0	<2.0	9.0
	Acrylonitrile	µg/L	0.07 ***		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Benzene	µg/L	1 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.34	0.27	0.30	0.84
	Bromochloromethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromodichloromethane	µg/L	0.3 ***	80 * THM	**0.83**	**0.69**	**0.34**	**0.35**	**0.66**	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromoform	µg/L	5 ***	80 * THM	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromomethane	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon Disulfide	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Carbon Tetrachloride	µg/L	0.3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chlorobenzene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloroethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.66	<0.50	0.75	<0.50
	Chloroform	µg/L	7 ***	80 * THM	**11**	**9.3**	5.3	5.2	**9.0**	0.36	0.34	0.24	0.30	0.30	0.57	0.67	1.0	0.65
	Chloromethane	µg/L			<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	cis-1,2-Dichloroethene	µg/L		70 *	<0.20	<0.20	<0.20	<0.20	<0.20	13	13	9.4	13	13	16	14	17	17
	cis-1,3-Dichloropropene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane	µg/L		80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Dibromomethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Ethylbenzene	µg/L		700 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Iodomethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Methylene Chloride	µg/L	5 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	1.5	2.1	2.6	1.3
	m,p-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene	µg/L		100 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethene	µg/L	0.8 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	**11**	**12**	**11**	**9.6**	**9.7**	**6.6**	**5.3**	**6.7**	**5.8**
	Toluene	µg/L		1000 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,2-Dichloroethene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	0.32	0.36	0.30	0.37	0.42	<0.20	<0.20	<0.20	0.22
	trans-1,3-Dichloropropene	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,4-Dichloro-2-butene	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Trichloroethene	µg/L	3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	**5.8**	**5.5**	**3.6**	**4.8**	**5.0**	**3.3**	2.7	**3.2**	**3.1**
	Trichlorofluoromethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Vinyl Acetate	µg/L			<1.0	<1 F1	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vinyl Chloride	µg/L	0.02 ***	2 *	<0.020	<0.020	<0.020	<0.020	<0.020	**0.053**	**0.042**	**0.029**	<0.020	<0.020	**1.1**	**0.95**	**0.97**	**1.0**
	Total Xylenes	µg/L		10000 * XYL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NATURAL ATTENUATION PARAMETERS	Methane	µg/L			<1.2	<1.2	<5	<5	<1.2	<1.2	<1.2	<5	1.6	<1.2	1500	360	1700	930
	Ethane	µg/L			<10	<10	<5	<5	<10	<10	<10	<5	<10	<10	<10	<10	<5	<10
	Ethene	µg/L			<10	<10	<5	<5	<10	<10	<10	<5	<10	<10	<10	<10	<5	<10

Table D-4. Groundwater Quality Monitoring Results, Horn Rapids Landfill, 2017

	Analyte	Units	GWQS	MCL	MW-11 2/16/2017	MW-11 5/23/2017	MW-11 8/28/2017	MW-11 11/14/2017	Trip Blank 2/16/2017	Trip Blank 5/23/2017	Trip Blank 8/28/2017	Trip Blank 11/14/2017
VOLATILE ORGANIC COMPOUNDS (Cont.)	Acetone	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.5	<2.0
	Acrylonitrile	µg/L	0.07 ***		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	Benzene	µg/L	1 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromochloromethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromodichloromethane	µg/L	0.3 ***	80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Bromoform	µg/L	5 ***	80 * THM	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Bromomethane	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Carbon Disulfide	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Carbon Tetrachloride	µg/L	0.3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chlorobenzene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloroethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Chloroform	µg/L	7 ***	80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Chloromethane	µg/L			<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
	cis-1,2-Dichloroethene	µg/L		70 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	cis-1,3-Dichloropropene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Dibromochloromethane	µg/L		80 * THM	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Dibromomethane	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Ethylbenzene	µg/L		700 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Iodomethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Methylene Chloride	µg/L	5 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	m,p-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	o-Xylene	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Styrene	µg/L		100 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Tetrachloroethene	µg/L	0.8 ***	5 *	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Toluene	µg/L		1000 *	<0.20	<0.20	<0.20	<0.20	0.25 B	<0.20	<0.20	<0.20
	trans-1,2-Dichloroethene	µg/L		100 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,3-Dichloropropene	µg/L			<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	trans-1,4-Dichloro-2-butene	µg/L			<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Trichloroethene	µg/L	3 ***	5 *	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Trichlorofluoromethane	µg/L			<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Vinyl Acetate	µg/L			<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vinyl Chloride	µg/L	0.02 ***	2 *	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Total Xylenes	µg/L		10000 * XYL	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
NATURAL ATTENUATION PARAMETERS	Methane	µg/L			<1.2	<1.2	<5	<1.2	<1.2	<1.2	<5	<5
	Ethane	µg/L			<10	<10	<5	<10	<10	<10	<5	<5
	Ethene	µg/L			<10	<10	<5	<10	<10	<10	<5	<5

Notes:
GWQS = Water Quality Standards for Ground Waters of the State of Washington (WAC 173-200)
MCL = Maximum Contaminant Level, State Drinking Water Regulations (WAC 246-290)
* = Primary
** = Secondary
*** = Carcinogen
*THM = Primary MCL for the sum of all trihalomethanes
*XYL = Primary MCL for the sum of all xylenes
J = Estimated value; see lab report for details
R = Rejected value; field instrument calibration error
H = Estimated value; analyzed beyond specified holding time
B = Detected in reagent blank or trip blank
Bold = Does not meet GWQS or MCL
NA = Not analyzed

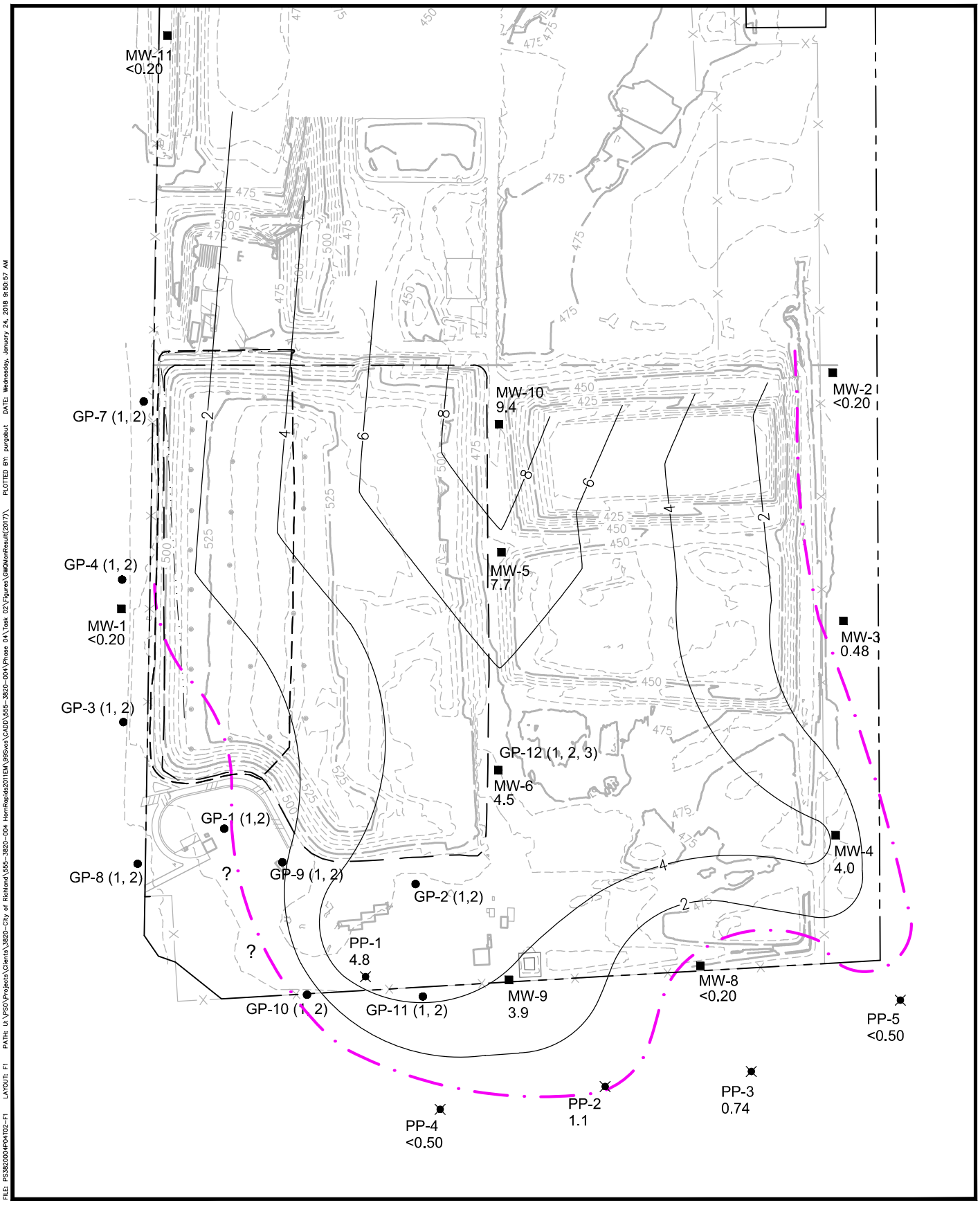
Table D-5. Groundwater Monitoring Well and Push Probe Results for Selected VOCs used in Isoconcentration Maps, Horn Rapids Landfill, 2017

				Groundwater Samples										Push Probe Samples				
				MW-1	MW-2	MW-3	MW-4	MW-5	MW-6	MW-8	MW-9	MW-10	MW-11	PP-1	PP-2	PP-3	PP-4	PP-5
	Units	GWQS	MCL	11/14/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/15/2017	11/14/2017	11/14/2017	11/14/2017	11/14/2017	11/15/2017	11/7/2017	11/9/2017	11/13/2017	11/16/2017
1,1-Dichloroethane	µg/L	1 ***		<0.20	<0.20	0.48	**4.0**	**7.7**	**4.5**	<0.20	**3.9**	**9.4**	<0.20	**4.8**	**1.1**	0.74	<0.5	<0.5
cis-1,2-Dichloroethene	µg/L		70 *	<0.20	<0.20	0.43	2.7	30	55	<0.20	13	17	<0.20	28	<0.5	0.67	<0.5	<0.5
Tetrachloroethene	µg/L	0.8 ***	5 *	0.73	<0.50	<0.50	<0.50	**11**	**24**	<0.50	**9.6**	**5.8**	<0.50	**4.1**	<0.5	<0.5	<0.5	<0.5
Trichloroethene	µg/L	3 ***	5 *	<0.20	<0.20	<0.20	<0.20	**5.1**	**13**	<0.20	**4.8**	**3.1**	<0.20	**4.9**	<0.5	<0.5	<0.5	<0.5
Vinyl Chloride	µg/L	0.02 ***	2 *	<0.020	<0.020	<0.020	<0.020	**4.5**	**3.3**	<0.020	<0.020	**1.0**	<0.020	**0.3481**	0.0052	0.0087	<0.005	<0.02

Notes:
GWQS = Water Quality Standards for Ground Waters of the State of Washington (WAC 173-200)
MCL = Maximum Contaminant Level, State Drinking Water Regulations (WAC 246-290)
* = Primary
*** = Carcinogen
Bold = Does not meet GWQS or MCL

Appendix E

Isoconcentration Maps



Parametrix

DATE: January 24, 2018 FILE: PS3820004P04T02-F1

N

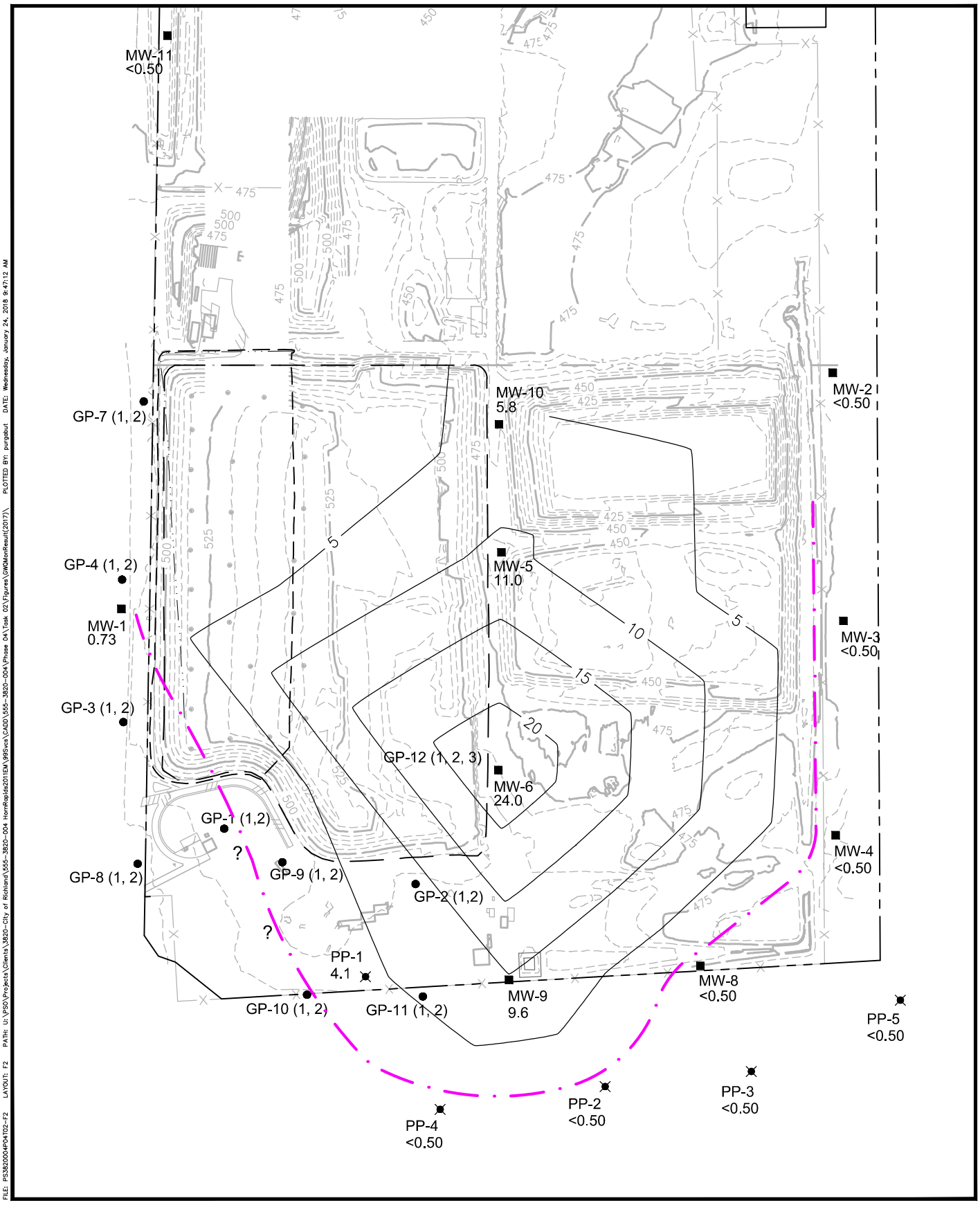
0 500

SCALE IN FEET

Legend:

- Facility Boundary
- Refuse Limit
- Closure Limit
- 2 Isoconcentration Contour
- 1,1-Dichloroethane GWQS = 1 µg/L

Figure 1
November 2017 Concentrations of 1,1-Dichloroethane (µg/L) in Groundwater
Horn Rapids Landfill



FILE: PS3820004P04T02-F2 LAYOUT: F2 PATH: U:\PSO\Projects\Clients\3820--City of Richland\555--3820--004 HornRapids2011EM\99Svcs\CAD\555--3820--004\Phase 04\Task 02\Figures\GWQonResult(2017)\ PLOTTED BY: purgabut DATE: Wednesday, January 24, 2018 9:47:12 AM

Parametrix

DATE: January 24, 2018 FILE: PS3820004P04T02-F2

N

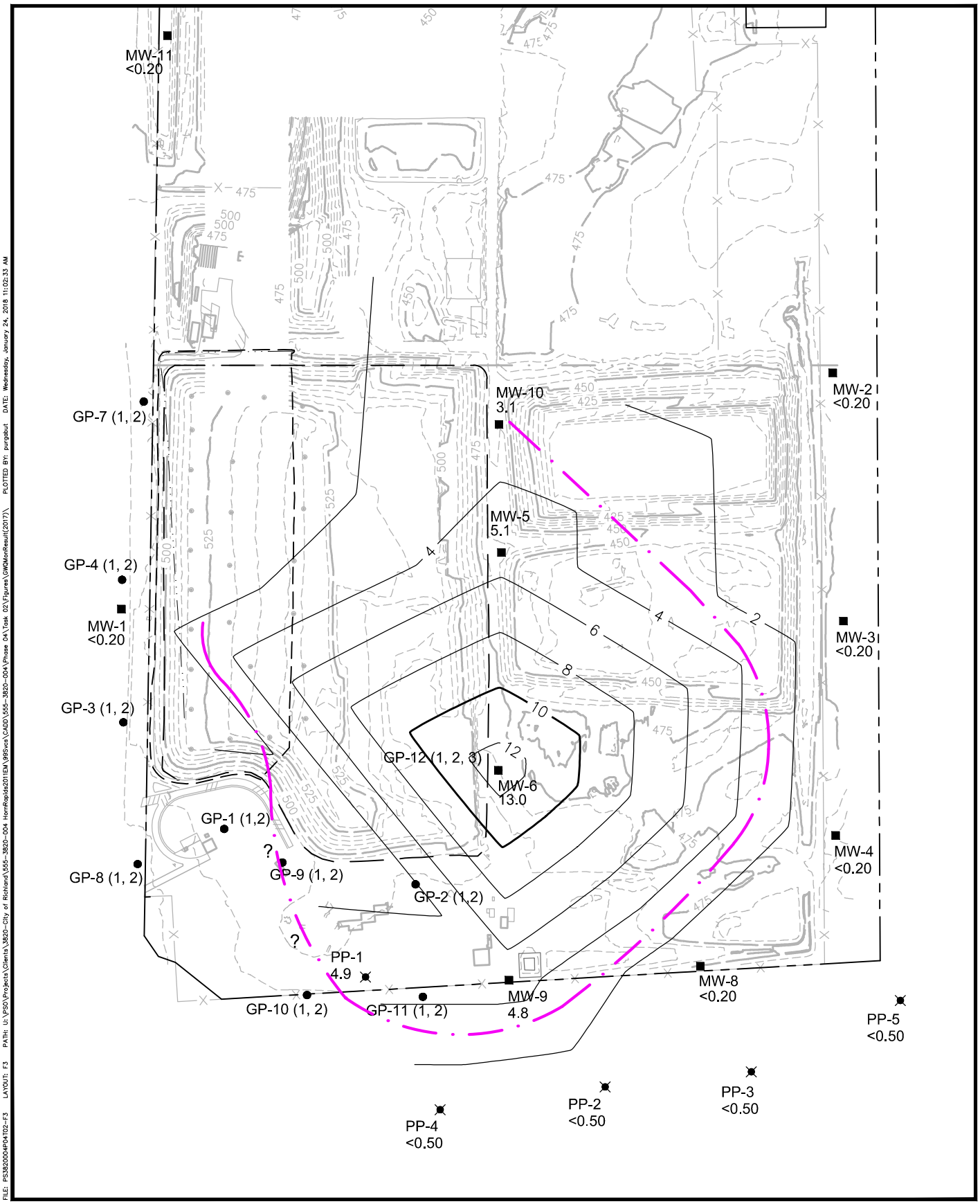
0 500

SCALE IN FEET

Legend:

- Facility Boundary
- Refuse Limit
- Closure Limit
- 2 Isoconcentration Contour
- Tetrachloroethene GWQS = 0.8 µg/L

Figure 2
November 2017 Concentrations of Tetrachloroethene (µg/L) in Groundwater
Horn Rapids Landfill



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Parametrix

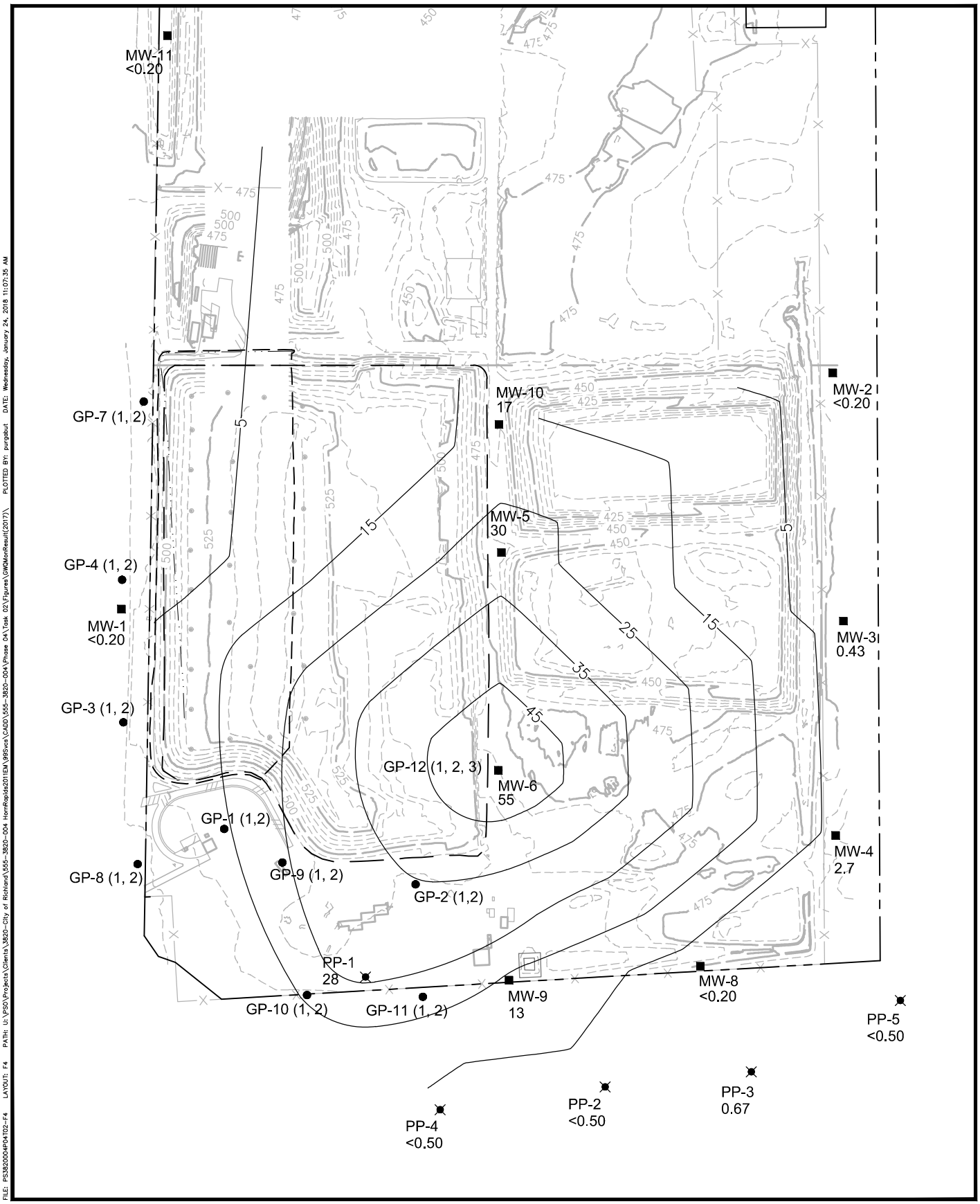
DATE: January 24, 2018 FILE: PS3820004P04T02-F3

0 N 500
SCALE IN FEET

Legend:

- Facility Boundary
- Refuse Limit
- Closure Limit
- 2 Isoconcentration Contour
- Trichloroethene GWQS = 3 µg/L

Figure 3
November 2017 Concentrations of Trichloroethene (µg/L) in Groundwater
Horn Rapids Landfill



FILE: PS3820004P04T02-F4 LAYOUT: F4 PATH: U:\PS0\Projects\Clients\3820--City of Richland\555--3820--004 HornRapids2011EM\99Svcs\CAD\555--3820--004\Phase 04\Task 02\Figures\GWQonResult(2017)\ PLOTTED BY: purgabut DATE: Wednesday, January 24, 2018 11:07:35 AM

Parametrix

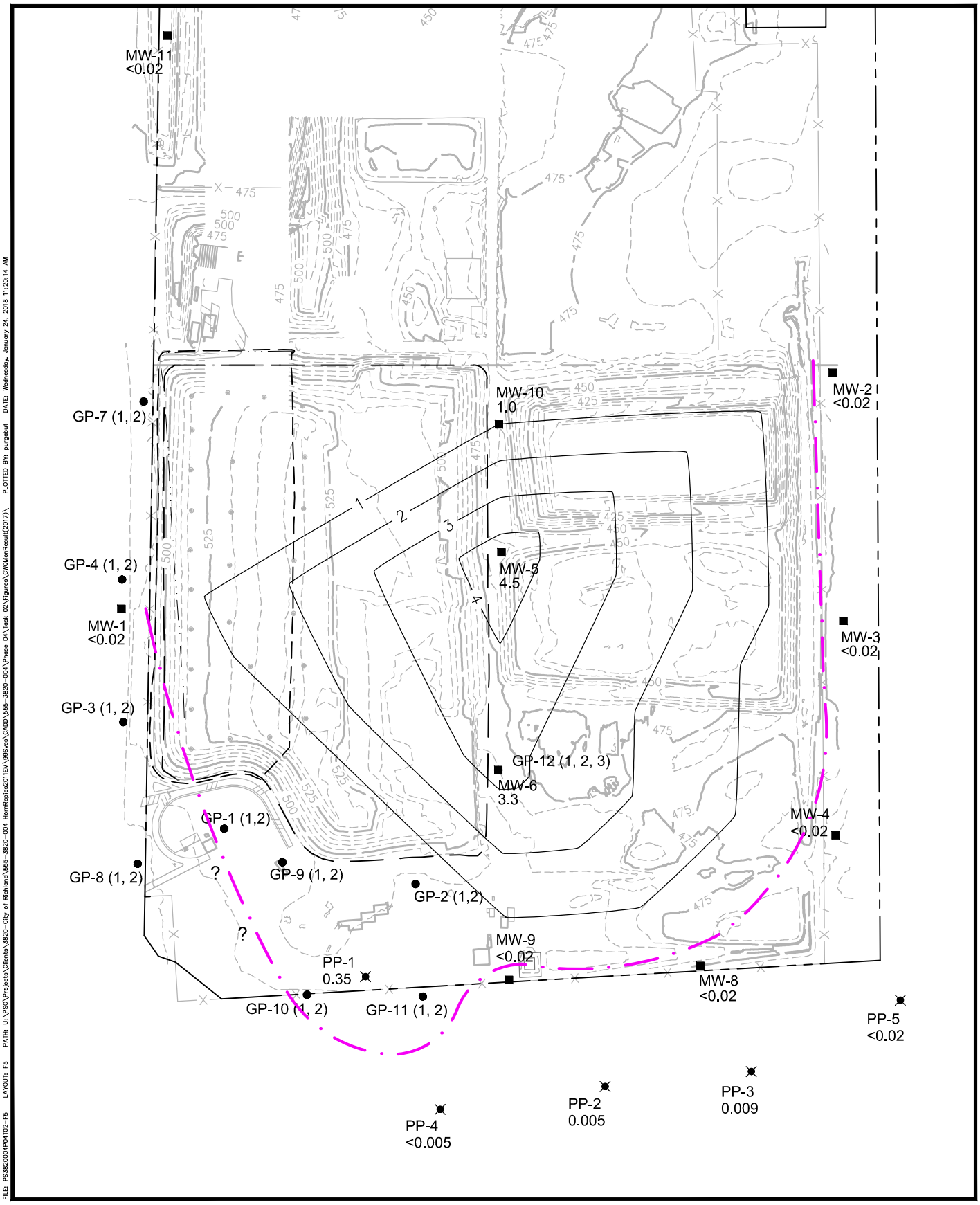
DATE: January 24, 2018 FILE: PS3820004P04T02-F4

0 500
SCALE IN FEET

Legend:

- Facility Boundary
- Refuse Limit
- Closure Limit
- 2 Isoconcentration Contour
- cis-1, 2-Dichloroethene MCL = 70 µg/L

Figure 4
November 2017 Concentrations of cis-1, 2-Dichloroethene (µg/L) in Groundwater
Horn Rapids Landfill



Parametrix

DATE: January 24, 2018 FILE: PS3820004P04T02-F5

N

0 500

SCALE IN FEET

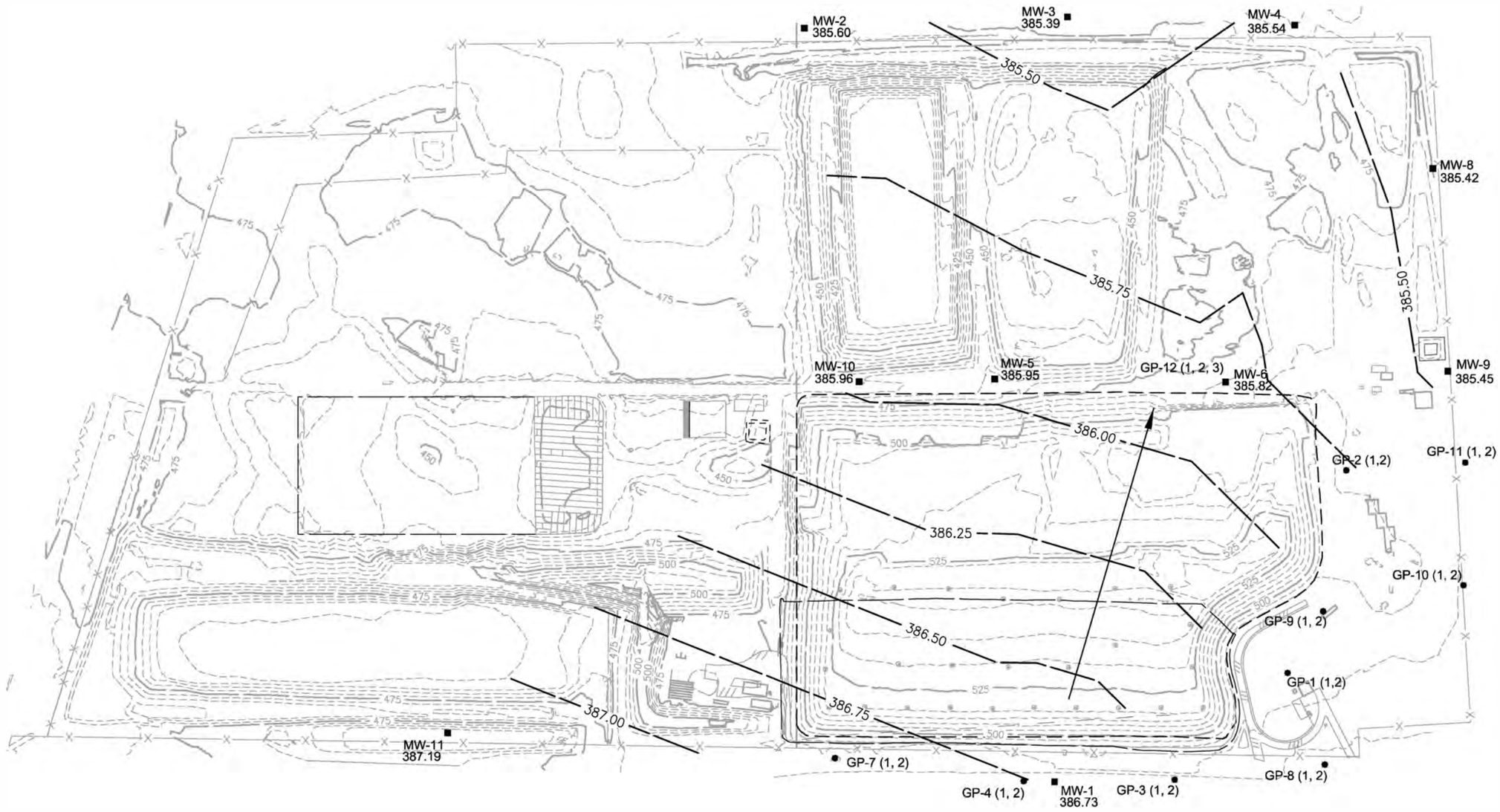
Legend:

- Facility Boundary
- Refuse Limit
- Closure Limit
- 2 Isoconcentration Contour
- Vinyl Chloride GWQS = 0.02 µg/L

Figure 5
November 2017 Concentrations of Vinyl Chloride (µg/L) in Groundwater
Horn Rapids Landfill

Appendix F

2017 Potentiometric Surface Maps



Topographic Contour Interval: 10 ft

Elevation Datum: NAVD88

Parametrix DATE: Mar 21, 2017 FILE: BL3820004P04T02-F-G1-1stQ2017

0 N 400
SCALE IN FEET

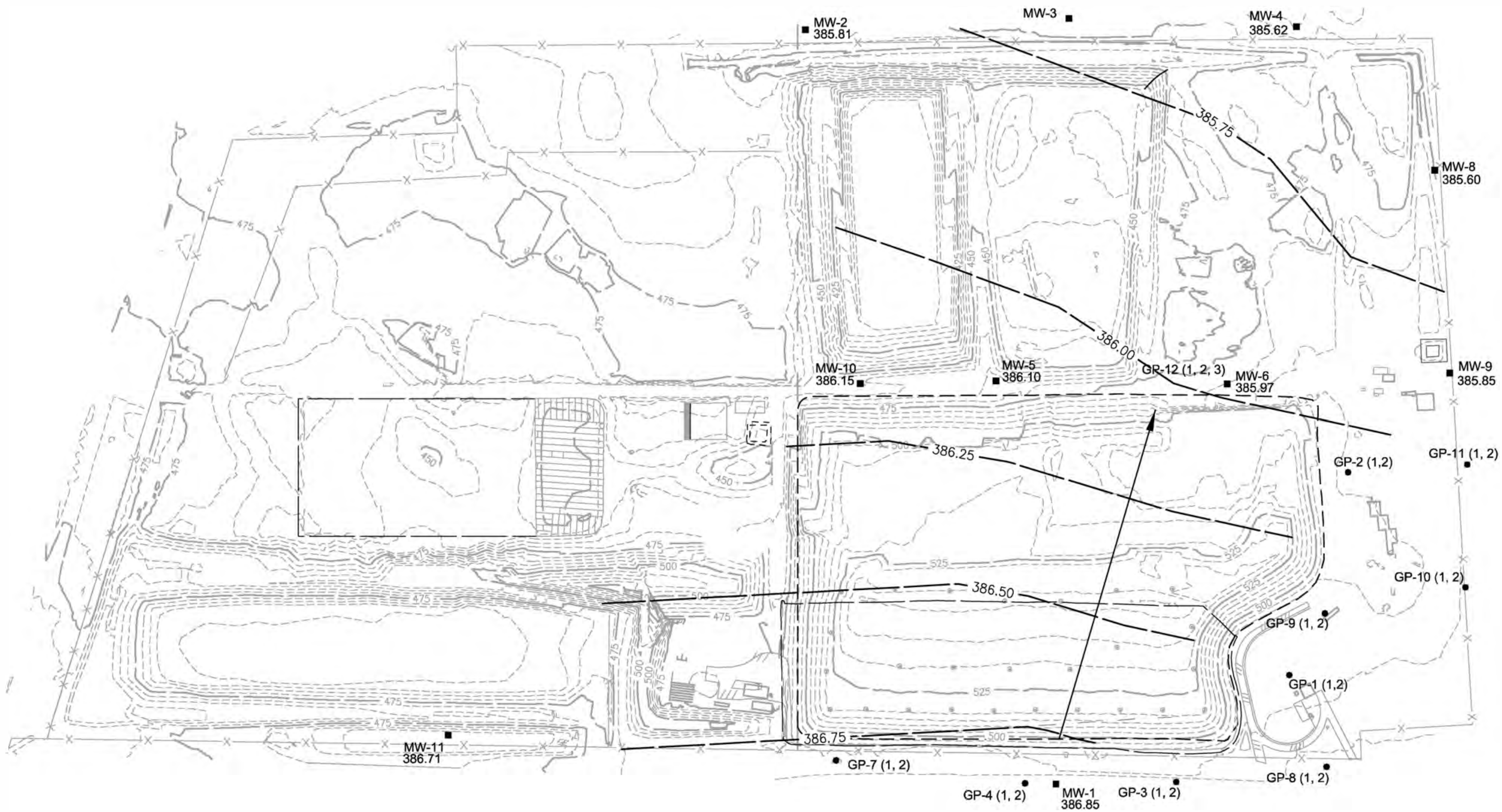
LEGEND:

- Approximate extent of refuse
- Approximate site boundary
- Groundwater elevation contour
- Approximate groundwater flow direction

Monitoring Stations

- ■ Monitoring well, with groundwater elevation in ft NAVD88 measured February 16 and 17 , 2017
- ● Gas Probe (1, 2, 3) with variable-depth screens

Figure F-1
Potentiometric Surface Map
First Quarter 2017
Horn Rapids Landfill



Topographic Contour Interval: 10 ft

Elevation Datum: NAVD88

Parametrix DATE: Jun 15, 2017 FILE: BL3820004P04T02-F-G1-2ndQ2017

0 400
SCALE IN FEET

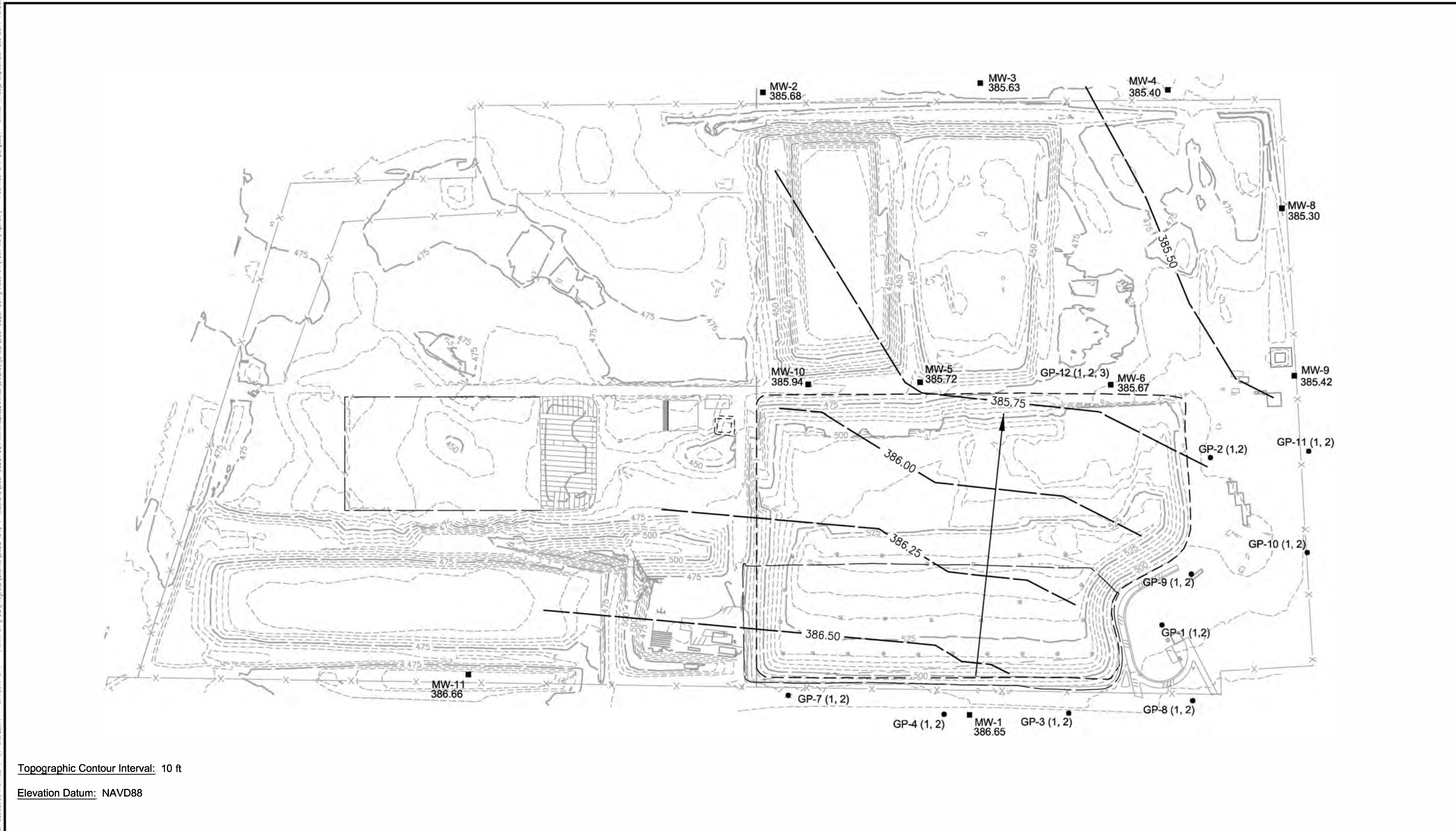
LEGEND:

- Approximate extent of refuse
- Approximate site boundary
- Groundwater elevation contour
- Approximate groundwater flow direction

Monitoring Stations

- ■ Monitoring well, with groundwater elevation in ft NAVD88 measured May 23 and 24 , 2017
- ● Gas Probe (1, 2, 3) with variable-depth screens

Figure F-2
Potentiometric Surface Map
Second Quarter 2017
Horn Rapids Landfill



Parametrix DATE: Sep 29, 2017 FILE: BL3820004P04T02-F-G1-3rdQ2017

N
0 400
SCALE IN FEET

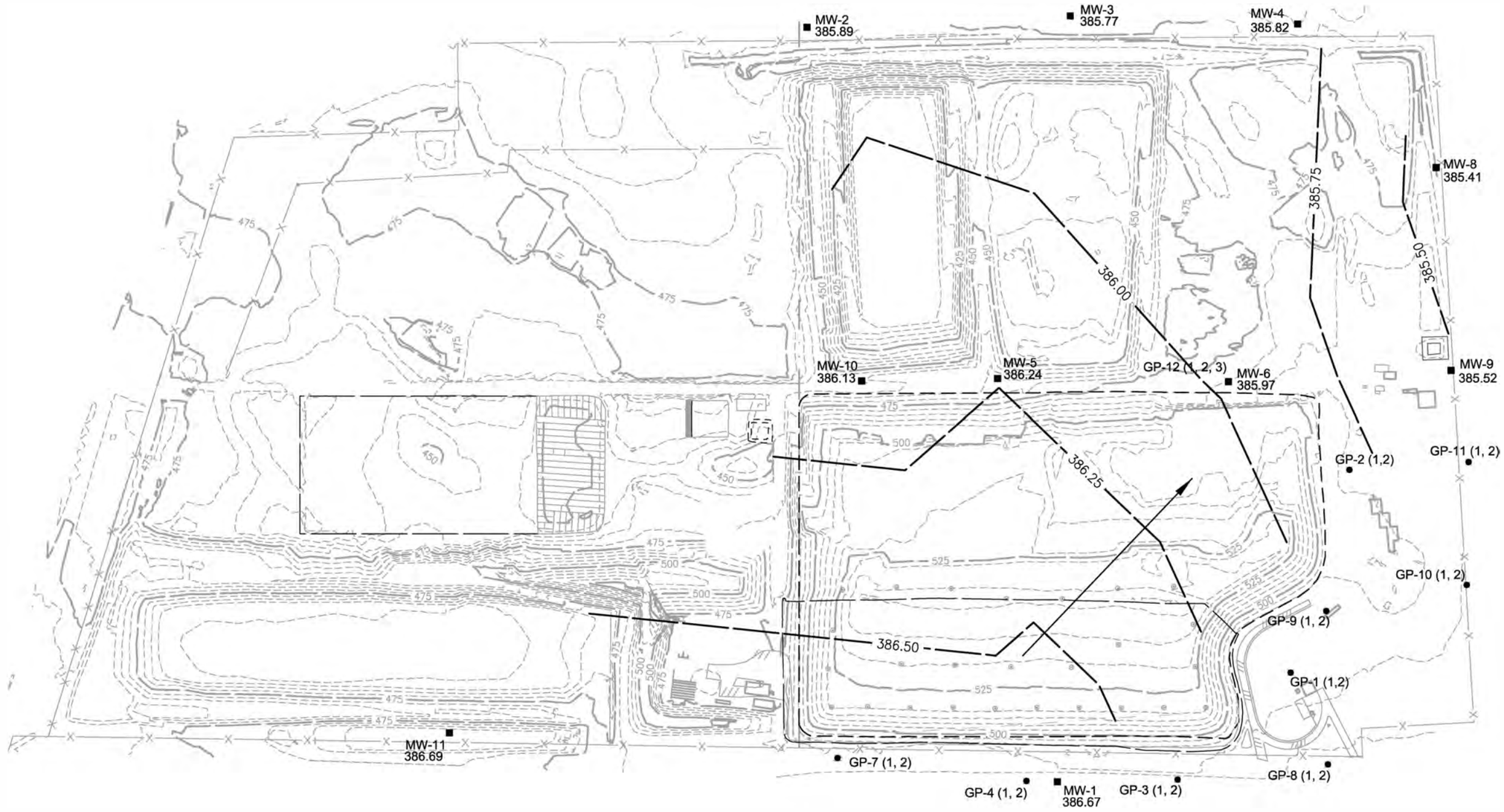
LEGEND:

- Approximate extent of refuse
- Approximate site boundary
- Groundwater elevation contour
- Approximate groundwater flow direction

Monitoring Stations

- ■ Monitoring well, with groundwater elevation in ft NAVD88 measured August 28 and 29 , 2017
- ● Gas Probe (1, 2, 3) with variable-depth screens

Figure F-3
Potentiometric Surface Map
Third Quarter 2017
Horn Rapids Landfill



Topographic Contour Interval: 10 ft

Elevation Datum: NAVD88

Parametrix DATE: Jan 05, 2018 FILE: BL3820004P04T02-F-G1-4thQ2017

N

0 400

SCALE IN FEET

LEGEND:

- Approximate extent of refuse
- Approximate site boundary
- Groundwater elevation contour
- Approximate groundwater flow direction

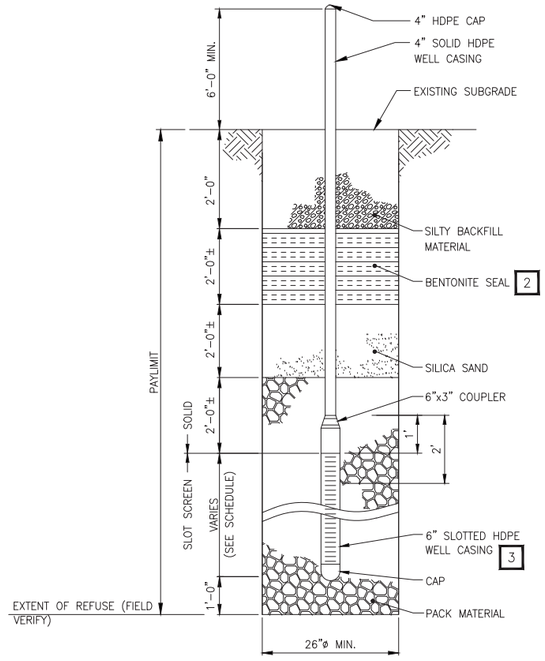
Monitoring Stations

- ■ Monitoring well, with groundwater elevation in ft NAVD88 measured November 14 and 15 , 2017
- ● Gas Probe (1, 2, 3) with variable-depth screens

Figure F-4
Potentiometric Surface Map
Fourth Quarter 2017
Horn Rapids Landfill

Appendix G

Monitoring Well Specification



TYPICAL IN-REFUSE GAS VERTICAL LANDFILL GAS WELL DETAIL 1 C2, C3

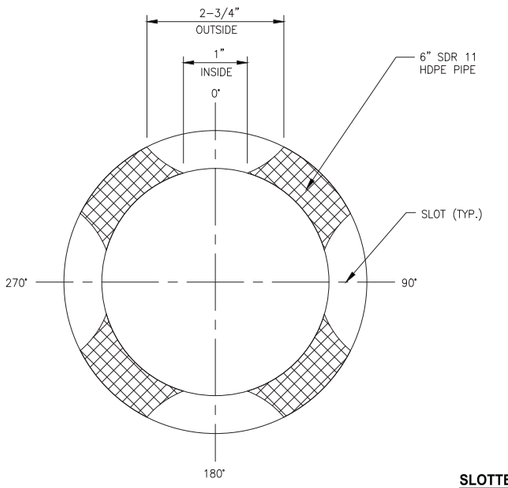
NO SCALE

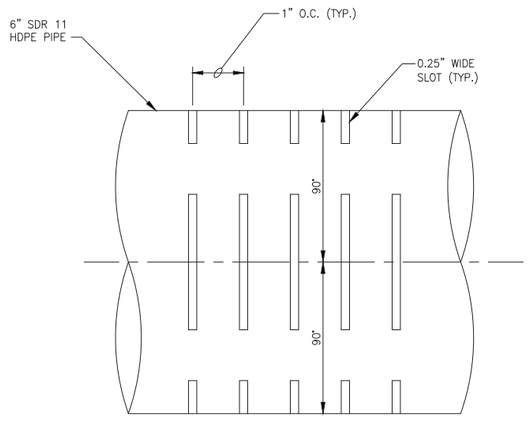
NOTE:

1. EXCAVATED MATERIAL SHALL BE DISPOSED OF BY THE CONTRACTOR IN THE LANDFILL ACTIVE AREA, SEE SHEET C2

2 BENTONITE TO BE HYDRATED WITH CLEAN WATER.

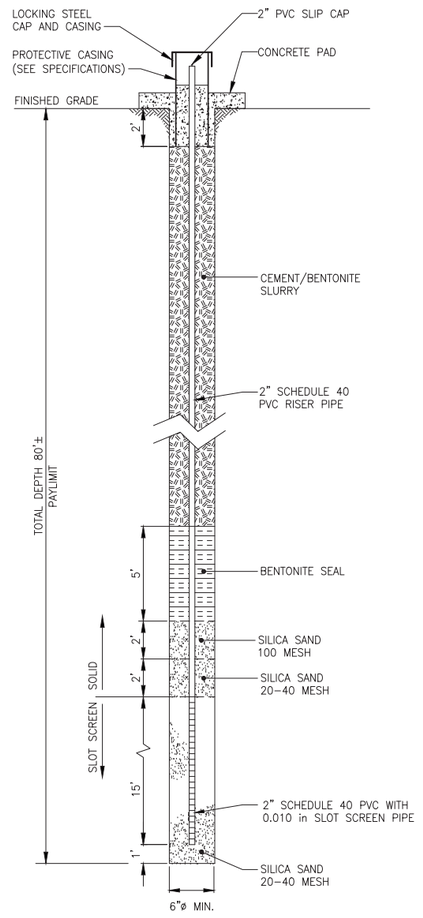
3 SLOTTED PIPE, SEE DETAIL 2 C3





SLOTTED PIPE DETAIL 2 C3

NO SCALE



GROUNDWATER MONITORING WELL (MW-11) DETAIL 3 C2

NO SCALE

WELL SCHEDULE

NUMBER	NORTHING	EASTING	EXISTING GRADE	BOTTOM BORING ELEVATION	TOP OF SCREEN ELEVATION
EXTRACTION WELLS					
GW-5	372390.66	2291954.81	512.90	468.00	504.90
GW-6	372240.63	2291954.46	514.70	468.00	506.70
GW-7	372090.52	2291954.25	515.70	468.00	507.70
GW-8	371940.66	2291954.40	516.80	468.00	508.80
GW-9	371790.84	2291954.50	516.60	468.00	508.60
GW-10	371640.01	2291955.17	515.00	468.00	507.00
GW-11	371490.79	2291954.10	513.90	468.00	505.90
GW-12	371340.44	2291953.94	514.50	468.00	506.50
GW-13	371190.00	2291954.83	515.40	468.00	507.40
GW-14	371040.70	2291954.49	510.40	468.00	502.40
GW-15	372380.77	2292092.47	514.60	454.00	506.60
GW-16	371078.39	2292100.27	519.50	454.00	511.50
GW-17	372363.24	2292229.23	519.00	455.00	511.00
GW-18	371351.05	2292177.70	528.80	455.00	520.80
GW-19	371085.43	2292249.96	529.90	455.00	521.90
GW-20	372343.76	2292376.40	519.00	455.00	511.00
GW-21	372143.80	2292384.48	529.70	455.00	521.70
GW-22	371944.55	2292377.54	531.80	455.00	523.80
GW-23	371748.86	2292341.31	535.50	455.00	527.50
GW-24	371549.98	2292339.94	535.20	455.00	527.20
GW-25	371353.81	2292378.15	532.80	455.00	524.80
GW-26	371155.11	2292385.19	532.80	455.00	524.80
GW-27	371003.77	2292375.44	532.40	455.00	524.40

NOTE:

1 BOTTOM BORING ELEVATION SHALL BE FIELD VERIFIED BASED ON ACTUAL REFUSE LIMITS.

2 OWNER SHALL SURVEY WELL LOCATION AND LABEL EXISTING GROUND SURFACE AND WELL NUMBER.

IMAGES:
DATE: 02/12/10 08:46am XREF's: XBL3820001P2AT03-TB | XBL3820001P02AT03-DE | XBL3820001P02AT03-BA |

△	REVISIONS	DATE	BY

DESIGNED S.EMGE
DRAWN S. SIRES
CADD CHECKED
CHECKED
APPROVED

ONE INCH AT FULL SCALE. IF NOT, SCALE ACCORDINGLY

FILE NAME BL3820001P2AT03-C01
JOB No. 555-3820-001
DATE FEBRUARY 2010

STEPHEN M. EMGE STATE OF WASHINGTON 34389 REGISTERED PROFESSIONAL ENGINEER

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PROJECT NAME
HORN RAPIDS LANDFILL GAS and GROUNDWATER WELLS INSTALLATION PROJECT
RICHLAND, WA

DETAILS and WELL SCHEDULE

DRAWING NO. 3 OF 4

C4