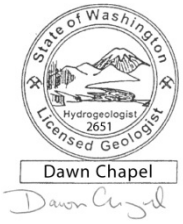
Technical Memorandum



To: Grant County Public Works and City of Ephrata

From: Dawn Chapel and Charles (Pony) Ellingson (Pacific Groundwater Group)

Re: Results of Interim Remedial Action (Ephrata Landfill Corrective Action): Contaminated Soil Removal and Confirmation Sampling for the Neva Lake Road Extension.

Date: January 24, 2013

This memorandum summarizes the results of an interim remedial action conducted in late November and early December 2012 at the Ephrata Landfill (site) in Grant County, Washington. The interim remedial action consisted of removing uncapped contaminated soil and refuse (collectively referred to as north end soils; NES) to bedrock from the north end of the site in preparation for Grant County's (County) extension of Neva Lake Road (Figure 1). Confirmation soil samples were collected at targeted locations after excavation to document conditions of soils left in place.

This interim action was performed in conjunction with the Ephrata Landfill Remedial Investigation and Feasibility Study (RI/FS) being conducted to evaluate site cleanup requirements in accordance with the Model Toxics Control Act (MTCA), Chapter 70.105D Revised Code of Washington, and its implementing regulations, Chapter 173-340 Washington Administrative Code (WAC). The RI was completed in 2010 and approved by the Washington Department of Ecology (Ecology) on October 19, 2010 (Pacific Groundwater Group, 2010 and Ecology, 2010). The draft FS was recently completed in 2012 (Parametrix, 2012). The draft FS identified NES as a potential source of continued groundwater contamination and developed various excavation and capping and monitoring options as components of several cleanup action alternatives. NES cleanup actions beyond those performed with this interim action, if any, will be addressed in the final cleanup action plan (CAP) for the site.

This interim action was performed in accordance with the Interim Remedial Action Plan (IRAP, Parametrix and Pacific Groundwater Group, 2012) developed for this work in accordance with Chapter 173-340 WAC and approved by Ecology on November 23, 2012. The following sections describe the results of this work.

SOIL AND REFUSE REMOVAL

The following sections describe the method of NES removal and field observations during the removal.

METHOD OF SOIL AND REFUSE REMOVAL

NES were excavated vertically to bedrock within an 80 foot wide road corridor along the planned Neva Lake Road centerline (Figure 1). NES were removed laterally to bedrock outcrops towards the east and north except where the northern County property boundary line was encountered before bedrock. Two small "islands" of soil were also left around monitoring well MW-3b and around monitoring well nest MW-41a and MW-40p2 in order to avoid damaging these wells. The southern limit of the excavation was about 40-ft from the road centerline and the western limit was determined in the field based on observations of clean soils and PID readings below background. The final excavation extent is shown in Figure 1.

NES excavation was performed by the Tommer Construction Company (Grant County's contractor for the Neva Lake Road project). Pacific Groundwater Group (PGG) and County field personnel were on site during the excavation to direct Tommer and ensure NES removal to bedrock. PGG also observed and mapped excavation extents, soil conditions, and approximate depth to bedrock within the excavation. Numerous digital photos were also taken to document the work (see attached). Field observations and mapping were tied to County lateral surveys (as shown on Neva Lake Road bid documents) which were staked in the field at 50-ft intervals both north and south of the road centerline. The 80-ft wide road corridor was also marked in the field with orange spray paint to help guide excavation extent. As excavation work progressed, survey stakes and spray paint were unavoidably disturbed and had to be reestablished by Tommer.

Tommer used a large track hoe to excavate NES and several haulers to transport NES to the active landfill. Wet NES were stockpiled in a bermed, lined on-site area and allowed to dry before disposal to the landfill. The excavation began at the eastern edge of the road corridor and progressed westward. Soils on the bottom of the excavation that could not be removed with the track hoe were scraped off the bedrock using the cutting edge of a front end loader, with this method there was essentially no soil greater than 3-inches thick left in the excavation.

OBSERVATIONS DURING SOIL AND REFUSE REMOVAL

The following key observations were made during the NES excavation work:

- Refuse consisting of house-hold garbage up to 10 feet thick with about 2 to 3 feet of cover gravel-fill was excavated near the southeast end of the excavation (Figure 1). The depth to bedrock was greatest at this location (almost 15-ft) and appears to form an erosional channel in the bedrock surface leading towards the Hole[1] (Figure 1). Water was observed seeping into the bottom of the excavation from the south at the lowest position in the bedrock channel; however the elevation of the seep is about 10 feet higher than the water level in the Hole, so it is not

[1] A 20-ft depression in the basalt surface beneath the landfill (Figure 1).

clear if these two areas of saturation above bedrock are hydraulically connected (Figure 1).

- The depth to bedrock decreased to less than 6 feet west of the channel near survey station 32 (Figure 1). The character of the soil also changed from refuse to mostly silt, sand, and gravel mixed with occasional construction-like debris (metal parts, glass, asphalt, wood, and charred debris).

- West of survey station 32 the depth to bedrock increased to as much as 8 feet and water was observed at the bottom of the excavation possibly originating from the south.

- Buried PVC drain pipes oriented north-south were observed extending into the excavation from the south. The drain pipes likely drained surface water from the old shop area located immediately to the south (Figure 1). The old shop was demolished in 2012.

- A larger amount of construction material mixed with soil was encountered at the north part of the excavation near the well nest MW-41a and MW-40p2 (Figure 1) and continued westward for about 50 feet and then tapering out to relatively clean looking soil.

- West of survey station 31 the depth to bedrock decreased to about 6 feet and west of station 30.5 the soils appeared relatively clean with PID readings at background (0.00 ppm). Soils were excavated 50 feet further west to survey station 30 which marked the western edge of the excavation (Figure 1).

RESULTS OF CONFIRMATION SOIL SAMPLING

In accordance with the IRAP, confirmation soil samples were collected after soils and refuse were excavated to document conditions of soils left in place.

Soil samples were collected every 20-ft along the north boundary of the excavation at the County property line where soils were not laterally removed to bedrock (soil samples NES-1 through NES-8 in Figure 1). These samples were collected to document the condition of soils at the County property line. The soils extend offsite beyond the property line at this location, but those soils were not excavated or sampled.

Soil samples were also collected every 20-ft along the western limit of the excavation (Soil samples NES-10 through NES-14 in Figure 1)[2]. These samples were collected to document that all potentially contaminated soils were removed from the 80-ft wide road corridor (the eastern limit of the road corridor was excavated to bedrock; therefore, confirmation soil sampling was not necessary at that location).

[2] A soil sample 20-ft south of NES-14 was not collected because Tommer constructed a truck ramp using clean fill at that location to enter and exit the excavation and therefore the location was inaccessible to sample.

Soils were also collected from small islands of soils left within the excavation around monitoring well pair MW-41a and MW-40p2 (NES-MW-41a) and around monitoring well MW-3b (NES-MW-3b). Islands of soils were left in place to avoid damaging the monitoring wells. These samples were collected to document the condition of soils left around the wells.

The soils sampled at discrete locations along the west and north limits of the excavation (NES-1 through NES-14) consisted of vertically composited samples collected across the soil profile at that location. The soils sampled at MW-41a and MW-3b consisted of composited samples collected at the four corners of the soil islands (Figure 1).

Soils were analyzed for volatile organic compounds (VOCs) using EPA method 8260C; three semi-VOCs using EPA method 8270D and select inorganics. These constituents were based on Contaminants of Concern identified in the RI addendum (PGG, 2012).

Complete analytical results are presented in Table 1. A summary of the quality assurance and quality control laboratory measures is presented in Table 2. Detected constituents are presented in Table 3 and compared to standard MTCA Method-B soil clean up levels in the CLARC[3] database and to soil concentrations protective of groundwater calculated using the fixed three-phase partitioning model (Chapter 173-340-747 (4) WAC)[4]. The fixed three-phase partitioning calculations are presented in Table 4. Default MTCA input parameter values were used in the three-phase partitioning model and compared to groundwater screening levels based on MTCA Method-B or the Federal MCL[5] groundwater standards, which ever was lower. The approach of using the lower of MTCA Method-B or the Federal MCL for groundwater is the same as was used for screening of groundwater data in the RI (PGG, 2010 and 2012)[6]. Groundwater cleanup levels presented in the draft FS (Parametrix, 2012) are slightly different; however, because final cleanup levels have not yet been established for the site, the RI method was used. Note that there are no standards for some of the detected constituents (e.g. 1,2,4-Trimethylbenzene). Key observations in Table 3 are summarized below:

- The results show low level detections of up to 18 VOCs and one semi-VOC (Table 2). Summed total VOCs in each sample ranged from 0.03 to 0.73 mg/kg. The most commonly detected VOCs[7] were 2-butanone, acetone, benzene, carbon disulfide, and methylene chloride; however, a number of detections for acetone and methylene chloride are laboratory qualified due to detections of these analytes in method blanks, trip blanks, or to continuing calibration above acceptance criteria (Table 2).

[3] Cleanup Levels and Risk Calculations (CLARC): https://fortress.wa.gov/ecy/clarc/Reporting/CLARCReporting.aspx

[4] Default MTCA parameter values were used in the three-phase partitioning model for unsaturated soils with the exception of the Henry's Gas Constant which was obtained from EPA's On Line Calculator assuming 13 degrees Celsius (http://www.epa.gov/athens/learn2model/part-two/onsite/esthenry.html).

[5] Federal Maximum Contaminant Level (40 CFR 141.61)

[6] MTCA Method-B groundwater cleanup levels for PCE and TCE have been updated in the CLARC database since the RI (PGG, 2010 and 2012). The new values are used for three-phase partitioning calculations (Table 3).

[7] Detected in 9 or more of the 15 total soil samples.

- The highest concentrations were detected in soil samples collected along the northern boundary of the excavation at NES-2, NES-3, and NES-4 and at NES-MW-41a (total VOCs in this group ranged from 0.22 to 0.73 mg/kg). The highest total VOC concentrations were at NES-4 (Table 2). Tetrachlorothene (PCE) and trichloroethene (TCE) were commonly detected in northern boundary group of soil samples and may represent the source of low level groundwater concentrations of PCE and TCE observed in nearby monitoring well MW-41a[8] - this well is completed above bedrock within saturated soils (Figure 1). As mentioned above construction material mixed with soil was notably denser near MW-41a (see previous section).
- In contrast, the soil samples collected along the western boundary of the excavation (NES-10 to NES-14) had lower concentrations of VOCs (total VOCs in this group ranged from 0.03 to 0.06 mg/kg).
- All VOC and Semi-VOC soil concentrations were below standard MTCA Method-B soil cleanup levels.
- Three VOCs were detected in some of the soil samples at concentrations above those calculated to be protective of groundwater (shaded results in Table 2):
    - Benzene was above the soil concentration protective of groundwater in four samples collected along the northern boundary of the excavation (NES-2, NES-3, NES-4 and NES-5) and the composite sample at NES-MW-41a. One sample collected along the western boundary of the excavation (NES-10) was also slightly above the concentration of benzene protective of groundwater (about 1.4 times above).
    - PCE was above the soil concentration protective of groundwater in one sample collected along the northern boundary of the excavation (NES-2) and in the composite sample at NES-MW-41a.
    - TCE was above the soil concentration protective of groundwater in three samples collected along the northern boundary of the excavation (NES-3, NES-4, and NES-5).
- Total iron was detected in one sample along the northern boundary of the excavation (NES-3) slightly above the standard MTCA Method-B soil cleanup level (shaded result in Table 2).

Although the fixed three-phase partitioning model predicts soil concentrations for benzene, PCE, and TCE could result in groundwater concentrations above screening levels at the above locations, the maximum measured concentration of benzene and PCE in groundwater in contact with these soils (well MW-41a) are below groundwater screening levels:

[8] Maximum PCE and TCE concentrations measured in MW-41a during the RI were 2.2 and 1.2 ug/L respectively.

- Benzene groundwater screening level based on MTCA Method-B is 0.8 ug/L and the maximum concentration measured in MW-41a is 0.2U (not detected with a reporting limit of 0.2 ug/L)
- PCE groundwater screening level based on Federal MCL is 5 ug/L and the maximum concentration measured in MW-41a is 2.2 ug/L.

The maximum measured groundwater concentrations for TCE in MW-41a; however, is slightly above the groundwater screening level:

- TCE groundwater screening level based on MTCA Method-B is 0.54 ug/L and the maximum concentration measured in MW-41a is 1.2 ug/L.

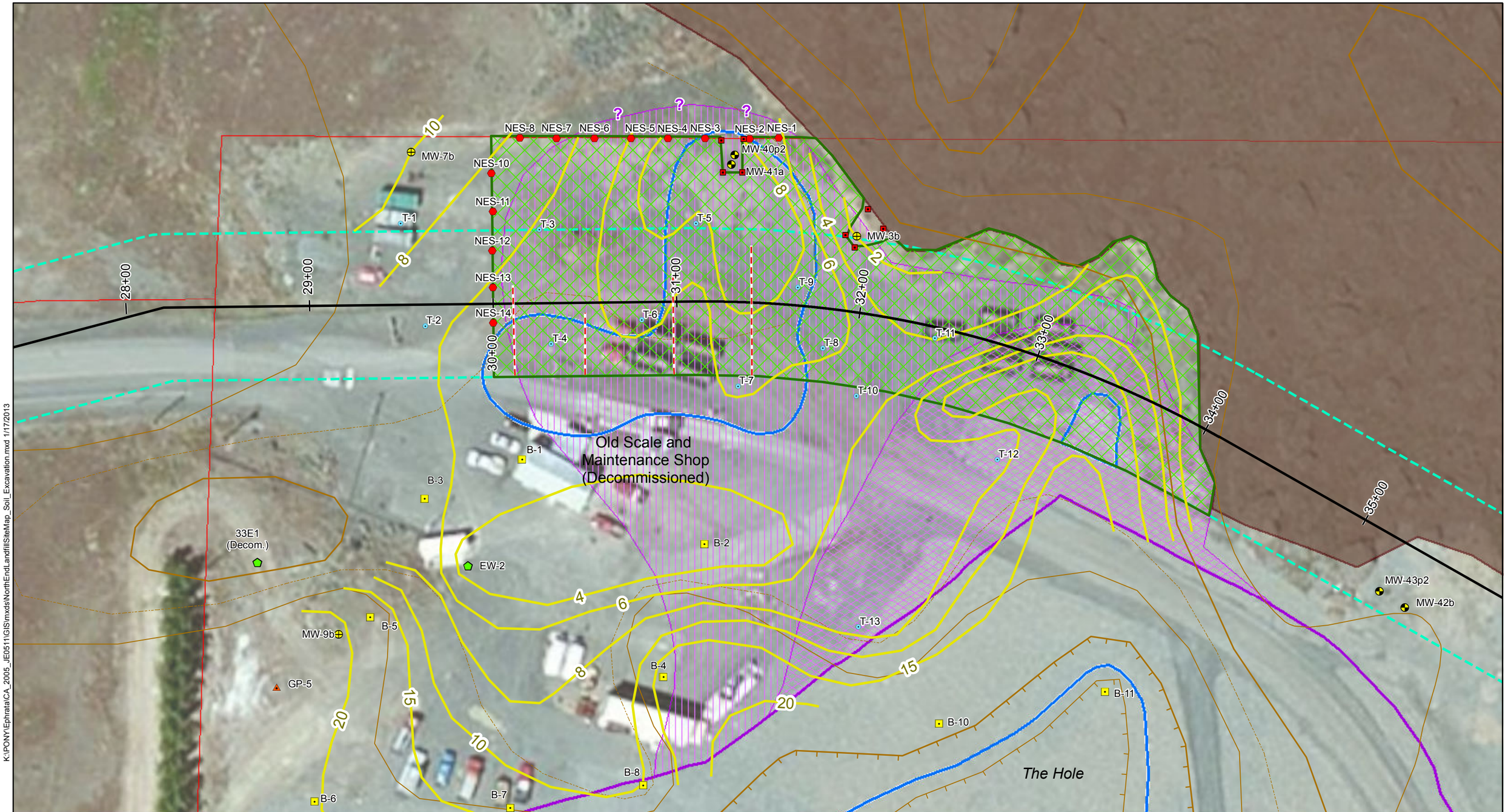
REFERENCES

Ecology, 2010. Letter to City of Ephrata and Grant County Public Works. Dated October 19, 2010.

Pacific Groundwater Group, 2010. Agency Review Draft Remedial Investigation Report Ephrata Landfill.

Pacific Groundwater Group, 2012. Addendum to Remedial Investigation Ephrata Landfill (Agency Draft). Technical memorandum dated August 28, 2012.

Parametrix, 2012. Agency Review Draft Ephrata Landfill Feasibility Study.



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- Quarterly Monitoring Well (MW)
- Remedial Investigation Monitoring Well (MW)
- Gas Extraction (GE)
- Gas Probe (GP)
- Other Wells
- RI Soil Boring
- RI Test Pit

- Capped Unlined Landfill Extent
- Approximate Area of Landfill Refuse Not Capped
- Approximate Area of Contaminated Soils Not Capped
- Approximate Extent of Saturation Above Bedrock
- County Owned Parcels
- Neva Lake Road Center Line
- 80-foot Coridor

- Approximate Soil Thickness Contours (feet)
- Soil Sample Location
- Composite Soil Sample Location
- Approximate Extent of Excavation
- Approximate Basalt Outcrops
- Approximate Buried PVC Drain Pipes

Top of Basalt Elevation Contours
- 20-foot Contour
- 10-foot Contour
- 20-foot Depression Contour
- 10-foot Depression Contour

0 Feet 50

June 2011 Bing Aerial Photo

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Figure 1
North End Soil Excavation Ephrata Landfill Map

Ephrata Landfill
RIFS

PgG

Table 1. Confirmation Soil Sample Results (North End Soil Interim Remeidal Action - Ephrata Landfill RI/FS)

		Northern Boundary Samples								Western Boundary Samples					Soil Island Samples	
Constituents	Units	NES-1	NES-2	NES-3	NES-4	NES-5	NES-6	NES-7	NES-8	NES-10	NES-11	NES-12	NES-13	NES-14	NES-MW-3b	NES-MW-41a
Semi-Volatile Organic Compounds (Semi-VOCs)																
2-Methylphenol	mg/kg	0.06U	0.061U	0.06U	0.06U	0.065U	0.061U	0.064U	0.059U	0.061U	0.059U	0.059U	0.06U	0.059U	0.062U	0.063U
4-Methylphenol	mg/kg	0.06U	0.061U	0.06U	0.06U	0.065U	0.061U	0.064U	0.059U	0.061U	0.059U	0.059U	0.06U	0.059U	0.062U	0.063U
bis(2-Ethylhexyl)phthalate	mg/kg	0.06U	0.061U	0.06U	0.06U	0.065U	0.061U	0.064U	0.059U	**0.1**	0.059U	0.059U	0.06U	**0.064**	**0.1**	0.063U
Volatile Organic Compounds (VOCs)																
1,1,1,2-Tetrachloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1,1-Trichloroethane	mg/kg	0.0009U	0.0017U	0.001U	**0.0025**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1,2,2-Tetrachloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0012Y	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1,2-Trichloro-1,2,2-trifluoroetha	mg/kg	0.0018U	0.0034U	0.002U	0.0025U	0.0022U	0.0021U	0.0019U	0.0017U	0.0017U	0.0019U	0.0018U	0.0017U	0.0019U	0.0017U	0.0023U
1,1,2-Trichloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1-Dichloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1-Dichloroethene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,1-Dichloropropene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,2,3-Trichlorobenzene	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
1,2,3-Trichloropropane	mg/kg	0.0018U	0.0034U	0.002U	0.0025U	0.0022U	0.0021U	0.0019U	0.0017U	0.0017U	0.0019U	0.0018U	0.0017U	0.0019U	0.0017U	0.0023U
1,2,4-Trichlorobenzene	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
1,2,4-Trimethylbenzene	mg/kg	0.0009U	0.0017U	0.001U	**0.0054**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,2-Dibromo-3-chloropropane	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
1,2-Dichlorobenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,2-Dichloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,2-Dichloropropane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,3,5-Trimethylbenzene	mg/kg	0.0009U	0.0017U	0.001U	**0.0034**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,3-Dichlorobenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,3-Dichloropropane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
1,4-Dichlorobenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
2,2-Dichloropropane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
2-Butanone	mg/kg	**0.0073**	**0.019**	**0.015**	**0.07**	**0.014**	**0.0097**	0.0048U	0.0044U	**0.01**	0.0047U	0.0046U	0.0043U	**0.0059**	**0.0064**	**0.011**
2-Chloroethylvinylether	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
2-Chlorotoluene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
2-Hexanone	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
4-Chlorotoluene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
4-Isopropyltoluene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
4-Methyl-2-Pentanone (MIBK)	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
Acetone	mg/kg	**0.066Q**	**0.2Q**	**0.13Q**	**0.29Q**	**0.13B**	**0.086B**	**0.028B**	**0.034B**	0.0042U	**0.031**	**0.039**	**0.035**	**0.049**	**0.067B**	**0.1B**
Acrolein	mg/kg	0.044U	0.084U	0.049U	0.063U	0.056U	0.053U	0.048U	0.044U	0.042U	0.047U	0.046U	0.043U	0.048U	0.043U	0.057U
Acrylonitrile	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
Benzene	mg/kg	**0.0019**	**0.038**	**0.039**	**0.094**	**0.0078**	**0.0025**	0.001U	0.0009U	**0.0061**	**0.0029**	**0.0012**	0.0009U	**0.0012**	**0.0042**	**0.031**
Bromobenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Bromochloromethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Bromodichloromethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Bromoethane	mg/kg	0.0018U	0.0034U	0.002U	0.0025U	0.0022U	0.0021U	0.0019U	0.0017U	0.0017U	0.0019U	0.0018U	0.0017U	0.0019U	0.0017U	0.0023U
Bromoform	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Bromomethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U

Table 1. Confirmation Soil Sample Results (North End Soil Interim Remeidal Action - Ephrata Landfill RI/FS)

		Northern Boundary Samples								Western Boundary Samples					Soil Island Samples	
Constituents	Units	NES-1	NES-2	NES-3	NES-4	NES-5	NES-6	NES-7	NES-8	NES-10	NES-11	NES-12	NES-13	NES-14	NES-MW-3b	NES-MW-41a
Volatile Organic Compounds (VOCs) Cont.																
Carbon Disulfide	mg/kg	**0.0009**	**0.0059**	**0.0021**	**0.0027**	**0.0015**	0.0011U	0.001U	**0.0009**	**0.0028**	0.0009U	0.0009U	0.0009U	0.001U	**0.0012**	**0.0029**
Carbon Tetrachloride	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Chlorobenzene	mg/kg	0.0009U	0.0017U	0.001U	**0.0034**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Chloroethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Chloroform	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Chloromethane	mg/kg	0.0009U	**0.0024**	**0.0011**	**0.0019**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
cis-1,2-Dichloroethene	mg/kg	0.0009U	0.0017U	0.001U	**0.0042**	**0.0013**	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
cis-1,3-Dichloropropene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Dibromochloromethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Dibromomethane	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Ethylbenzene	mg/kg	0.0009U	0.0017U	**0.0015**	**0.0062**	0.0011U	0.0011U	0.001U	0.0009U	**0.0024**	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	**0.0012**
Hexachlorobutadiene	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
Isopropylbenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Methylene Chloride	mg/kg	**0.0039**	**0.0072**	**0.0033**	**0.0041**	**0.003**	**0.003**	**0.0023**	**0.0032**	0.0017U	**0.0021B**	**0.0033B**	**0.0038B**	**0.0026B**	**0.003**	**0.003**
Naphthalene	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
n-Butylbenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
n-Propylbenzene	mg/kg	0.0009U	0.0017U	0.001U	**0.0019**	0.0011U	0.0011U	0.001U	0.0009U	**0.001**	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
o-Xylene	mg/kg	0.0009U	0.0017U	**0.001**	**0.012**	0.0011U	0.0011U	0.001U	0.0009U	**0.0011**	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
sec-Butylbenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Styrene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
tert-Butylbenzene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Tetrachloroethene (PCE)	mg/kg	0.0009U	**0.057**	**0.0055**	**0.013**	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	**0.057**
Toluene	mg/kg	**0.0012**	**0.0098**	**0.012**	**0.096**	**0.0021**	**0.0015**	0.001U	0.0009U	**0.0069**	**0.0011**	0.0009U	0.0009U	0.001U	**0.0023**	**0.0099**
trans-1,2-Dichloroethene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
trans-1,3-Dichloropropene	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
trans-1,4-Dichloro-2-butene	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
Trichloroethene (TCE)	mg/kg	0.0009U	0.0017U	**0.019**	**0.092**	**0.033**	**0.0027**	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	**0.0012**
Trichlorofluoromethane (CFC 11)	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Vinyl Acetate	mg/kg	0.0044U	0.0084U	0.0049U	0.0063U	0.0056U	0.0053U	0.0048U	0.0044U	0.0042U	0.0047U	0.0046U	0.0043U	0.0048U	0.0043U	0.0057U
Vinyl Chloride	mg/kg	0.0009U	0.0017U	0.001U	0.0013U	0.0011U	0.0011U	0.001U	0.0009U	0.0008U	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	0.0011U
Xylene Isomers, M+P	mg/kg	0.0009U	0.0017U	**0.002**	**0.03**	0.0011U	0.0011U	0.001U	0.0009U	**0.0019**	0.0009U	0.0009U	0.0009U	0.001U	0.0009U	**0.0023**
Inorganic Constituents																
Total Solids	Percent	**93.5**	**81.2**	**90.4**	**84.6**	**84.9**	**88.6**	**95.5**	**92.4**	**88.6**	**93.3**	**91.6**	**90.9**	**92.3**	**87.6**	**83.2**
Chloride	mg/kg	**34.4**	**53.8**	**92.4**	**56**	**30.9**	**142**	0.981U	**2.1**	1.1U	**21.2**	**55.5**	**218**	**50.3**	1.14U	**21**
Nitrate	mg-N/kg	**15.4**	**2.86**	**7.61**	**20.4**	**6.2**	**8.97**	**5.09**	**2.38**	**1.59**	**15.3**	**47.3**	**145**	**53.5**	**3.77**	**8.2**
Sulfate	mg/kg	**99.1**	**283**	**1780**	**3080**	**827**	**2410**	**27.9**	**57.2**	**28.9**	**156**	**299**	**581**	**852**	**43.6**	**2700**
Arsenic, Total	mg/kg	10U	10U	10U	10U	10U	5U	10U	10U	10U	10U	10U	10U	10U	10U	10U
Iron, Total	mg/kg	**27900**	**43000**	**59800**	**37500**	**37500**	**25300**	**33600**	**35500**	**29900**	**29100**	**29200**	**30100**	**37300**	**36400**	**44000**
Manganese, Total	mg/kg	**386**	**544**	**597**	**525**	**483**	**403**	**851**	**522**	**381**	**453**	**437**	**472**	**501**	**486**	**515**

Bold = detected concentration
U = not detected with reporting limit concentration
Y = not detected with elevated reporting limit
Q = Detected analyte with continuing calibration too high (does not meet established accetance criteria).
B = Detected analyte also detected in an associated Method Blank at concentration greater than 1/2 ARI reporting limit or 5% of the regulatory limit or 5% of the analyte concentration in sample
NES-11, NES-12, NES-13, and NES-14: Methylene Chloride detected in associated method blank at 2.5 ug/kg (0.0025 mg/kg)
NES-5, NES-6, NES-7, NES-8, NES-MW-41a, and NES-MW-3b: Acetone detected in associated method blank at 9.8 ug/kg (0.0098 mg/kg). Acetone also detected in water trip blank associated with these samples at 10 ug/L

Table 2. Quality Assurance Quality Control Summary for Soil Samples
Laboratory: Analytical Resources, Inc. (Tukwila, WA)

Soil Sample ID	NES-1, NES-2, NES-3, NES-4	NES-10, NES-11, NES-12, NES-13, NES-14	NES-5, NES-6, NES-7, NES-8, NES-MW-41a, NES-MW-3b
Lab Data Batch -------->	**ARI vu58**	**ARI vv06**	**ARI vv07**
METHODOLOGY			
Method	ok	ok	ok
Date Sampled	ok	ok	ok
Date Analyzed	ok	ok	ok
Holding Time	ok	ok	ok
Preservative	ok	ok	ok
Acceptability	Yes	Yes	Yes
SURROGATE SPIKES			
Surrogate Used	Yes (4 for VOC and 8 for Semi-VOCs)[1]	Yes (4 for VOC and 8 for Semi-VOCs)[1]	Yes (4 for VOC and 8 for Semi-VOCs)[1]
Sample Spike Recovery	Bromofluorobenzene recovery too low for NES-2, NEW-3, and NES-4 in original analysis. Samples were re-analyzed with surrogate recoveries in control except NES-3.	ok	Bromofluorobenzene recovery too low for NES-MW-41a. Sample re-analyzed and recovery within limits.
Control Spike Recovery	ok	ok	2-Fluorophenol recovery too low in LCS, LCSD, and Method Blank by <2% (no corrective actions)
Acceptability	Yes	Yes	Yes
MS/MSD	MS for Metals, N-Nitrate, Chloride, and Sulfate (NES-1)	MS and MSD for VOCs and Semi-VOCs, and MS for Metals, Chloride, N-Nitrate and Sulfate (NES-11)	None
MS Recovery	Percent recoveries for iron and manganese too high; however percent recoveries not applicable per lab because sample concentrations were too high.	Percent recovery for a number of VOCs out of control high and/or low. No further corrective action	NA
		Percent recovery for iron too high; however, percent recoveries not applicable per lab because sample concentrations were too high.	
MSD Recovery	NA	Percent recovery for a number of VOCs out of control high and/or low. No further corrective action.	NA
Relative Percent Differenct (RPD)	NA	ok	NA
Acceptability	YES	YES	YES
METHOD BLANK	Yes (Metals, Chloride, N-Nitrate, Sulfate, Total Solids, VOCs, Semi-VOCs)	Yes (Metals, Chloride, N-Nitrate, Sulfate, Total Solids, VOCs, Semi-VOCs)	Yes (Metals, Chloride, N-Nitrate, Sulfate, Total Solids, VOCs, Semi-VOCs)
Detections	None	Chloromethane detected at 1.1 ug/kg - All associated samples that contain analyte flagged with "B" qualifier.	Acetone detected at 9.8 ug/kg - All associated samples that contain analyte flagged with "B" qualifer.
		Methylene chloride detected at 2.5 ug/kg - All associated samples that contain analyte flagged with "B" qualifier.	Methylene chloride detected at 3.1 ug/kg- All associated samples that contain analyte flagged with "B" qualifier.
Surrogate Recovery	ok	ok	2-Fluorophenol recovery too low by < 2%. No corrective actions.
Acceptability	Yes	Yes	Yes
TRIP BLANK	Yes (VOCs)	None	Yes (VOCs)
Detections	None	NA	Acetone (10 ug/L)
Acceptability	Yes	Yes	Yes

Table 2. Quality Assurance Quality Control Summary for Soil Samples
Laboratory: Analytical Resources, Inc. (Tukwila, WA)

Soil Sample ID	NES-1, NES-2, NES-3, NES-4	NES-10, NES-11, NES-12, NES-13, NES-14	NES-5, NES-6, NES-7, NES-8, NES-MW-41a, NES-MW-3b
Lab Data Batch -------->	**ARI vu58**	**ARI vv06**	**ARI vv07**
Reporting Limit (RL)			
Regulation/Method	ok	ok	ok
Lab	RL's variable for method SW8260C (VOCs) and method EPA 300 (sulfate, chloride, N-Nitrate) depending on total solids and sample amount.	RL's variable for method SW8260C (VOCs) and method EPA 300 (sulfate, chloride, N-Nitrate) depending on total solids and sample amount.	RL's variable for method SW8260C (VOCs) and method EPA 300 (sulfate, chloride, N-Nitrate) depending on total solids and sample amount.
Acceptability	Yes	Yes	Yes
FIELD DUPLICATES			
Sample:	None	None	None
Relative Percent Differenct (RPD)	NA	NA	NA
Acceptability	NA	NA	NA
LAB DUPLICATES	Metals, Chloride, N-Nitrate, Sulfate, and Total Solids	Metals, Chloride, N-Nitrate, Sulfate, and Total Solids	None
Sample	NES-1	NES-11	NA
Relative Percent Differenct (RPD)	ok	Sulfate = 45% (No further action)	NA
Acceptability	Yes	Yes	Yes
LAB CONTROL	Yes (LCS and LCSD for VOCs and Semi-VOCs, and LCS for Metals)	Yes (LCS and LCSD for VOCs and Semi-VOCs, and LCS for Metals)	Yes (LCS and LCSD for VOCs and Semi-VOCs, and LCS for Metals)
Spike Recovery	Percent Recovery too high for cis-1,2-Dichloroethene (126%)	ok	ok
Surrogate Recovery	ok	ok	ok
Spike Dupl. Recovery	Percent Recovery too high for cis-1,2-Dichloroethene (124%).	ok	Methylene Chloride recovery too high in LCSD (143%)
RPD	ok	ok	ok
Acceptability	YES	YES	YES
STANDARD REFERENCE	Yes (Sulfate, Chloride, and N-Nitrate)	Yes (Sulfate, Chloride, and N-Nitrate)	Yes (Sulfate, Chloride, and N-Nitrate)
Recovery	ok	ok	ok
COC	ok	ok	ok
Acceptability	Yes	Yes	Yes
LAB REPORT	Cover Report	Cover Report	Cover Report
Additional Information	VOC Method SW8260B: Continuing calibration out of control high for trichlorofluoromethane and acetone. All samples that contain analyte have been flagged with "Q" qualifier.	VOC Method SW8260B: Continuing calibration out of control low for 2-chloroethylvinyhlether and out of control high for trichlorofluoromethane. All samples that contain analyte have been flagged with a "Q" qualifier.	VOC Method SW8260B: Internal standard d4-1,2-dichlorobenzene not within control limits following initial analysis of NES-MW-41a. Sample re-analyzed and still no within control. Lab concluded sample matrix was cause of poor recovery.
Acceptability	ok	ok	ok
QA/QC performed by:	Dawn Chapel	Dawn Chapel	Dawn Chapel

1 VOC Surrogates: d4-1,2-dichloroethane; d8-Toluene; Bromofluorobenzene; and d4-1,2-dichlorobenzene
Semi-VOC Surrogates: d5-Nitrobenzene; d14-p-Terphenyl; d5-Phenol; 2,4,6-Tribromophenol; 2-Fluorobiphenyl; d4-1,2-Dichlorobenzene; 2-Fluorophenol; d4-2-Chlorophenol

VOC Surrogates: d4-1,2-dichloroethane; d8-Toluene; Bromofluorobenzene; and d4-1,2-dichlorobenzene
Semi-VOC Surrogates: d5-Nitrobenzene; d14-p-Terphenyl; d5-Phenol; 2,4,6-Tribromophenol; 2-Fluorobiphenyl; d4-1,2-Dichlorobenzene; 2-Fluorophenol; d4-2-Chlorophenol

VOC Surrogates: d4-1,2-dichloroethane; d8-Toluene; Bromofluorobenzene; and d4-1,2-dichlorobenzene
Semi-VOC Surrogates: d5-Nitrobenzene; d14-p-Terphenyl; d5-Phenol; 2,4,6-Tribromophenol; 2-Fluorobiphenyl; d4-1,2-Dichlorobenzene; 2-Fluorophenol; d4-2-Chlorophenol

Table 3. Screening of Detected Soil Results to MTCA Standards (North End Soil Interim Remeidal Action - Ephrata Landfill RI/FS)

		MTCA Standards[1]			Northern Boundary Samples[2]								Western Boundary Samples[2]					Soil Island Samples[2]	
Constituents	Units	MTCA-B Soil Carcin (Ingestion)	MTCA-B Soil Non-Carcin (Ingestion)	Soil Concentration Protected of Groundwater	NES-1	NES-2	NES-3	NES-4	NES-5	NES-6	NES-7	NES-8	NES-10	NES-11	NES-12	NES-13	NES-14	NES-MW-3b	NES-MW-41a
Semi-Volatile Organic Compounds (Semi-VOCs)																			
bis(2-Ethylhexyl)phthalate	mg/kg	71	1600	13.36	ND	ND	ND	ND	ND	ND	ND	ND	**0.1**	ND	ND	ND	**0.064**	**0.1**	ND
Volatile Organic Compounds (VOCs)																			
1,1,1-Trichloroethane	mg/kg	NR	160000	1.48	ND	ND	ND	**0.0025**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	mg/kg	NR	R-ND	NA	ND	ND	ND	**0.0054**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	mg/kg	NR	800	NA	ND	ND	ND	**0.0034**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	mg/kg	NR	48000	NA	**0.0073**	**0.019**	**0.015**	**0.07**	**0.014**	**0.0097**	ND	ND	**0.01**	ND	ND	ND	**0.0059**	**0.0064**	**0.011**
Acetone	mg/kg	NR	72000	28.89	**0.066Q**	**0.2Q**	**0.13Q**	**0.29Q**	**0.13B**	**0.086B**	**0.028B**	**0.034B**	ND	**0.031**	**0.039**	**0.035**	**0.049**	**0.067B**	**0.1B**
Benzene	mg/kg	18	320	0.0044	**0.0019**	**0.038**	**0.039**	**0.094**	**0.0078**	**0.0025**	ND	ND	**0.0061**	**0.0029**	**0.0012**	ND	**0.0012**	**0.0042**	**0.031**
Carbon Disulfide	mg/kg		8000	5.04	**0.0009**	**0.0059**	**0.0021**	**0.0027**	**0.0015**	ND	ND	**0.0009**	**0.0028**	ND	ND	ND	ND	**0.0012**	**0.0029**
Chlorobenzene	mg/kg	NR	1600	0.86	ND	ND	ND	**0.0034**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloromethane	mg/kg	R-ND	NR	NA	ND	**0.0024**	**0.0011**	**0.0019**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-Dichloroethene	mg/kg	NR	160	0.078	ND	ND	ND	**0.0042**	**0.0013**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	mg/kg	NR	8000	5.85	ND	ND	**0.0015**	**0.0062**	ND	ND	ND	ND	**0.0024**	ND	ND	ND	ND	ND	**0.0012**
Methylene Chloride	mg/kg	133	4800	0.021	**0.0039**	**0.0072**	**0.0033**	**0.0041**	**0.003**	**0.003**	**0.0023**	**0.0032**	ND	**0.0021B**	**0.0033B**	**0.0038B**	**0.0026B**	**0.003**	**0.003**
n-Propylbenzene	mg/kg	NR	8000	NA	ND	ND	ND	**0.0019**	ND	ND	ND	ND	**0.001**	ND	ND	ND	ND	ND	ND
o-Xylene	mg/kg	NR	16000	14.40	ND	ND	**0.001**	**0.012**	ND	ND	ND	ND	**0.0011**	ND	ND	ND	ND	ND	ND
Tetrachloroethene (PCE)	mg/kg	476	480	0.050	ND	**0.057**	**0.0055**	**0.013**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.057**
Toluene	mg/kg	NR	6400	4.51	**0.0012**	**0.0098**	**0.012**	**0.096**	**0.0021**	**0.0015**	ND	ND	**0.0069**	**0.0011**	ND	ND	ND	**0.0023**	**0.0099**
Trichloroethene (TCE)	mg/kg	12	40	0.003	ND	ND	**0.019**	**0.092**	**0.033**	**0.0027**	ND	ND	ND	ND	ND	ND	ND	ND	**0.0012**
Xylene Isomers, M+P	mg/kg	NR	16000	14.28	ND	ND	**0.002**	**0.03**	ND	ND	ND	ND	**0.0019**	ND	ND	ND	ND	ND	**0.0023**
TOTAL SUMMED VOCs	mg/kg				0.08	0.34	0.23	0.73	0.19	0.11	0.03	0.04	0.03	0.04	0.04	0.04	0.06	0.08	0.22
Inorganics																			
Chloride	mg/kg	NR	NR	NA	**34.4**	**53.8**	**92.4**	**56**	**30.9**	**142**	0.981U	**2.1**	1.1U	**21.2**	**55.5**	**218**	**50.3**	1.14U	**21**
Nitrate	mg-N/kg	NR	128000	NA	**15.4**	**2.86**	**7.61**	**20.4**	**6.2**	**8.97**	**5.09**	**2.38**	**1.59**	**15.3**	**47.3**	**145**	**53.5**	**3.77**	**8.2**
Sulfate	mg/kg	NR	NR	NA	**99.1**	**283**	**1780**	**3080**	**827**	**2410**	**27.9**	**57.2**	**28.9**	**156**	**299**	**581**	**852**	**43.6**	**2700**
Iron, Total	mg/kg	NR	56,000	NA	**27,900**	**43,000**	**59,800**	**37,500**	**37,500**	**25,300**	**33,600**	**35,500**	**29,900**	**29,100**	**29,200**	**30,100**	**37,300**	**36,400**	**44,000**
Manganese, Total	mg/kg	NR	11,200	NA	**386**	**544**	**597**	**525**	**483**	**403**	**851**	**522**	**381**	**453**	**437**	**472**	**501**	**486**	**515**

1. Soil concentrations compared to MTCA-B carcinogenic and noncarcinogenic soil cleanup levels in CLARC database and to concentrations protective of groundwater using MTCA 3-phase partitioning model (see Table 3)
2. Shaded results indicate concentrations above the following standards:
   Benzene, PCE, and TCE in a few samples were above the concentration calculated to be protective of groundwater (see Table 4)
   Total Iron in one sample was slightly above MTCA-B Soil Cleanup Levels

ND = Not Detected
NR = Not Researched
R-ND = Researched - No Data
NA = Not all parameters available to calculate soil concentration protective of groundwater
Q = Detected analyte with continuing calibration too high (does not meet established accetance criteria).
B = Detected analyte also detected in an associated Method Blank at concentration greater than 1/2 ARI reporting limit or 5% of the regulatory limit or 5% of the analyte concentration in sample
NES-11, NES-12, NES-13, and NES-14: Methylene Chloride detected in associated method blank at 2.5 ug/kg (0.0025 mg/kg)
NES-5, NES-6, NES-7, NES-8, NES-MW-41a, and NES-MW-3b: Acetone detected in associated method blank at 9.8 ug/kg (0.0098 mg/kg). Acetone also detected in water trip blank associated with these samples at 10 ug/L

Table 4. Fixed Parameter Three-Phase Partitioning Calculation (North End Soil Interim Remeidal Action - Ephrata Landfill RI/FS)

		MTCA Default Input Parameters[1]					MTCA-B and Federal MCL Groundwater Standards (ug/L)[2]			Cs = soil concentrations protective of groundwater at MTCA-B and Federal MCL standards (mg/kg)[3]			
Constituents	Units	Koc (L/kg)	foc	Kd (L/kg)	Hcc (13 C)[4]	Dilution Factor	MTCA-B Carcin (GW)	MTCA-B Non Carcin (GW)	FED MCL (GW)	Cs based on MTCA-B Carcin	Cs based on MTC-B Non Carcin	Cs based on Federal MCL	Soil Concentration Protective of Groundwater (mg/kg) based on lowest groundwater standard
Semi-Volatile Organic Compounds (Semi-VOCs)													
bis(2-Ethylhexyl)phthalate	mg/kg	111123	0.001	111.12	0.00000066	20	6.25	320	6	13.92	712.47	13.36	13.36
Volatile Organic Compounds (VOCs)													
1,1,1-Trichloroethane	mg/kg	135	0.001	0.135	0.417	20	NR	16000	200		118.76	1.48	1.48
1,2,4-Trimethylbenzene	mg/kg	NR	0.001		NA	20	NR	R-ND	NA				
1,3,5-Trimethylbenzene	mg/kg	NR	0.001		NA	20	NR	80	NA				
2-Butanone (MEK)	mg/kg	NR	0.001		NA	20	NR	4800	NA				
Acetone	mg/kg	1	0.001	0.00058	0.00097	20	NR	7200	NA		28.89		28.89
Benzene	mg/kg	62	0.001	0.062	0.132	20	0.80	32	5	0.004	0.18	0.03	0.004
Carbon Disulfide	mg/kg	46	0.001	0.0457	0.798	20	NR	800	NA		5.04		5.04
Chlorobenzene	mg/kg	224	0.001	0.224	0.0779	20	NR	160	100		1.38	0.86	0.86
Chloromethane	mg/kg	6	0.001	0.006	0.199	20	R-ND	NR	NA				
cis-1,2-Dichloroethene	mg/kg	36	0.001	0.0355	0.0997	20	NR	16	70		0.08	0.34	0.08
Ethylbenzene	mg/kg	204	0.001	0.204	0.162	20	NR	800	700		6.69	5.85	5.85
Methylene Chloride	mg/kg	10	0.001	0.01	0.0565	20	5.83	480	5	0.03	2.06	0.02	0.02
n-Propylbenzene	mg/kg	NR	0.001		NA	20	NR	800	NA				
o-Xylene	mg/kg	241	0.001	0.241	0.105	20	NR	1600	NA		14.40		14.40
Tetrachloroethene (PCE)	mg/kg	265	0.001	0.265	0.393	20	20.80	48	5	0.21	0.48	0.05	0.05
Toluene	mg/kg	140	0.001	0.14	0.146	20	NR	640	1000		4.51	7.05	4.51
Trichloroethene (TCE)	mg/kg	94	0.001	0.094	0.238	20	0.54	4	5	0.003	0.03	0.03	0.003
Xylene Isomers, M+P	mg/kg	233	0.001	0.233	0.1535	20	NR	1600	10000		14.28	89.26	14.28

1. Default parameters in Department of Ecology online CLARC database except Hcc (see footnote 4)

2. Values in Department of Ecology online CLARC database

3. Values for "Cs" calculated using equation 747-1 in WAC 173-340-747 (4). Default values used for water-filled (0.3) and air-filled porosity (0.13).

4. Hcc values for groundwater temperature at 13 degrees celcius - from EPA On Line Calculator (CLARC uses 25 degrees celcius): http://www.epa.gov/athens/learn2model/part-two/onsite/esthenry.html

NA = not available on EPA On Line Calculator

ND = Not Detected

NR = Not Researched

R-ND = Researched - No Data

Koc = soil organic carbon-water partition coefficient

foc = fraction organic carbon. Default value used (0.001)

Kd = partitioning coefficient = Koc*foc

Hcc = Hentry's law constant (unitless)

Photo 1: Soil removal method using track hoe (looking south)

Photo 2: Refuse in eastern part of excavation (looking south):

Photo 3: Method of scraping bedrock bottom (looking south)

Photo 4: Low area in southeast where seep was observed (looking southeast)

Photo 5: Area of saturation near MW-41a (looking west)

Photo 6: Soils left in place around MW-41a and MW-40p2 (looking north)

Photo 7: Soils left in place around MW-41a and MW-40p2 and areas of saturation

Photo 8: Excavation looking east from approximate western limit of excavation

Photo 9: Bedrock srcaping western part of excavation (looking east)