APPENDIX A

Sampling and Analysis Plan

King County Department of Natural Resources and Parks

Solid Waste Division

CEDAR HILLS REGIONAL LANDFILL
ENVIRONMENTAL CONTROL SYSTEMS MODIFICATIONS PROJECT
CONTRACT NO. E00286E12

East Perched Zones Sampling and Analysis Plan

Final

Prepared by
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King County
Department of
Natural Resources and Parks
Solid Waste Division

Waste **Prevention** *Resource* **Recovery** *Waste* **Disposal**

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ACRONYMS AND ABBREVIATIONS

Aspect	Aspect Consulting, LLC
CHRLF	Cedar Hills Regional Landfill
Ecology	Washington State Department of Ecology
EPZ	East Perched Zones
FS	Feasibility Study
FSP	Field Sampling Plan
KCEL	King County Environmental Laboratory
KCSWD	King County Solid Waste Division
µm	micrometer
µS/cm	microsiemens per centimeter
mg/L	milligrams per liter
mL	milliliter
mV	millivolt
MNA	monitored natural attenuation
MTCA	Model Toxics Control Act
NTU	nephelometric turbidity unit
PDB	passive diffusion bag
PVC	polyvinyl chloride
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RI	Remedial Investigation
RPP	rigid porous polyethylene
SAP	Sampling Analysis Plan
SKCDPH	Seattle-King County Department of Public Health
TDS	total dissolved solids

TSS	total suspended solids
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
VOC	volatile organic compound
WAC	Washington Administrative Code

1.0 INTRODUCTION

In response to compliance requirements in the 2004 Municipal Solid Waste Handling Permit, King County Solid Waste Division (KCSWD) initiated a project to investigate environmental control systems in the pre-1986 unlined areas of the Cedar Hills Regional Landfill adjacent to the Main Hill (CHRLF; Figure A1). The report of which is entitled Cedar Hills Regional Landfill Site-Wide Groundwater Wells and Hydrogeologic Report (CH2M HILL and Udaloy, 2004), addressed hydrogeology to resolve questions regarding the East Perched Zones (EPZ) among other portions of the landfill.

A Hydrogeologic Report Addendum (Aspect, 2012a) was developed to fulfill the requirements of the 2009-2019 MSWH permit, which required an update to the Site-Wide Hydrogeologic Report (CH2M HILL and Udaloy, 2004a) including a more detailed investigation of the EPZ.

Data from the EPZ indicate impacts on groundwater, potentially from landfill gas interactions. As a result of the findings of the Site-Wide Hydrogeologic and Addendum projects, the Washington State Department of Ecology (Ecology) requested that KCSWD implement corrective action for perched saturated zones beneath the EPZ at the CHRLF. Ecology and KCSWD agreed to proceed under the Model Toxics Control Act (MTCA) with an Independent Remedial Action in accordance with Washington Administrative Code (WAC) 173-340-510 and WAC 173-340-515.

This Sampling and Analysis Plan (SAP) has been prepared as part of the CHRLF East Perched Zones Remedial Investigation (RI) /Feasibility Study (FS) Work Plan to meet the requirements of the corrective action issued by the Seattle-King County Department of Public Health (SKCDPH) and entered into by KCSWD under the Environmental Control Systems Modifications (ECSM) Project.

The purpose of this SAP is to ensure that field sample collection, handling, and laboratory analysis conducted during the EPZ RI/FS field activities will generate data to meet project-specific data quality objectives in accordance with the MTCA requirements (WAC 173-340-350). This SAP consists of two major components: a Field Sampling Plan (FSP) defining sampling locations and field protocols and a Quality Assurance Project Plan (QAPP) defining analytical methods, field and laboratory quality assurance (QA) protocols.

Field sampling activities not directly relating to the EPZ RI/FS are not discussed in this SAP. Instead, field sampling activities for these data gaps, which are identified in the CHRLF ECSM Project Data Gaps Report, shall be referenced within a separate report entitled the Field Sampling and Analysis Plan.

2.0 FIELD SAMPLING PLAN

2.1 Sampling Locations

This section describes the monitoring well network, sampling parameters and analytical methods, sampling protocols, and schedule for the RI/FS field activities.

2.1.1 Groundwater Level Monitoring Locations

Groundwater level monitoring will be conducted during the RI to assess the current hydrological model. The groundwater level monitoring network for the RI consists of monitoring wells, groundwater extraction wells, gas probes, and gas extraction wells within the general EPZ area. Table A-1 lists the locations where groundwater level monitoring is required, and Figure A-2 depicts the locations in relation to the EPZ project area.

2.1.2 Groundwater Sampling Network

The RI/FS groundwater monitoring network for the RI consists of EPZ perched and regional aquifer monitoring wells, groundwater extraction wells, and select piezometers. Table A-2 lists the locations where groundwater samples will be collected, and Figure A-3 depicts the locations in relation to the EPZ project area. Well construction logs are presented in the Site-Wide Hydrogeologic Report, Volume II (CH2M HILL and Udaloy, 2004) and the East Main Hill Perched Zones Technical Memorandum, Attachment A (Aspect, 2010). RI well and probe boring logs proposed for sampling are presented in Attachment B of this SAP. The geological cross-sections of the site are presented in the main body of the RI/FS Work Plan.

The field sampling will be performed for the purpose of (1) defining the nature and extent of groundwater impacts, (2) providing data to support the evaluation of monitored natural attenuation (MNA), and (3) to support the evaluation of the extraction well system shutdown.

2.1.2.1 Passive Diffusion Sampling

Passive diffusion samples will be collected from wells depicted on Figure A-3 on a trial basis to evaluate this technology for future sample collection as compared to conventional low-flow groundwater sampling (see explanation in the Work Plan). Passive diffusion bags (PDBs) are suitable for collection of samples for analysis of volatile organic compounds (VOCs), while rigid porous polyethylene (RPP) samplers are suitable for collection of samples for metals analysis. The deployment of these passive samplers will be 2 weeks prior to the sample collection date to allow for equilibration.

2.1.2.2 Low-Flow Groundwater Sampling

Low-flow groundwater samples will be collected from the sampling points summarized in Table A-2. Low-flow groundwater samples will only be collected from EW-9 through EW-13 if there is sufficient water present in these wells at the time of sampling. Historically, these wells have been dry or have not contained sufficient water. There will be some overlap between the low-flow sampling and the passive diffusion sampling because the intent of the conventional, low-flow sample collection is to allow comparison to the passive diffusion sample results.

2.1.3 Stream Sampling

Stream samples will be collected from SW-E1, at the downstream end of Stream 3 (Figure A-3). The intent of the stream sampling is to evaluate the concentrations of analytical parameters to evaluate if contaminant plumes within the EPZ are affecting stream conditions.

2.1.4 Leachate Sampling

Leachate will be collected from MH-17N (a conveyance manhole) and FS-3 (flow meter vault), if both locations have sufficient flow (Figure A-3). The intent of the leachate sampling is to evaluate the raw leachate from the unlined portion of the Main Hill for comparison to groundwater quality to evaluate if leachate is affecting groundwater conditions.

2.1.5 Soil Gas Sampling

Soil gas samples will be collected from existing gas probes, a piezometer, and existing monitoring wells located throughout the project area (Figure A-3). The intent of the soil gas sampling is to determine VOC concentrations in soil gas for evaluation of the vapor intrusion pathway. The data will also be used to evaluate the relative contribution of volatilization from impacted groundwater versus fugitive landfill gas.

2.2 Monitoring Parameters

Analytical methods for the laboratory-analyzed parameters for each sample medium are listed in Table A-4 and are discussed from a QA standpoint in Section 3. Table A-5 presents the specific parameters that are the target of this investigation. It is important to follow these tables because there are some variations in the analyte list for the different sample media. Prior to beginning the sampling and analysis program, Tables A-4 and A-5 will be provided to the KCEL (laboratory for groundwater, surface water, and leachate samples), and Table A-5 will be provided to Fremont Analytical (laboratory selected for soil gas samples) so that the laboratories can document these project-specific analyte lists.

2.2.1 Groundwater Monitoring Parameters

The monitoring parameters required for groundwater samples per WAC 173-351-990, Criteria for Municipal Solid Waste Landfills, are as follows:

- Appendix I – Constituents for Detection Monitoring
- Appendix II – Groundwater Quality Parameters

These are collectively referred to as the RI project-specific analytes. Appendix I parameters include metals and select organic constituents from the VOCs list. Table A-5 contains a complete list of the RI project-specific organic and inorganic analytes. Mercury is not listed as an Appendix I parameter, but has been added to Table A-5 as it is a routine parameter monitored at the Landfill.

Field parameters, geochemical indicator constituents, and leachate indicator parameters, as defined in WAC 173-351-990, Criteria for Municipal Solid Waste Landfills, Appendix II (Groundwater Quality Parameters), will also be monitored during the RI groundwater monitoring events. These parameters will be analyzed for the following purposes:

- To support source assessment (e.g., use of chloride as an indicator of leachate sources); and
- To evaluate MNA.

The Appendix II list omits several key field parameters and geochemical indicator constituents that are necessary for the evaluation of MNA, and those have been added to Table A-3 in italics. The MNA evaluation will be performed in general accordance with the U.S. Environmental Protection Agency's (USEPA's) Monitored Natural Attenuation of Inorganic Contaminants in Ground Water, Volume 1, Technical Basis for Assessment (2007) and USEPA's Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water (1998).

MNA is an approach to remediation that relies on natural processes to attenuate the mass, toxicity, mobility, volume, or concentration of constituents of concern to achieve remediation objectives within an acceptable timeframe. MNA can take place through naturally occurring physical, chemical, and biological processes. However, MNA can be used only at sites with conditions that are favorable. Some MNA parameters are already included as geochemical indicator parameters from Appendix II of WAC 173-351, such as conductivity, pH, alkalinity, chloride, arsenic, dissolved manganese, sulfate, total organic carbon, and dissolved iron.

To evaluate whether the groundwater conditions within the CHRLF EPZ are suitable for MNA and to evaluate if MNA is occurring, a select number of additional field and geochemical parameters have been added to the RI project-specific analyte list including oxidation-reduction potential, dissolved oxygen, nitrate plus nitrite, dissolved ferrous iron, methane, ethene, and ethane. These parameters, coupled with those already included on the project-specific analyte list, will help to assess the following:

- Whether the aquifer is aerobic or anaerobic;
- The presence of anaerobic biological/microbial activity and whether this activity is dissolving metals from the aquifer matrix material;
- The stages of anaerobic degradation process; whether samples are collected from the same groundwater system;
- Whether chlorinated solvent reduction is occurring;
- Whether chlorinated solvents are undergoing biological transformation; and
- Whether organic carbon is available in the aquifer (excluding anthropogenic carbon) for reductive dechlorination.

2.2.2 Surface Water Monitoring Parameters

Surface water samples will be analyzed for the same WAC 173-351-990 Appendix I and II analytes as groundwater.

2.2.3 Leachate Monitoring Parameters

Leachate samples will be analyzed for select WAC 173-351-990 Appendix I and II analytes as listed in Table A-5. Leachate samples will not be analyzed for the additional MNA parameters.

2.2.4 Soil Gas Monitoring Parameters

Soil gas samples will be analyzed for the standard list of VOCs under EPA Method TO-15. Table A-5 presents the EPA Method TO-15 analyte list.

2.3 Schedule

The RI field activities will commence within 30 days of Ecology's approval of the RI/FS Work Plan. . Sampling will occur during sequential field activities. Each of the field activities is expected to take approximately 5 to 7 days of field work. Field work will be followed by period of approximately 45 days during which analytical results would be generated; the standard turn-around-time for the KCEL to provide analytical results is 30 calendar days in addition to time for data validation by KCSWD. The total time that the RI data collection period will take is approximately 70 days.

The following table summarizes the main RI activities and the locations where those activities will take place:

RI Activity	Location
Groundwater level monitoring; stream gaging	Table A-1 locations; SG-4 and SG-5
Deployment of PDB and RPP samplers	MW-102 through MW-104; EW-18 and EW-20; MW-62, MW-30A, MW-47, and EB-6
Collection of PDB and RPP samplers; collection of low-flow groundwater samples	Table A-2 locations
Stream sampling and gaging	SW-E1; SG-4 and SG-5
Leachate sampling	MH-17N and FS-3
Soil vapor sampling	EB-6; MW-102 and MW-104; GP-ATC-5 and GP-ATC-7; GP-8, GP-56, GP-58, GP-60, GP-62; GP-15 through 20

The RI activities will be generally sequenced in the logical order of the intended tasks. For example, groundwater and surface water level measurements will be collected prior to installation of the PDB and RPP samplers in order to obtain the water levels before disturbing the wells during passive sampler installation. The passive diffusion samplers must be allowed to equilibrate for a minimum of 2 weeks. The sample collection activities will begin after the 2-week equilibration period has lapsed and will include the collection of the passive diffusion samplers, the collection of comparison samples using conventional low-flow sample methodology, the stream sampling and gaging, and the leachate sampling. The soil vapor sampling will be conducted approximately 2 weeks after the groundwater sampling mobilization to allow gas-collection-specific wellhead configurations to be fitted to MW-102, MW-104, and EB-6 and allow enough time for gas equilibration to occur within the closed-off well. However, the exact timing of the soil gas sampling will be weather dependent. The following sections describe the protocols necessary for completing the RI field work.

2.4 Groundwater Sampling Procedures

This section summarizes the procedures and protocols that will be followed for the field data collection phase of the RI. Sampling protocols are documented in the Environmental Monitoring Sampling and Analysis Plan for Cedar Hills Regional Landfill (Aspect, 2013; henceforth referred to as the CHRLF Environmental Monitoring SAP). Specific methods to be used in the RI are presented below for the convenience of field crews. Work will be performed under the project-specific Health and Safety Plan.

The field sampling procedures and sample handling protocols for samples collected during the RI will be in accordance with the following:

- CHRLF Environmental Monitoring SAP (Aspect, 2013);
- USEPA low-flow sampling procedures (Puls and Barcelona, 1996, revised 2010);
- U.S. Geological Survey (USGS) passive diffusion sampling protocols (2001); and
- Aspect sampling protocols.

Pertinent portions of these reference documents are summarized in this section of the SAP. Field sampling data will be documented on field report forms (Attachment A) as described in Section 2.11, Field Documentation and Reporting.

2.4.1 Instrument Calibration

Prior to initiating any groundwater or surface water sampling, the field instruments for measuring water quality parameters (pH, conductivity, dissolved oxygen, oxygen-reduction potential, and turbidity) will be checked and calibrated to make sure that all parts are present, working, and clean and that the batteries are fully charged. The instruments will be calibrated per the manufacturers' specifications. Calibration activities will be documented in the field notebook. Instrument calibration should take place each day prior to sampling.

2.4.2 Well Inspection

Monitoring wells are protected by secure stick-up monuments that are locked. Expansion well caps are installed in the 2-inch-diameter well casings and provide a watertight seal. Each monitoring well included in the RI field program will be inspected during the first mobilization. Field personnel will take note of the condition of the monument, well cap, well casing, and pump (if present); identify required maintenance activities; and report the information to the KCSWD lead engineer in accordance with the CHRLF Environmental Monitoring SAP. No groundwater samples will be collected and no passive diffusion samplers will be deployed if the security or integrity of a well or pump equipment is severely compromised. During sample collection, the condition and response of the well to sample purging will be noted for evaluation during the RI and corrective action (if necessary) will be implemented before future sampling events.

2.4.3 Groundwater Level Monitoring

Depth-to-groundwater will be measured in the wells and probes listed in Table A-1 and depicted on Figure A-2 using an electric well sounder, graduated to 0.01 foot, according to the following procedure. In some of the gas probes (in particular GP-17, -18, and -19), dedicated tubing inside the probe will need to be temporarily removed in order to collect the water level measurement. Any tubing that is removed will be reinstalled after the reading is collected.

1. Lower the probe through the top of the polyvinyl chloride (PVC) well casing or probe opening until the level alarm sounds.
2. Read the depth-to-water measurement at the top of the PVC casing at the designated mark. If there is no marked reading location, then the depth-to-water measurement will be collected from the north side of the casing.
3. Raise the probe line until the alarm goes silent and lower the line again to collect duplicate and triplicate static water level readings. The depth to the bottom of the monitoring well will also be measured to evaluate siltation of the monitoring well. This measurement can be performed with the level alarm turned off after the static water level has been collected.
4. Record the static water level, date, and time of collection on the field report forms.
5. Decontaminate the water level indicator between wells.

If access to the gas extraction wells is inadequate to obtain a groundwater level reading due to the wellhead configuration, then that well will be skipped and its condition noted on the field report forms.

2.4.4 Well Redevelopment

Three of the wells that have been included in the RI sampling program (EB-1, EB-2, and MW-50) have not been sampled in the past. These three wells will need to be redeveloped prior to sampling. Each of these monitoring wells will be developed to remove fine-grained material from inside the well casing and filter pack that may have accumulated overtime and to improve hydraulic communication between the well screen and the surrounding water-bearing formation. The field representative will document well development activities in the field documentation for that well. Well development will be performed by means of a surge block and a 12-volt submersible pump. During development, the surge block will be surged along the entire length of the well screen. Each well will be developed until visual turbidity is reduced to minimal levels or until a minimum of three well casing volumes of water have been removed.

During RI groundwater sample collection from the EW series wells, the condition and response of the well to sample purging will be evaluated. If during sample collection significant drawdown is encountered and the determinations in the RI include additional sampling of EW series wells, then rehabilitation will be considered.

2.4.5 Passive Sampler Deployment and Sample Collection

PDB and RPP samplers and noncorrosive stainless steel hanging assemblies will be obtained from ALS Environmental. The numbers and types of samplers are presented in the table below and depicted on Figure A-3. VOC samples will be collected using PDBs for monitoring wells MW-102, MW-103, and MW-104; detection monitoring wells MW-30A, MW-62, MW-47, and EB-6; and groundwater extraction wells EW-18 and EW-20. Samples collected for metals analysis using an RPP sampler will be collected from detection monitoring wells MW-30A, MW-62, MW-47, and EB-6 and extraction wells EW-20 and EW-25. Therefore, MW-30A, MW-62, MW-47, EB-6, EW-18, and EW-20 will have both a PDB and an RPP sampler installed.

Wells	Installation of PDB Samplers	Installation of RPP Samplers	Collection of Low-Flow Samples	Comments
MW-102, MW-103, and MW-104	3	No	No	
EW-20 and EW-25	2	2	No	
MW-62, MW-30A, MW-47, and EB-6	4	4	No	
Table A-2 Wells	No	No	Yes	Retrieve PDB and RPP samplers; collect low-flow samples; SW-E1 sampled
Total samples	9	6	28	

Passive sampler deployment

1. Record the static water level in the well at the time of deployment. Collect this reading prior to removing any dedicated pumps (if applicable).
2. Remove dedicated sampling pumps in small diameter monitoring wells that cannot also accommodate the passive sampler. Dedicated pumps that are removed from wells will be kept clean and segregated while out of the wells to prevent contamination. Upon completion of sampling, the removed sample pumps will be decontaminated and reinstalled in the same well from which they were removed.
3. Install the passive samplers in the extraction wells with great care. Pump wiring and electrical submersible pumps are present within the extraction wells. The wiring will have to be adjusted to set the PDB and RPP samplers. If the pump is set too high, the PDB and RPP samplers will not be deployed.

4. Measure the depth to the bottom of the well and compare the measured depth with well construction records to see if sediment has accumulated in the bottom of the well and if the elevation of the passive samplers requires adjusting.
5. Use the plug at the bottom of the sampler, a funnel, and deionized water to fill the passive sampler with laboratory provided deionized water until the water rises and stands at least halfway into the funnel. Remove the funnel and replace the plug. The samplers will then be ready for installation. If the passive samplers were delivered prefilled, they can be installed directly into the wells.
6. The mid-point of the PDB will be placed at the mid-point of the saturated well screen interval using the hanging assemblies. The screen interval depths for the wells receiving passive samplers are provided in Table A-3. The mid-point of the saturated well screen will be determined in the field based on the current water levels. The approximate elevation will be provided to ALS Environmental in order for the samplers to be strung from the hanging assemblies at the appropriate locations. The hanging assembly will hook to the well cap or wellhead assembly.
7. Lower the passive sampler and hanging assembly into the well until the desired depth is reached and attach the hanging assembly to the well cap or wellhead assembly.
8. Allow the passive samplers to equilibrate, undisturbed in the wells for 14 days.

Removal of passive samplers and sample collection

9. Record the static water level in the well.
10. Carefully lift the passive sampler out of the well, minimizing the amount of agitation to the sample. Be careful not to tear or damage the sample bag. Make sure the PDB does not come into contact with potentially contaminated surfaces once it is removed from the well.
11. Detach the sample bag from the hanging assembly and inspect the bag for bio-film buildup that could affect sample results. Note the presence of bio-film on the field report form.
12. Collect the sample by cutting off the corner of the bag and pouring it directly into laboratory-supplied pre-cleaned containers. Samples from the PDBs for VOC analysis are poured into 40-milliliter (mL) vials. Once filled and capped, the vials should have no headspace (i.e., no visible air bubbles). Samples from the RPP bags are for metals analysis are poured into preserved poly-bottles.

2.4.6 Low-Flow Groundwater Sample Collection

Conventional, low-flow groundwater samples will be collected from the monitoring wells listed in Table A-2 in accordance with the procedures described below, USEPA's low-flow groundwater sampling procedures (Puls and Barcelona, 1996), and the CHRLF Environmental Monitoring SAP (Aspect, 2013). Low-flow sampling will occur after the passive samplers have been removed.

1. Record the static water level in the well. Keep the water level tape suspended in the well so that static water level measurements can be collected during the purge process.

2. Use a QED portable bladder pump with disposable tubing and bladders or the dedicated pump deployed in the well to collect low-flow groundwater samples. Compressed nitrogen will be used for the bladder compression gas, per the CHRLF Environmental Monitoring SAP (Aspect, 2013). New tubing will be used for each well sampled by means of the portable bladder pump.
    a. Install any dedicated pumps that were removed for the passive sampler deployment.
    b. Install portable or dedicated pumps slowly so that agitation of the well bottom sediment does not occur.
3. Place the pump intake for the portable pump at the center of the saturated section of well screen. Dedicated pumps will be reinstalled at their designated elevations.
4. Purge each well at a low-flow rate 0.1 to 0.5 liter per minute (Puls and Barcelona, 1996). The flow rate should be adjusted to ensure that the water level drawdown during purging is not greater than 4 inches (Puls and Barcelona, 1996).
5. Monitor field parameters (temperature, pH, specific conductivity, dissolved oxygen, oxidation-reduction potential, and turbidity) using a YSI meter, flow-through cell, and Hach 2100Q turbidimeter during well purging. These field parameters in addition to the static water level will be recorded at 3- to 5-minute intervals throughout well purge until they stabilize. Turbidity is not listed in the ASTM method and will be measured prior to the collection of the groundwater sample. Water temperature will also be monitored but can be affected by air temperature and solar radiation. During well evacuation, the flow rate will be monitored and the total volume of water evacuated will be calculated. Groundwater field parameters will be measured and confirmed as stable before the well is sampled.

    Stabilization is defined as three successive readings with the following variations in the parameter values:

    - Conductivity ±3% microsiemens per centimeter (µS/cm, specific conductance)
    - Dissolved oxygen ±10% milligrams per liter (mg/L) (or 0.5 mg/L if readings are less than 1 mg/L)
    - pH ±0.1
    - Oxidation-reduction potential ±10 millivolts (mV)
    - Turbidity ±10% nephelometric turbidity units (NTU)
    - Turbidity will also be measured directly from the pump discharge point (not from the flow-through cell) immediately the groundwater sample is collected and the reading is recorded.

6. Purge slow-recovery wells and dry and collect the sample within 24 hours after the well has sufficiently recovered if dewatering is the likely outcome of the well purge. At the end of the day, take a second depth-to-water measurement and record it on the field report form.
    a. Measure the static water level the following day to confirm the well has sufficiently recovered. Till a cup with enough water to perform field parameter measurements one time, and immediately begin filling the laboratory bottles in the following order:
        1. Volatile organics analysis (VOA) bottles (VOCs, methane, ethane, ethene)
        2. TOC
        3. Chloride and sulfate
        4. Bicarbonate and alkalinity
        5. Ammonia, nitrate, nitrate + nitrite
        6. Metals, total and dissolved
        7. Dissolved ferrous iron
        8. Total dissolved solids (TDS)
        9. Total suspended solids (TSS)
    b. Collect only the minimum volume the laboratory requires for each of the above analytes if the well will not produce an adequate volume of water to fill the normal bottle set. Below are the normal and minimum volumes the laboratory typically asks for:

ANALYTE	NORMAL VOLUME	MINIMUM VOLUME
VOCs	4, 40 mL	1, 40 mL
Metals (dissolved)	500 mL	150 mL
Metals (total)	500 mL	200 mL
Ammonia/nitrate/nitrite	250 mL	50 mL
TSS	1,000 mL	1,000 mL
TDS	500 mL	150 mL
TOC	125 mL	1, 40 mL
Chloride/sulfate	125 mL	50 mL
Bicarbonate/Alkalinity	500 mL	120 mL
Dissolved methane/ethene/ethane	2, 40 mL	1, 40 mL
Dissolved ferrous iron	500 mL	50 mL

7. Collect groundwater samples at the same low-flow rate after parameter stabilization is reached by directly filling the laboratory-supplied sample containers from the dedicated pump tubing. When the sample bottle is full, replace the lid and fill the next bottle, if required. For dissolved metals samples, an inline 0.1-micrometer (µm) filter will be attached to the purge tubing and the dissolved metals bottle will be filled with filtered groundwater. Add an additional label to the dissolved metal sample container that reads, “Field Filtered,” indicating to the laboratory which of the two identical sample containers is to be tested for dissolved metals. Additional notes on groundwater sample collection are presented in Table D.4 of the CHRLF Environmental Monitoring SAP (Aspect, 2013).
8. Collect groundwater quality control (QC) samples (e.g., field duplicates, rinsate blanks, and trip blanks) as per Section 3 and Table A-6 of this SAP.
9. Replace the well cap and monument cap securely. Any damaged or defective well caps or monuments will be noted and reported to KCSWD.

2.5 Stream Sampling Procedures and Protocols

2.5.1 Staff Gage Reading

Surface water elevations will be monitored by reading the stage height on the staff gages installed at the upstream (SG-4) and downstream (SG-5) ends of Stream 3 (Figure A-2). The measurements in Stream 3 will be taken at the same time as the initial groundwater level measurements so that the stream levels can be compared to the EPZ monitoring well water levels.

Surface water stage readings are recorded at the level of the water on the staff gage to the nearest 0.01 foot. If Stream 3 is dry or the water level is below the staff gage, the water level will be collected from the adjacent piezometer using a water level meter, referencing the survey point at the top of the piezometer. The stage reading is converted to a surface water elevation by adding the stage reading to the surveyed 0.00-foot mark on the staff gage.

2.5.2 Stream Sampling

Stream samples will be collected from SW-E1 (Figure A-3) and handled in accordance with the procedures described below:

1. Measure pH, temperature, conductivity, dissolved oxygen, and turbidity directly within the surface water flow.
2. Collect a water sample of Stream 3 at SW-E1 from approximately mid-depth at mid-channel either using a peristaltic pump and new, dedicated tubing (polyethylene tubing with a short length of silicon tubing through the pump head) or using a laboratory-provided clean, unpreserved vessel to transfer the water into the appropriate sample containers.
    a. Minimize the disturbance of sediments in the areas surrounding the surface water monitoring station during sample collection. Dam or block the downstream flow to pool the water so that a clean container or peristaltic pump can be used to fill the sample

containers provided by the laboratory. Materials used to dam or block the flow should be decontaminated prior to use by means of the decontamination procedures specified in this SAP. Damming the stream is only necessary when the flow is low.

b. Wade into the stream, face upstream, and collect the sample from the upstream water to avoid disturbing the sediments. Allow any sediment to pass the collection point prior to collecting a sample. Avoid allowing sediment, algae, weeds, etc., from entering the sample container. Rinse the plastic container twice with the sample water prior to collection of the sample.

3. Pump or pour stream water directly into laboratory-supplied sample containers. Avoid overfilling preserved containers and as this will result in loss of the preservative. Replace the lid securely when the sample bottle is full and fill the next bottle, if required. Filter dissolved metals samples using an inline 0.1-µm filter attached to the peristaltic pump tubing. Fill the dissolved metals bottle directly with filtered surface water. Add an additional label to the dissolved metal sample container that reads, “Field Filtered,” indicating to the laboratory which of the two identical sample containers is to be tested for dissolved metals.
4. Label and transport stream samples to the laboratory under chain-of-custody per Sections 2.8, 2.9, and 2.11.

2.6 Soil Gas Sampling

Soil gas samples will be collected in 6-liter Summa canisters for laboratory analysis of VOCs. The samples will be analyzed according to EPA method TO-15.

2.6.1 Ideal Sampling Conditions

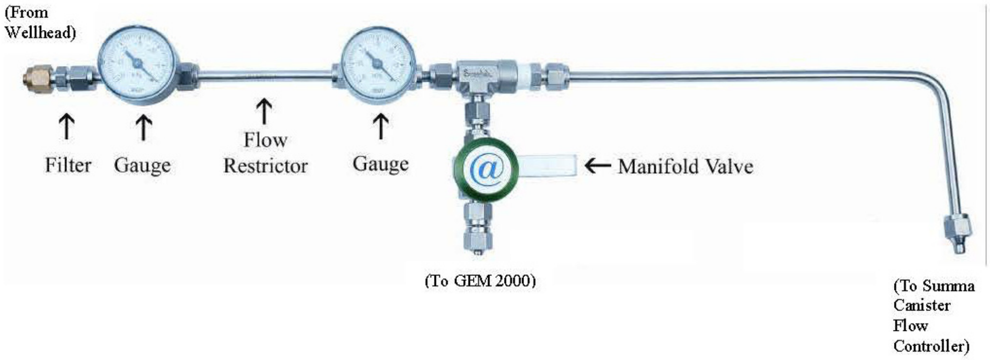
The ideal condition for sampling is low and decreasing barometric pressure. Sampling will ideally occur following at least 12 hours of falling barometric pressure, with a drop from peak of at least 0.25 inches mercury.

2.6.2 Soil Gas Sampling Procedures

Soil gas sampling will be attempted at the 16 locations indicated on Figure A-4. Two screen intervals will be sampled at locations GP-15 through GP-20. Therefore, up to 22 Summa canister samples will be collected for laboratory analysis. However, GP-ATC-7 could not be located during previous field efforts (Aspect, 2007). Another attempt will be made to locate GP-ATC-7, including the use of a metal detector. If it is not found, that location will not be included in the soil gas sampling program. (Nearby well MW-103 cannot be used for soil gas sampling because its screen is fully submerged.)

The gas probe wellheads are equipped with a suitable port for gas sampling. MW-102, MW-104, and EB-6 will be prepared for gas sampling by removing the downhole pumps (assuming pumps are installed) and replacing the caps with caps that have a suitable port for LFG sampling. This will be done immediately after groundwater samples have been collected from these wells.

The manifold that is used for soil gas sampling is shown below. The Teflon tube from the wellhead assembly connects to the manifold's left side. The manifold branches to a purge tube that connects to the GEM-2000 and a sample tube that connects to the Summa canister's flow controller.



The following procedure will be used to collect soil gas samples for VOC analysis:

1. Calculate the volume of air in the probe/well/piezometer casing.
2. Calibrate the GEM-2000 multi-gas meter.
3. Check the vacuum in the 6-liter Summa canister. Vacuum should ideally be between 28 and 29 inches, and not less than 25 inches. If vacuum is less than 25 inches, the canister should be replaced with a canister meeting this specification. Remove the brass cap from the canister valve and connect the canister to the 1-hour flow controller. Then connect the sampling manifold (shown above) to the flow controller. Proceed to Step 5 for sampling gas probes with relatively small casing volumes.
4. Pre-purge the monitoring wells, piezometer EB-6, and the gas probes that have relatively large casing volumes by connecting in series a low-flow vacuum pump, a rotameter, and a GEM-2000 to the wellhead tubing. The vacuum pump and rotameter will be sized for a purge rate of one casing volume every 5 to 10 minutes. Start the pump and purge until two casing volumes have been removed. During purging, record methane, carbon dioxide, and oxygen concentrations, LEL, and barometric pressure measured by the GEM-2000 at minimum 1-minute intervals. Stop the pump after two casing volumes have been removed, disconnect the wellhead tubing from the pump, and immediately connect the tubing to the sampling manifold.
5. Connect the GEM-2000 and the wellhead tubing to the sampling manifold shown in the diagram above. Open the manifold valve and begin purging with the GEM-2000. The purge rate will be regulated by the flow restrictor in the manifold to approximately 170 ml/min.

During purging, record methane, carbon dioxide, and oxygen concentrations, LEL, and barometric pressure at minimum 20-second intervals until parameters have stabilized or until a total of three casing volumes have been purged (i.e., one additional casing volume for locations where pre-purging was conducted in Step 4 above, since two casing volumes were previously removed). Stabilization is defined as three readings over a 1-minute period that are within 10 percent of one another.

6. Turn off the GEM-2000 and close the manifold valve.
7. Open the valve on the Summa canister to start sample collection. The sampling rate will be regulated by the flow controller at approximately 100 ml/min.
8. Stop sample collection and close the canister valve when the Summa canister vacuum reaches 5 inches mercury (after approximately one hour).
9. Record the final canister vacuum on the chain of custody and on the Summa canister tag.
10. Disconnect the canister from the manifold and replace the brass cap on the canister valve.

2.7 Leachate Sampling

Leachate samples will be collected from MH-17N and FS-3 to characterize raw leachate in the East Main Hill (Figure A-3). Sample collection at each of these stations will be dependent on flow observations at the time of sampling. For manhole MH-17N, the sample location is the leachate line from the north Main Hill that enters the southwest corner of the manhole. At manhole FS-3, the sample location is the influent pipe discharge. The following steps will be taken for the leachate sampling:

1. Measure the static water level in MH-17N and FS-3 using a water level tape.
2. Monitor the pH and conductivity (measured in specific conductance units) in the manhole and flow meter vault and record the reading(s) on the field report form. Measurement may also be made at the surface prior to sampling (Step 3, below), if downhole measurements are not feasible.
3. Using a peristaltic pump and dedicated tubing or a grab sampler (whichever is most appropriate for the volume of flow and the access point at each leachate sampling location), directly fill the laboratory-supplied sample containers from the dedicated pump tubing. If leachate depths exceed the lift of the peristaltic pump (about 22 ft), collect the sample using a dedicated Teflon bailer and string. When the sample bottle is full, replace the lid and fill the next bottle, if required. No field filtering of the sample is required because dissolved metals are not a targeted analyte.

2.8 Sample Labeling

A label will be placed on each sample container with the following information: name of client (KCSWD), location, date, time, database sample ID, and sampler's initials. PDB, RPP, and low-flow samples collected from the same well will each be considered unique samples and, as such, require unique sample IDs. Sample IDs will be in accordance with KCSWD standards, which consist of an 11- to 13-digit labeling convention:

Examples: W62-151001 = Low-flow groundwater sample from MW-62 on October 1, 2015; GG62151001 = Soil gas sample from GP-62 on October 1, 2015; LE17N151001 = Leachate sample from MH-17N on October 1, 2015.

Digits 1–4: Consist of the medium type and sampling location.

- Medium type is typically the first digit and includes groundwater (W), surface water (S), leachate (L), or gas (G).
- The sampling location is typically a three-digit number (digits 2–4); however, shallow or deep sampling locations are distinguished by "S" or "D," respectively. If the sampling location is only a two-digit number, the symbol "-" is used for the third digit.

  For example, monitoring wells will use just their two- or three-digit number (omitting the MW), whereas extraction wells and piezometers will include an EW or WB before their two-digit number to differentiate the different types of sampling points.

  Examples: WB6-151001 = Low-flow groundwater sample from EB-6 on October 1, 2015; EW6-151001 = Low-flow groundwater from EW-6 collected on October 1, 2015.
- "VTRP" is used as the media type and sampling location designation for VOC trip blanks.

  Example: VTRP151001 = Trip blank collected October 1, 2015

Digits 5–10: Consist of the sampling date.

- Digits 5–6 are the two-digit year.
- Digits 7–8 are the two-digit month.
- Digits 9–10 are the two-digit day.

Digits 11–13: Indicate field QC or other unique samples.

- The symbol "-" is used if the sample is not a field duplicate or a trip blank.
- "D" is used if the sample is a field duplicate.
- "E" is used if the sample is an equipment/rinsate blank.
- "F" is used if the sample is a field blank.
- "PDB" is used for samples collected using PDB samplers.
- "RPP" is used for samples collected using RPP samplers.

Examples: W62-151001RPP = RPP groundwater sample from MW-62 on October 1, 2015; EW20151001PDB = PDB groundwater sample from EW-20 on October 1, 2015.

Field Filtering: Sample bottles for dissolved metals analysis where the sample was field filtered will need to be identified. "Field Filtered" will be written on all bottles that received field filtration in preparation for dissolved metals analysis.

2.9 Sample Custody

Upon collection and labeling, groundwater, surface water, and leachate samples will be placed upright in a cooler. Ice or blue ice will be placed in each cooler to cool samples down to meet sample preservation temperature requirements. Inert cushioning material will be placed in the remaining space of the cooler, as needed, to limit movement and breakage of the sample containers. If the sample coolers are being shipped, not hand carried to the laboratory, the chain-of-custody form will be placed in a waterproof bag taped to the inside lid of the cooler for shipment. Soil gas samples will be shipped back to the laboratory in the same shipping container they were received in. Soil gas samples do not require temperature preservation.

After collection, samples will be maintained in the sampling personnel's custody until formally transferred to the analytical laboratory. For the purposes of this work, custody of the samples will be defined as one of the following:

- In plain view of the field representatives;
- Inside a cooler that is in plain view of the field representative; or
- Inside any locked space such as a cooler, locker, car, or truck to which the field representative has the only immediately available key(s).

A chain-of-custody record provided by the laboratory will be initiated at the time of sampling for all samples collected. The record will be signed by the field representative and others who subsequently take custody of the sample. Couriers or other professional shipping representatives are not required to sign the chain-of-custody form; however, shipping receipts will be collected and maintained as a part of custody documentation in project files. This procedure tracks the sample status from the point of sample collection to completion of the laboratory analyses. Most importantly, responsibility for sample integrity is placed on a single individual at all times. A copy of the chain-of-custody form with appropriate signatures will be kept by the project manager. This procedure becomes particularly important if the sampling protocol and analytical determination are ever challenged in litigation.

Proper chain-of-custody procedures play a crucial role in enforcement cases. The following are some basic guidelines of legal significance:

- As few people as possible should handle the sample.
- Chain-of-custody records should accompany the sample. The chain-of-custody record should contain the sample number, the date and time the sample was collected, the sample location, analysis required, the name of the person(s) who collected the sample, and the time of sample collection.

- The field team is responsible for the care and custody of the samples collected until custody has been relieved and documented by laboratory personnel. A four-part chain-of-custody document is used. The laboratory keeps the original chain-of-custody documents.

Upon sample receipt, the laboratory will fill out a cooler receipt form to document the sample delivery conditions. A designated sample custodian will accept custody of the shipped samples and will verify that the chain-of-custody form matches the samples received. The laboratory will notify the project manager, as soon as possible, of any issues noted with the sample shipment or custody.

2.10 Decontamination and Investigation-Derived Waste Management

Nondisposable sampling equipment (e.g., portable bladder pumps) will be decontaminated between each well. The decontamination sequence consists of a scrub with a nonphosphate (Alconox or Liquinox) solution, followed by a tap water (potable) rinse, and finished with thorough spraying with deionized or distilled water.

Investigation-derived waste water generated during equipment decontamination and monitoring well sampling will be disposed of in the on-site leachate treatment lagoons. Disposable equipment and used personal protective equipment will be placed in plastic trash bags and disposed of at CHRLF.

2.11 Field Documentation and Reporting

Inspection and monitoring results will be documented in the field report forms (Attachment A) and in field notebooks. Adequate records will be maintained for each sample collected. The field representative will document pertinent observations and events specific to each activity and specific to each sample collected on field forms (e.g., groundwater sampling form) and in a field notebook, and, when warranted, provide photographic documentation of specific sampling efforts. Field notes will include the following:

- Date, time, weather conditions, project location, and sampler’s name
- Sample location, sample type, and sample number
- Description of the field activity
- Sample descriptions and sampling method
- Size, type, and quantity of sample containers
- Field equipment used
- Field parameters

Pertinent observations of the sample condition that are worthy of noting in the field documentation include the following:

- Sample color
- Sedimentation or turbidity

- Oil or sheen
- Separate phase liquids
- Odor
- Effervescence
- Beginning canister vacuum (soil gas samples only)
- Ending canister vacuum (soil gas samples only)

Other information to be included in the field notebook includes the following:

- Reason for sampling
- Problems encountered due to unusual conditions
- Communications with KCSWD, laboratory, or field staff

3.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

A sound quality QA/QC program is essential to obtaining high-quality and well-documented analytical data. The objectives of the QA program include the following:

- Collect, process, and analyze with consistent and appropriate techniques;
- Minimize the number of lost, damaged, or uncollected samples;
- Maintain and document the integrity of the data from sample collection to entry into the data record;
- Obtain comparable data; and
- Obtain reproducible results.

3.1 Analytical Methods

As discussed in Section 2.2, “Monitoring Parameters,” the RI project-specific analytes for the groundwater and surface water samples are the WAC 173-351-990 Appendix I and II constituents and the additional project-specific MNA parameters methane, nitrate/nitrite, ethane, and ethene. Table A-4 lists the laboratory analytical methods for groundwater, surface water, leachate, and soil gas analyses to be performed during the RI/FS, along with the sample containers, preservation, and analytical holding times for each analysis. It is important to follow this table because there are some variations in the analyte list for the different sample media. This QAPP, including Tables A-4 and A-5, will be provided to the laboratory for its review prior to sample analysis so that the laboratory personnel are aware of the desired analytical methods and project-specific analyte lists ahead of time.

3.2 Quality Assurance

QA is a system of documented checks that validate the reliability of the data set. QA procedures are used to verify that field and laboratory analytical data are within acceptable limits and that the data are accurate, precise, representative, comparable, and complete.

Sampling activities will be traceable to the person collecting the sample and to the specific piece of sampling equipment used to collect that sample. Records (field records, calibration logs, and chain-of-custody forms) shall be kept so that they are traceable. The following procedures will be used:

- Proper calibration of sampling and field equipment;
- Use of field records to record field measurements and other pertinent information necessary to document what was done;
- Review of field records by the lead engineer to ensure that the procedures are being followed;
- Strict adherence to established field sampling protocols;
- Proper preservation of samples immediately upon collection in the field (pH to be checked by laboratory);
- Recording of canister vacuum at time of canister closure in field and a subsequent recheck in the laboratory to ensure that no leaks occurred during transport;
- Minimal sample handling after collection; and
- Adherence to chain-of-custody procedures.

Field documents (notebooks, reports, chain-of-custody forms) will be reviewed by the lead scientist or geologist to ensure that the documents are accurate, precise, representative, comparable, and complete.

The laboratory will follow its own standard QA/QC procedures to ensure that the data it provides are accurate, precise, representative, comparable, and complete. Laboratory QA/QC procedures are discussed in the Section 3.4.

3.3 Field Quality Control

QC is the system of technical actions that measure the attributes and performance of field activities to control the quality of the data that are collected. The aim is to provide quality data that are adequate, dependable, and economical.

QA/QC samples collected in the field include VOA trip blanks, field blanks, field duplicates, and equipment/rinsate blanks. Table A-6 provides a summary of the type of QC samples and the frequency of collection. QA/QC samples make up roughly 10 percent of all samples collected (with some variation based on the type of QA/QC sample collected, as noted below). The following subsections describe the various field QC samples to be collected and their frequency of collection.

Trip blanks, field blanks, field duplicates, and equipment/rinsate blanks will be collected and submitted to the analytical laboratory to provide a method for assessing the quality of data collected from the monitoring program. The blanks and duplicates will be submitted to the laboratory as blinds, with sample labels that are indistinguishable from the primary samples. Specific QA/QC sample descriptions and collection frequencies are discussed in the following subsections.

3.3.1 Trip Blanks

Trip blank samples will be used to monitor possible VOC cross-contamination during sample handling, transport, and storage. Trip blank samples are prepared and supplied by the laboratory using organic-free reagent-grade water in a VOC vial prior to the collection of field samples. The trip blank sample vials are placed with and accompany the VOC samples through the entire transport process. One trip blank will be collected for each sample cooler that contains a VOC sample container. VOA trip blanks will be given a sample ID, in accordance with the labeling protocols, for identification of the primary samples it accompanies. The sample ID will be recorded in the field records and on the chain-of-custody form. Trip blanks will be transported to the laboratory in the same cooler as the VOC samples. VOA trip blanks will be analyzed for the same VOC parameters as the primary samples for the respective media.

In case a target compound is present in a trip blank, results for samples shipped with this trip blank will be evaluated and data qualified accordingly if determined that the results are affected.

3.3.2 Field Blanks

Field blanks are analyzed to check for contamination resulting from the sample collection, handling, and transport and from the bottles themselves. At the end of the sampling event, field blanks are prepared in the field by directly filling the sample bottles with deionized water provided by the laboratory and handling the field blank samples in accordance with the primary samples. Field blanks are analyzed for the same sample parameters as the groundwater samples. One field blank per 10 samples will be collected and analyzed. Each field blank will be given a sample ID in accordance with the labeling protocols in order to identify which primary samples it accompanies. The sample ID will be recorded in the field records and on the chain-of-custody form. Field blanks will be analyzed for the same parameters as the primary samples for the respective media.

3.3.3 Field Duplicates

During the RI field program, field duplicate samples will be collected at a frequency of 10 percent of the primary samples and will be analyzed for the monitoring well RI project-specific analytes. Field duplicates are collected from the same sample source and device by alternately filling like sample containers for two sample sets until all containers are full. Samples are preserved, stored, and analyzed under identical conditions. The intent of field duplicates is to indicate field and laboratory precision and reproducibility (the degree of contaminant variability within the sample matrix for nonhomogeneous sample matrices). However, the field duplicate sample results include variability introduced during both field sampling and laboratory preparation and analysis, and USEPA data validation guidance provides no specific evaluation criteria for field duplicate samples.

3.3.4 Equipment Rinsate Blanks

Equipment rinsate blanks are collected to determine the potential of cross-contamination introduced by non-dedicated equipment (e.g., bladder pump and YSI meter) that is used at multiple sample locations. Deionized water (obtained from the laboratory) is rinsed through the decontaminated sampling equipment and collected into adequate sample containers for analysis of VOCs. The equipment rinsate blank is then handled in a manner identical to the primary samples collected with that piece of equipment. The blank is then processed, analyzed, and reported as a regular field sample. The rinsate blank collection frequency will be 1 per 20 samples that are collected. When dedicated equipment is used, these blanks are not needed.

3.4 Laboratory QA/QC

The laboratories' analytical procedures will meet the requirements specified in the respective analytical methods or approved laboratory standard operating procedures (SOPs), e.g., instrument performance check, initial calibration, calibration check, blanks, surrogate spikes, internal standards, and/or labeled compound spikes. Additional laboratory QA/QC that is related only to Fremont Analytical includes 100 percent laboratory certification of the Summa canister, manifold, and flow controller. Noncertified components will be the new Teflon tubing and the wellhead quick-connect fitting.

Specific laboratory QC analyses required for this project will consist of the following at a minimum:

- Instrument tuning, instrument initial calibration, and calibration verification analyses as required in the analytical methods and the laboratory SOPs;
- Laboratory and/or instrument method blank measurements at a minimum frequency of 5 percent (1 per 20 samples) or in accordance with method requirements, whichever is more frequent; and
- Accuracy and precision measurements will be collected at a minimum frequency of 5 percent (1 per 20 samples) or in accordance with method requirements, whichever is more frequent. In cases where a pair of matrix spike/matrix spike duplicate or matrix spike/laboratory duplicate analyses are not performed on a project sample, a set of laboratory control spike and laboratory control spike duplicate analyses will be performed to provide sufficient measures for analytical precision and accuracy evaluation.

KCEL's data quality objectives are presented in Table E.1 of the CHRLF Environmental Monitoring SAP (Aspect, 2013). The laboratory's QA officers are responsible for ensuring that the laboratory implements the internal QC and QA procedures detailed in the laboratory's Quality Assurance Manual. The Fremont Analytical methods manual is available on request.

3.5 Data Management and Validation

The groundwater and surface water quality data will be validated by KCSWD and managed in KCSWD's project EQUIS database in addition to Aspect's project-specific ACCESS database. The data will be uploaded to Ecology's Environmental Information Management database system only if requested by Ecology. Field and laboratory QC will be validated by KCSWD in accordance with the USEPA National Functional Guidelines for organic and inorganic analyses (USEPA 2008 and 2010, respectively), the laboratory-defined QC limits, and the data validation guidelines detailed in the CHRLF Environmental Monitoring SAP (Aspect, 2013). Data validation is conducted as the data is received for accuracy, precision, representativeness, completeness, and comparability with regard to the following: sample documentation/custody, holding times, reporting limits, blank/rinsate samples, and surrogate percent recoveries, laboratory duplicates, field duplicates, comparability, and completeness. Section 14.5 of the CHRLF Environmental Monitoring SAP details how the data validation process will be conducted.

4.0 REFERENCES

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Tables

Table A-1 - List of RI/FS Water Level Monitoring Locations

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

King County Solid Waste Division
April 2015

Monitoring Wells	Gas Probes		Groundwater Extraction Wells	Gas Extraction Wells	Surface Water Level Gauge Station
MW-29	GP-1A	***GP-13A***	EW-1	E-29D	SG-4
MW-30A	GP-1B	***GP-13B***	EW-2	E-29C	SG-5
MW-47	GP-2A	***GP-13C***	EW-3	E-29B	
MW-48	GP-2B	***GP-13D***	EW-4	E-29A	
MW-50	***GP-3***	***GP-14A***	EW-5	***E-61S***	
MW-62	***GP-4A***	***GP-14B***	EW-6	***E-61D***	
MW-63	***GP-4B***	GP-15A	EW-7	***E-62***	
MW-102	***GP-5A***	GP-15C	EW-8	***E-63***	
MW-103	***GP-5Ba***	GP-15D	EW-9	***E-64***	
MW-104	***GP-5Bb***	GP-16A	EW-10	***E-65***	
EB-1	***GP-5Bc***	GP-16B	EW-11		
EB-2	***GP-5Bd***	GP-16C	EW-12		
EB-3	GP-6A	GP-17	EW-13		
EB-4	GP-6B	GP-18	EW-14		
EB-5	GP-6C	GP-19	EW-15		
EB-5s	GP-6D	***GP-45S***	EW-16		
EB-6	GP-6E	***GP-45L***	EW-17		
EB-7	GP-6F	***GP45d***	EW-18		
	GP-6G	***GP-ATC-1S***	EW-19		
	GP-6H	***GP-ATC-1D***	EW-20		
	GP-7	***GP-ATC-2***	EW-21		
	GP-8	***GP-ATC-3S***	EW-22		
	GP-9	***GP-ATC-3D***	EW-23		
	GP-11A	***GP-ATC-4***	EW-24		
	GP-11B	***GP-ATC-5S***	EW-25		
	GP-11C	***GP-ATC-5D***	EW-26		
	GP-11D	GP-ATC-6S	EW-27		
	GP-12A	GP-ATC-6D	EW-28		
	GP-12B	GP-ATC-7	EW-29		
	GP-12C	GP-ATC-8S			
	GP-12D	GP-ATC-8D			

Bold italics inidicates secondary water level location.

Table A-2 - List of RI/FS Sampling Locations

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Location ID	PDB Sample	RPP Sample	Conventional Low Flow or Grab Sample	Soil Gas Samples
Groundwater				
MW-62	X	X	X	
MW-30A	X	X	X	
MW-47	X	X	X	
MW-50			X	
MW-102	X		X	X
MW-103	X		X	
MW-104	X		X	X
EB-1			X	
EB-2			X	
EB-6	X	X	X	D
EW-2			X	
EW-6			X	
EW-7			X	
EW-8			X	
EW-9			†	
EW-10			†	
EW-11			†	
EW-12			†	
EW-13			†	
EW-14			X	
EW-15			X	
EW-16			X	
EW-17			X	
EW-18			X	
EW-19			X	
EW-20	X	X	X	
EW-21			X	
EW-23			X	
EW-24			X	
EW-25	X	X	X	
EW-26			X	
EW-27			X	
EW-29			X	
Surface Water				
SW-E1			X	
Leachate				
MH-17N & FS-3			X	
Soil Gas				
GP-8				X
GP-15				S & M1, M2, or D
GP-16				S & M or D
GP-17				S & M or D
GP-18				S & M or D
GP-19				S & M or D
GP-20				S & M or D
GP-56				S
GP-58				S
GP-60				S
GP-62				S
GP-ATC-5				D
GP-ATC-7				D
Analytes:	Appendix I VOCs	Appendix II Metals	Appendix I & II Constituents; *MNA parameters	TO-15 VOCs

Notes:
PDB = Passive diffusion bag sampler
RPP = Rigid Porous Polyethylene sampler
Appendix I & II constituents are defined in WAC 173-351-990
MNA parameters = ethane and ethene; methane; nitrate/nitrite
* MNA parameters will only be analyzed in groundwater samples.
† Low-flow groundwater samples will only be collected if sufficient water is present.
X = Sample to be collected. Sample point has only one screened interval.
S = Sample to be collected from the shallow screened interval.
M or D = Sample to be collected from either the middle or the deep screened interval, whichever exhibits the highest methane. If no methane is detected, select the deep screened interval for sample collection.
M1, M2, or D = Sample to be collected from either one of the two middle or the deep screened interval, whichever exhibits the highest methane concentration. If no methane is detected, select the M2 intermediate screen interval (GP-15C).
D = Sample to be collected from the deep screened interval.

Table A-3 - RI/FS Well Screened Intervals

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Well ID	Top of PVC Elevation (ft)	Total Well Depth (ft bgs)	Top of Screen Depth (ft bgs)	Bottom of Screen Depth (ft bgs)
Groundwater				
MW-29	532.92	27	18	27
MW-30A	568.43	35	25	35
MW-47	634.6	44	23.5	43.5
MW-48	594.49	47	37	47
MW-50	637.02	38	27.5	37.5
MW-62	556.21	54	44	54
MW-63	515.88	17	11.5	16.5
MW-102	552.48	49.5	34.5	49.5
MW-103	639.08	35	25	35
MW-104	629.68	32	22	32
EB-1	532.3	22	17	22
EB-2	530.12	24	13.5	23.5
EB-6	589.61	30	20	30
EW-2	561.56	34.8	19.3	28.6
EW-6	582.87	59.9	45.54	54.89
EW-7	593.47	45.8	30.4	39.73
EW-8	600.38	54.5	39.2	48.4
EW-9	602.92	46.2	31.2	40.5
EW-10	609.03	43.8	28.28	37.6
EW-11	617.6	43.5	28	37.4
EW-12	623.25	39.8	22.5	31.8
EW-13	633.77	39.9	24.4	33.7
EW-14	633.66	47.9	32.6	42
EW-15	635.3	47.8	29.6	39
EW-16	636.88	43.7	29.5	38.81
EW-17	637.27	43.5	29.5	38.9
EW-18	639.88	43.1	27.4	36.7
EW-19	640	44	29	38.4
EW-20	639.03	43.2	28.7	38
EW-21	641.04	39.5	24	33.4
EW-22	639.71	44.1	30.5	39.8
EW-23	640.65	44.5	30.7	40.1
EW-24	643.11	39	24.1	33.4

EW-25	643.61	38.3	22.8	32
EW-26	642.16	36	21.1	30.5
EW-27	640.63	36.9	21.7	31
EW-28	640.86	22.8	7.7	17
EW-29	638.93	23.6	8.2	17.5

Notes:
bgs = below ground surface
ft = feet

Table A-3 - RI/FS Well Screened Intervals

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Well ID	Surface Elevation	Total Depth (ft bgs)	Top of Shallow Screen Depth (ft bgs)	Bottom of Shallow Screen Depth (ft bgs)	Top of Mid Screen Depth (ft bgs)	Bottom of Mid Screen Depth (ft bgs)	Top of Deep Screen Depth (ft bgs)	Bottom of Deep Screen Depth (ft bgs)	Notes
Gas Extraction Wells									
E-29D									Boring log has not been located
E-29C									Boring log has not been located
E-29B									Boring log has not been located
E-29A									Boring log has not been located
E-61S									Boring log has not been located
E-61D									Boring log has not been located
E-62									Boring log has not been located
E-63	607.64	151	22	60	83	103	130	150	
E-64	615.91	146	31	60	80	100	125	145	
E-65	625.35	103	83	102	-	-	-	-	

Table A-3 - RI/FS Well Screened Intervals

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Well ID	Top of PVC Elevation (ft)	Total Depth (ft bgs)	Top of Shallow Screen Depth (ft bgs)	Bottom of Shallow Screen Depth (ft bgs)	Top of Mid Screen Depth (ft bgs)	Bottom of Mid Screen Depth (ft bgs)	Top of Deep Screen Depth (ft bgs)	Bottom of Deep Screen Depth (ft bgs)	Notes
Soil Gas									
GP-1A	639.93	22.5	8	12	-	-	-	-	
GP-1B	639.82	22.5	18.5	22.5	-	-	-	-	
GP-2A	627.03	22.5	6	10	-	-	-	-	
GP-2B	627.03	22.5	18	20	-	-	-	-	
GP-3	594.21	63	5	9	16	20	-	-	Colocated with MW-48
GP-4A	605.72	24	4.5	8.5	-	-	-	-	
GP-4B	605.85	24	15.5	19.5	-	-	-	-	
GP-5A	617.47	75	6	7	-	-	-	-	
GP-5Ba	619.33	75	6	7	-	-	-	-	
GP-5Bb	619.3	75	22	23	-	-	-	-	
GP-5Bc	619.31	75	51	52	-	-	-	-	
GP-5Bd	619.31	75	63	64	-	-	-	-	
GP-6A	634.81	203	54	55	-	-	-	-	
GP-6B	634.53	203	84	85	-	-	-	-	
GP-6C	634.75	203	94	95	-	-	-	-	
GP-6D	634.69	203	113	114	-	-	-	-	
GP-6E	634.62	203	134	135	-	-	-	-	
GP-6F	634.81	203	148	149	-	-	-	-	
GP-6G	634.68	203	163	164	-	-	-	-	
GP-6H	634.71	203	178	179	-	-	-	-	
GP-7	640.24	58	48	50	-	-	-	-	
GP-8	642.23	60	44	45	-	-	-	-	
GP-9	644.99	70	58	59	-	-	-	-	
GP-11A	566.69	100	6.5	7.5	-	-	-	-	
GP-11B	566.71	100	23.5	24.5	-	-	-	-	
GP-11C	566.74	100	54.5	55.5	-	-	-	-	
GP-11D	566.72	100	91.5	92.5	-	-	-	-	

Table A-4 - RI/FS Analytical Methods

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Sample Matrix	Analytical Parameter	Analytical Method	Sample Container	No. Containers	Min. Sample Volume, mL	Min. No. Containers	Preservation Requirements	Holding Time
Water	VOCs	EPA 8260C	40-mL VOA Vials	4	40, 1 full vial	1	4°C ±2°C, HCl pH < 2	14 days for analysis
	Dissolved Metals (freshwater)*	EPA 6020A and EPA 7470	500-mL acid-washed HDPE	1	150	1	4°C ±2°C; **HNO3 pH < 2 in lab, after filtration 0.1-micron**	28 days for Hg, 180 days for other elements
	Total Metals (freshwater)*	EPA 6020A and EPA 7470	500-mL acid-washed HDPE	1	200	1	4°C ±2°C; **HNO3 pH < 2 in lab**	28 days for Hg, 180 days for other elements
	Ammonia, Nitrate-N, Nitrite-N	**Kerouel & Aminot 1997** or SM4500-NH3-G (ammonia); SM4500-NO3-F (nitrate, nitrite)	250-mL WM HDPE	1	50	1	filter within one day of collection then freeze	14 days @ -20°C
	TSS	SM2540D	1-L WM HDPE	1	1000	1	4°C ±2°	7 days
	TDS	SM2540C	500-mL WM HDPE	1	150	1	4°C ±2°	7 days
	TOC	SM5310-B	125-mL amber glass	1	40	1	4°C ±2°C, H3PO4 pH < 2	28 days
	Chloride, Sulfate	SM4110B	125-mL NM HDPE	1	50	1	4°C ±2°	28 days
	Bicarbonate (HCO3);and Alkalinity (as CaCO3)	**SM2320-B** or EPA 310.1	500-mL WM HDPE	1	120	1	4°C ±2°	14 days
	Dissolved methane; ethene; ethane	RSK 175 (subcontract)	40-mL VOA Vials	2	40, 1 full vial	1	4°C ±2°C; Na3PO4 or BAK	14 days
	Dissolved Ferrous Iron	Hach kit Method 8146 or subcontract	500-mL HDPE (same bottle as dissolved metals)	1	50	1	4°C ±2°C, **after filtration 0.1-micron**	ASAP
Leachate	VOCs	EPA 8260C	40-mL VOA Vials	4	40, 1 full vial	1	4°C ±2°C, HCl pH < 2	14 days for analysis
	Total Metals (freshwater)*	EPA 6020A and EPA 7471	500-mL HDPE	1	200	1	4°C ±2°C; **HNO3 pH < 2 in lab**	28 days for Hg, 180 days for other elements
	Ammonia, Nitrate-N, Nitrite-N	**Kerouel & Aminot 1997** or SM4500-NH3-G (ammonia); SM4500-NO3-F (nitrate, nitrite)	250-mL WM HDPE	1	50	1	filter within one day of collection then freeze	14 days @ -20°C
	TSS	SM2540D	1-L WM HDPE	1	1000	1	4°C ±2°	7 days
	TDS	SM2540C	500-mL WM HDPE	1	150	1	4°C ±2°	7 days
	TOC	SM5310-B	125-mL amber glass	1	40	1	4°C ±2°C, H3PO4 pH < 2	28 days
	Chloride, Sulfate	SM4110B	125-mL NM HDPE	1	50	1	4°C ±2°	28 days
	Bicarbonate (HCO3);and Alkalinity (as CaCO3)	**SM2320-B** or EPA 310.1	500-mL WM HDPE	1	120	1	4°C ±2°	14 days
Soil Gas	VOCs	EPA TO-15 (subcontract)	6-L Summa Canister	1	NA	1	-	30 days

Notes:
* = WAC 173-351 Appendix I metals list includes antimony, arsenic, barium, beryllium, cadmium, chlomium, cobalt, copper, lead, nickel, selenium, silver, thallium, vanadium, zinc, and nitrate. Also includes select WAC 173-351 Appendix II geochemical parameters including calcium, magnesium, sodium, chloride, potassium, iron, manganese.
ASAP = as soon as possible
BAK = Benzyl ammonium chloride
EPA = U.S. Environmental Protection Agency
HDPE = high-density polyethylene
TDS = total dissolved solids
TOC = total organic carbon
TSS = total suspended solids
VOA = volatile organic analysis
VOC = volatile organic compound

Table A-5 - RI/FS Analytical List

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

Volatile Organic Compounds - Water & Leachate Samples		
CAS	**Common Analytical Name**	**Synonym**
67-64-1	Acetone	
107-13-1	Acrylonitrile	
71-43-2	Benzene	
74-97-5	Bromochloromethane	
75-27-4	Bromodichloromethane	
75-25-2	Bromoform	Tribromomethane
75-15-0	Carbon disulfide	
56-23-5	Carbon tetrachloride	
108-90-7	Chlorobenzene	
75-00-3	Chloroethane	Ethyl chloride
67-66-3	Chloroform	Trichloromethane
124-48-1	Dibromochloromethane	Chlorodibromomethane
96-12-8	1,2-Dibromo-3-chloropropane	DBCP
106-93-4	1,2-Dibromoethane	Ethylene dibromide; EDB
95-50-1	1,2-Dichlorobenzene	o-Dichlorobenzene;
106-46-7	1,4-Dichlorobenzene	p-Dichlorobenzene
110-57-6	trans-1,4-Dichloro-2-butene	
75-34-3	1,1-Dichloroethane	Ethylidene chloride
107-06-2	1,2-Dichloroethane	Ethylene dichloride; EDC
75-35-4	1,1-Dichloroethylene	1,1-Dichloroethene; Vinylidene chloride
156-59-2	cis-1,2-Dichloroethene	cis-1,2-Dichloroethylene
156-60-5	trans-1,2-Dichloroethene	trans-1,2-Dichloroethylene
78-87-5	1,2-Dichloropropane	Propylene dichloride
10061-01-5	cis-1,3-Dichloropropene	
10061-02-6	trans-1,3-Dichloropropene	
100-41-4	Ethylbenzene	
591-78-6	2-Hexanone	Methyl butyl ketone
74-83-9	Bromomethane	Methyl bromide
74-87-3	Methyl chloride	Chloromethane
74-95-3	Dibromomethane	Methylene bromide
75-09-2	Dichloromethane	Methylene chloride
78-93-3	2-Butanone	Methyl ethyl ketone; MEK
74-88-4	Methyl iodide	Iodomethane
108-10-1	4-Methyl-2-pentanone	Methyl isobutyl ketone
100-42-5	Styrene	
630-20-6	1,1,1,2-Tetrachloroethane	
79-34-5	1,1,2,2-Tetrachloroethane	
127-18-4	Tetrachloroethylene	Tetrachloroethene; Perchloroethylene
108-88-3	Toluene	
71-55-6	1,1,1-Trichloroethane	Methyl chloroform
79-00-5	1,1,2-Trichloroethane	
79-01-6	Trichloroethylene	Trichloroethene
75-69-4	Trichlorofluoromethane	CFC-11
96-18-4	1,2,3-Trichloropropane	
108-05-4	Vinyl acetate	
75-01-4	vinyl chloride	
1330-20-7	Xylenes	

Inorganics - Water & Leachate Samples	
CAS	**Metals**
7440-36-0	Antimony
7440-38-2	Arsenic
7440-39-3	Barium
7440-41-7	Beryllium
7440-43-9	Cadmium
7440-47-3	Chromium (Total)
7440-48-4	Cobalt
7440-50-8	Copper
7439-92-1	Lead
7439-97-6	Mercury
7440-02-0	Nickel
7782-49-2	Selenium
7440-22-4	Silver
7440-28-0	Thallium
7440-62-2	Vanadium
7440-66-6	Zinc
14797-55-8	Nitrate
	Field Parameters
	pH
	Conductivity (measured in specific conductance units)
	Temperature
	Static Water Level
	Geochemical Indicator Parameters
7440-70-2	Calcium
71-52-3	Bicarbonate
7439-95-4	Magnesium
14808-79-8	Sulfate
TSS	Total suspended solids
7440-23-5	Sodium
16887-00-6	Chloride
7440-09-7	Potassium
	Alkalinity
7439-89-6	Iron (Dissolved)
7439-96-5	Manganese (Dissolved)
	Leachate Indicators
7664-41-7	Ammonia
	Total Organic Carbon
	Total Dissolved Solids
	Additional MNA Parameters (GW Only)
	Oxidation Reduction Potential
	Dissolved Oxygen
74-82-8	*Methane*
	Nitrate + nitrite
	Ethene and Ethane

Notes:
Parameters in *italics* are those for groundwater sample analysis only. They are for monitored natural attenuation evaluation and are not listed in Appendix I or II of WAC 173-351.

Volatile Organic Compounds - Soil Gas Samples		
CAS	**Common Analytical Name**	**Synonym**
71-55-6	1,1,1-Trichloroethane	TCA
79-34-5	1,1,2,2-Tetrachloroethane	
79-00-5	1,1,2-Trichloroethane	
76-13-1	1,1,2-Trichlorotrifluoroethane	
75-34-3	1,1-Dichloroethane	1,1-DCA
75-35-4	1,1-Dichloroethene	1,1-DCE
95-63-6	1,2,4-Trimethylbenzene	
106-93-4	1,2-Dibromoethane	Ethylene dibromide; EDB
76-14-2	1,2-Dichloro-1,1,2,2-tetrafluoroethane	CFC 114
95-50-1	1,2-Dichlorobenzene	
107-06-2	1,2-Dichloroethane	
78-87-5	1,2-Dichloropropane	
108-67-8	1,3,5-Trimethylbenzene	
106-99-0	1,3-Butadiene	
541-73-1	1,3-Dichlorobenzene	
106-46-7	1,4-Dichlorobenzene	
540-36-3	1,4-Difluorobenzene	
78-93-3	2-Butanone	MEK
591-78-6	2-Hexanone	
460-00-4	4-Bromofluorobenzene	
622-96-8	4-Ethyltoluene	
108-10-1	4-Methyl-2-pentanone	
67-64-1	Acetone	
71-43-2	Benzene	
74-97-5	Bromochloromethane	
75-27-4	Bromodichloromethane	
75-25-2	Bromoform	
74-83-9	Bromomethane	
75-15-0	Carbon Disulfide	
56-23-5	Carbon Tetrachloride	
108-90-7	Chlorobenzene	
3114-55-4	Chlorobenzene-d5	
75-00-3	Chloroethane	
67-66-3	Chloroform	
74-87-3	Chloromethane	
110-82-7	Cyclohexane	
124-48-1	Dibromochloromethane	
75-71-8	Dichlorodifluoromethane	CFC 12
74-95-3	Dichloromethane	
141-78-6	Ethyl Acetate	
100-41-4	Ethylbenzene	
1634-04-4	Methyl tert-Butyl Ether	
100-42-5	Styrene	
127-18-4	Tetrachloroethene	PCE
109-99-9	Tetrahydrofuran	THF
108-88-3	Toluene	
79-01-6	Trichloroethene	TCE
75-69-4	Trichlorofluoromethane	CFC 11
108-05-4	Vinyl Acetate	
75-01-4	Vinyl Chloride	
540-59-0	cis-1,2-Dichloroethene	
10061-01-5	cis-1,3-Dichloropropene	
179601-23-1	m,p-Xylenes	
142-82-5	n-Heptane	
110-54-3	n-Hexane	

Volatile Organic Compounds - Soil Gas Samples		
CAS	**Common Analytical Name**	**Synonym**
156-60-5	trans-1,2-Dichloroethene	
10061-02-6	trans-1,3-Dichloropropene	
526-73-8	1,2,3-Trimethylbenzene	
120-82-1	1,2,4-Trichlorobenzene	
96-12-8	1,2-Dibromo-3-chloropropane	DBCP
17060-07-0	1,2-Dichloroethane-d4	
123-91-1	1,4-Dioxane	
71-36-3	1-Butanol	
540-84-1	2,2,4-Trimethylpentane	Isooctane
611-14-3	2-Ethyltoluene	
75-65-0	2-Methyl-2-propanol	
67-63-0	2-Propanol	
107-05-1	3-Chloro-1-propene	
620-14-4	3-Ethyltoluene	
99-87-6	4-Isopropyltoluene	
75-05-8	Acetonitrile	
107-02-8	Acrolein	
107-13-1	Acrylonitrile	
100-44-7	Benzyl Chloride	
108-20-3	Diisopropyl Ether	
64-17-5	Ethanol	
637-92-3	Ethyl tert-Butyl Ether	
87-68-3	Hexachlorobutadiene	
108-21-4	Isopropyl Acetate	
98-82-8	Isopropylbenzene	Cumene
80-62-6	Methyl Methacrylate	
91-20-3	Naphthalene	
115-07-1	Propene	
2037-26-5	Toluene-d8	
98-83-9	alpha-Methylstyrene	
80-56-8	alpha-Pinene	
5989-27-5	d-Limonene	
123-86-4	n-Butyl Acetate	
124-18-5	n-Decane	
111-84-2	n-Nonane	
111-65-9	n-Octane	
103-65-1	n-Propylbenzene	
1120-21-4	n-Undecane	
135-98-8	sec-Butylbenzene	
994-05-8	tert-Amyl Methyl Ether	
95-47-6	o-Xylene	

Table A-6 - RI/FS Field QC Sampling Matrix

East Perched Zones RI/FS Work Plan - CHRLF, King County, WA

QC Sample	Approximate Quantity	Analysis
Water Samples		
Field Duplicates	3	All groundwater parameters
Field Blanks	3	
Trip Blanks	~10	VOCs
Rinsate Blanks	2	VOCs

Figures

King County

Aspect CONSULTING

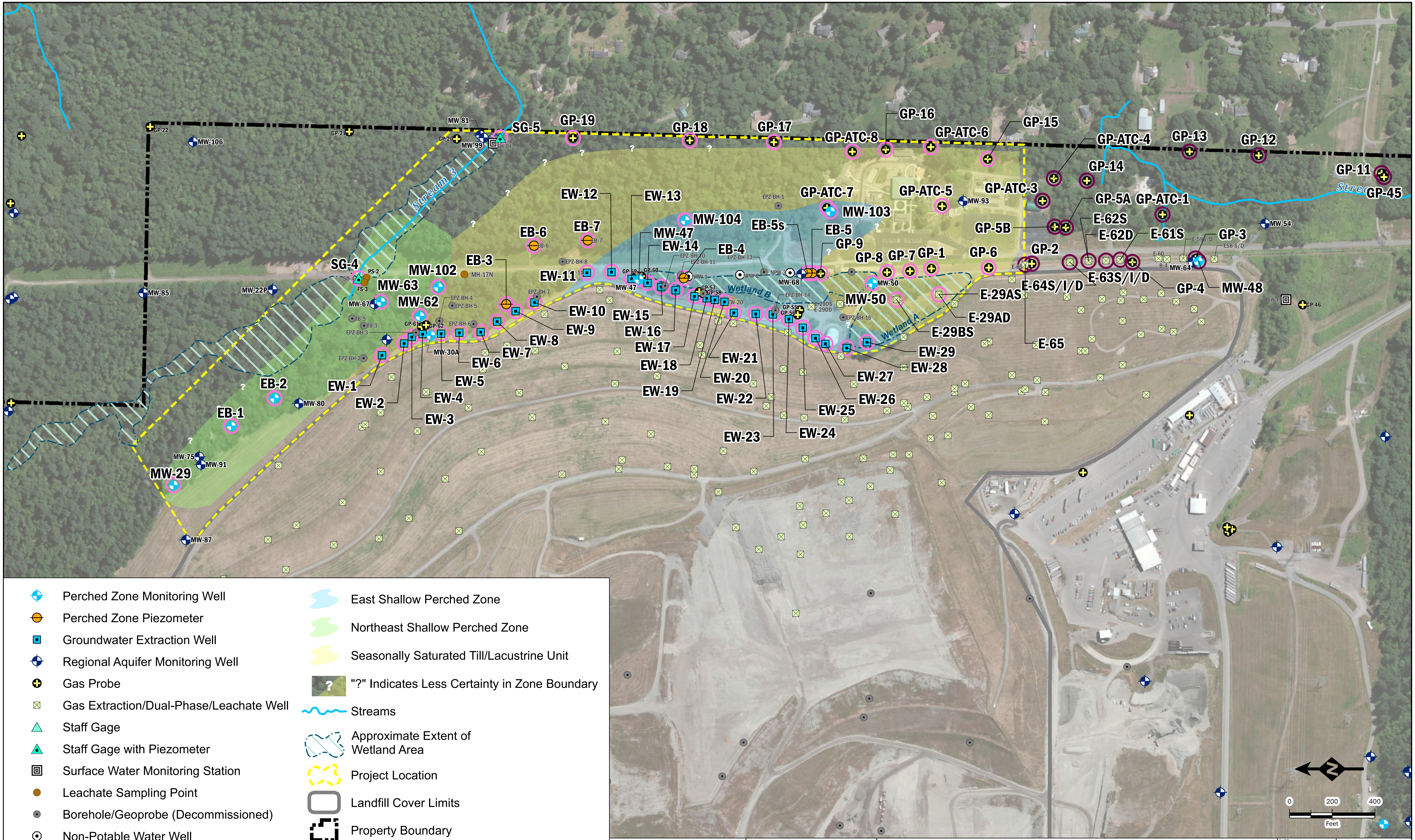
Cedar Hills Regional Landfill Property Features

Cedar Hills Regional Landfill

King County, Washington

DATE: Apr-2015	PROJECT NO. 130088
DESIGNED BY: KSL/RAA	
DRAWN BY: KSL/RAA	FIGURE NO. A-1
REVISED BY: PPW	

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



***Note:** The secondary water level information will be utilized based on results of the nature and extent evaluation.*

Aspect CONSULTING

King County

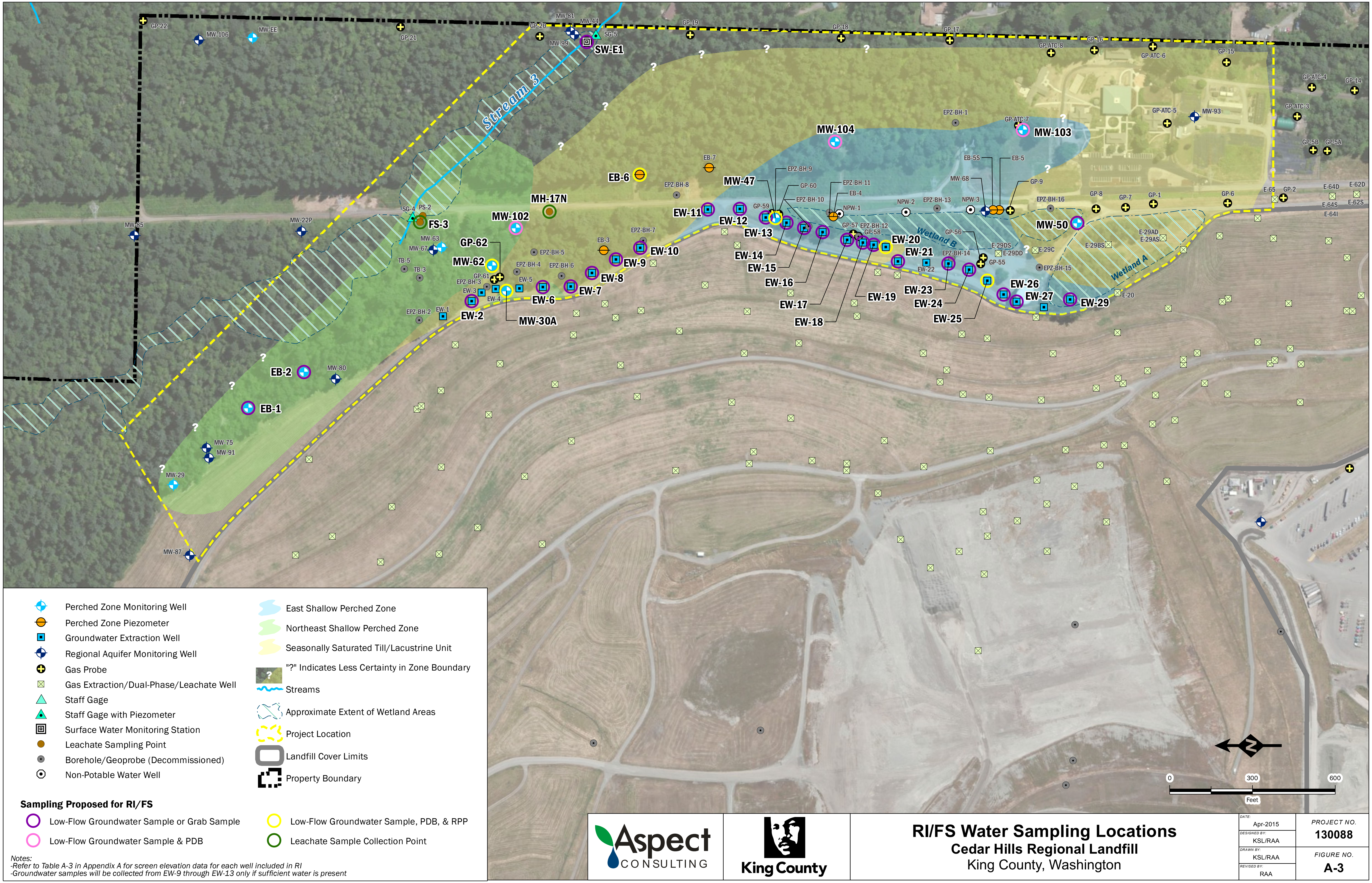
RI/FS Water Level Monitoring Locations

Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014	PROJECT NO. 130088
DESIGNED BY: KSL/RAA	
DRAWN BY: KSL/RAA	FIGURE NO. A-2
REVISED BY: RAA	

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Perched Zone Monitoring Well
Perched Zone Piezometer
Groundwater Extraction Well
Regional Aquifer Monitoring Well
Gas Probe
Gas Extraction/Dual-Phase/Leachate Well
Staff Gage
Staff Gage with Piezometer
Surface Water Monitoring Station
Leachate Sampling Point
Borehole/Geoprobe (Decommissioned)
Non-Potable Water Well

East Shallow Perched Zone
Northeast Shallow Perched Zone
Seasonally Saturated Till/Lacustrine Unit
"?" Indicates Less Certainty in Zone Boundary
Streams
Approximate Extent of Wetland Areas
Project Location
Landfill Cover Limits
Property Boundary

Sampling Proposed for RI/FS

Low-Flow Groundwater Sample or Grab Sample
Low-Flow Groundwater Sample & PDB
Low-Flow Groundwater Sample, PDB, & RPP
Leachate Sample Collection Point

Notes:
-Refer to Table A-3 in Appendix A for screen elevation data for each well included in RI
-Groundwater samples will be collected from EW-9 through EW-13 only if sufficient water is present

Aspect CONSULTING

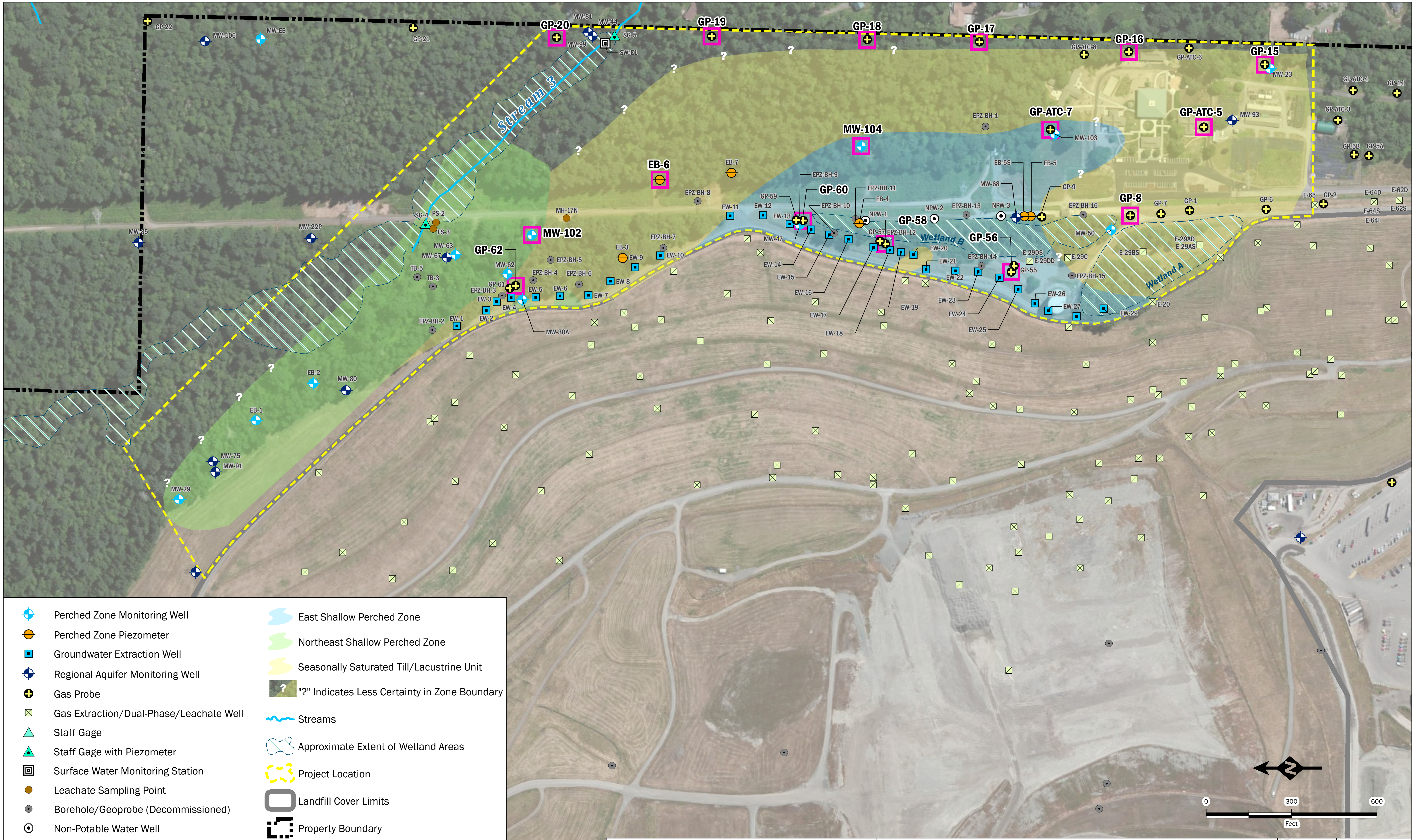
King County

RI/FS Water Sampling Locations
Cedar Hills Regional Landfill
King County, Washington

DATE: Apr-2015
DESIGNED BY: KSL/RAA
DRAWN BY: KSL/RAA
REVISED BY: RAA

PROJECT NO. 130088
FIGURE NO. A-3

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Perched Zone Monitoring Well
Perched Zone Piezometer
Groundwater Extraction Well
Regional Aquifer Monitoring Well
Gas Probe
Gas Extraction/Dual-Phase/Leachate Well
Staff Gage
Staff Gage with Piezometer
Surface Water Monitoring Station
Leachate Sampling Point
Borehole/Geoprobe (Decommissioned)
Non-Potable Water Well
RI/FS Soil Gas Sample Locations

East Shallow Perched Zone
Northeast Shallow Perched Zone
Seasonally Saturated Till/Lacustrine Unit
"?" Indicates Less Certainty in Zone Boundary
Streams
Approximate Extent of Wetland Areas
Project Location
Landfill Cover Limits
Property Boundary

Note: Soil gas sample locations GP-ATC-5, GP-ATC-7, and GP-15 through GP-20 include multiple gas probles completed at different depth intervals. One sample per location will be collected at GP-ATC-5 and GP-ATC-7, and two per locations at GP-15 through GP-20. Refer to Section 8.2.1.4 for sampling strategy.

Aspect CONSULTING

King County

RI/FS Soil Gas Sampling Locations
Cedar Hills Regional Landfill
King County, Washington

DATE:	Dec-2014
DESIGNED BY:	KSL/RAA
DRAWN BY:	KSL/RAA
REVISED BY:	RAA
PROJECT NO.	130088
FIGURE NO.	A-4

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

ATTACHMENT A

Field Documentation Records

Stream Sampling Record

Cedar Hills Regional Landfill 130088

350 Madison Avenue North
Bainbridge Island, Washington 98110
(206) 780-9370

401 Second Avenue S, Suite 201
Seattle, Washington 98104
(206) 328-7443

STREAM SAMPLING RECORD **LOCATION ID:** __________ **Page:____ of ____**

Project Name: ____

Project Number:____________________ Date:________________________

Sampler: ____

Sample ID:____________________Sample Time:________________________

Sample Method:____

Sample Collection Point In Stream: ________________________________

Pump Intake Depth:____________________________________

Sample Observations/Comments: ______________________	Sample Analysis	Field Filtered?	Bottle Type	Quantity	Preservative
Staff Gauge Readings: ______________________					

Passive Diffusion Sampling Record

Cedar Hills Regional Landfill 130088

Well Number	Screen Interval (ft BGS)	Deployment Date	Total Depth (ft BTOC)	Depth to Water (ft BTOC)	Depth to Middle of PDB (ft BTOC)	Depth to Middle of RPP (ft BTOC)	Collection Date	Collection Time	Depth to Water (ft BTOC)	Temp (^{o}C)	DO (mg/L)	Sp. Cond. (µS/cm)	pH	ORP (mV)	Observations and Comments
MW-102	34.5 - 49.5														
MW-103	25 - 35														
MW-104	22 - 32														
EW-18	55 - 65 ?														
EW-19	30.5 - 39.8														
MW-62	44 - 54														
MW-30A	25 - 35														
MW-47	23.50 - 43.50														
EB-6	20.45 - 30.45														

Sampling Event:

Sampler Initials:

Sampling Equipment with IDs:

Decon Equipment:

Disposal of Decon/Purge Water:

Aspect
CONSULTING

Groundwater Sampling Record
Cedar Hills Regional Landfill 130088

GROUNDWATER SAMPLING RECORD **WELL NUMBER: _______** **Page:____ of ____**

Project Name:
Project Number:
Date:
Starting Water Level (ft TOC):
Developed by:
Casing Stickup (ft):
Measuring Point of Well:
Total Depth (ft TOC):
Screened Interval (ft. TOC)
Casing Diameter (inches):
Filter Pack Interval (ft. TOC)

Casing Volume ___________ (ft Water) x ___________ (Lpfv)(gpf) = ___________ (L)(gal)
Casing volumes: 2" = 0.16 gpf 4" = 0.65 gpf 6" = 1.47 gpf
2" = 0.62 Lpf 4" = 2.46 Lpf 6" = 5.56 Lpf
Sample Intake Depth (ft TOC):

PURGING MEASUREMENTS

Criteria:		Typical 0.1-0.5 Lpm	Stable and minimal and stable	na	± 3%	± 10%	± 0.1	± 10 mV	± 10%	
Time	Cumul. Volume (gal or L)	Purge Rate (gpm or Lpm)	Water Level (ft)	Temp. (C or F)	Specific Conductivity (µS/cm)	Dissolved Oxygen (mg/L)	pH	Eh ORP (mv)	Turbidity (NTU)	Comments

Total Gallons Purged:
Total Casing Volumes Removed:

Ending Water Level (ft TOC):
Ending Total Depth (ft TOC):

SAMPLE INVENTORY

Time	Volume	Bottle Type		Quantity	Filtration	Preservation	Appearance		Remarks
							Color	Turbidity & Sediment	

METHODS

Sampling Equipment with IDs:
Purging Equipment:
Decon Equipment:
Disposal of Discharged Water:

Observations/Comments:

Aspect CONSULTING

Cedar Falls Landfill
Gas Probe Data Sheet - Cedar Hills Regional Landfill 130088

Gas Well ID:
Sample ID:
Date & Time: ____________________

Total Casing Volume (cc):

Canister ID:
Initial Canister Pressure:
Final Canister Pressure:

Field Personnel: ____________

Casing Volume Purged	Volume Purged (cc)	Purge Rate (ml/min)	Purge Time	Purge Time	CH_4 (% volume)	CO_2 (% volume)	O_2 (% volume)	H2S (ppm)
	0	0		0 min 0 sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				
				min sec				

Comments: ____

Barometric Pressure: ____________
Well Head Pressure: ____________
Water Level/Well Bottom: ____________

Screen:

Northing/Easting:
Well diameter:

Equipment Used: Gem 2000, Water Level Meter

Attachment B

Boring Logs for RI Sample Locations

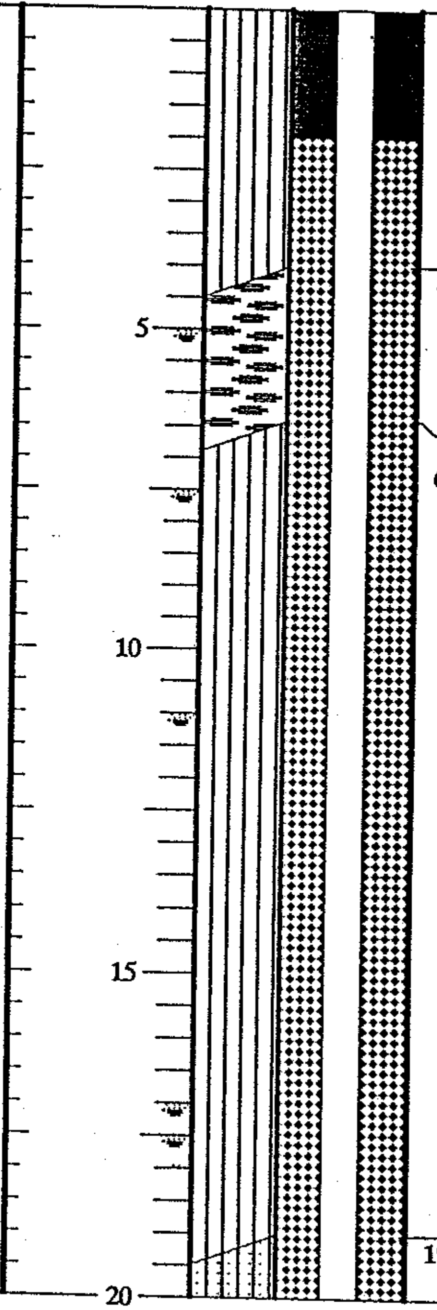
LOG OF EXPLORATORY BORING

Renumbered as MW-62 as of 8/91.

PROJECT NAME Cedar Hills Landfill
LOCATION Adjacent to MW-30A
DRILLED BY Holt Drilling, Inc.
DRILL METHOD Cable Tool
LOGGED BY Mike Noll

BORING NO. ~~MW-60~~
PAGE 1 OF 4
REFERENCE ELEV. 554.41' MSL
TOTAL DEPTH 65.50'
DATE COMPLETED 2/1/90

SAMPLING METHOD AND NUMBER	BLOW COUNTS	SPECIFIC CONDUCTANCE (umhos)
G 1		*150
G 2		*145
G 3		*150
G 4		*250



LITHOLOGIC DESCRIPTION

0 - 4 feet: SANDY SILT with gravel, light olive brown, non-plastic, fine to coarse sand, trace fine to coarse subrounded gravel, trace cobbles (to 4-inches diameter), moist. (GLACIAL TILL) (ML)

4 - 6.5 feet: SANDY GRAVEL, olive, fine to coarse, subangular to subrounded, fine to coarse sand, trace non-plastic fines, moist. Boulders at 4.5 to 5 feet. (GLACIAL TILL) (GP)

6.5 - 19 feet: SANDY SILT with gravel, olive, non-plastic, fine to coarse sand, trace to some fine to coarse subrounded gravel, moist. (GLACIAL TILL) (ML)

19 - 40 feet: See description on the following page.

REMARKS

1) Conductivity of water used during drilling = 165 to 185 umhos. 2) G = grab samples, collected over a 0.5 to 1 foot interval from bailed drill cuttings; SB = split barrel samples collected using a 2.5-inch O.D. Sprigs- Hendley core barrel driven using a 300-lb hammer. 3) * = Muddy water samples, diluted with drilling water. 4) Reference elevation = ground surface.

SWEET-EDWARDS/EMCON

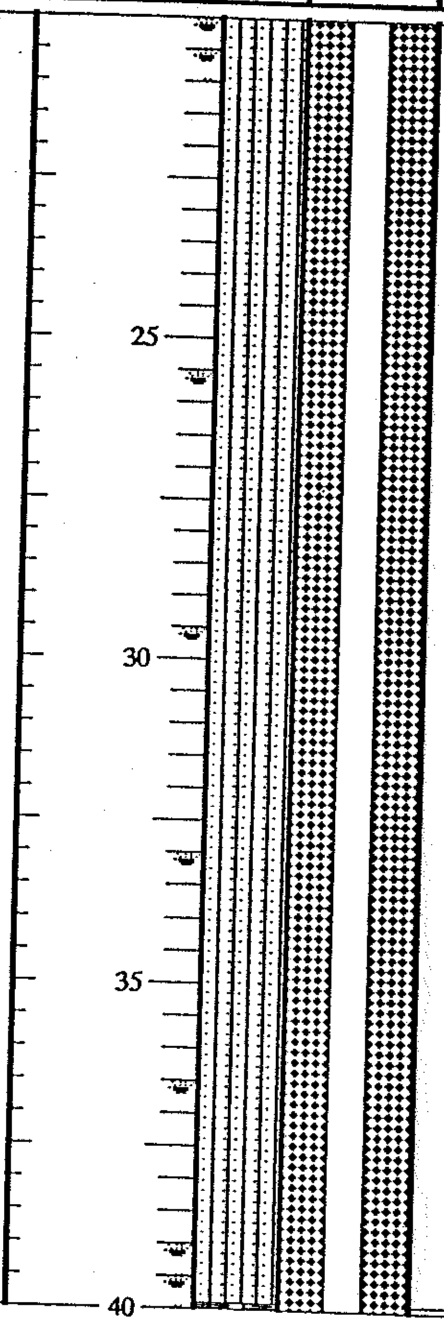
LOG OF EXPLORATORY BORING

Renumbered as MW-62 as of 8/91.

PROJECT NAME Cedar Hills Landfill
LOCATION Adjacent to MW-30A
DRILLED BY Holt Drilling, Inc.
DRILL METHOD Cable Tool
LOGGED BY Mike Noll

BORING NO. ~~MW-60~~
PAGE 2 OF 4
REFERENCE ELEV. 554.41' MSL
TOTAL DEPTH 65.50'
DATE COMPLETED 2/1/90

SAMPLING METHOD AND NUMBER	BLOW COUNTS	SPECIFIC CONDUCTANCE (umhos)	LITHOLOGIC DESCRIPTION
G 5		*245	19 - 40 feet: SILTY SAND, olive gray, fine to coarse, non-plastic fines, trace fine to coarse subrounded gravel, moist. (GLACIAL TILL/STRATIFIED DRIFT) (SM)
G 6		*225	
G 7		*250	
G 8		*215	
		*195	
G 9		*175	
G 10		490	



REMARKS
1) Conductivity of water used during drilling = 165 to 185 umhos. 2) G = grab samples, collected over a 0.5 to 1 foot interval from bailed drill cuttings; SB = split barrel samples collected using a 2.5-inch O.D. Sprigs- Hendley core barrel driven using a 300-lb hammer. 3) * = Muddy water samples, diluted with drilling water. 4) Reference elevation = ground surface.

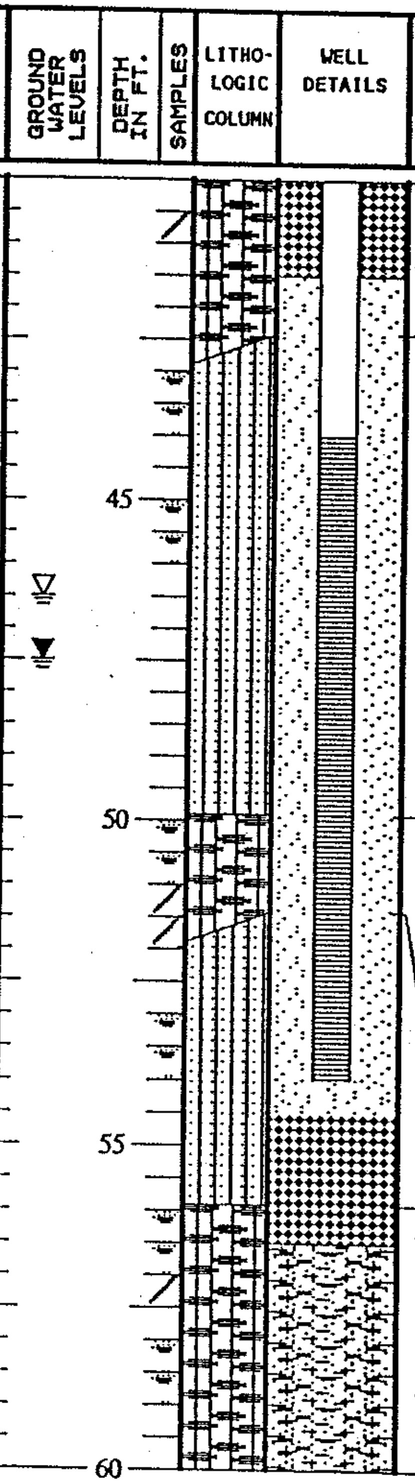
LOG OF EXPLORATORY BORING

Renumbered as MW-62 as of 8/91.

PROJECT NAME Cedar Hills Landfill
LOCATION Adjacent to MW-30A
DRILLED BY Holt Drilling, Inc.
DRILL METHOD Cable Tool
LOGGED BY Mike Noll

BORING NO. ~~MW-60~~
PAGE 3 OF 4
REFERENCE ELEV. 554.41' MSL
TOTAL DEPTH 65.50'
DATE COMPLETED 2/1/90

SAMPLING METHOD AND NUMBER	BLOW COUNTS	SPECIFIC CONDUCTANCE (umhos)
SB 11	50/6"	
G 12		525
G 13		
G 14		310
SB 15	75/12"	
G 16		245
G 17		480
SB 18	50/6"	
G 18		510



LITHOLOGIC DESCRIPTION

40 - 42.5 feet: SILTY GRAVEL with sand, light olive brown, fine to coarse, subrounded, fine to coarse sand, non-plastic fines, moist. (STRATIFIED DRIFT) (GM)

42.5 - 50 feet: SILTY SAND with gravel, light olive brown, fine to coarse, fine to coarse subrounded gravel, low plasticity fines, moist. (DRIFT?) (SM)

50 - 51.5 feet: SILTY GRAVEL with sand, olive to yellowish brown, fine to coarse, subrounded, some oxidized gravel, some fine to coarse sand, low plasticity fines, moist to wet. (GM)

51.5 - 56 feet: SILTY SAND with gravel, light olive brown, fine to coarse, some fine to coarse subrounded gravel, low plasticity fines, moist to wet. (SM)

56 - 65.5 feet: SILTY GRAVEL with sand, olive to yellowish brown, some yellowish brown staining and blueish gray to olive mottling, fine to coarse, subrounded, fine to coarse sand, moist to wet. (GM)
--- Color change to light olive brown between 58 and 61 feet.

REMARKS

1) Conductivity of water used during drilling = 165 to 185 umhos. 2) G = grab samples, collected over a 0.5 to 1 foot interval from bailed drill cuttings; SB = split barrel samples collected using a 2.5-inch O.D. Sprigs- Hendley core barrel driven using a 300-lb hammer. 3) * = Muddy water samples, diluted with drilling water. 4) Reference elevation = ground surface.

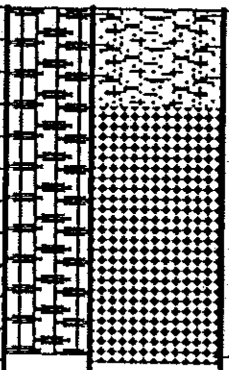
LOG OF EXPLORATORY BORING

Renumbered as MW-62 as of 8/91.

PROJECT NAME Cedar Hills Landfill
LOCATION Adjacent to MW-30A
DRILLED BY Holt Drilling, Inc.
DRILL METHOD Cable Tool
LOGGED BY Mike Noll

BORING NO. ~~MW-60~~
PAGE 4 OF 4
REFERENCE ELEV. 554.41' MSL
TOTAL DEPTH 65.50'
DATE COMPLETED 2/1/90

SAMPLING METHOD AND NUMBER	BLOW COUNTS	SPECIFIC CONDUC-TANCE (umhos)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-LOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION
								61 - 65.5 feet: See previous page for description.
G 19		450						
SB 20	50/12"			65				
								Bottom of boring at 65.5 feet.
				70				
				75				
				80				



WELL CONSTRUCTION DETAILS:
0 - 44 feet: 2-inch schedule 40 PVC casing
44 - 54 feet: 2-inch schedule 40 PVC screen with 0.010-inch slots
0 - 2 feet: Concrete
2 - 41.5 feet: Bentonite chips
41.5 - 54.5 feet: Colorado silica sand (8x10)
54.5 - 56.5 feet: Bentonite chips
56.5 - 61.5 feet: Native caved material
61.5 - 65.5 feet: Bentonite chips

REMARKS

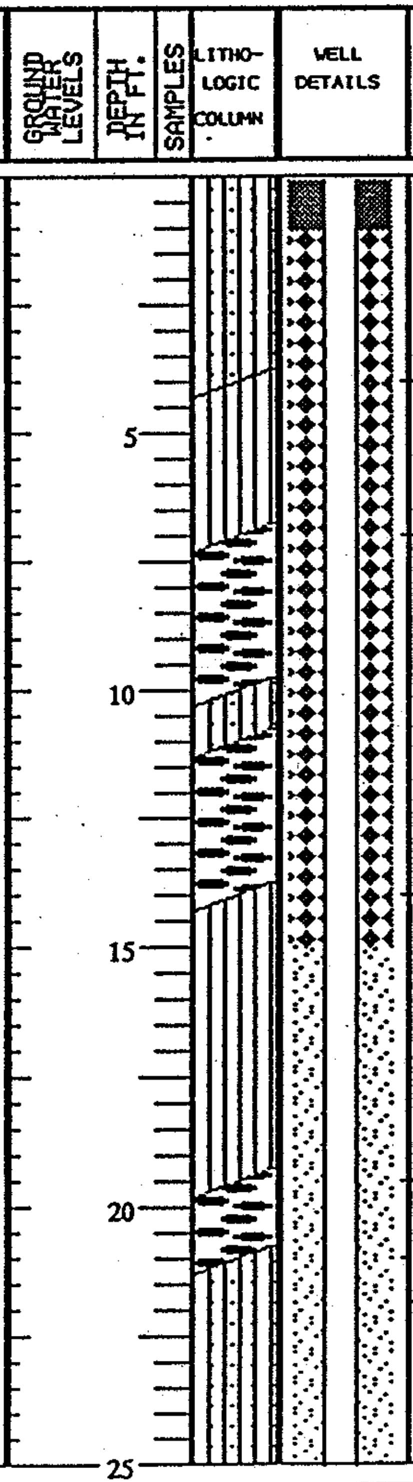
1) Conductivity of water used during drilling = 165 to 185 umhos. 2) G = grab samples, collected over a 0.5 to 1 foot interval from bailed drill cuttings; SB = split barrel samples collected using a 2.5-inch O.D. Sprigs- Hendley core barrel driven using a 300-lb hammer. 3) * = Muddy water samples, diluted with drilling water. 4) Reference elevation = ground surface.

SWEET-EDWARDS/EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME	King County Solid Waste Division	BORING NO.	MW-30A
LOCATION	Cedar Hills Regional Landfill	PAGE	1 OF 2
DRILLED BY	Holt Drilling	REFERENCE ELEV.	567 '
DRILL METHOD	Cable Tool	TOTAL DEPTH	40 '
LOGGED BY	M.D. Noll	DATE COMPLETED	9/6/89

Sample Number	Sampling Method
1	C
2	C
3	C
4	C
5	C



LITHOLOGIC DESCRIPTION

0 - 4 feet: SILTY SAND, medium brown, fine;trace fine gravel; moist, organic-rich. (FILL) (SM)

4 - 7 feet: SILT, dark grayish brown, non-plastic, abundant fine to coarse sand, some fine gravel; moist. (ML)

7 - 14 feet: GRAVEL, olive gray; abundant silt and coarse sand; moist. (GP)

-- @ 10 - 11 feet: Olive gray silty sand lense. (SM)

14 - 19.5 feet: SILT, olive gray, non-plastic to low plasticity; abundant fine to coarse sand and fine subrounded gravel, moist, some cobbles with oxidized surfaces. (TILL?) (ML)

19.5 - 21 feet: GRAVEL, olive brown, fine, subangular to subrounded, some fine to coarse sand, trace silt, moist. (GP)

21 - 26 feet: SILTY SAND, Olive gray to olive brown, fine to coarse, abundant fine subrounded gravel, some cobbles; moist to wet. (SM)

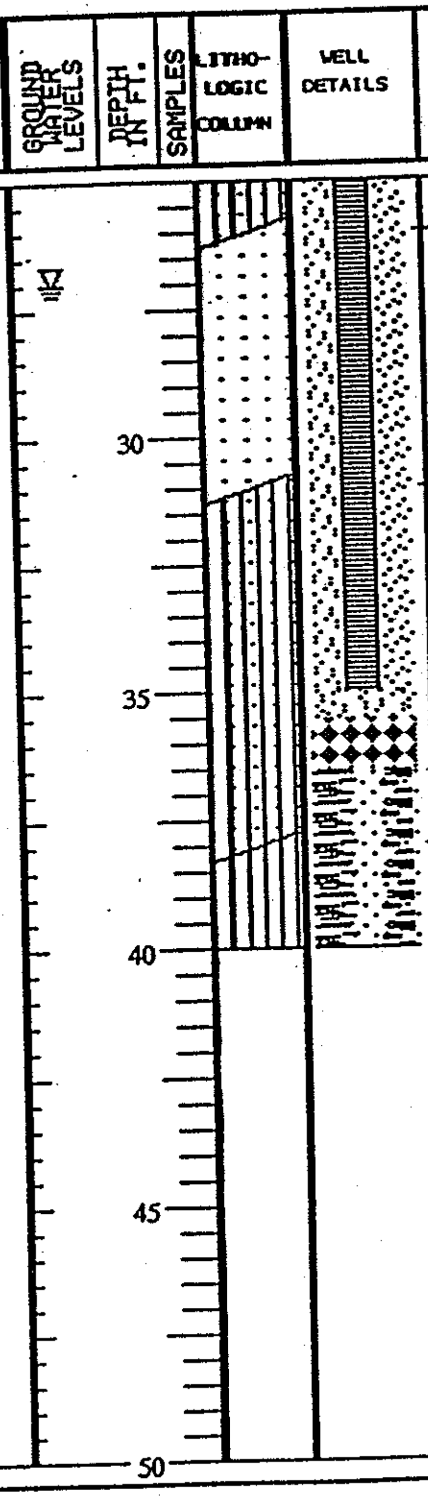
REMARKS

1) Reference elevation is ground surface, based on topography. 2) C = sample of cuttings.

LOG OF EXPLORATORY BORING

PROJECT NAME	King County Solid Waste Division	BORING NO.	MW-30A
LOCATION	Cedar Hills Regional Landfill	PAGE	2 OF 2
DRILLED BY	Holt Drilling	REFERENCE ELEV.	567 '
DRILL METHOD	Cable Tool	TOTAL DEPTH	40 '
LOGGED BY	M.D. Noll	DATE COMPLETED	9/6/89

Sample Number	Sampling Method
6	C
7	C
8	C
9	C
10	C



LITHOLOGIC DESCRIPTION

26 - 31 feet: SAND, olive gray to gray brown, fine to coarse, abundant fine to coarse subangular to subrounded gravel, some cobbles, granitic boulder at 31 feet, wet. (SP)

31 - 38 feet: SILTY SAND, gray brown, fine becoming fine to coarse at 37 feet, some fine to coarse subrounded gravel, trace cobbles, moist. (SM)

38 - 40 feet: SILT, gray brown, non-plastic, abundant fine sand, trace gravel, moist. (ML)

Bottom of boring at 40 feet

NOTES:

Monitoring well completion details: 25 - 35 feet, 2-inch diameter, Schedule 40 PVC screen with 0.010-inch slots; 0 - 25 feet, 2-inch, Schedule 40 PVC riser; 0 - +3 feet, 8-inch steel security casing. Backfill materials: 36.5 - 40 feet, native caved material; 35.5 - 36.5 feet, bentonite chips; 15 - 35.5 feet, Colorado Silica Sand; 1 - 15 feet, bentonite chip seal; 0 - 1 foot, concrete.

REMARKS

1) Reference elevation is ground surface, based on topography. 2) C = sample of cuttings.

65

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT CEDAR HILLS SITE DEVELOPMENT PLAN

Page 1 **of** 2

Location NE corner of Landfill Boundary

Boring No. MW-47

Surface Elevation 633.56

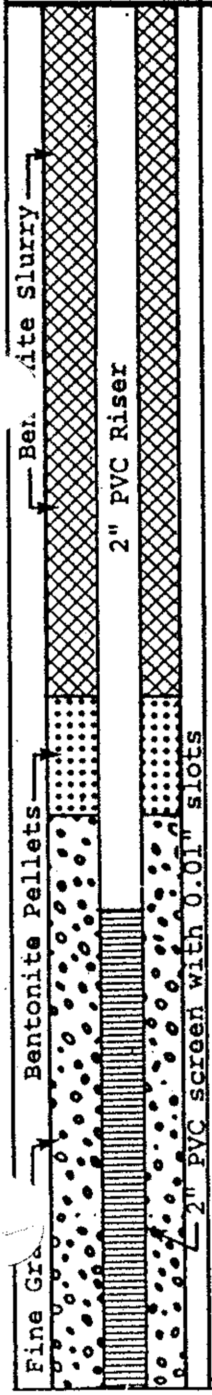
Drilling Method ODEX and Air Rotary

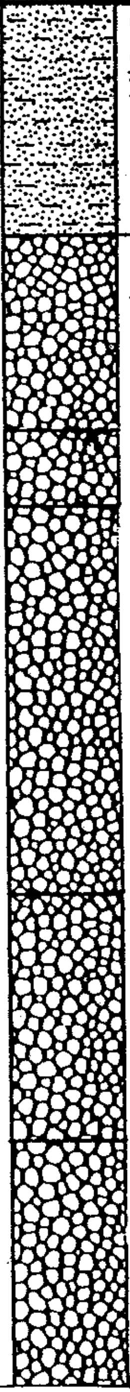
Total Depth 50.0 Feet

Drilled By Kring Drilling Co.

Date Completed 31 May 1985

Logged By D.E. Nadler





PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE		PERMEABILITY TESTING	LITHOLOGIC DESCRIPTION	WATER QUALITY
		NO.	TYPE			
	0 5	S1	SS		0-6.0' SANDY SILT and GRAVELLY SANDY SILT, mottled brown and gray, moist, loose. Gravel to 1.5" diameter rounded to subangular. (FILL AND DISTURBED TILL)	
	10	S2	SS		6.0-11.0' SANDY SILT and GRAVELLY SANDY SILT, variable ratios of silt, sand, and gravel, light brown, dry, very clense. Gravel to 1.5" diameter, rounded. Cobbles at 8-11'. (WEATHERED TILL)	
					11.0-13.0' SILTY GRAVEL, light brown, dry, very dense. (WEATHERED TILL)	
	15 20				13.0-23.0' SILTY GRAVELLY SAND and SANDY GRAVEL, gray to brown-gray below 19.5', dry, very dense. Gravel to 1.0" diameter rounded, cobbles encountered at 17.5-18' and 21-23'. (TILL)	
	25	S3 S4	SS SS		23.0-29.5' SILTY SAND and SANDY SILT, gray, saturated, very dense. Trace gravel to 0.5" diameter, rounded at 23 to 23.3' Sand primarily fine to medium. (TILL)	
	30 35				29.5-44.5' Description on following page	

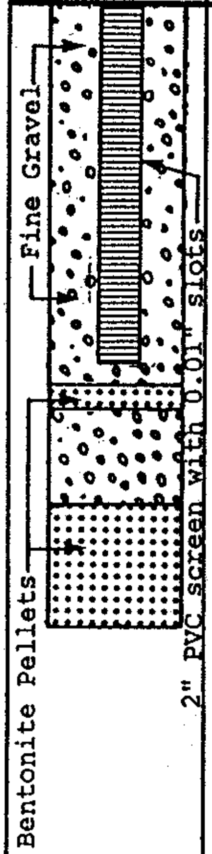
Sweet, Edwards & Associates, Inc.

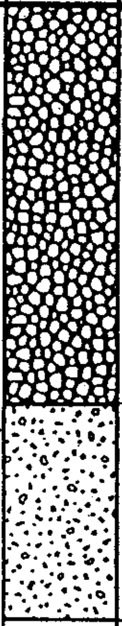
BORING LOG

PROJECT CEDAR HILLS SITE DEVELOPMENT PLAN

Page 2 **of**

Boring No. MW-47





WELL DETAILS	PENE-TRATION TIME/RATE	DEPTH (FEET)	SAMPLE		PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
			NO.	TYPE				
		35					29.5-44.5' CLAYEY SANDY SILT to CLAYEY SILT and SILTY SANDY CLAY, gray, light brown below 42.5 saturated, very stiff. Trace fine gravel, rounded at 31-33' and 38-39.5' (TILL)	
			S5	SS				
		40						
		45					44.5-50.0' SILTY SANDY GRAVEL, brown, dry, very dense. Gravel 0.75-3" diameter, rounded; cobbles at 44.5-46'. (ADVANCE OUTWASH)	
		50						
		55					NOTES: 1. SS=Split Spoon Sample 2. Boring advanced by ODEX method to 43.0 ft. Air rotary with tricone bit used 43.0 to 50.0 ft.	

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT CEDAR HILLS SITE DEVELOPMENT PLAN

Page 1 **of** 2

Location East side of landfill

Boring No. MW-50

Surface Elevation 637.3 feet a.s.l.

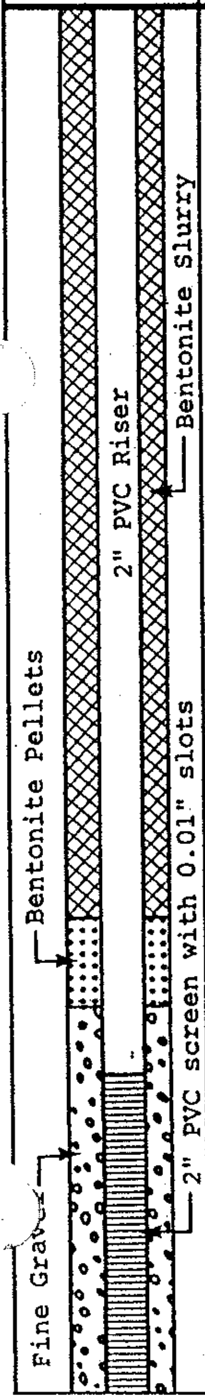
Drilling Method ODEX

Total Depth 39.5 feet

Drilled By Kring Drilling Co.

Date Completed 6/3/85

Logged By D.E. Nadler



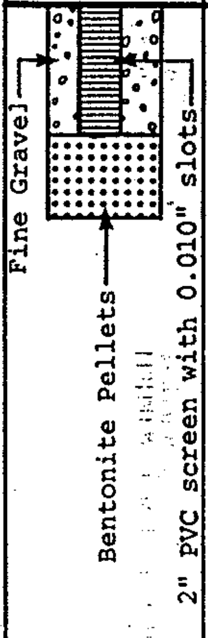
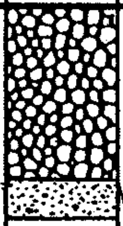
WELL DETAILS	PENE-TRATION TIME/RATE	DEPTH (FEET)	SAMPLE		PERME-ABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
			NO.	TYPE				
		0					0-7.0' CLAYEY SANDY SILT, light brown, moist, medium density. Cobble at 3'. (WEATHERED TILL)	
			S1	SS				
		5						
							7.0-20.0' SANDY SILT and GRAVELLY SANDY SILT, variable ratios of silt, sand, and gravel, gray, moist, very dense. Gravel chiefly to 0.5" diameter rounded, some to 0.75" diameter. Sand primarily fine. (TILL)	
		10	S2	SS				
		15						
		20	S3	SS			20.0-26.5' SILTY SAND to SILTY GRAVELLY SAND and GRAVELLY SANDY SILT, variable ratios of silt, sand, and gravel, gray, moist at 20-22', dry below 22', very dense. Gravel to 1.0" diameter, rounded. Gravel content increases at 25.5'. (TILL)	
		25						
							26.5-27.5' SANDY CLAYEY SILT, gray, saturated, very dense. (TILL)	
		30	S4	SS			27.5-38.5' Description on following page.	
		35						

BORING LOG

PROJECT CEDAR HILLS SITE DEVELOPMENT PLAN

Page 2 **of** 2

Boring No. MW-50

WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE		PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
			NO.	TYPE				
		35 40					27.5-38.5' SANDY GRAVELLY SILT to GRAVELLY SANDY SILT, SANDY CLAYEY SILT, and SILTY GRAVELLY CLAY, gray to 37', tan below 37', moist, very dense. Clay at 38 to 38.5'. Gravel to 1.5" diameter, rounded to subrounded. (TILL) 38.5-39.5' SANDY GRAVEL, brown, dry, very dense. Gravel to 1.5" diameter, rounded to subrounded. Sand medium to coarse. (ADVANCE OUTWASH) NOTES: 1. SS=Split Spoon Sample.	

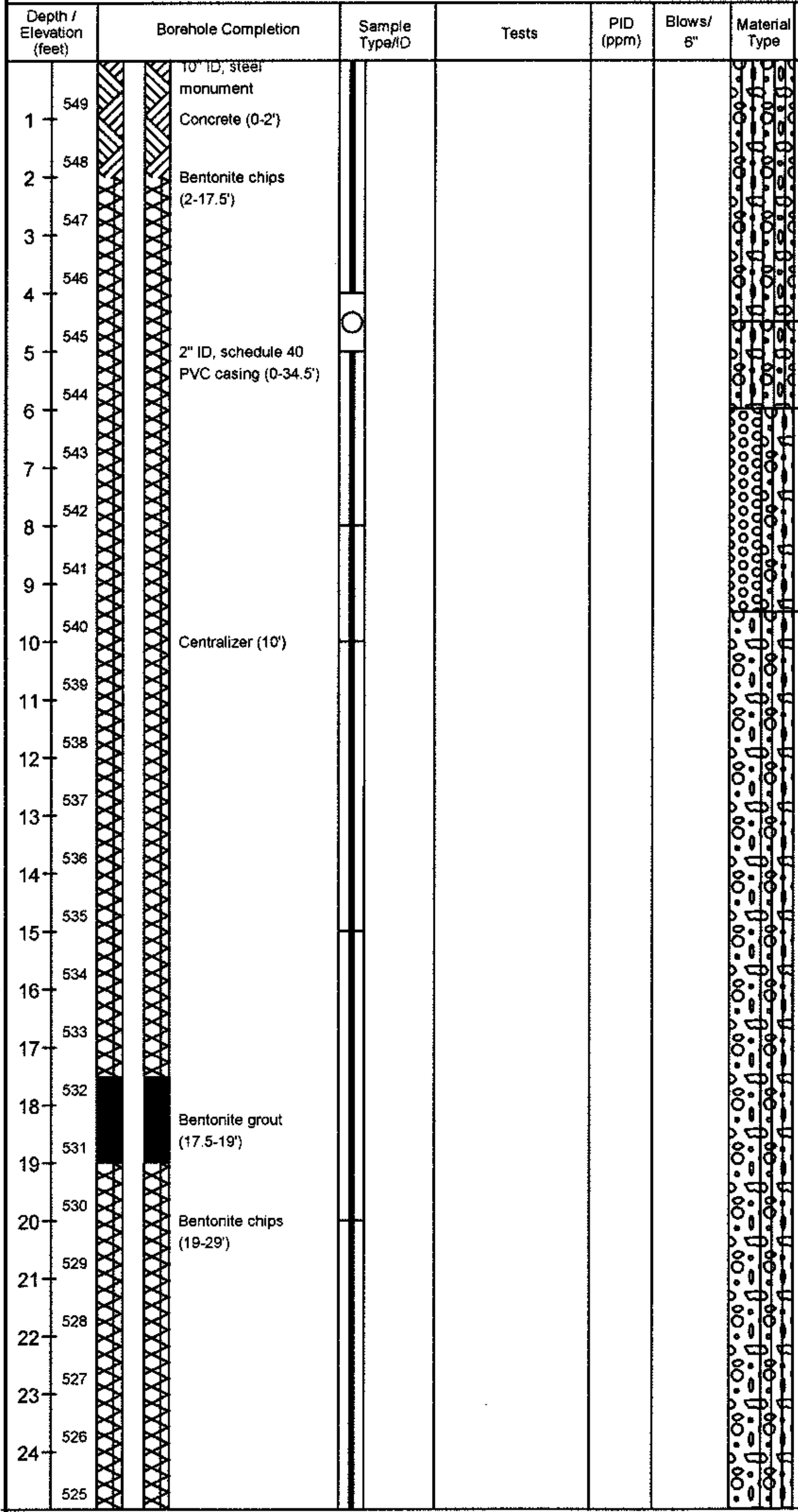
Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-102	1 of 2

Project Name: Groundwater Monitoring Well System Enhancement
Location: 172313.75 N,1701858.76 E / Cedar Hills Landfill, Maple Valley, Wa
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev: 549.73
Top of Casing Elev.: 552.48
Depth to Water (ft BGS): 42.96 - 3/3/2009
Start/Finish Date: 1/26/2009-1/27/2009



Depth (ft)	Description
0	Very moist/wet, red-brown, silty GRAVEL (GM); fine to coarse gravel, subrounded; organics (roots); charred layer at 4.5 ft.
4.5	Wet, red-brown, silty GRAVEL (GM); fine gravel to cobbles, subangular/rounded.
6	Moist, light gray w/ red-brown staining, slightly silty GRAVEL (GP-GM); predominantly coarse gravel.
8	18-inch boulders and powdered rock (8-9.5').
9.5	Moist, yellow-brown/light gray w/ red-brown staining, slightly silty GRAVEL (GW-GM); fine to coarse gravel, subrounded.
14	More gray in color; some coarse sand (14-15').
15	Less sand (15-17').
17	Some yellow-red, clay (17-18').
19	Red and purple clasts.
20	Increase in yellow clay (20-22.5').
23	Less yellow clay (22.5-25.5').

Sampler Type:
○ No Recovery
▯ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: SJR
Approved by: EWM
Figure No. A- 2

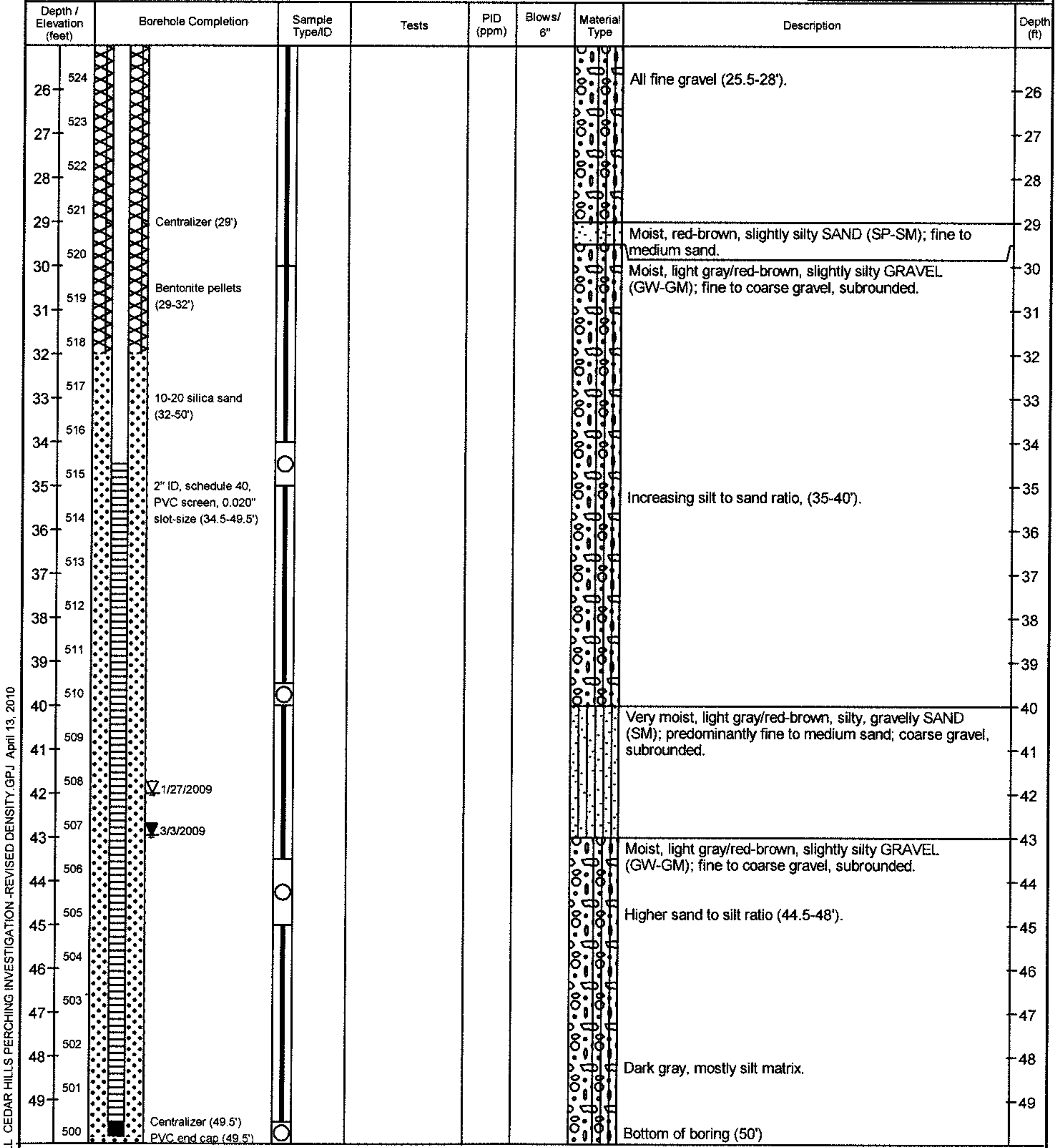
Aspect consulting earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-102	2 of 2

Project Name: Groundwater Monitoring Well System Enhancement
Location: 172313.75 N,1701858.76 E / Cedar Hills Landfill, Maple Valley, Wa
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev: 549.73
Top of Casing Elev.: 552.48
Depth to Water (ft BGS): 42.96 - 3/3/2009
Start/Finish Date: 1/26/2009-1/27/2009



Depth (feet)	Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Description	Depth (ft)
26	524						All fine gravel (25.5-28').	26
27	523							27
28	522							28
29	521	Centralizer (29')					Moist, red-brown, slightly silty SAND (SP-SM); fine to medium sand.	29
30	520						Moist, light gray/red-brown, slightly silty GRAVEL (GW-GM); fine to coarse gravel, subrounded.	30
31	519	Bentonite pellets (29-32')						31
32	518							32
33	517	10-20 silica sand (32-50')						33
34	516							34
35	515	2" ID, schedule 40, PVC screen, 0.020" slot-size (34.5-49.5')					Increasing silt to sand ratio, (35-40').	35
36	514							36
37	513							37
38	512							38
39	511							39
40	510						Very moist, light gray/red-brown, silty, gravelly SAND (SM); predominantly fine to medium sand; coarse gravel, subrounded.	40
41	509							41
42	508	∇ 1/27/2009						42
43	507	▼ 3/3/2009					Moist, light gray/red-brown, slightly silty GRAVEL (GW-GM); fine to coarse gravel, subrounded.	43
44	506							44
45	505						Higher sand to silt ratio (44.5-48').	45
46	504							46
47	503							47
48	502						Dark gray, mostly silt matrix.	48
49	501							49
	500	Centralizer (49.5') PVC end cap (49.5')					Bottom of boring (50')	

Sampler Type:
○ No Recovery
▯ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level
∇ Water Level (ATD)

Logged by: SJR
Approved by: EWM
Figure No. A- 2

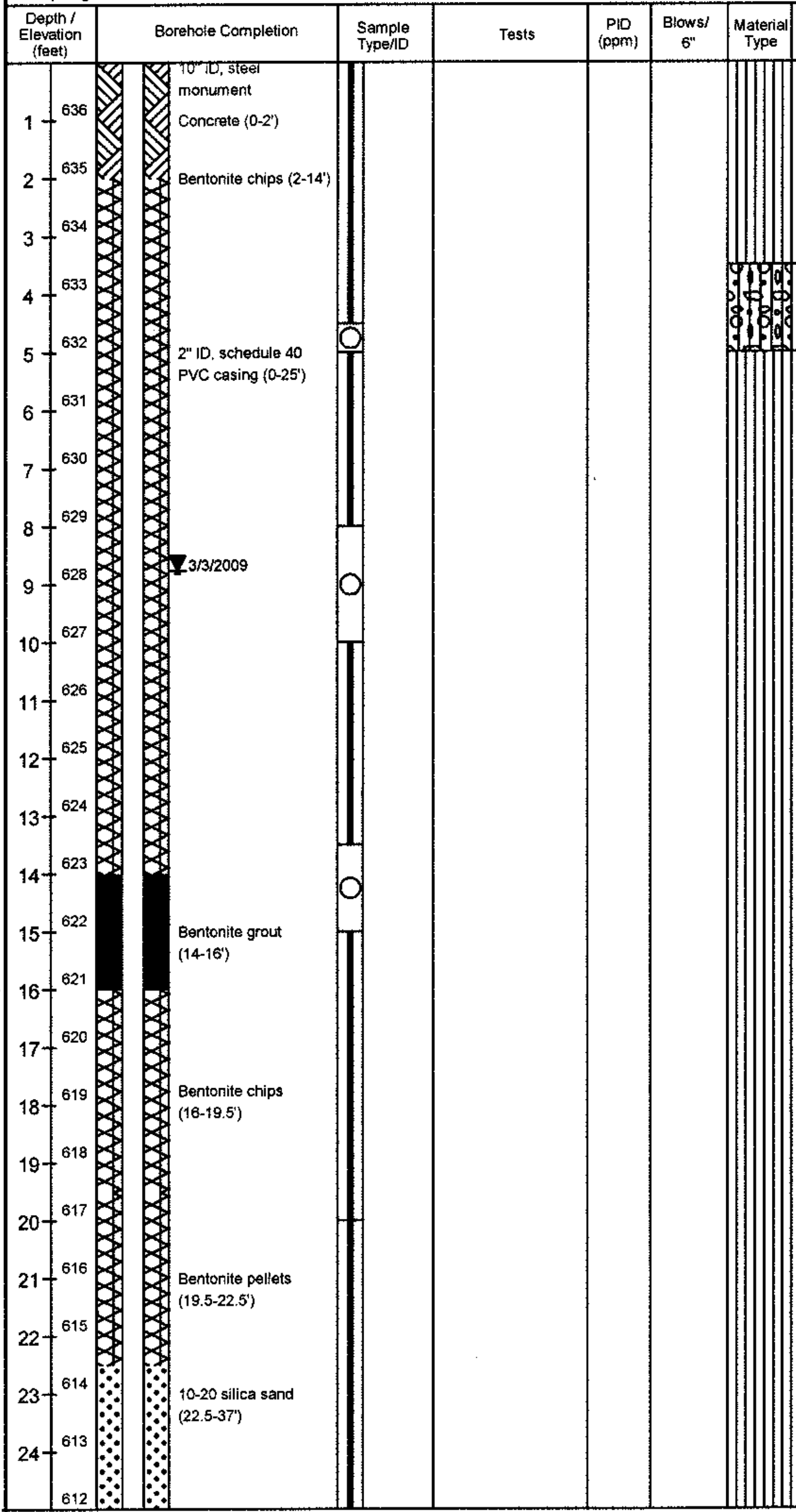
Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-103	1 of 2

Project Name: Groundwater Monitoring Well System Enhancement
Location: 170473.99 N,1702210.55 E / Cedar Hills Landfill, Maple Valley, Wa
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev 636.8
Top of Casing Elev. 639.08
Depth to Water (ft BGS) 8.76 - 3/3/2009
Start/Finish Date 1/28/2009



Description — Depth (ft)

Wet, dark red-brown, SILT (ML); numerous organics (roots), decreasing organics to 2.5'.

Change in color to yellow-red (2.5-3.5').

Very moist, yellow-red, slightly sandy, silty GRAVEL (GM); fine to medium sand; fine gravel to cobbles, rounded.

Hard, slightly moist, brown/light olive gray, slightly gravelly SILT (ML); trace fine sand.

Hard, slightly moist, olive gray/gray, SILT; trace fine gravel, rounded; trace fine sand.

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Sampler Type:
○ No Recovery
▯ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level
▽ Water Level (ATD)

Logged by: SJR
Approved by: EWM
Figure No. A- 3

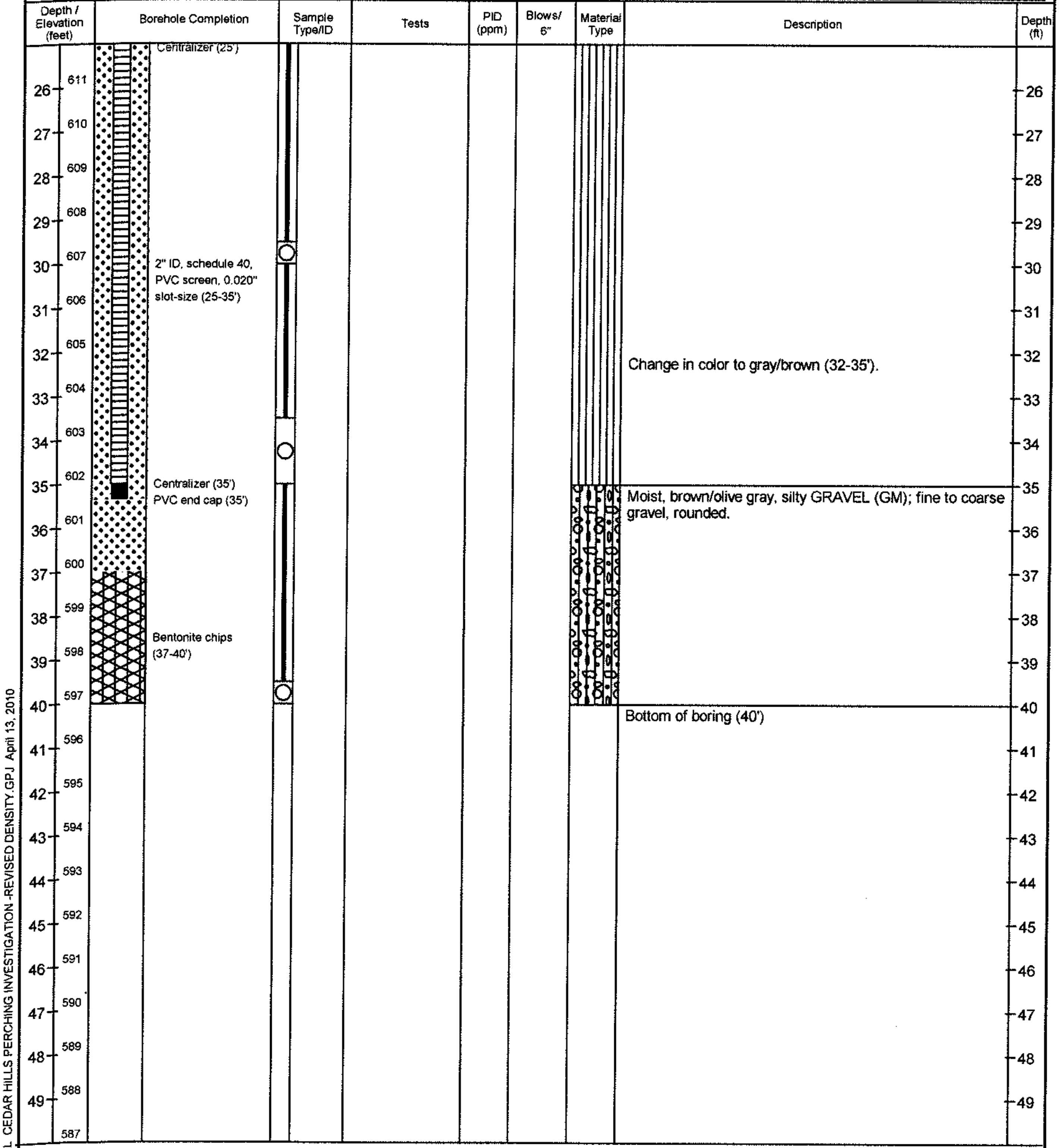
Aspectconsulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-103	2 of 2

Project Name: Groundwater Monitoring Well System Enhancement
Location: 170473.99 N,1702210.55 E / Cedar Hills Landfill, Maple Valley, Wa
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev 636.8
Top of Casing Elev. 639.08
Depth to Water (ft BGS) 8.76 - 3/3/2009
Start/Finish Date 1/28/2009



Change in color to gray/brown (32-35').

Moist, brown/olive gray, silty GRAVEL (GM); fine to coarse gravel, rounded.

Bottom of boring (40')

Sampler Type:
◘ No Recovery
▥ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level
▽ Water Level (ATD)

Logged by: SJR
Approved by: EWM
Figure No. A- 3

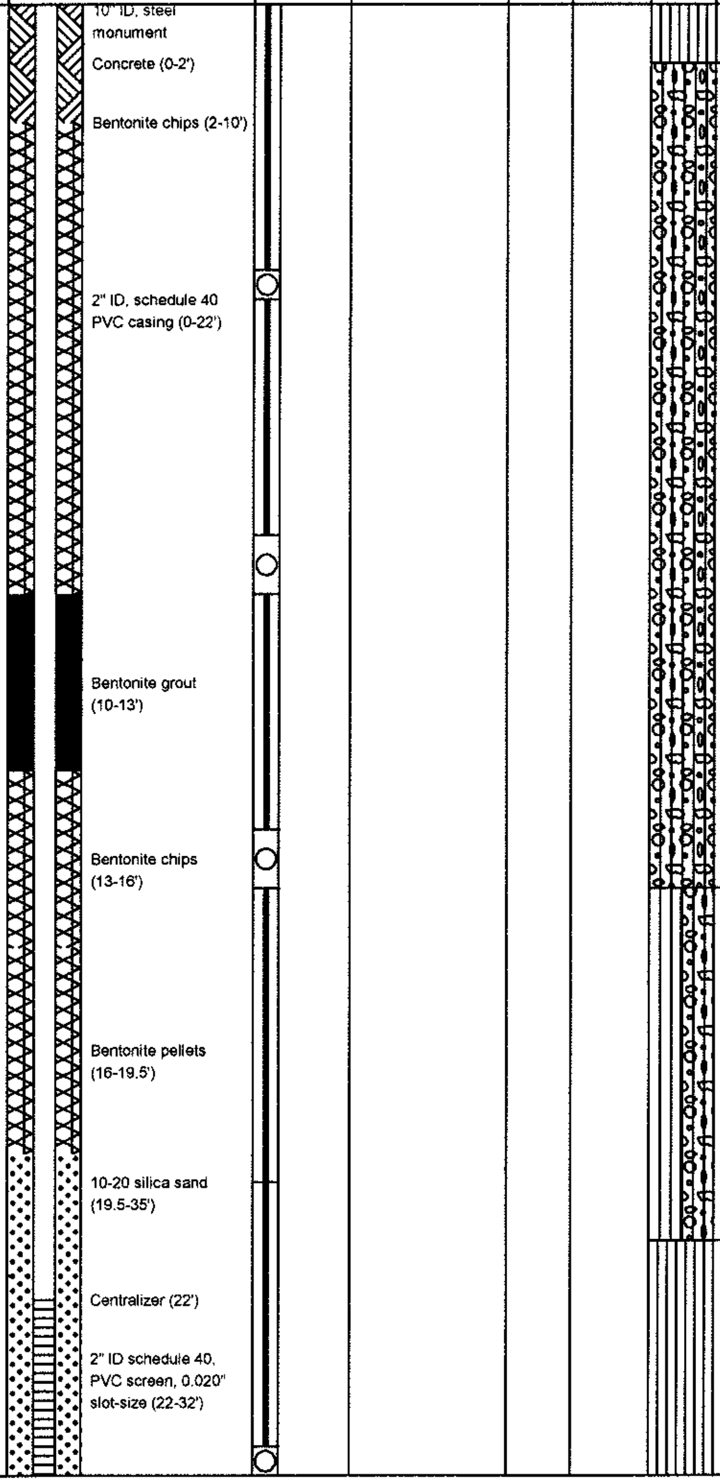
Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-104	1 of 2

Project Name: Groundwater Monitoring Well System Enhancement
Location: 171153.34 N,1702169.14 E / Cedar Hills Landfill, Maple Valley, Wa
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev: 626.92
Top of Casing Elev.: 629.68
Depth to Water (ft BGS): 29.59 - 3/3/2009
Start/Finish Date: 1/28/2009-1/29/2009



Depth / Elevation (feet)	Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
	10" ID, steel monument						Medium stiff, very moist, yellow-red/red-brown, SILT (ML); trace fine sand; trace fine gravel; trace organics (roots).	
1 626	Concrete (0-2')						Very moist, yellow-red, silty GRAVEL (GM); trace fine to medium sand; trace organics (roots); fine gravel to cobbles (6-inch), rounded.	1
2 625	Bentonite chips (2-10')							2
3 624								3
4 623								4
5 622	2" ID, schedule 40 PVC casing (0-22')	○					Slightly moist, yellow-red/light gray, silty GRAVEL (GM); trace fine sand; fine gravel to cobbles, rounded.	5
6 621								6
7 620								7
8 619								8
9 618		○						9
10 617								10
11 616								11
12 615	Bentonite grout (10-13')							12
13 614								13
14 613		○						14
15 612	Bentonite chips (13-16')						Hard, moist, yellow-red/light gray, silty GRAVEL (GM) and gravelly SILT (ML); trace fine sand; fine gravel to cobbles, rounded.	15
16 611								16
17 610								17
18 609	Bentonite pellets (16-19.5')							18
19 608								19
20 607	10-20 silica sand (19.5-35')							20
21 606							Hard, slightly moist/moist, gray, SILT (ML); trace fine to coarse gravel, rounded; trace fine sand.	21
22 605	Centralizer (22')							22
23 604	2" ID schedule 40, PVC screen, 0.020" slot-size (22-32')							23
24 603		○						24

Sampler Type:
○ No Recovery
▯ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: SJR
Approved by: EWM
Figure No. A- 4

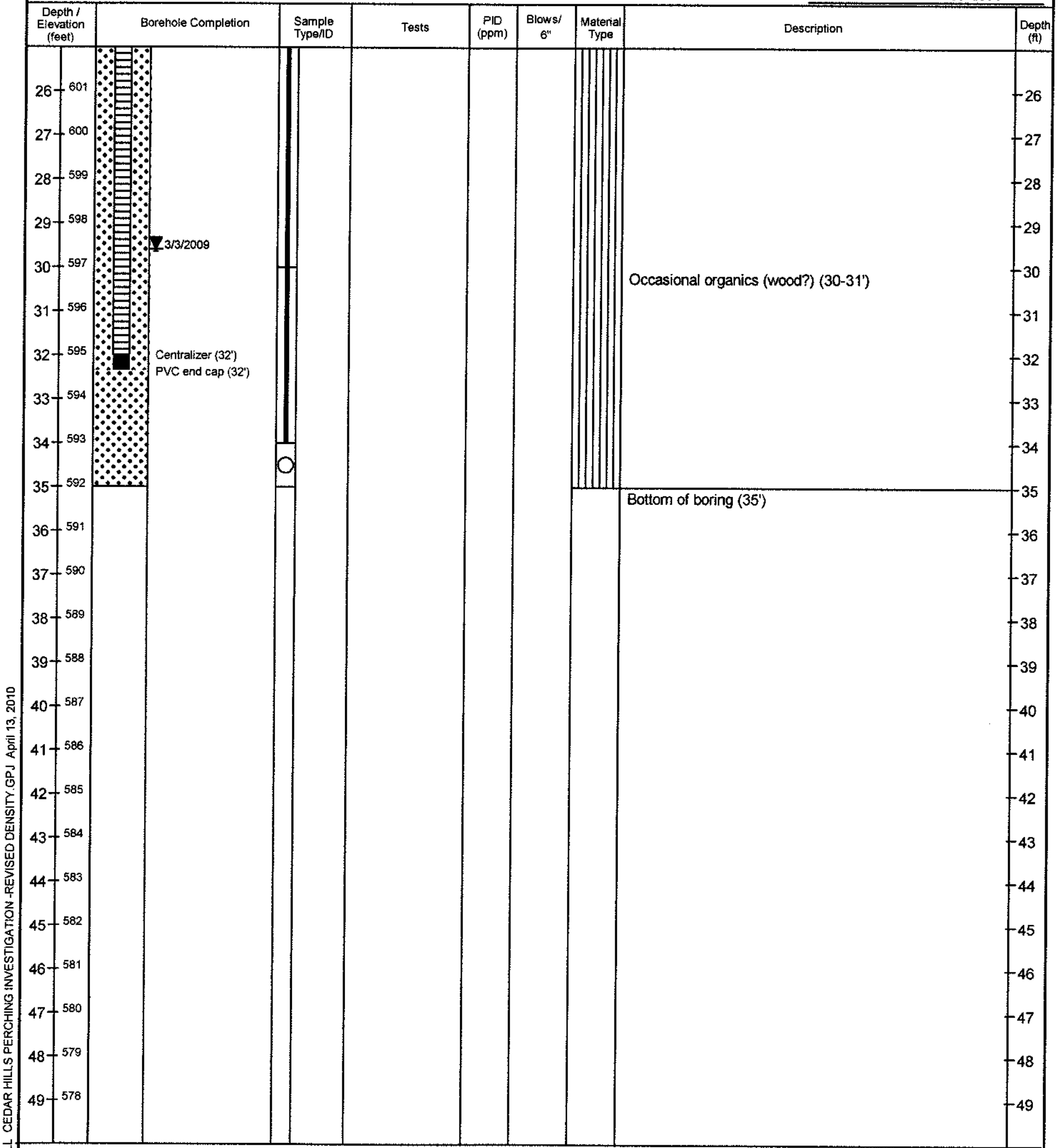
MONITORING WELL CEDAR HILLS PERCHING INVESTIGATION -REVISED DENSITY.GPJ April 13, 2010

Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	MW-104	2 of 2

Project Name:	Groundwater Monitoring Well System Enhancement	Ground Surface Elev	626.92
Location:	171153.34 N.1702169.14 E / Cedar Hills Landfill, Maple Valley, Wa	Top of Casing Elev.	629.68
Driller/Method:	Boart Longyear / Rotary Sonic	Depth to Water (ft BGS)	29.59 - 3/3/2009
Sampling Method:	Continuous Core	Start/Finish Date	1/28/2009-1/29/2009



Occasional organics (wood?) (30-31')

Bottom of boring (35')

Sampler Type:

- ○ No Recovery
- ▥ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level

▽ Water Level (ATD)

Logged by: SJR

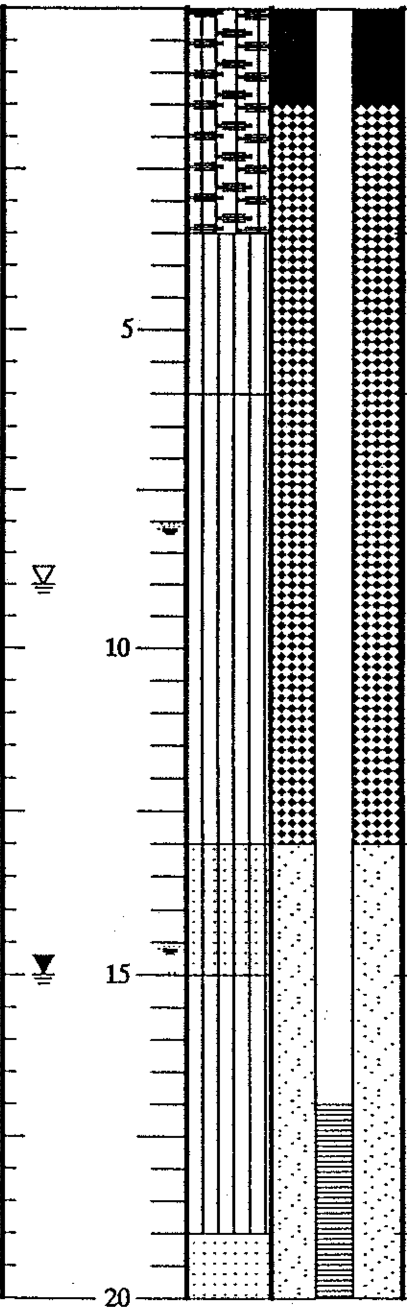
Approved by: EWM

Figure No. A- 4

LOG OF EXPLORATORY BORING

PROJECT NAME	**Cedar Hills Landfill**	**BORING NO.**	**EB-1**
LOCATION	**See below**	**PAGE**	**1 OF 2**
DRILLED BY	**Tacoma Pump & Drill**	**REFERENCE ELEV.**	**530.89' MSL**
DRILL METHOD	**Cable Tool**	**TOTAL DEPTH**	**30.00'**
LOGGED BY	**Mike Noll**	**DATE COMPLETED**	**6/26/90**

SAMPLING METHOD AND NUMBER	SPECIFIC CONDUCTANCE (umhos)	BLOW COUNTS
G 1	850	
	83	
G 2	347	
	155	



LITHOLOGIC DESCRIPTION

0 - 3.5 feet: SILTY GRAVEL (GM), dark brown, fine to coarse, subrounded, to 3 inches, fine to coarse sand, trace cobbles and boulders (subrounded, to 1-1/2 feet), loose to medium dense, dry to moist. (ALLUVIUM)

3.5 - 6 feet: GRAVELLY SILT with sand (ML), olive, low plasticity, fine to coarse gravel (subrounded, to 2 inches), fine to coarse sand, firm, moist. (STRATIFIED DRIFT)

6 - 13 feet: SILT with gravel (ML), olive to olive brown, low plasticity, fine to coarse gravel (subrounded, to 2-1/2 inches), few to some fine to coarse sand, firm to stiff, moist. (STRATIFIED DRIFT)

-- increasing sand content at 10 feet

13 - 15 feet: SILTY SAND with gravel (SM), grayish brown to olive, fine to coarse, low plasticity fines, fine to medium gravel (subangular to subrounded, to 1-1/4 inch), stiff, moist to wet. (STRATIFIED DRIFT)

15 - 19 feet: SANDY SILT with gravel (ML), olive, low plasticity, fine to coarse sand, fine to medium gravel (subrounded, to 1 inch), stiff, moist to wet. (STRATIFIED DRIFT)

19 - 20 feet: Description on following page.

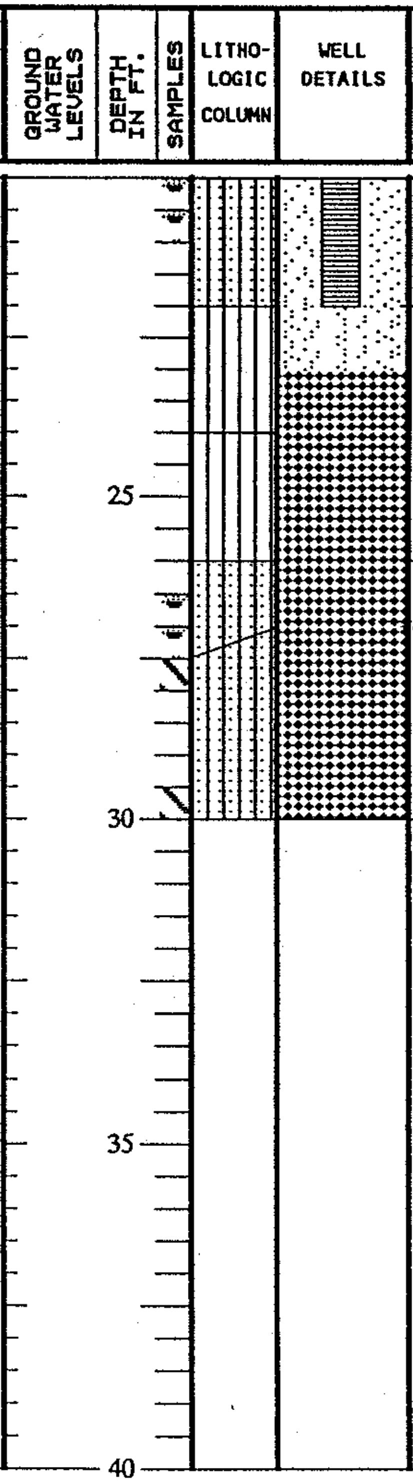
REMARKS

1) G=grab sample, collected from bailed drill cuttings; SB=split barrel sample. 2) Conductance of drill rig water is 170 to 180 umhos/cm. 3) Elevation measurement point (T.O.C.)=532.39 feet. 4) REFERENCE ELEVATION represents ground surface. 5) LOCATION: North of MW-30A.

LOG OF EXPLORATORY BORING

PROJECT NAME	**Cedar Hills Landfill**	BORING NO.	**EB- 1**
LOCATION	**See below**	PAGE	**2 OF 2**
DRILLED BY	**Tacoma Pump & Drill**	REFERENCE ELEV.	**530.89' MSL**
DRILL METHOD	**Cable Tool**	TOTAL DEPTH	**30.00'**
LOGGED BY	**Mike Noll**	DATE COMPLETED	**6/26/90**

SAMPLING METHOD AND NUMBER	SPECIFIC CONDUCTANCE (umhos)	BLOW COUNTS
G 3		
	317	
G 4		100/3"
SB 5		100/6"
SB 6	202	100/6"



LITHOLOGIC DESCRIPTION

19 - 22 feet: SAND and SILTY SAND with gravel (SP-SM), light olive gray, fine to coarse, low plasticity fines, fine to medium gravel (subrounded, to 1 inch), firm, wet. (STRATIFIED DRIFT)

22 - 26 feet: GRAVELLY SILT with sand (ML), olive to pale olive, becoming light gray at 24 feet, low plasticity, fine to medium gravel (subrounded, to 1 inch), fine to coarse sand, stiff, moist. (STRATIFIED DRIFT)

26 - 27.5 feet: SILTY SAND (SM), grey to olive grey, fine to medium, trace fine to medium gravel, dense, moist. Sand becoming finer with depth. (ADVANCE OUTWASH)

27.5 - 30 feet: GRAVELLY SILT (ML), dark grey with grey silty sand beds, non-plastic, fine to coarse gravel, very stiff, dry to moist. Interbedded with silty sand. (ADVANCE OUTWASH)

Bottom of borehole at 30 feet.

WELL COMPLETION DETAILS -- EB-1:

0 - 17 feet: 2-inch-diameter schedule 40 PVC riser pipe; stick up 1.5 feet above ground surface
17 - 22 feet: 2-inch-diameter schedule 40 PVC screen with 0.010-inch slots
0 - 1.5 feet: concrete
1.5 - 13 feet: bentonite chips
13 - 23 feet: 10 x 20 Colorado silica sand
23 - 30 feet: bentonite chips

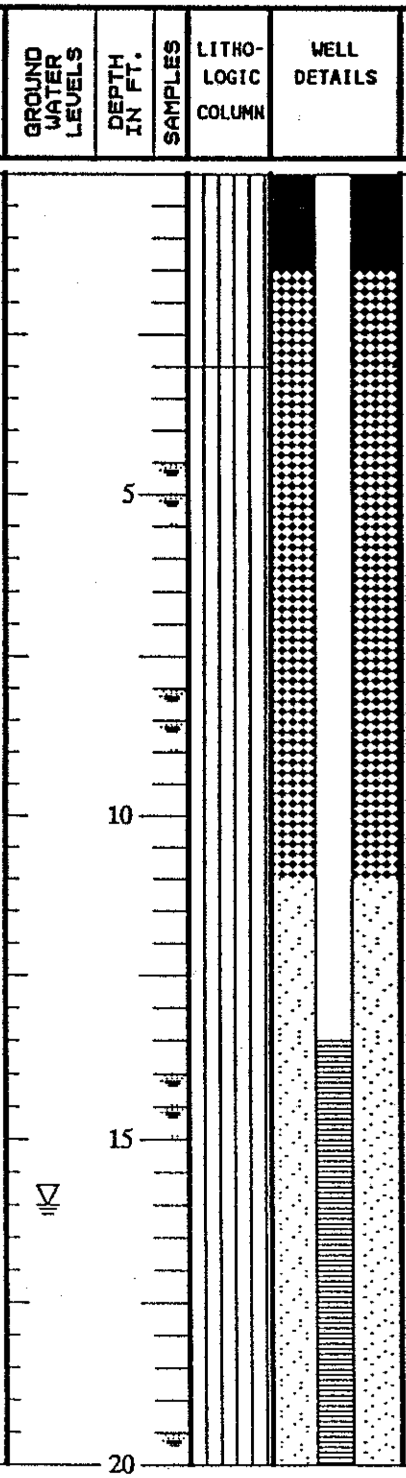
REMARKS

1) G = grab sample, collected from bailed drill cuttings; SB = split barrel sample. 2) Conductance of drill rig water is 170 to 180 umhos/cm. 3) Elevation measurement point (T.O.C.) = 532.39 feet. 4) REFERENCE ELEVATION represents ground surface. 5) LOCATION: North of MW-30A.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cedar Hills Landfill	BORING NO.	EB- 2
LOCATION	See below	PAGE	1 OF 2
DRILLED BY	Tacoma Pump & Drill	REFERENCE ELEV.	528.21' MSL
DRILL METHOD	Cable Tool	TOTAL DEPTH	33.00'
LOGGED BY	Mike Noll	DATE COMPLETED	6/28/90

SAMPLING METHOD AND NUMBER	SPECIFIC CONDUCTANCE (umhos)	BLOW COUNTS
G 1	290	
G 2	248	
G 3	226	
G 4	243	



LITHOLOGIC DESCRIPTION

0 - 3 feet: GRAVELLY SILT (ML), dark yellowish brown, non-plastic, fine to coarse gravel (subrounded, to 3 inches), some fine to coarse sand, trace cobbles and boulders (to 10 inches), firm, dry to moist. (ALLUVIUM)

3 - 31 feet: GRAVELLY SILT with sand (ML), olive brown olive, non-plastic to low plasticity, fine to coarse gravel (subrounded, to 2-1/2 inches), fine to coarse sand, stiff, moist. (STRATIFIED DRIFT)

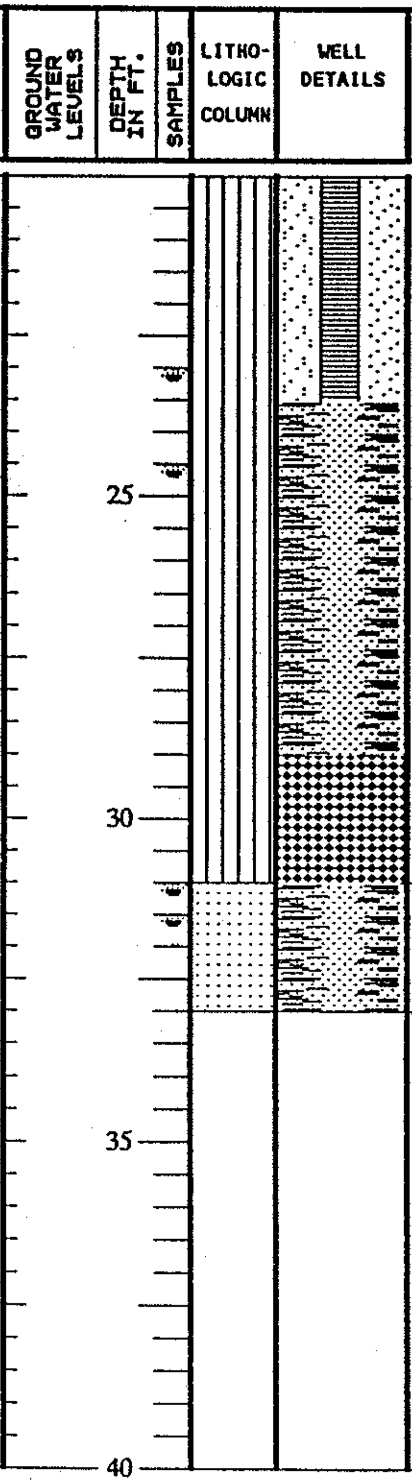
-- color change to light grey to grey; gravel becoming coarse (to 3 inches)

REMARKS
1) G = grab sample, collected from bailed drill cuttings. 2) Rig water conductivity = 175 to 185 umhos/cm. 3) Elevation measurement point (T.O.C.) = 530.32 feet (USC&GD). 4) REFERENCE ELEVATION represents ground surface elevation. 5) LOCATION: NW of MW-30A.

LOG OF EXPLORATORY BORING

PROJECT NAME	Cedar Hills Landfill	BORING NO.	EB- 2
LOCATION	See below	PAGE	2 OF 2
DRILLED BY	Tacoma Pump & Drill	REFERENCE ELEV.	528.21' MSL
DRILL METHOD	Cable Tool	TOTAL DEPTH	33.00'
LOGGED BY	Mike Noll	DATE COMPLETED	6/28/90

SAMPLING METHOD AND NUMBER	SPECIFIC CONDUCTANCE (umhos)	BLOW COUNTS
G 5		
G 6	336	
G 7		



LITHOLOGIC DESCRIPTION

See previous page for description.
-- color change to olive brown, with dark yellowish brown oxidation

WELL COMPLETION DETAILS -- EB-2:

0 - 13.5 feet: 2-inch-diameter schedule 40 PVC riser pipe, stick up 2.0 feet above ground surface
13.5 - 23.5 feet: 2-inch-diameter schedule 40 PVC screen with 0.010-inch slots
0 - 1.5 feet: concrete
1.5 - 11 feet: bentonite chips
11 - 23.5 feet: 10 x 20 Colorado silica sand
23.5 - 29 feet: native caved material
29 - 31 feet: bentonite pellets
31 - 33 feet: native caved material.

31 - 33 feet: GRAVELLY SAND (SP), very dark gray with some grayish brown, fine to coarse, fine to medium gravel (subrounded, to 1-1/4 inch), trace non-plastic fines, loose to medium dense, moist. (ADVANCE OUTWASH)

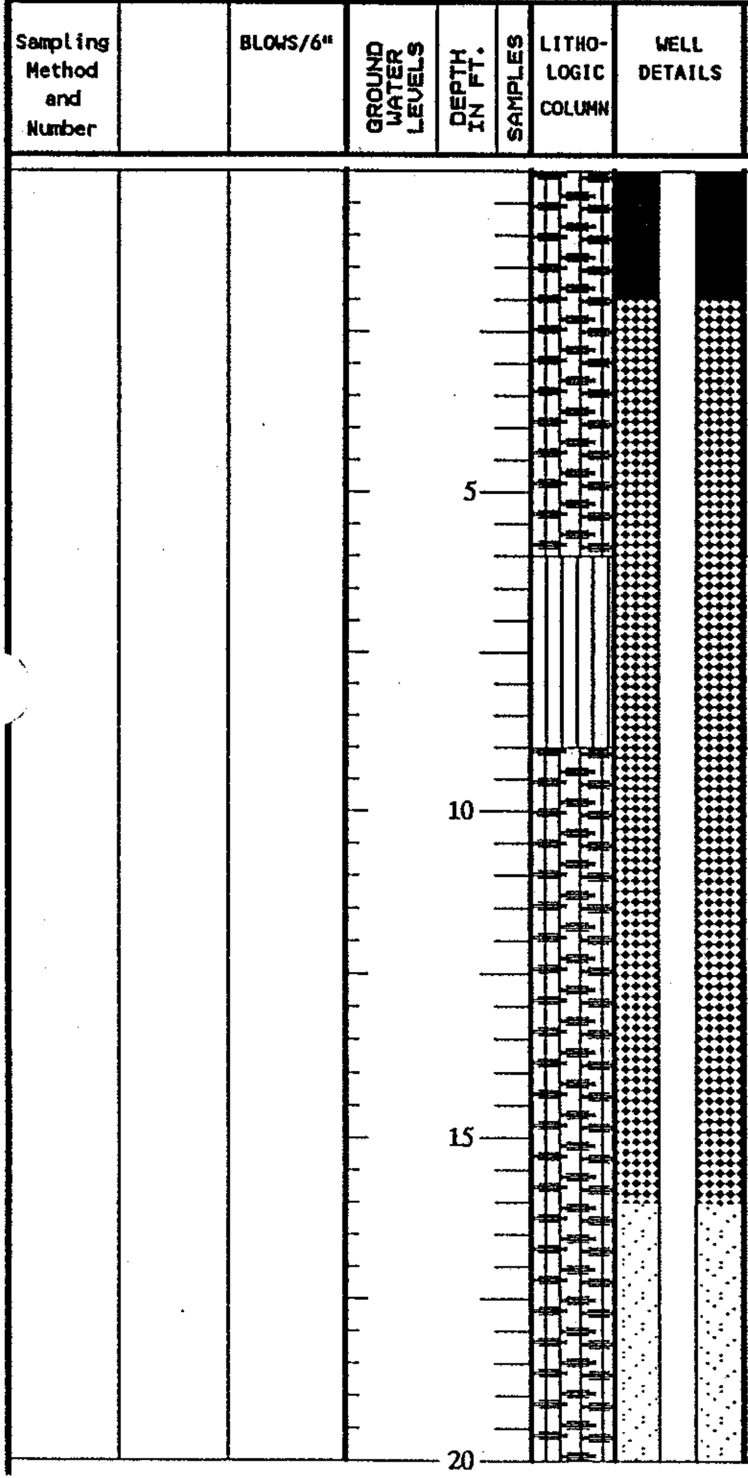
Bottom of borehole at 33 feet.

REMARKS

1) G = grab sample, collected from bailed drill cuttings. 2) Rig water conductivity = 175 to 185 umhos/cm. 3) Elevation measurement point (T.O.C.) = 530.32 feet (USC&GD). 4) REFERENCE ELEVATION represents ground surface elevation. 5) LOCATION: NW of MW-30A.

LOG OF EXPLORATORY BORING

PROJECT NAME	Harper Owes	BORING NO.	EB- 6
LOCATION		PAGE	1 OF 3
DRILLED BY	Tacoma Pump & Drill	REFERENCE ELEV.	587.41' MSL
DRILL METHOD	Air Rotary	TOTAL DEPTH	50.00'
LOGGED BY	Mike Noll	DATE COMPLETED	11/28/90



LITHOLOGIC DESCRIPTION

0 - 6.0 feet: SILTY GRAVEL with sand (GM); olive brown, fine to coarse (subangular to subrounded), non-plastic fines, fine to coarse sand, dense, moist. Boulder at 5 feet. (WEATHERED GLACIAL TILL)

6.0 - 9.0 feet: GRAVELLY SILT with sand (ML); olive to olive brown, non-plastic, fine to coarse gravel (subangular to subrounded), stiff, dry. (WEATHERED GLACIAL TILL)

9.0 -23.0 feet: SILTY GRAVEL with sand (GM); olive brown to olive gray, fine to coarse (subangular to subrounded), non-plastic fines, fine to coarse sand, dense, dry. Some cobbles and boulders at 16 feet and 23 feet. (GLACIAL TILL)

REMARKS

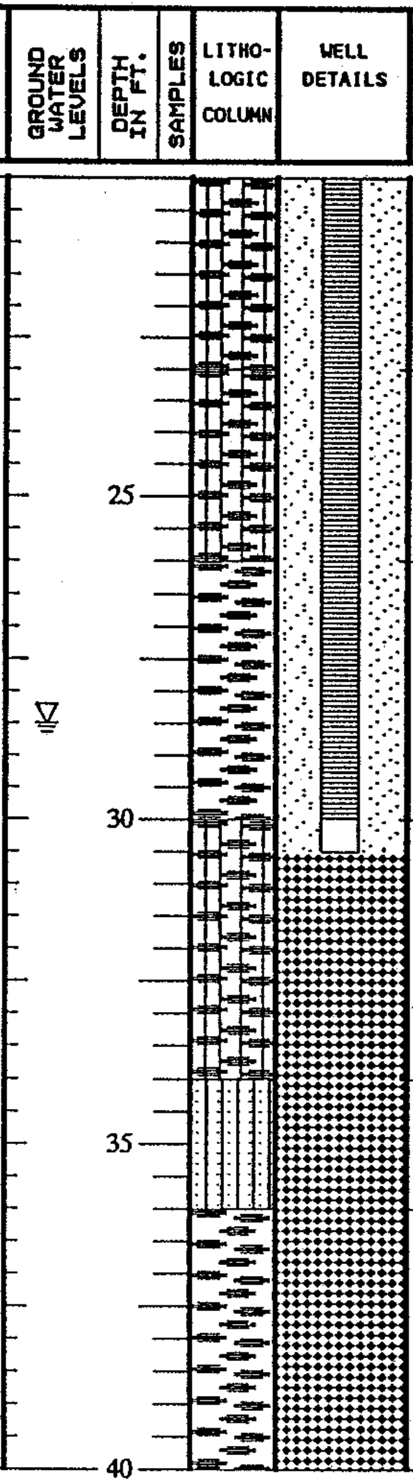
1) Elevation measurement point (T.O.C.) = 589.23 feet. 2) REFERENCE ELEVATION represents ground surface. 3) LOCATION: Northeast of MW-47.

SWEET-EDWARDS/EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME Harper Owes
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY Mike Noll

BORING NO. EB- 6
PAGE 2 OF 3
REFERENCE ELEV. 587.41' MSL
TOTAL DEPTH 50.00'
DATE COMPLETED 11/28/90



Sampling Method and Number		BLOWS/6"	LITHOLOGIC DESCRIPTION
	103		23.0 - 26.0 feet: SILTY GRAVEL with sand (GM); olive to olive gray, fine to coarse (subangular to subrounded), low plasticity fines, fine to coarse sand, dense, moist. (STRATIFIED DRIFT)
			26.0 - 30.0 feet: SANDY GRAVEL (GP); olive to olive gray, fine to coarse (subangular to subrounded), fine to coarse sand, trace fines, some cobbles, dense, moist to wet. (STRATIFIED DRIFT)
	115		30.0 - 34.0 feet: SILTY GRAVEL with sand (GM); olive brown, fine to coarse (subangular to subrounded), low plasticity fines, fine to coarse sand, dense, wet. Some possible water production at 30 feet. (STRATIFIED DRIFT)
			34.0 - 36.0 feet: SILTY SAND with gravel (SM); olive, fine to coarse, low plasticity fines, fine to coarse gravel, dense, moist. (ADVANCE OUTWASH)
			36.0 - 50.0 feet: SANDY GRAVEL with silt (GP); olive, fine to coarse (subangular to subrounded), fine to coarse sand, low plasticity fines, medium dense, dry to moist. (ADVANCE OUTWASH)

REMARKS
1) Elevation measurement point (T.O.C.) = 589.23 feet. 2) REFERENCE ELEVATION represents ground surface. 3) LOCATION: Northeast of MW-47.

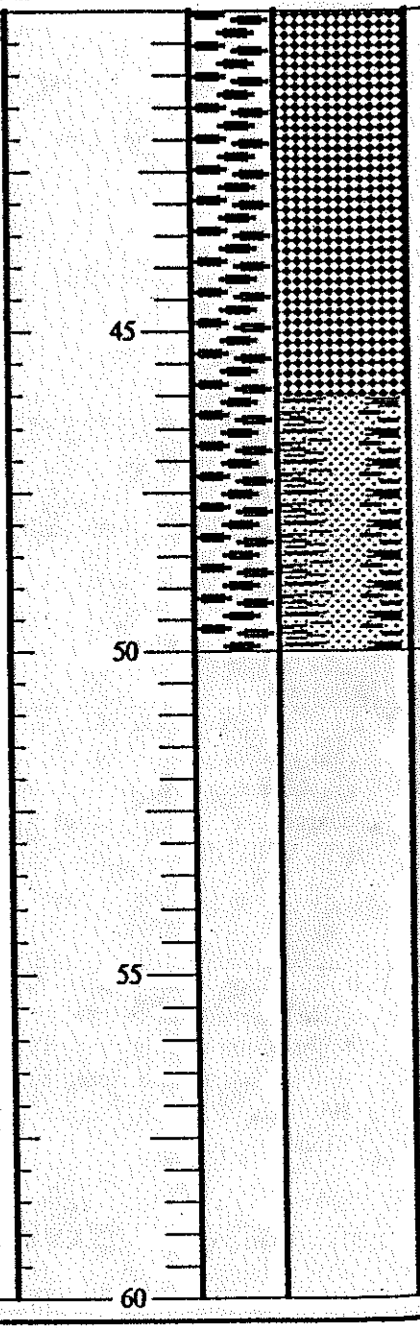
SWEET-EDWARDS/EMCON

LOG OF EXPLORATORY BORING

PROJECT NAME Harper Owes
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY Mike Noll

BORING NO. EB- 6
PAGE 3 OF 3
REFERENCE ELEV. 587.41' MSL
TOTAL DEPTH 50.00'
DATE COMPLETED 11/28/90

Sampling Method and Number		BLOWS/6"	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-LOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION



Bottom of boring at 50.0 feet.

<u>Well Completion Details - EB-6:</u>

0 - 20.0 feet: 2-inch diameter schedule 40 PVC riser pipe with 1.5 foot stick up.
20.0 - 30.0 feet: 2-inch diameter schedule 40 PVC screen with 0.010-inch machined slots.
30.0 - 30.5 feet: 2-inch diameter schedule 40 PVC end cap.
0 - 2.0 feet: concrete.
2.0 - 16.0 feet: bentonite chips.
16.0 - 30.5 feet: 10 x 20 Colorado silica sand.
30.5 - 46.0 feet: bentonite chips.
46.0 - 50.0 feet: native caved materials.

REMARKS
1) Elevation measurement point (T.O.C.) = 589.23 feet. 2) REFERENCE ELEVATION represents ground surface. 3) LOCATION: Northeast of MW-47.

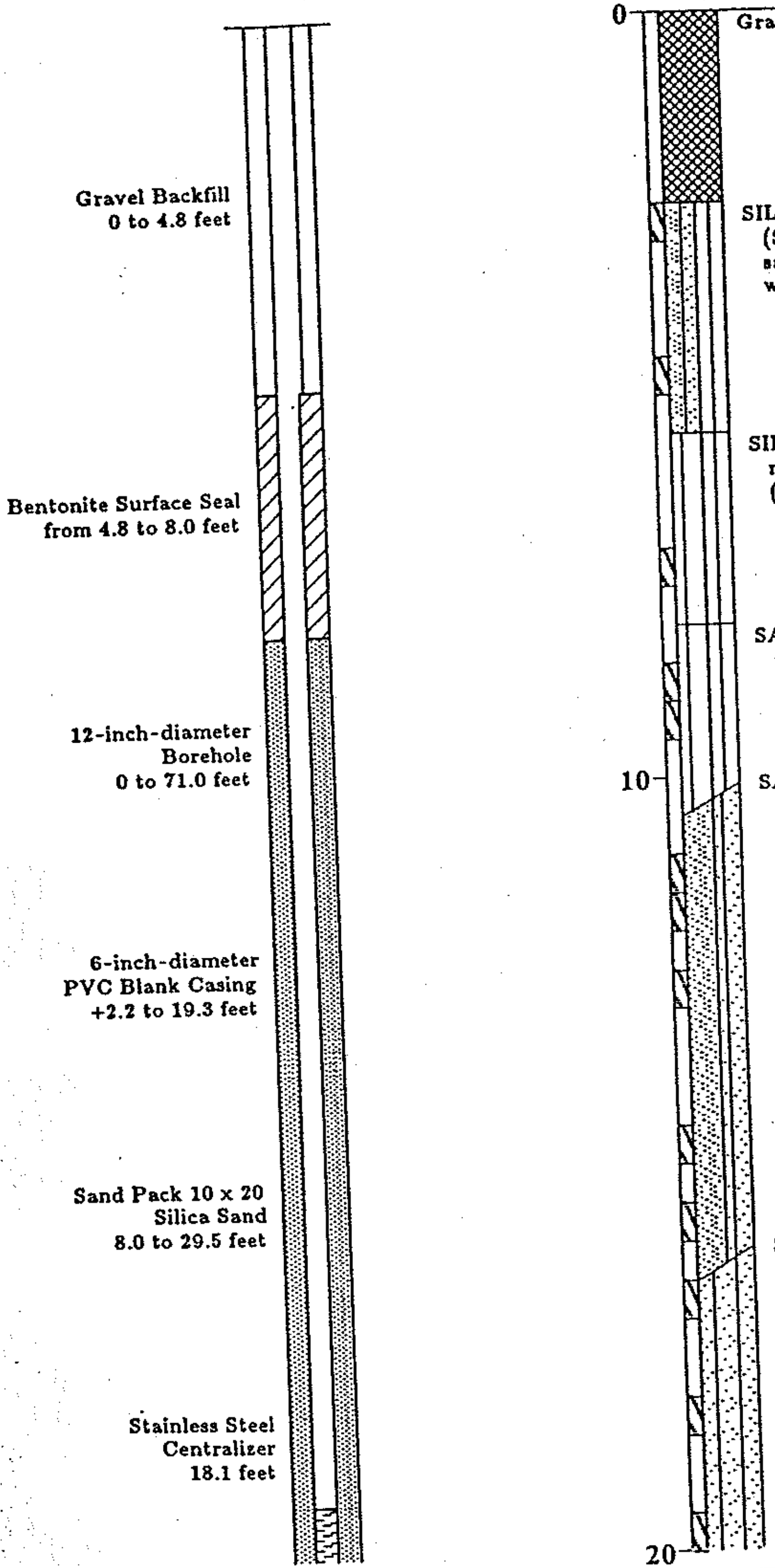
SWEET-EDWARDS/EMCON

kup 2.20 ft

Drill Method Air Rotary

Boring No. EW-~~12A~~ 2

TOC Elevation 561.56 ft Date 7/21/92



Gravel Borrow Import (FILL)

SILTY SAND with gravel and sandy silt with gravel (SM/ML); dark yellowish brown, fine to coarse sand, fine to medium gravel; trace organics-roots, wood, slight damp (FILL)

SILT with gravel (ML); brownish black; little fine to medium gravel; trace organics-wood, damp (WEATHERED TILL)

SANDY SILT with gravel (ML); grayish brown; some medium to coarse sand; little to fine medium gravel; damp (WEATHERED TILL)

SAND with silt, gravel, and cobbles (SW-SM); olive gray; little fine to coarse gravel; slightly damp (TILL)

SILTY SAND with gravel (SM); moderate brown, fine to coarse; some fine to coarse gravel; little fines; coated clasts; damp (TILL)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-12A (sheet 1 of 4)

Cedar Hills Landfill

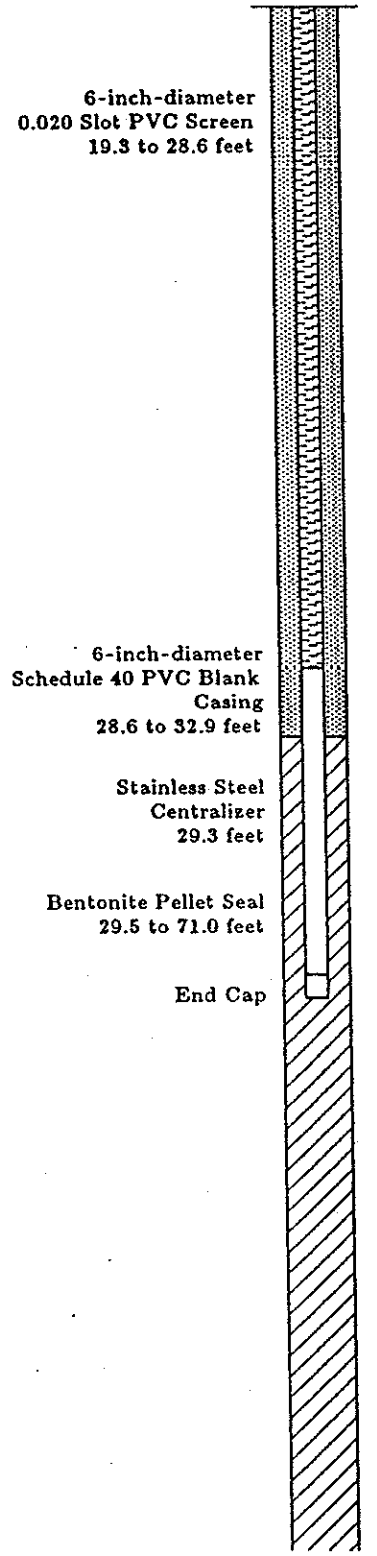
PLATE

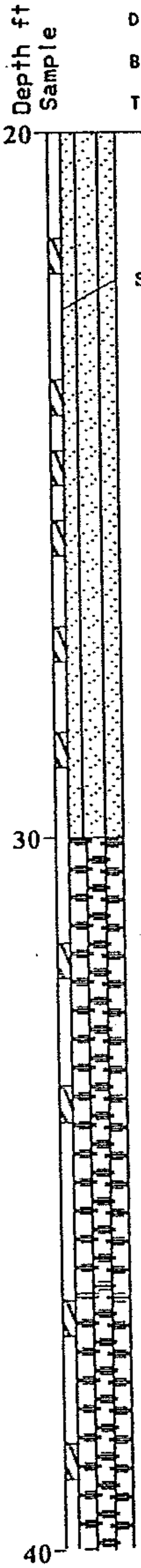
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

11101/D:

Stickup 2.20 ft

Drill Method Air Rotary
Boring No. EW-1~~2A~~ 2
TOC Elevation 561.56 ft **Date** 7/21/92





SILTY SAND with gravel (SM); moderate brown, fine to medium; few fine gravel; moist (TILL)

start adding water @ 30 feet

SILTY GRAVEL with sand (GM); olive gray, fine to coarse; some to little fine to coarse sand; some fines; water added to remove cuttings (STRATIFIED DRIFT)

cobbles @ 35 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-12A
(sheet 2 of 4)

Cedar Hills Landfill

PLATE

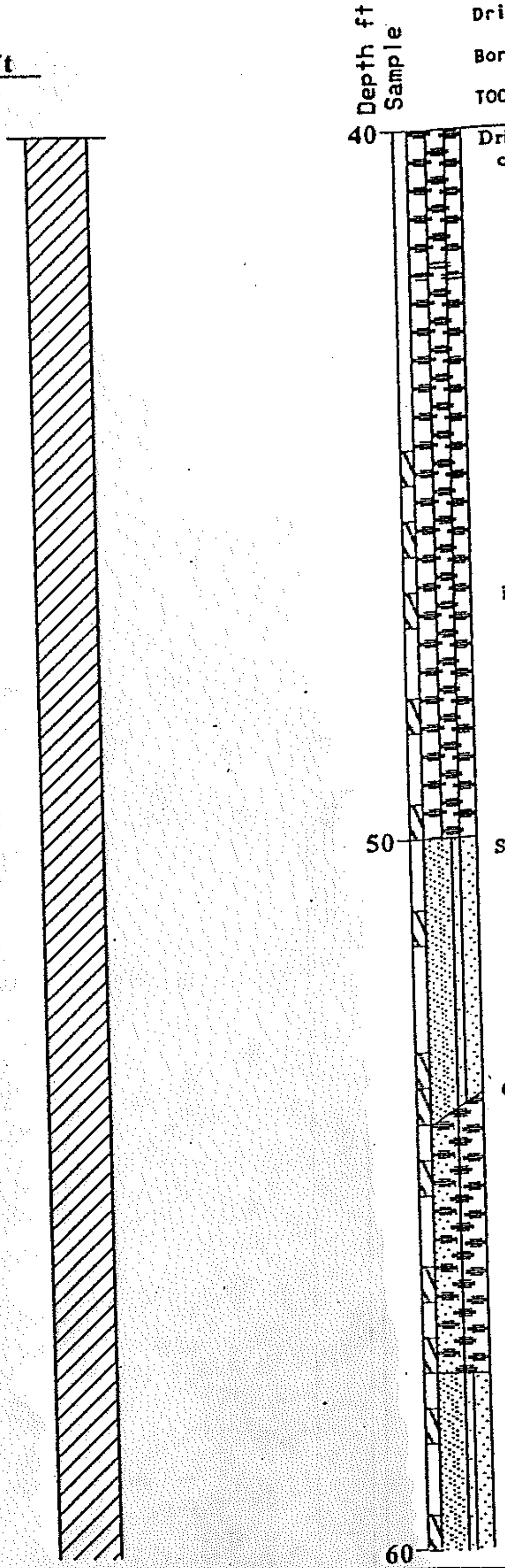
DRAWN JOB NUMBER APPROVED DATE REVISED DATE

ickup 2.20 ft

Drill Method Air Rotary

Boring No. EW-~~12A~~ 2

TOC Elevation 561.56 ft Date 7/21/92



Driller tried drilling without adding water - no cuttings discharged.

increase in medium to coarse sand to approximately 40 percent

SAND with silt and gravel and SILTY SAND with gravel (SW-SM/SM); light brownish gray, fine to coarse; some fine to medium gravel; few to little fines; water added (STRATIFIED DRIFT)

GRAVEL with silt (GP-GM); light brownish gray, fine to medium; trace sand; water added (STRATIFIED DRIFT)

SAND with silt and gravel (SW-SM); light brown; some to little fine to coarse gravel; water added (ADVANCE OUTWASH)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-12A (sheet 3 of 4)
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

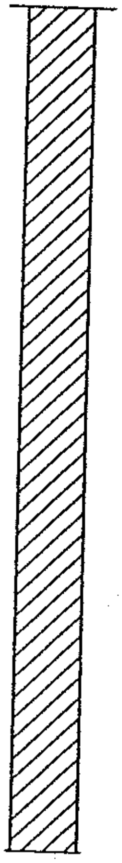
11101/D:

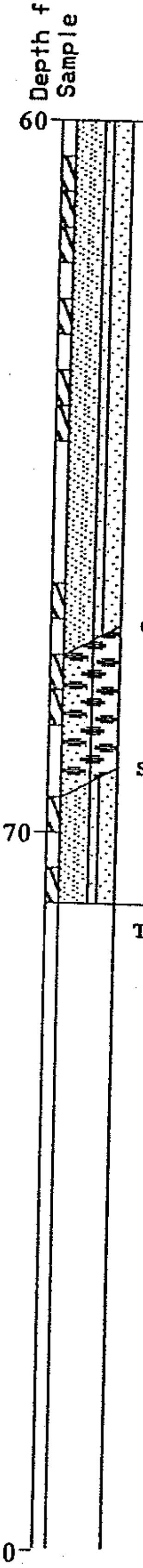
Stickup 2.20 ft

Drill Method Air Rotary

Boring No. EW-~~12A~~ 2

TOC Elevation 561.56 ft **Date** 7/21/92





GRAVEL with silt and sand (GP-GM); light brown, fine to medium; little fine to coarse sand; water added (ADVANCE OUTWASH)

SAND with silt and gravel (SW-SM); light brown; little fine to medium gravel; water added (ADVANCE OUTWASH)

Total depth drilled = 71 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-12A

(sheet 4 of 4)

Cedar Hills Landfill

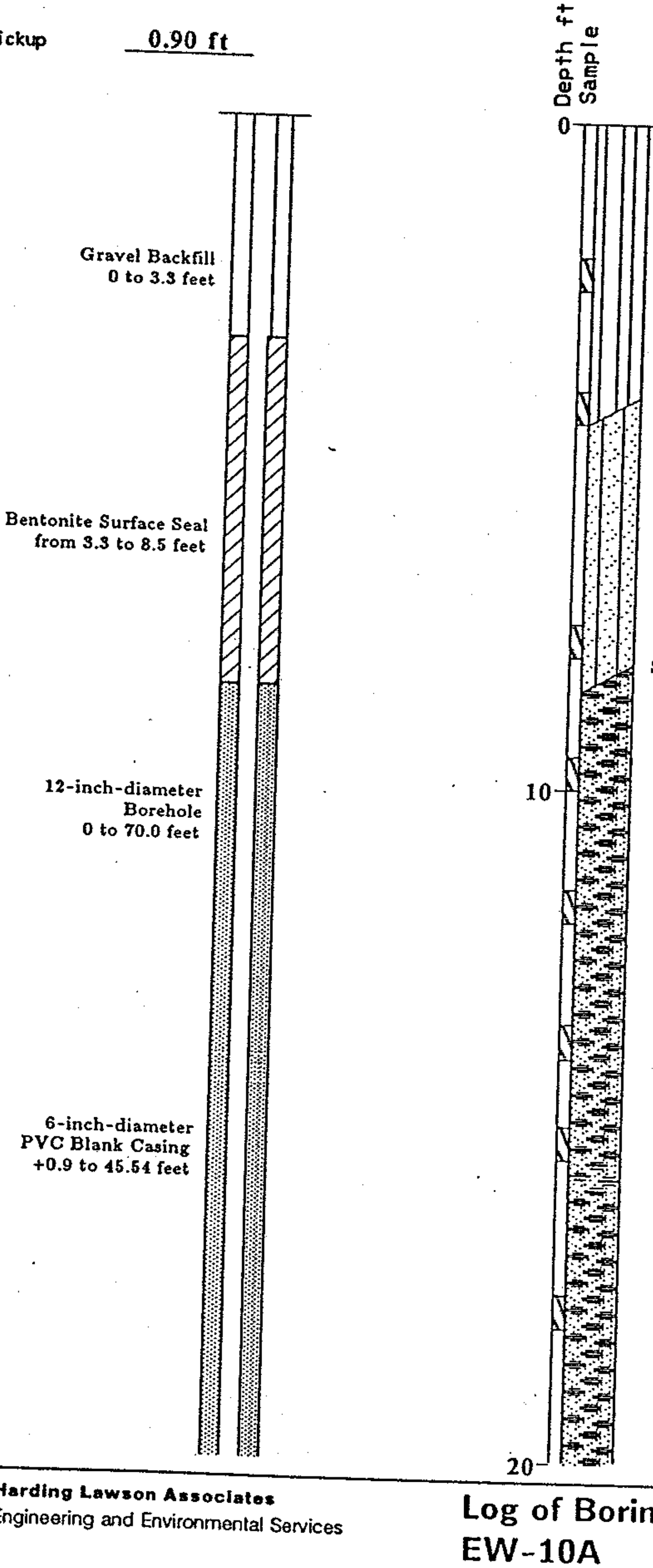
PLATE

DRAWN JOB NUMBER APPROVED

11101/D:

Stickup 0.90 ft

Drill Method Air Rotary
Boring No. EW-~~10A~~ 6
TOC Elevation 582.87 ft **Date** 7/15/92



SILT (ML); reddish brown; little fine to medium sand; trace organics (roots); damp (WEATHERED TILL)

SILTY SAND with gravel (SM); reddish brown, fine to coarse; trace coarse rounded gravel; moist (WEATHERED TILL)

SANDY GRAVEL with cobbles (GW); gray brown to olive gray; trace rounded cobbles; moist (TILL)

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Log of Boring and Well Completion
EW-10A

(sheet 1 of 4)

Cedar Hills Landfill

PLATE

DRAWN
HK

JOB NUMBER

APPROVED

DATE

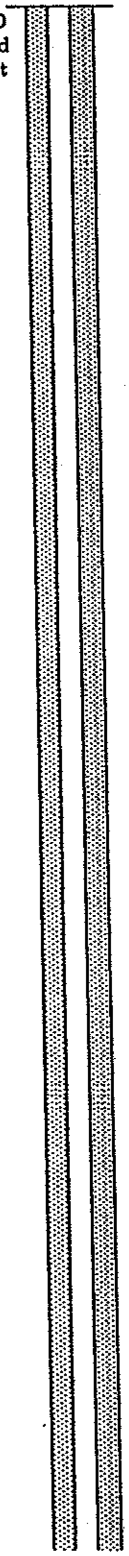
ickup 0.90 ft

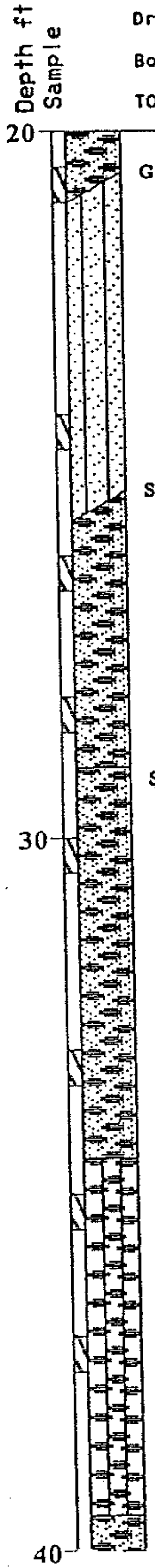
Drill Method Air Rotary

Boring No. EW-~~10A~~ 6

TOC Elevation 582.87 ft Date 7/15/92

Sand Pack 10 x 20
Silica Sand
8.5 to 55.5 feet





GRAVELLY SILTY SAND (SM); brown; moist (TILL)

started adding water @ 23 feet

SANDY GRAVEL with cobbles (GW); brown; with rounded cobbles; adding water (STRATIFIED DRIFT)

SANDY GRAVEL (GW); brown; little silt; adding water (STRATIFIED DRIFT)

SILTY GRAVEL (GM); olive gray (STRATIFIED DRIFT)

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Log of Boring and Well Completion
EW-10A (sheet 2 of 4)
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

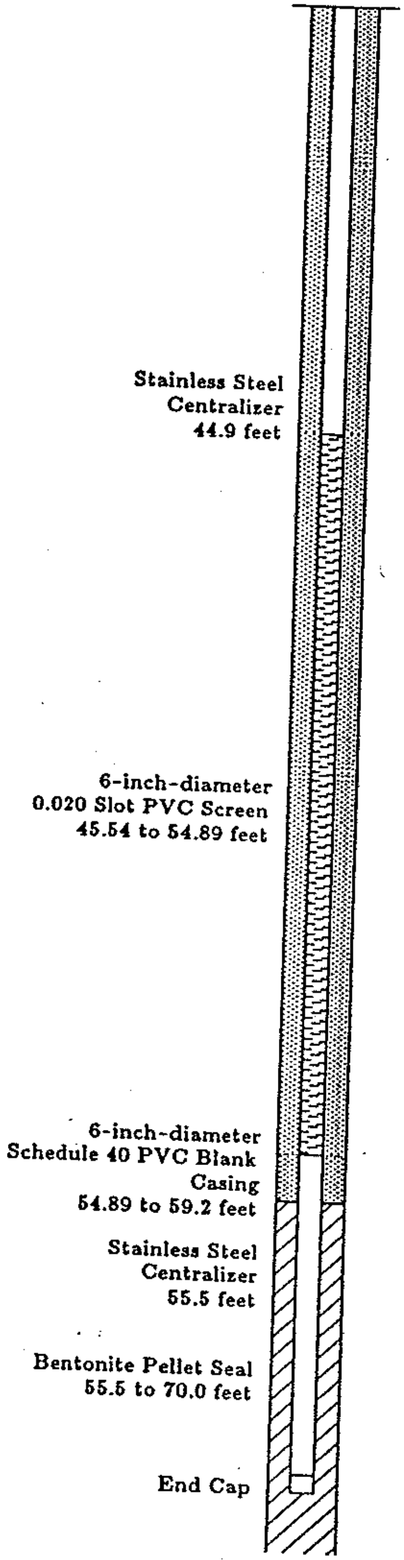
11101/D:

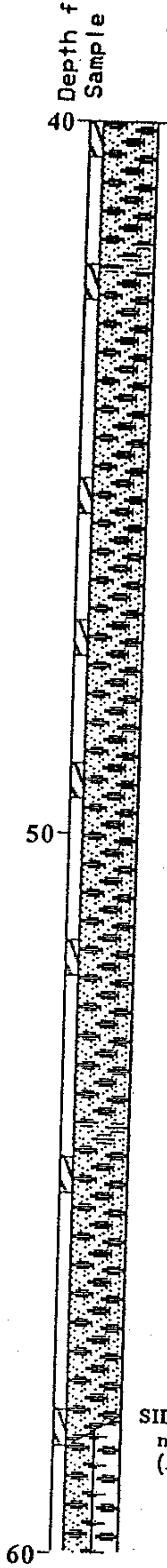
Stickup 0.90 ft

Drill Method Air Rotary

Boring No. EW-~~10A~~ 6

TOC Elevation 582.87 ft **Date** 7/15/92





SANDY GRAVEL (GW); olive gray; variable amounts of fines (STRATIFIED DRIFT)

SILTY GRAVEL with sand (GW-GM); little medium to coarse sand; little fines; water added (ADVANCE OUTWASH)

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Log of Boring and Well Completion EW-10A

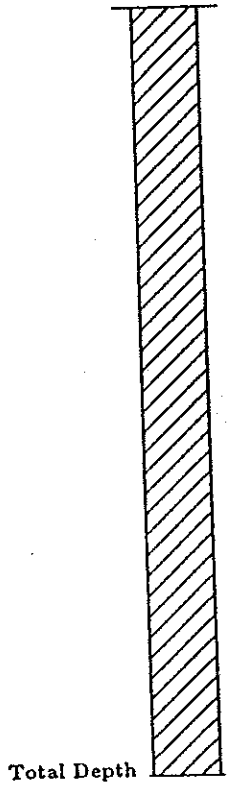
(sheet 3 of 4)

Cedar Hills Landfill

PLATE

DRAWN HK | JOB NUMBER | APPROVED | DATE

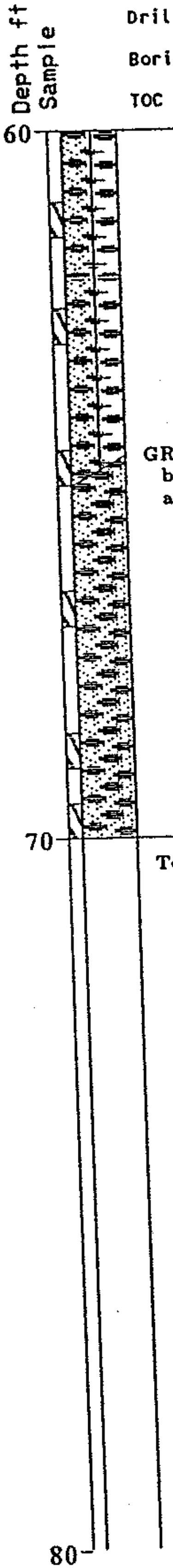
ckup 0.90 ft



Drill Method Air Rotary

Boring No. EW-~~10A~~ 6

TOC Elevation 582.87 ft Date 7/15/92



GRAVEL with sand (GW); moderate yellowish brown; some fine to coarse sand; trace fines; water added (ADVANCE OUTWASH)

Total depth drilled = 70.0 feet

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Log of Boring and Well Completion
EW-10A

(sheet 4 of 4)

Cedar Hills Landfill

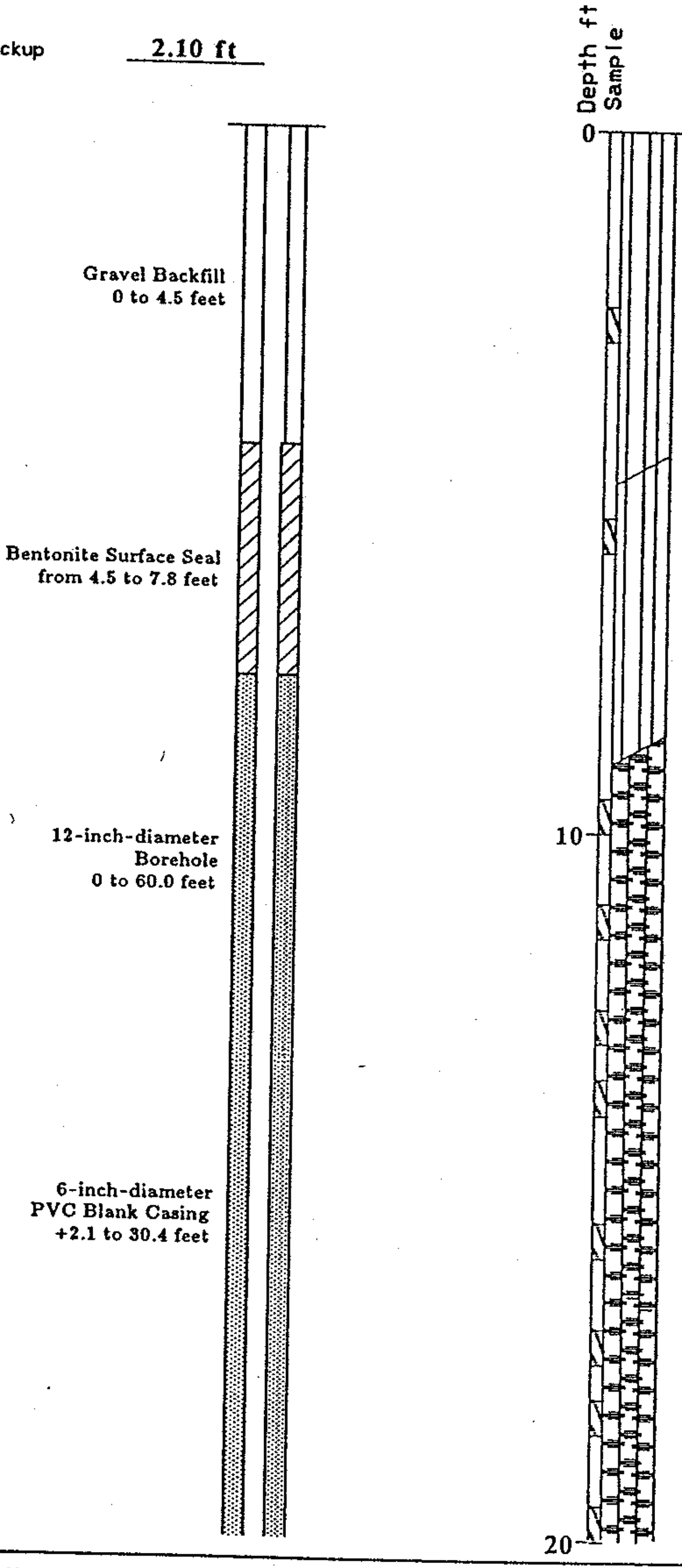
PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

11101/D:

Stickup 2.10 ft

Drill Method Air Rotary
Boring No. EW-1~~1A~~ 7
TOC Elevation 593.47 ft Date 7/17/92



SILT with cobbles (ML); moderate to reddish brown; dry (FILL)

GRAVELLY SILT (ML); moderate to grayish brown; some fine to medium gravel; trace sand; slightly damp (WEATHERED TILL)

SILTY GRAVEL with sand and cobbles (GM); dark yellowish brown, fine to coarse; some medium to coarse sand; little fines; damp (TILL)

becoming olive brown

moist below 18 feet

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Log of Boring and Well Completion
EW-11A

(sheet 1 of 3)

Cedar Hills Landfill

PL

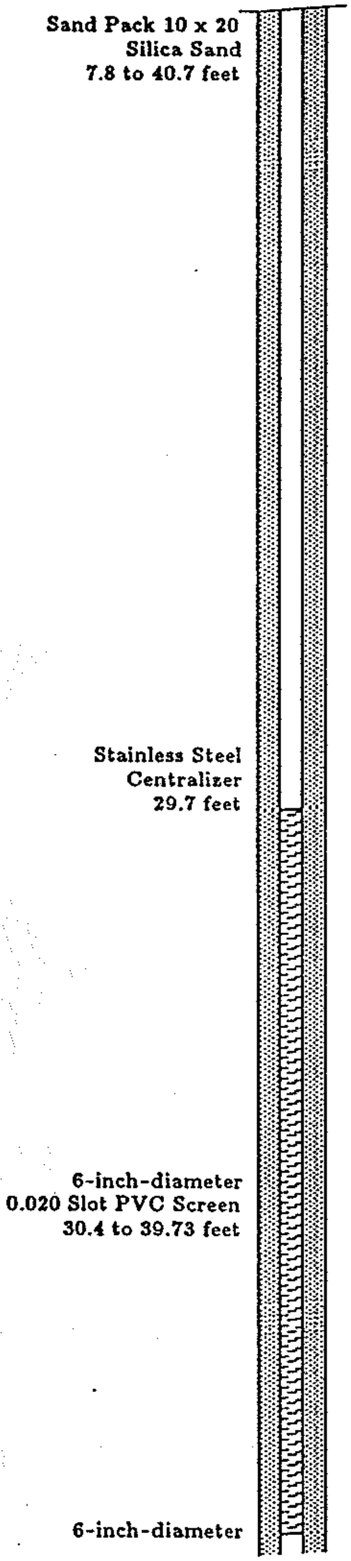
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

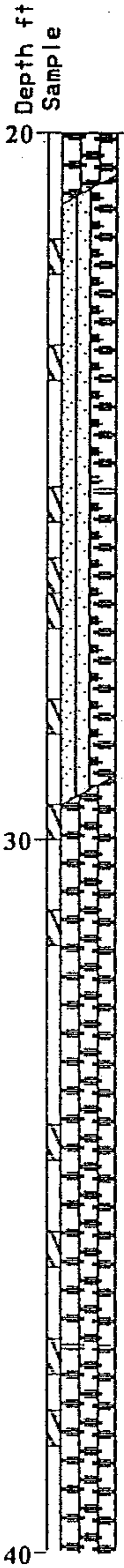
Stickup 2.10 ft

Drill Method Air Rotary

Boring No. EW-~~11A~~ 7

TOC Elevation 593.47 ft Date 7/17/92





SILTY SAND with gravel and SILTY GRAVEL with sand (SM and GM); olive brown, fine to coarse gravel, fine to coarse sand; some fines; moist (TILL)

SILTY GRAVEL with sand and cobbles (GM); medium gray, fine to medium; with trace coarse gravel; some medium to coarse sand; little fines; moist; becoming fine to coarse gravels (STRATIFIED DRIFT)

few coated clasts

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Log of Boring and Well Completion
EW-11A
(sheet 2 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

11101/D:

Stickup 2.10 ft

Drill Method Air Rotary

Boring No. EW-1~~1A~~ 7

TOC Elevation [illegible] Date 7/17/92

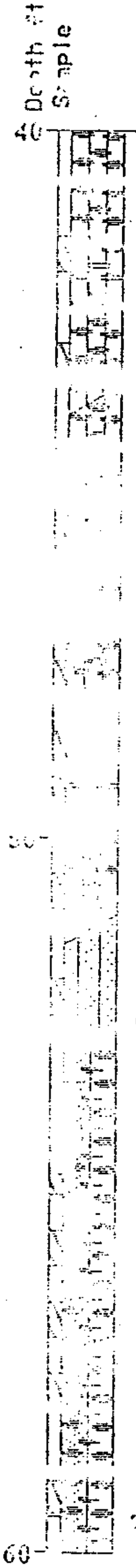
Schedule 40 PVC Blank Casing
39.75 to 44.0 feet

Stainless Steel Centralizer
40.4 feet

Bentonite Pellet Seal
40.7 to 60.0 fe[illegible]

End Cap

Total Depth



start adding drilling water @ [illegible] feet

[illegible] (GM); light olive grayish brown, fine to coarse; little fine to coarse sand; little fines; water added (STRATIFIED DRIFT)

SILTY SA[illegible] to medium; [illegible] fines, water added (STRATIFIED DRIFT)

GRAVEL [illegible]); dark [illegible] sand; few fines (ADVANCE OUTWASH)

fewer fines (GW)

Total depth drilled = 60 feet

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Log of Boring and Well Completion
EW-11A

(sheet 3 of 3)

Cedar Hills Landfill

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

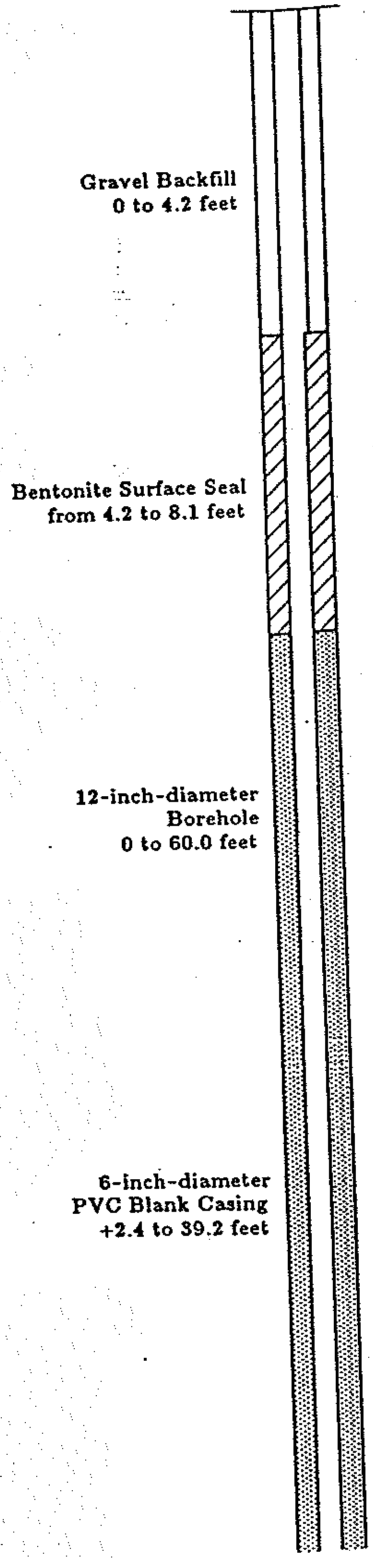
PLATE

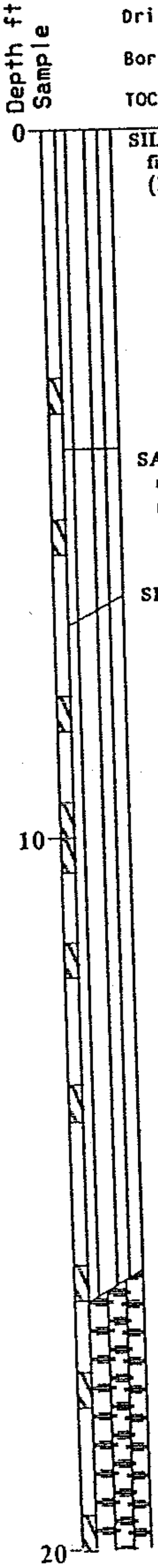
Drill Method Air Rotary

Boring No. EW-~~13A~~ 8

TOC Elevation 600.38 ft Date 7/24/92

kup 2.40 ft





SILT with gravel (ML); dark grayish brown; little fine to coarse gravel; trace plastic; dry to damp (FILL)

SANDY SILT with gravel (ML); dark grayish brown; some medium to coarse sand; little fine to medium gravel; damp (WEATHERED TILL)

SILT with cobbles and gravel (ML); moderate yellowish brown; few medium to coarse sand and few fine to medium gravel; (WEATHERED TILL)

trace cobbles

SILTY GRAVEL with cobbles and boulder (GM); moderate yellowish brown, fine to coarse; few medium to coarse sand; trace cobbles, boulders at 21 feet; some fines; adding water below 21 feet to remove cuttings (STRATIFIED DRIFT)

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Log of Boring and Well Completion
EW-13A (sheet 1 of 3)
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

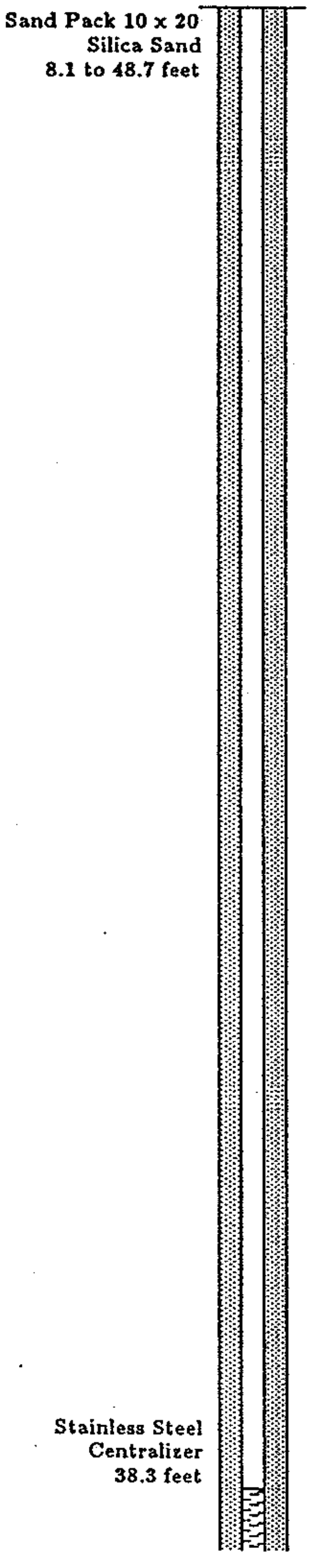
11101/D:

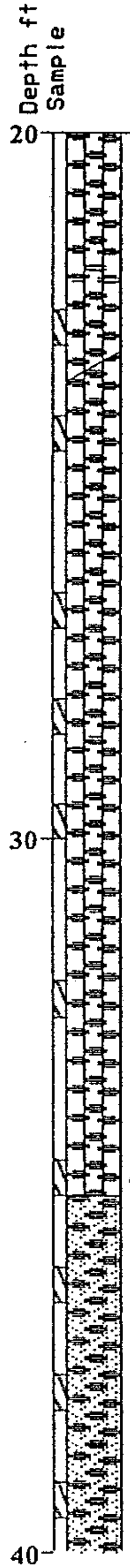
Stickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~13A~~ 8

TOC Elevation 600.38 ft **Date** 7/24/92





SILTY GRAVEL with sand, cobbles, and boulder (GM); moderate yellowish brown becoming brownish olive gray, fine to coarse gravel; little fine to coarse sand; little fines; adding water (STRATIFIED DRIFT)

large cobbles/boulders

GRAVEL with cobble (GW); olive gray with slight brownish color; trace fines; varied lithologies; water added (STRATIFIED DRIFT)

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Log of Boring and Well Completion
EW-13A

(sheet 2 of 3)

Cedar Hills Landfill

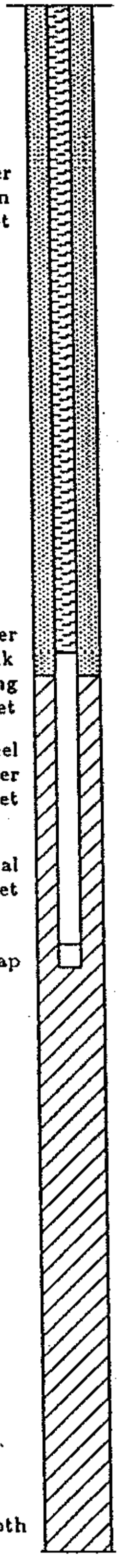
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

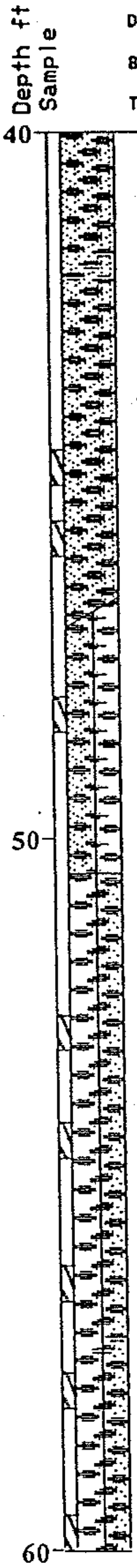
ickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~13A~~ 8

TOC Elevation 600.38 ft Date 7/24/92





tricone button bit and no downhole hammer used below 43 feet

GRAVEL with silt and sand (GW-GM); slight brownish olive gray; little very fine sand; water added (STRATIFIED DRIFT)

SILTY GRAVEL with sand and GRAVEL with silt and sand (GM/GP-GM); moderate yellowish brown, fine to coarse; little to few fine to coarse sand; bedded; few to little fines; water added (ADVANCE OUTWASH)

Total depth drilled = 60 feet

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Engineering and Environmental Services

Log of Boring and Well Completion
EW-13A

(sheet 3 of 3)

Cedar Hills Landfill

PLATE

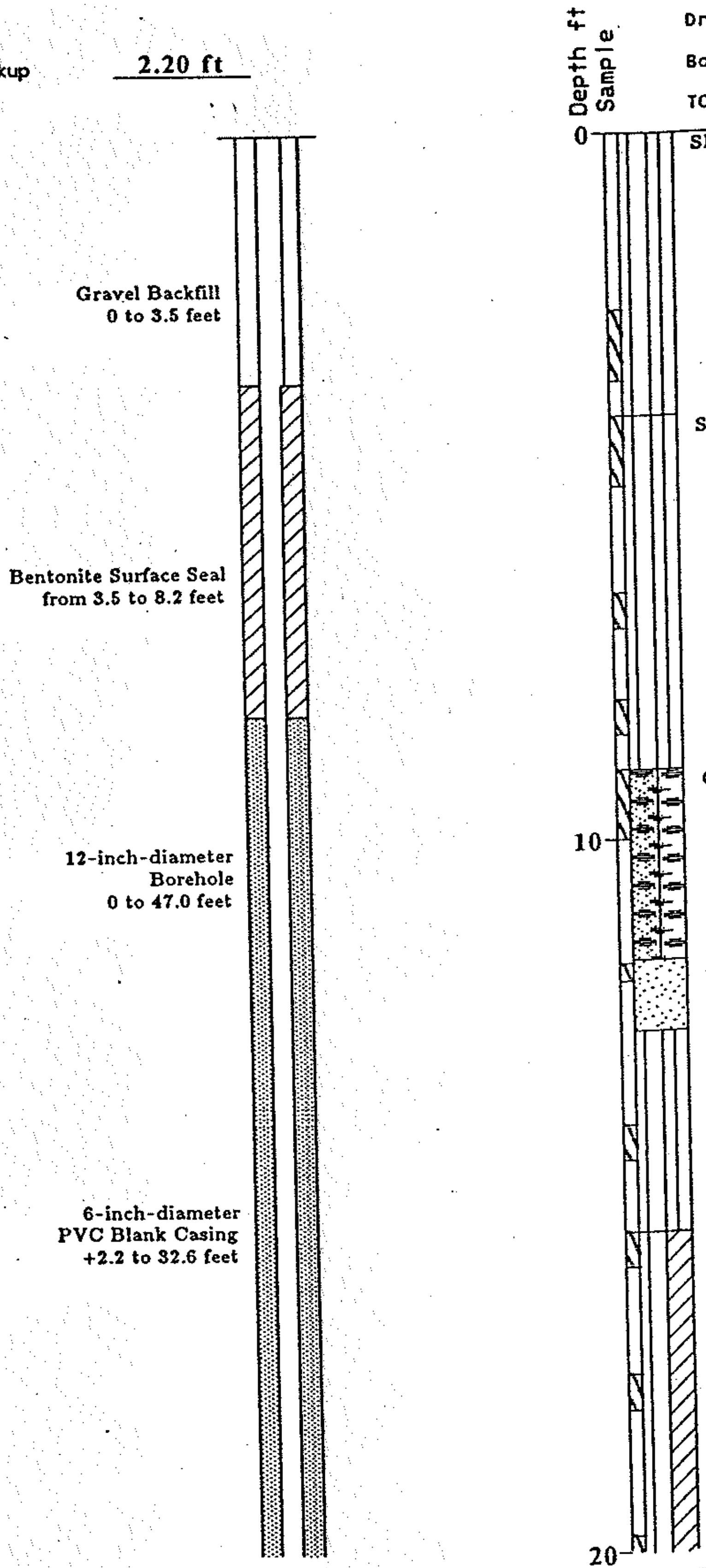
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Drill Method Air Rotary

Boring No. EW- ~~4A~~ 14

TOC Elevation 633.66 ft Date 6/25/92

Stickup 2.20 ft



SILT with organics and gravel (ML); moderate brown; abundant roots; trace fine to medium sand; medium to coarse gravel; damp (DISTURBED TILL FILL)

SILT with gravel (ML); moderate brown, non-plastic; little to fine to medium gravel; few fine to coarse sand; damp (TILL)

GRAVEL with silt (GW-GM); moderate brown; few fine to coarse sand; damp (TILL)

SAND (SP); moderate yellowish brown, fine grained; dry (GLACIAL TILL)

GRAVELLY SILT (ML); moderate yellowish brown; some medium to coarse grvel; few fine to medium sand; dry (GLACIAL TILL)

CLAYEY SILT with gravel (ML/CL); medium dark gray; little to few fine to medium gravel; trace sand, dry (LACUSTRINE)

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Engineering and Environmental Services

PLATE

Log of Boring and Well Completion
EW- 4A
(sheet 1 of 3)

Cedar Hills Landfill

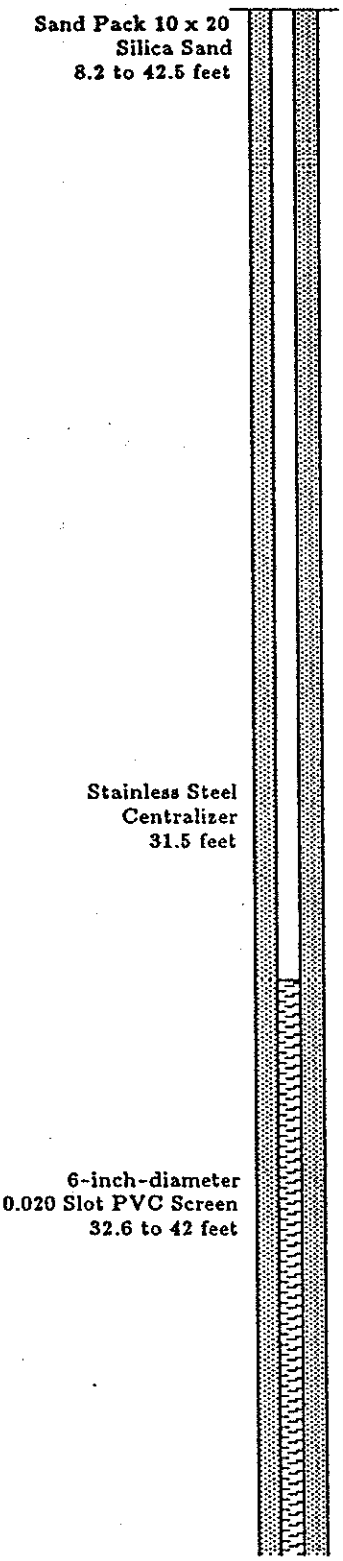
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

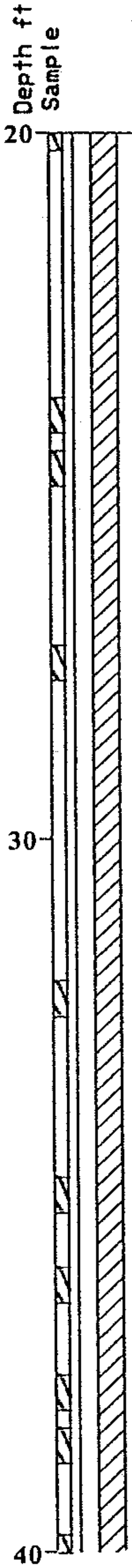
Stickup 2.20 ft

Drill Method Air Rotary

Boring No. EW- ~~4A~~ 14

TOC Elevation 633.66 ft Date 6/25/92





trace fine gravel

increase in moisture content (moist) below 23 feet

few fine grained gravels

cobbles at 32.5 feet

trace fine gravel and fine sand, moist from 35 to 40.5 feet

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Log of Boring and Well Completion
EW- 4A (sheet 2 of 3)
Cedar Hills Landfill

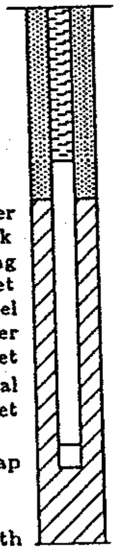
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

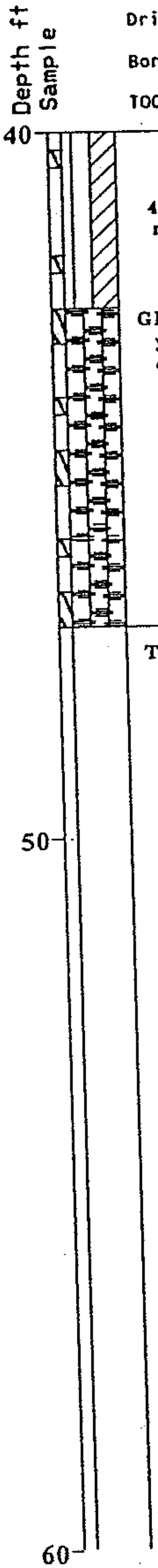
Drill Method **Air Rotary**

Boring No. EW- ~~4A~~ 14

TOC Elevation 633.66 ft Date 6/25/92

Stickup 2.20 ft





40.5 to 42.5 feet, few fine to medium gravel, few medium to coarse sand

GRAVEL with silt and sand (GM); moderate yellowish brown, fine to medium; some fine to coarse sand; some fines (ADVANCE OUTWASH)

Total depth drilled = 47.0 feet

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Log of Boring and Well Completion
EW- 4A (sheet 3 of 3)
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

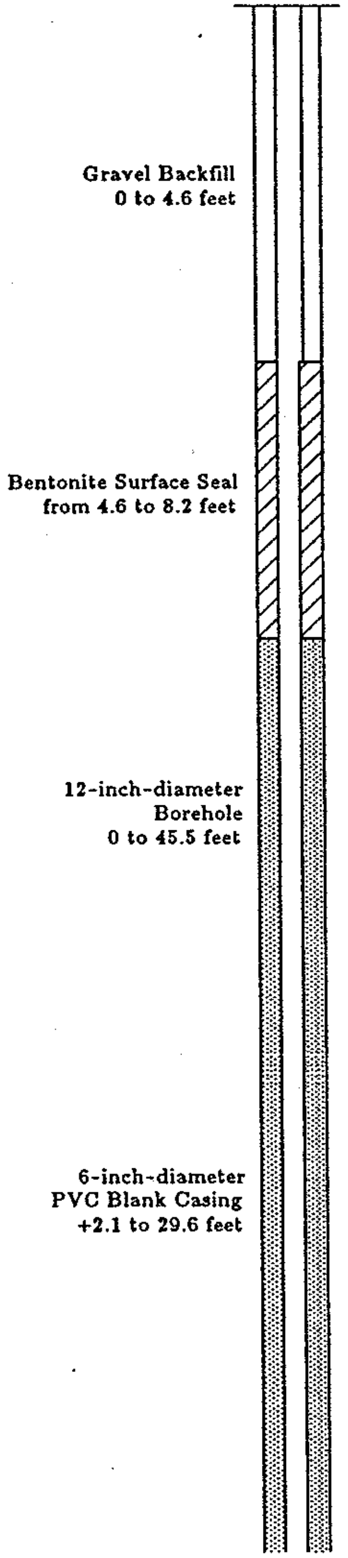
11101/D:

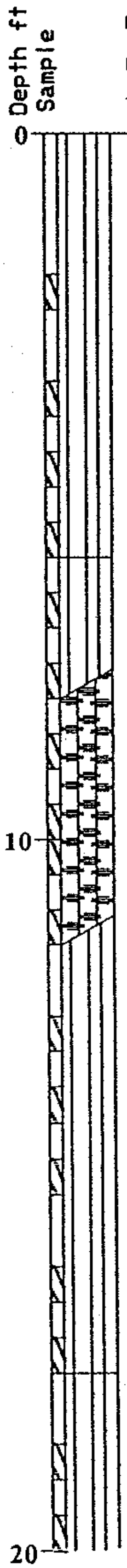
Stickup 2.10 ft

Drill Method Air Rotary

Boring No. EW-15~~A~~

TOC Elevation 635.30 ft **Date** 7/29/92





SILT with gravel (ML); reddish brown; trace fine to coarse sand; trace fine gravel; few organics - roots; dry (FILL)

SILT with gravel (ML); reddish brown; few fine to medium gravels; moist (WEATHERED TILL)

SILTY GRAVEL with sand (GM); moderate yellowish brown, fine to medium; little fine to coarse sand; some fines; moist (WEATHERED TILL)

start adding water at 11.5 feet

SILT (ML); moderate yellowish brown; few to trace fine to medium gravel; few medium to coarse sand; water added (WEATHERED TILL)

SILT (ML); medium gray; trace fine gravel and medium to coarse sand; water added (LACUSTRINE)

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Log of Boring and Well Completion
EW-15A

(sheet 1 of 3)

Cedar Hills Landfill

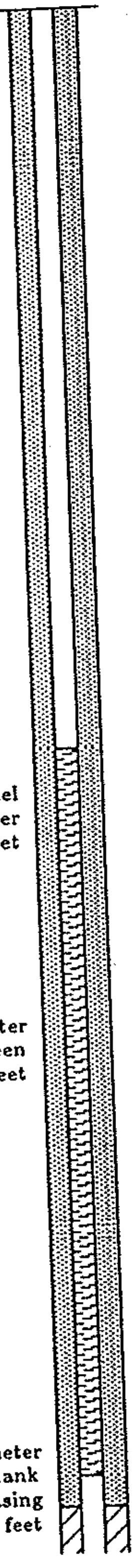
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Drill Method Air Rotary

Boring No. EW-15~~A~~

TOC Elevation 635.30 ft Date 7/29/92

kup 2.10 ft

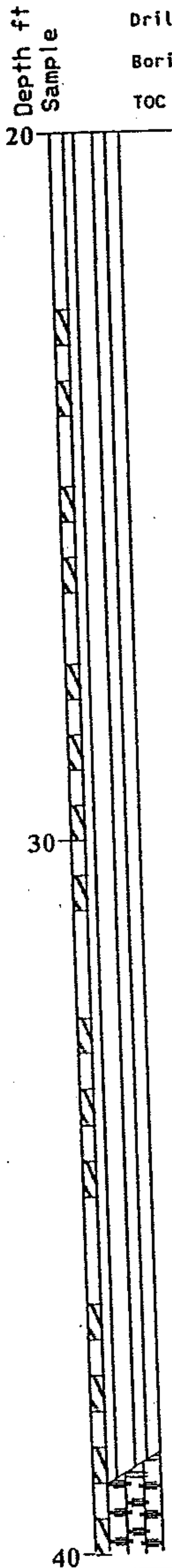


Sand Pack 10 x 20
Silica Sand
4.6 to 39.4 feet

28.8' Stainless Steel
Centralizer
28.8 feet

6-inch-diameter
0.020 Slot PVC Screen
29.6 to 39.0 feet

6-inch-diameter
Schedule 40 PVC Blank
Casing
39.0 to 43.1 feet



few fine to medium gravel and few medium to coarse sand

SILTY GRAVEL with sand (GM); medium gray, fine to medium; little medium to coarse sand; some fines; water added (STRATIFIED DRIFT)

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Log of Boring and Well Completion
EW-15A (sheet 2 of 3)
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

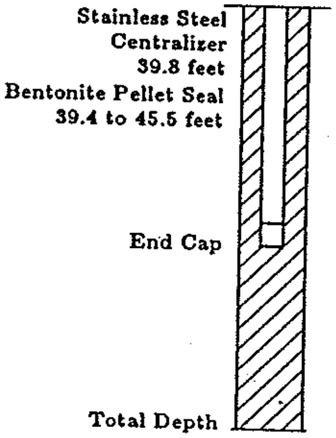
11101/D:

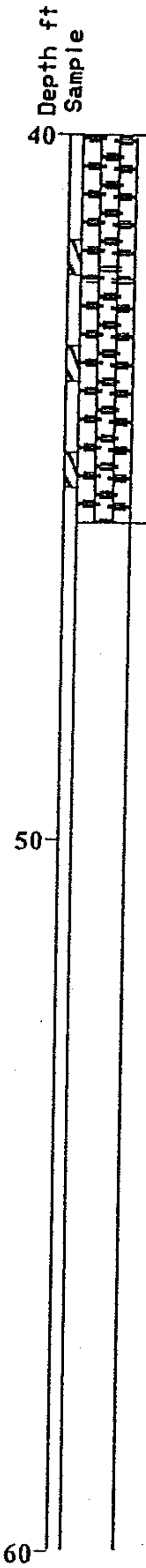
Drill Method Air Rotary

Boring No. EW-15A

TOC Elevation 635.30 ft **Date** 7/29/92

Stickup 2.10 ft





Total depth drilled = 45.5 feet

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Log of Boring and Well Completion
EW-15A

(sheet 3 of 3)

Cedar Hills Landfill

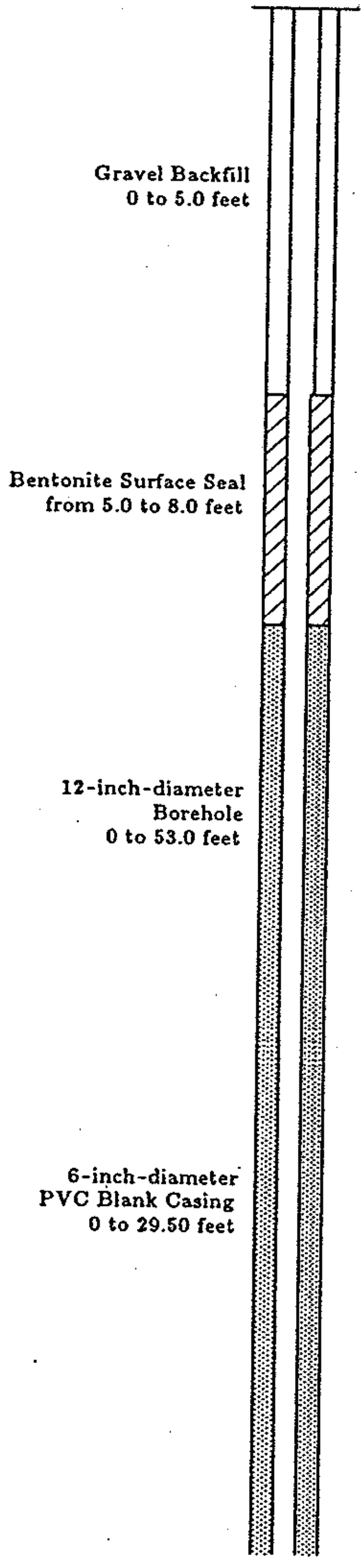
PLATE

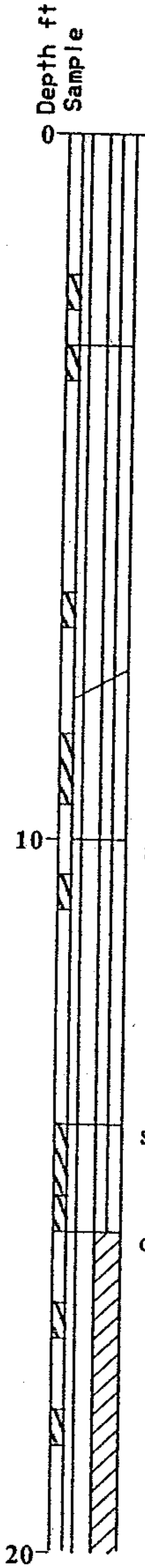
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

11101/D:

Stickup 1.40 ft

Drill Method Air Rotary
Boring No. EW- ~~7A~~ 16
TOC Elevation 636.88 ft **Date** 7/2/92





SILT (ML); reddish brown; non-plastic; little organics - roots and wood; dry (FILL)

SILT (ML); dark reddish brown; non-plastic; little organics - roots and wood; dry (WEATHERED TILL)

SILT (ML); grayish brown; few fine to medium gravel; trace coarse sand; non-plastic; wet (WEATHERED TILL)

SANDY SILT with gravel (ML); olive gray; some fine sand; trace fine gravel; non-plastic; wet (TILL)

SILT with gravel (ML); olive gray; damp; with a mottled dark yellowish brown to light brown SILT and a trace of fine gravel at base (TILL)

CLAYEY SILT with gravel (ML/CL); dark bluish gray; trace to few fine to medium gravel; damp (LACUSTRINE); grading to a SILT with a trace of clay

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Log of Boring and Well Completion
EW- 7A
(sheet 1 of 3)

Cedar Hills Landfill

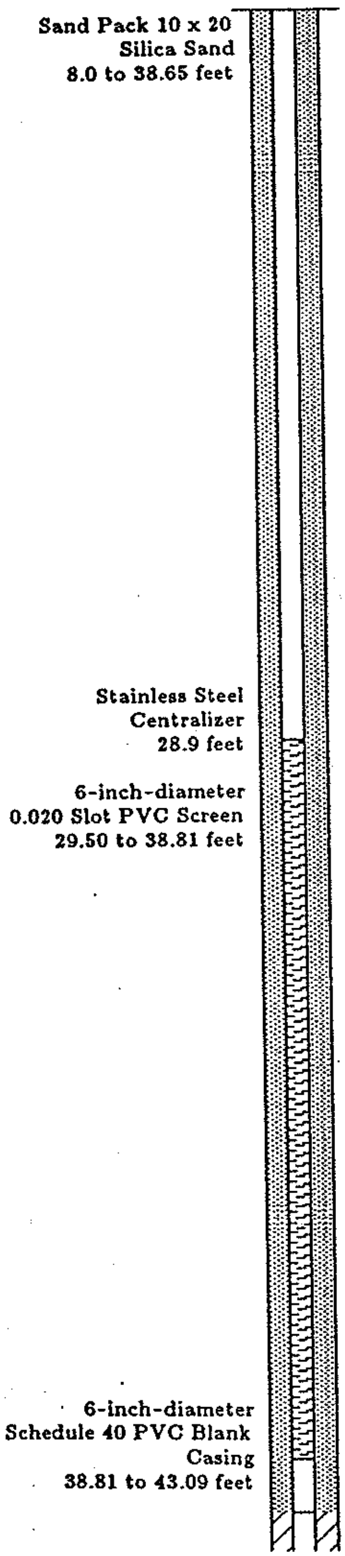
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

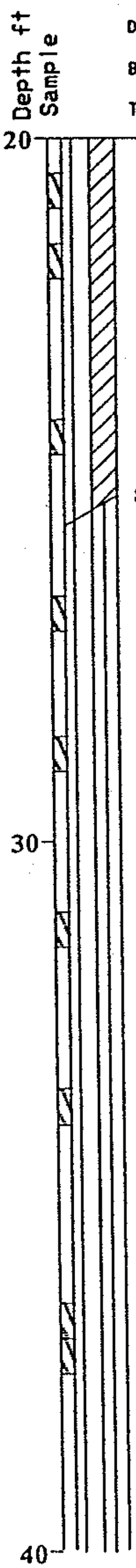
ickup 1.40 ft

Drill Method Air Rotary

Boring No. EW- ~~7A~~ 16

TOC Elevation 636.88 ft Date 7/2/92





slight to non-plasticity silt

SILT (ML); medium dark gray; non-plastic; moist (LACUSTRINE)

wet to moist

little fine to medium gravel

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Log of Boring and Well Completion
EW- 7A
(sheet 2 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

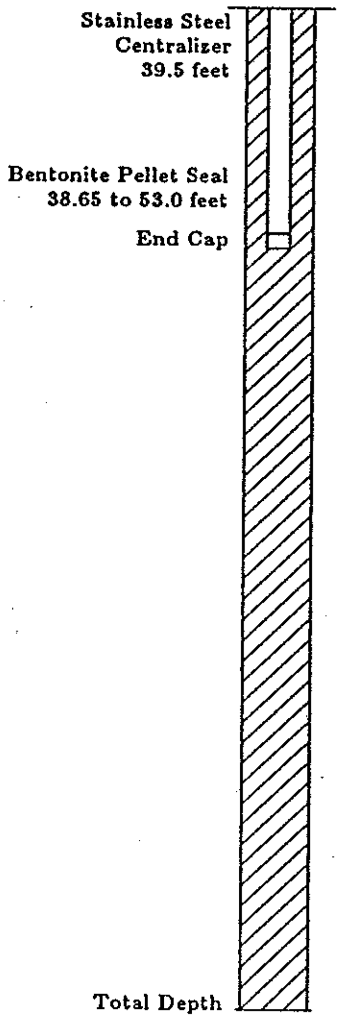
11101/D:

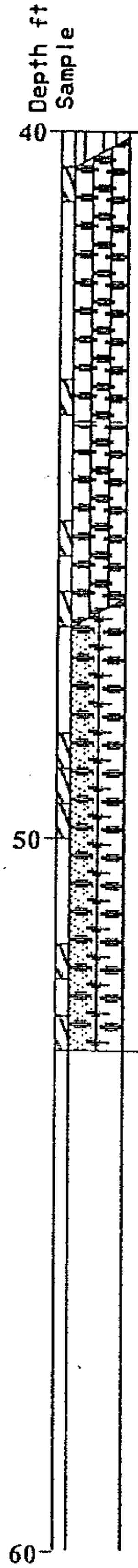
Stickup 1.40 ft

Drill Method Air Rotary

Boring No. EW- ~~7A~~ 16

TOC Elevation 636.88 ft Date 7/2/92





SILTY GRAVEL with sand (GM); medium dark gray; some medium to coarse sand; little fines; water added to remove cuttings (STRATIFIED DRIFT)

GRAVEL with silt and sand (GW-GM); moderate yellowish brown; some medium to coarse sand; water added to remove cuttings (ADVANCE OUTWASH)

Total depth drilled = 53.0 feet

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Log of Boring and Well Completion
EW- 7A
(sheet 3 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

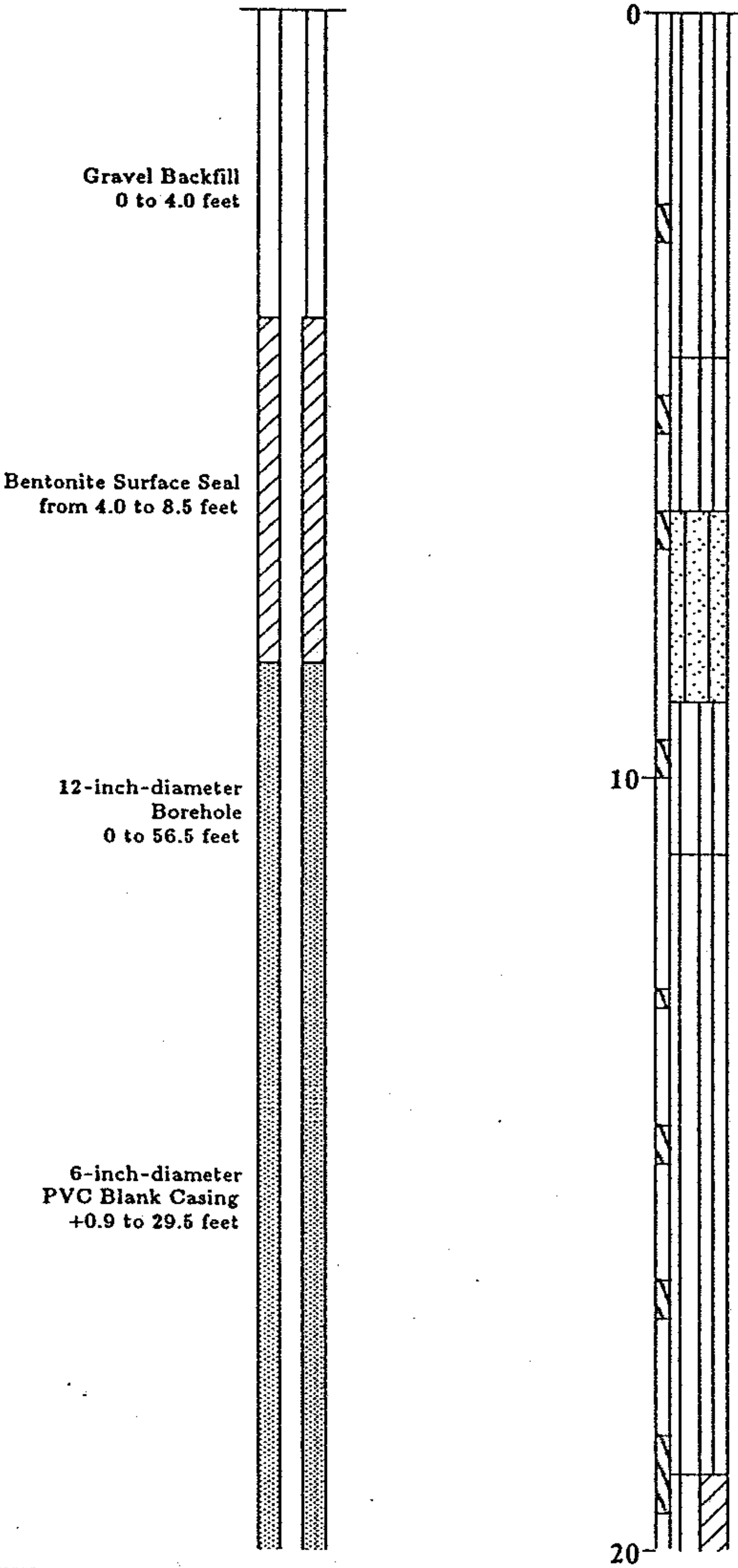
11101/D:

Stickup 0.90 ft

Drill Method Air Rotary

Boring No. EW-~~5A~~ 17

TOC Elevation 637.27 ft Date 6/25/92



Drilled with 12-inch button drag bit and downhole percussion hammer

SILT with gravel (ML); moderate reddish brown; few organics (roots and wood); trace fine to medium gravel; dry (ALLUVIUM)

SILT with gravel (ML); moderate brown; little fine to medium gravel; trace fine to medium sand; damp (ALLUVIUM)

SILTY SAND with gravel (SM); pale yellowish brown, fine to coarse-well graded sand; some non-plastic fines; little fine to medium subrounded gravel; damp (ALLUVIUM)

SANDY SILT (ML); pale brown; some very fine-grained sand

GRAVELLY SILT with sand (ML); moderate yellowish brown; non-plastic; some fine to coarse gravel; little fine to medium sand; dry (GLACIAL TILL)

CLAYEY SILT with gravel (ML/CL); dark gray; slight plasticity; trace fine to medium gravel; damp to moist (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW- 5A

(sheet 1 of 3)

Cedar Hills Landfill

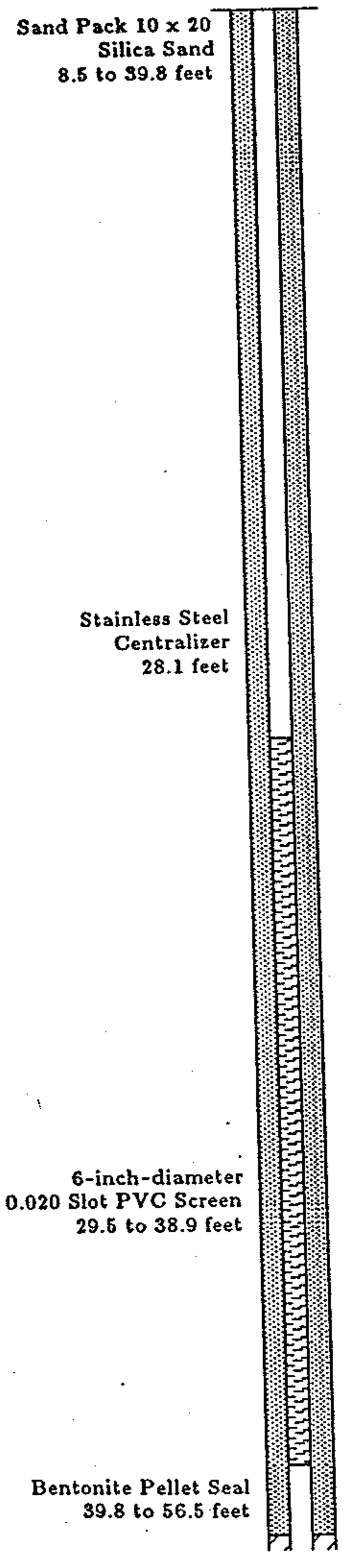
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

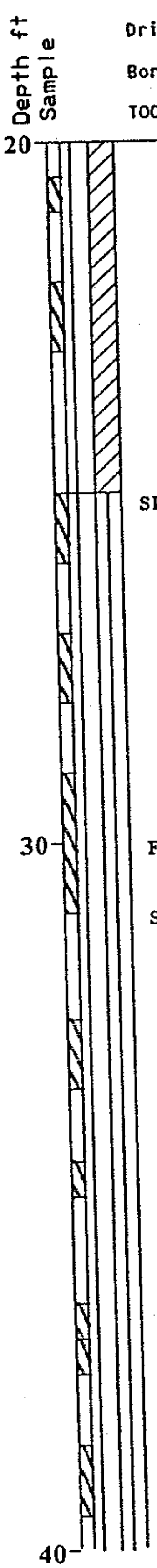
kup 0.90 ft

Drill Method Air Rotary

Boring No. EW- ~~5A~~ 17

TOC Elevation 637.27 ft Date 6/25/92





SILT (ML); dark gray; non-plastic; moist; becoming wet below 27 feet (LACUSTRINE)

Formation water blew out up outside of casing

SILT (ML); dark gray; non-plastic; wet, damp below 37 feet (LACUSTRINE)

damp

trace fine to medium gravel; no samples available

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Log of Boring and Well Completion
EW- 5A

(sheet 2 of 3)

Cedar Hills Landfill

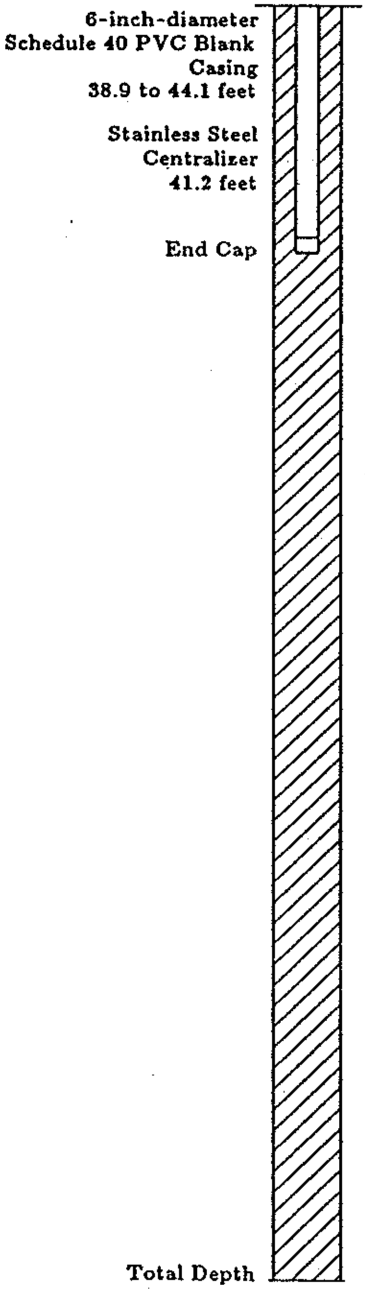
PLATE

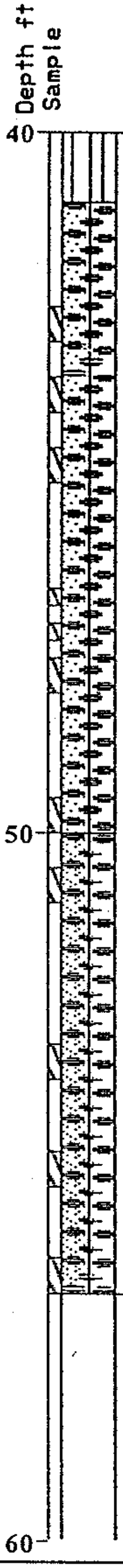
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

11101/D:

Drill Method	Air Rotary
Boring No.	EW- ~~5A~~ 17
TOC Elevation	637.27 ft
Date	6/25/92

Stickup 0.90 ft





between 39.5 and 42.5 feet - started adding water

SILTY GRAVEL with sand (GP-GM); olive gray, fine to medium; some medium to coarse sand; non-plastic fines; adding water (STRATIFIED DRIFT)

GRAVEL with silt and sand (GW-GM); moderate yellowish brown; some medium to coarse sand; few fines; adding water (ADVANCE OUTWASH)

Total depth drilled = 56.5 feet

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Log of Boring and Well Completion
EW- 5A

(sheet 3 of 3)

Cedar Hills Landfill

PL

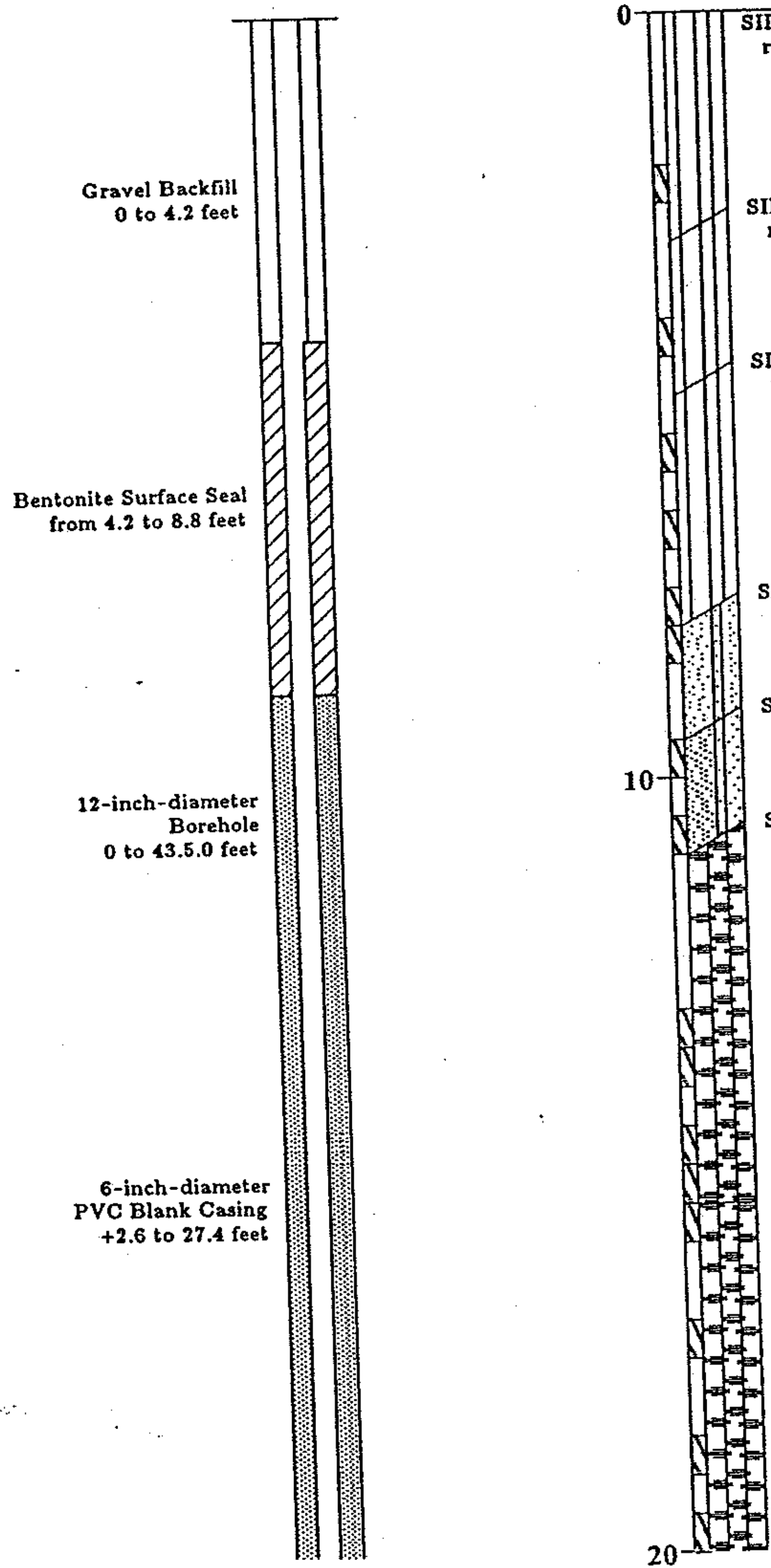
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 2.60 ft

Drill Method Air Rotary

Boring No. EW-~~23A~~ 18

TOC Elevation 639.88 ft Date 9/4/92



SILT (ML); reddish brown; few fery fine sand; trace roots - organics; dry (FILL)

SILT (ML); dark brown; few very fine sand; trace roots - organics; dry (FILL)

SILT with gravel (ML); dark brown; trace to few fine gravel and coarse sand; few wood; roots - organics; trace plastic; moist (FILL)

SAND with silt and gravel (SP-SM); light olive gray; fine to medium; little fine to coarse gravel; damp (WEATHERED TILL)

SAND with silt and gravel (SW-SM); light olive gray; little fine to coarse gravel; dry (WEATHERED TILL)

SILTY GRAVEL with sand and cobbles (GM); moderate yellowish brown, fine to coarse; little fine to medium little fines; trace cobbles; dry (WEATHERED TILL)

SILTY SAND with gravel (SM); olive brown, fine grained; few to little fine to medium gravel; little fines; wet to moist (WEATHERED TILL)

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Log of Boring and Well Completion
EW-23A

(sheet 1 of 3)

Cedar Hills Landfill

PLATE

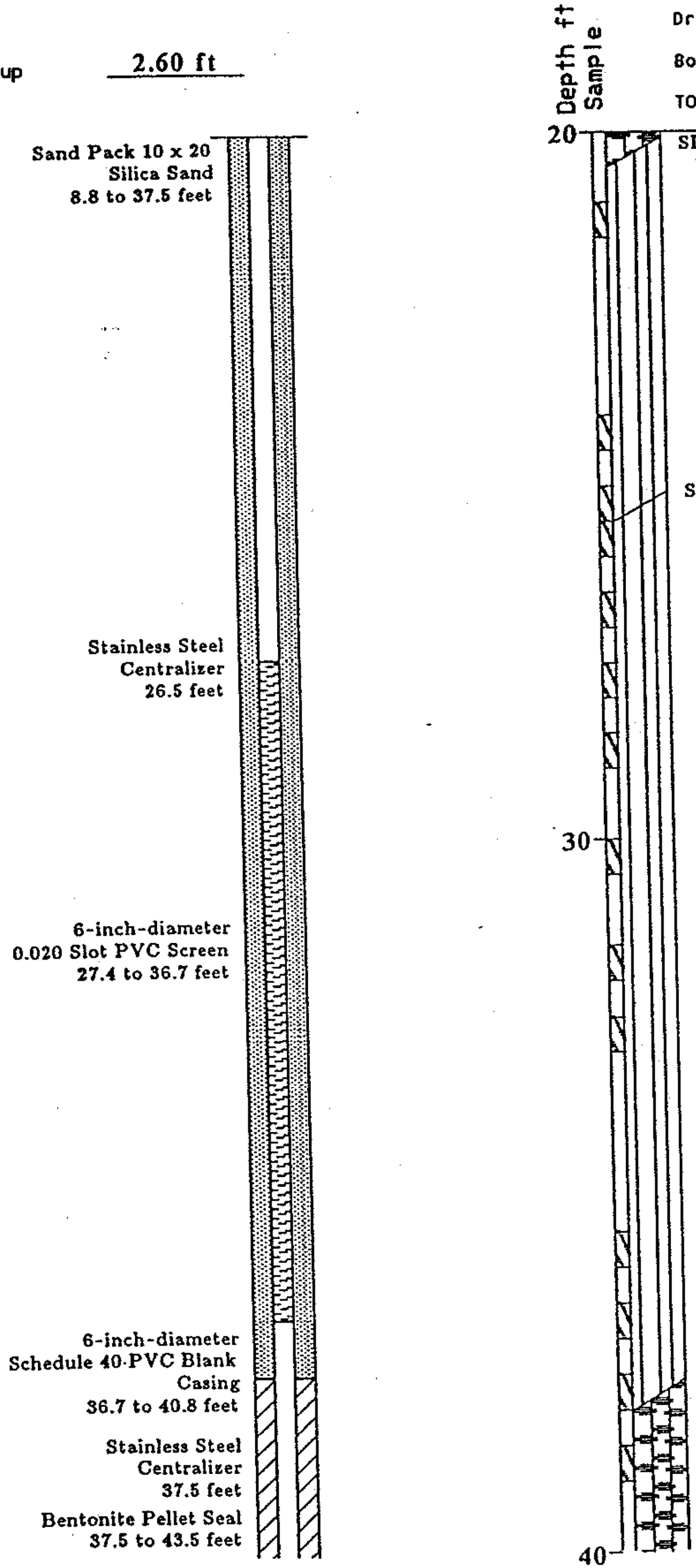
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 2.60 ft

Drill Method Air Rotary

Boring No. EW-~~23A~~ 18

TOC Elevation 639.88 ft Date 9/4/92



SILT with gravel (ML); olive brown; trace fine gravel and coarse sand; nonplastic; wet (TILL)

SANDY SILT (ML); medium gray; some very fine sand; moist to wet (LACUSTRINE

moist to wet

SILTY GRAVEL with sand (GM); medium gray, fine to coarse; little medium to coarse sand; some fines; damp (WEATHERED DRIFT)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-23A

(sheet 2 of 3)

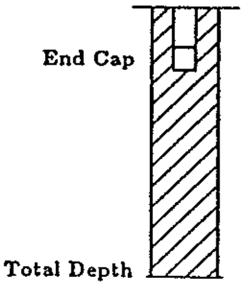
Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	11101-042		11/92		

11101/D:

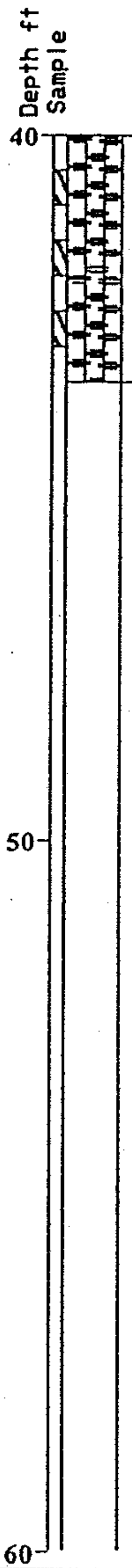
Stickup 2.60 ft



Drill Method Air Rotary

Boring No. EW-~~23A~~ 18

TOC Elevation 639.88 ft **Date** 9/4/92



Total depth drilled = 43.5 feet

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Log of Boring and Well Completion
EW-23A
(sheet 3 of 3)

Cedar Hills Landfill

PLATE

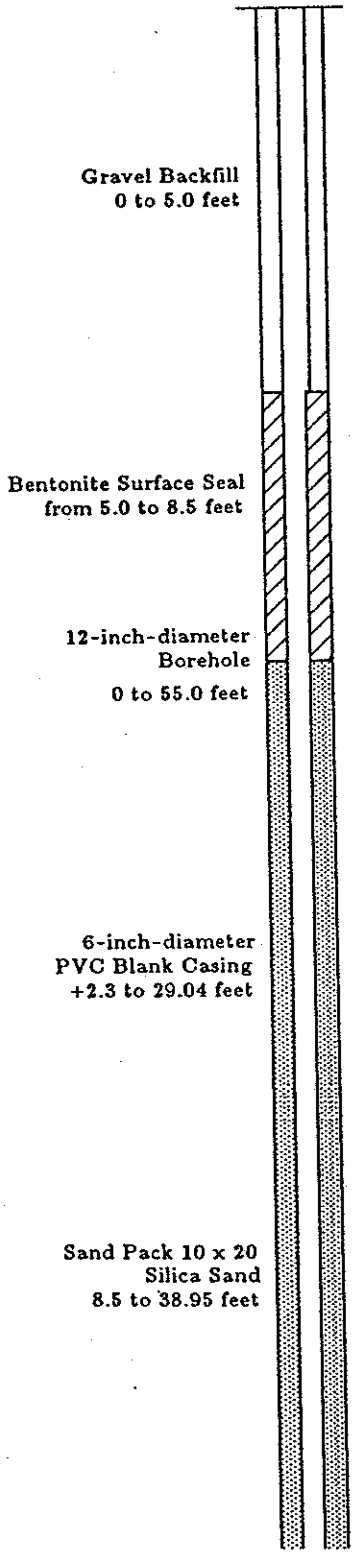
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

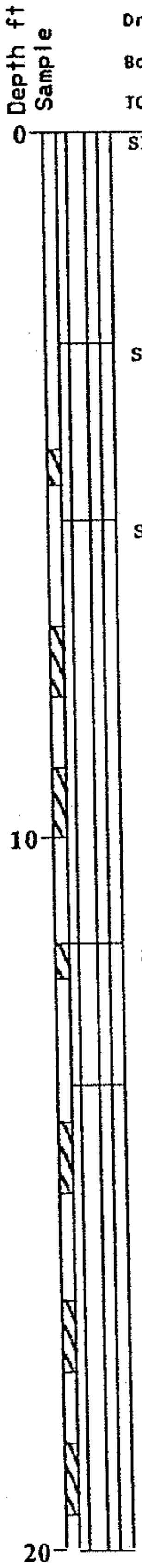
Drill Method Air Rotary

Boring No. EW- ~~6A~~ 19

TOC Elevation 640.00 ft Date 7/8/92

ckup 2.35 ft





SILT with gravel (ML); reddish brown; non-plastic; few organics - roots; trace fine to medium gravel; dry (WEATHERED TILL)

SILT with gravel (ML); dark brownish black; few fine to medium gravel; trace coarse gravel; trace organics - roots; moist (WEATHERED TILL)

SILT with gravel (ML); medium light gray; little fine to medium gravel; little medium to coarse sand; trace roots; non-plastic; damp (TILL)

SILT with gravel (ML); light brownish gray; slight plasticity; some fine to coarse sand; little fine to medium gravel; damp (TILL)

SILT with gravel (ML); yellowish brown; slight plasticity; trace medium to coarse sand; trace fine to medium gravel; dry (STRATIFIED DRIFT)

medium gray (bluish) SILT lense

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Log of Boring and Well Completion
EW- 6A

(sheet 1 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

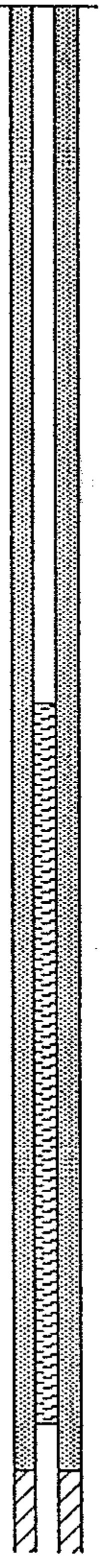
11101/D:

Stickup 2.35 ft

Drill Method Air Rotary

Boring No. EW- ~~6A~~ 19

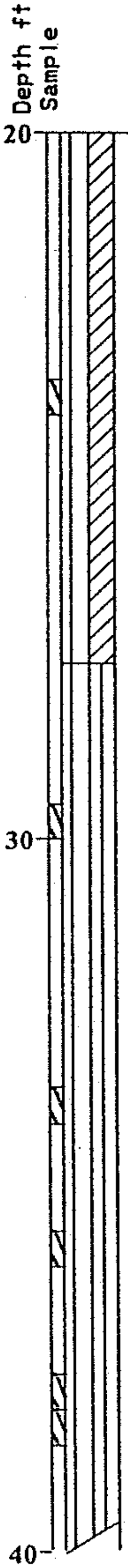
TOC Elevation 640.00 ft Date 7/8/92



Stainless Steel Centralizer 28.1 feet

6-inch-diameter 0.020 Slot PVC Screen 29.0 to 38.4 feet

6-inch-diameter Schedule 40 PVC Blank Casing 38.4 to 42.5 feet



CLAYEY SILT (ML/CL); dark bluish gray; moderate plasticity; damp (LACUSTRINE)

SILT (ML); medium dark gray; non-plastic; wet (LACUSTRINE)

trace coarse gravel; trace coarse sand

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Log of Boring and Well Completion EW- 6A

(sheet 2 of 3)

Cedar Hills Landfill

PLA

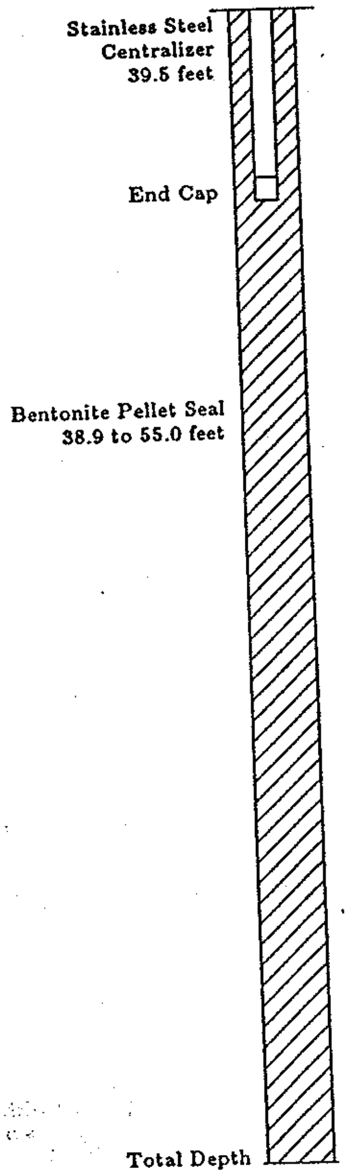
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

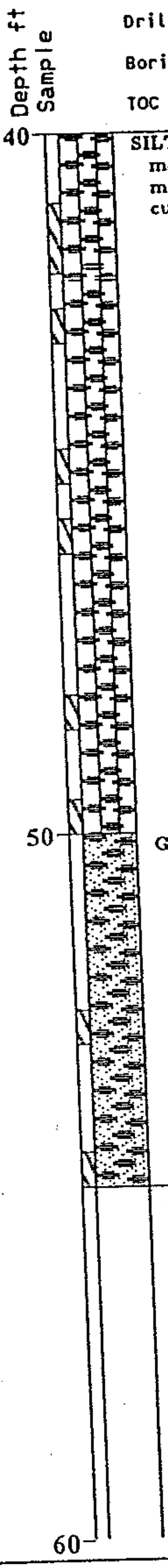
ickup 2.35 ft

Drill Method Air Rotary

Boring No. EW- ~~6A~~ 19

TOC Elevation 640.00 ft Date 7/8/92





SILTY GRAVEL with sand (GM); medium gray, medium to coarse; some fine to coarse sand; some medium gray fines; adding water to remove cuttings (STRATIFIED DRIFT)

GRAVEL with sand (GW); moderate yellowish brown; little medium to coarse sand; few fines; water added (ADVANCE OUTWASH)

Total depth drilled = 55.0 feet

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Log of Boring and Well Completion
EW- 6A (sheet 3 of 3)
Cedar Hills Landfill

PLATE

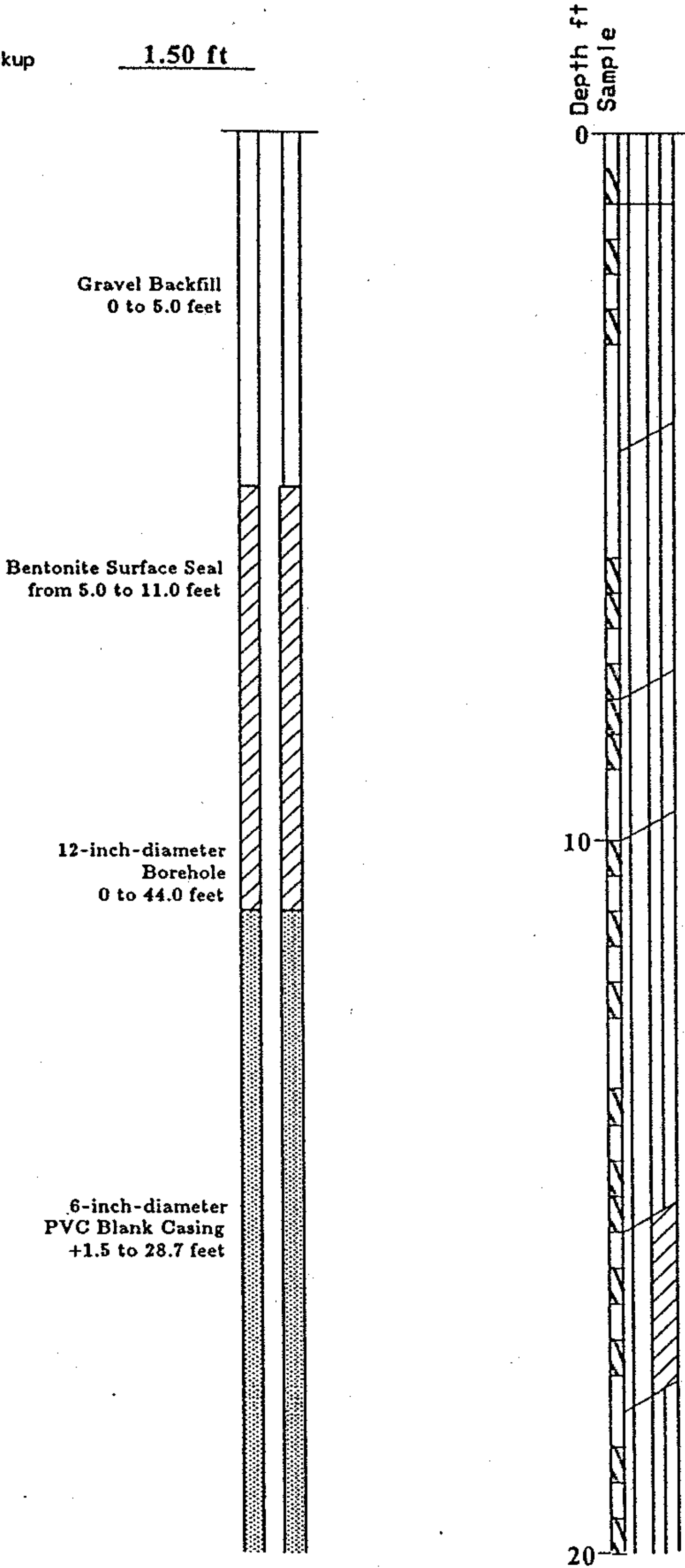
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

ickup 1.50 ft

Drill Method Air Rotary

Boring No. EW-~~22A~~ 20

TOC Elevation 639.03 ft Date 9/2/92



SILT with gravel (ML); reddish brown; few fine to medium gravel; dry (FILL)

SILT (ML); dark brown; trace roots and wood organics; moist (FILL)

SANDY SILT with gravel (ML); medium gray; some fine to coarse sand; little fine to medium gravel; with plastic, egg cartons; and wood (roots); moist (FILL)

SANDY SILT with gravel (ML); medium gray; some fine to coarse sand; little fine to medium gravel; moist (FILL)

SANDY SILT with gravel (ML); moderate yellowish brown; some very fine sand; little medium to coarse sand; few to little fine to medium gravel; moist to wet (WEATHERED TILL)

SILT with clay (ML/CL); dark gray; moderate plasticity; slightly moist (LACUSTRINE)

SANDY SILT (ML); medium gray; some very fine sand; occasional trace fine gravel; wet (LACUSTRINE)

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Log of Boring and Well Completion
EW-22A

(sheet 1 of 3)

Cedar Hills Landfill

PLATE

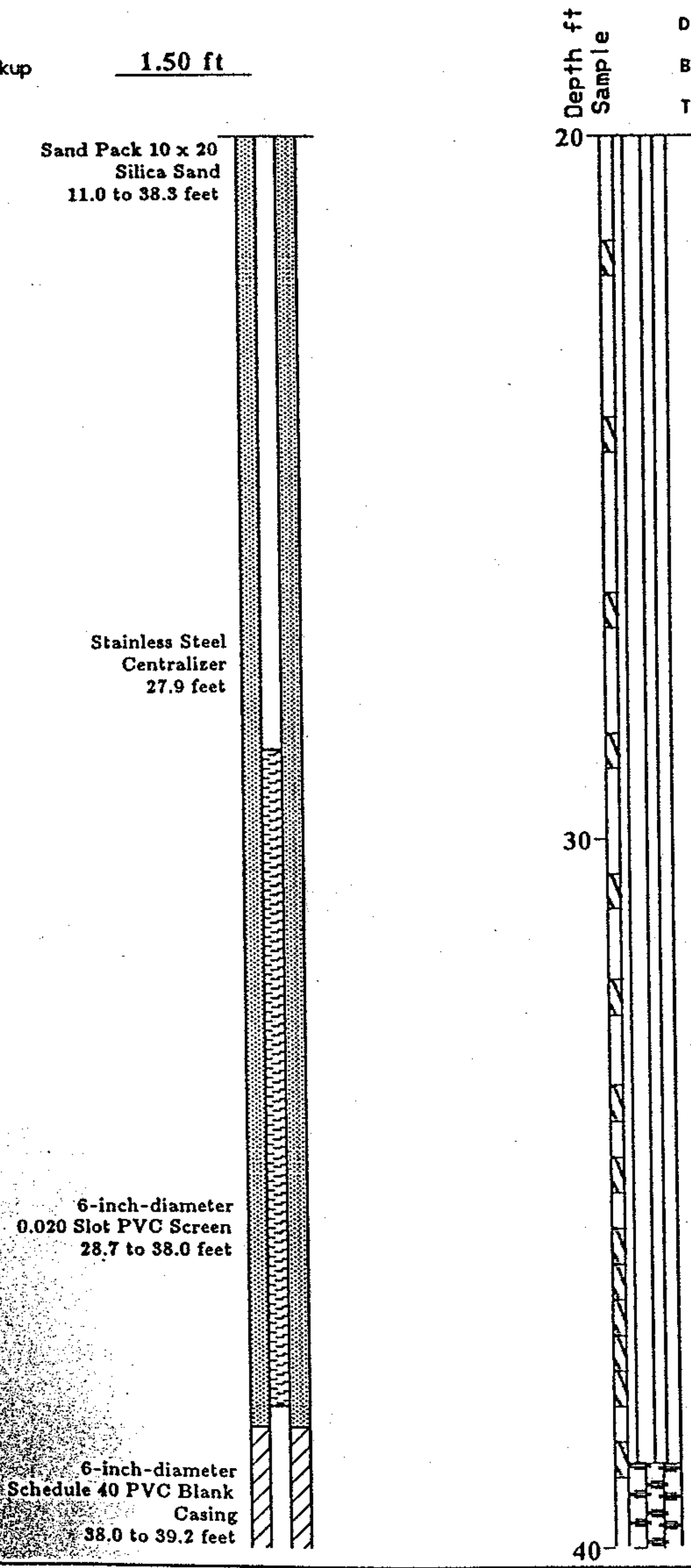
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 1.50 ft

Drill Method Air Rotary

Boring No. EW-~~22A~~ 20

TOC Elevation 639.03 ft Date 9/2/92



SILTY GRAVEL with sand (GM); medium gray, fine to medium; some fine to coarse sand; little fines; water added at 40 feet to remove cuttings

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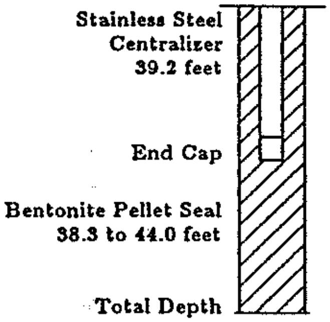
Log of Boring and Well Completion EW-22A

(sheet 2 of 3)

Cedar Hills Landfill

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

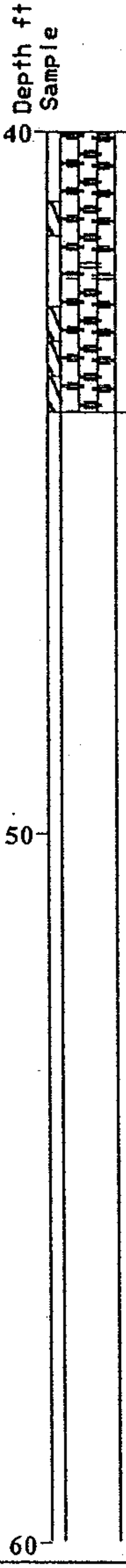
ckup 1.50 ft



Drill Method Air Rotary

Boring No. EW-~~22A~~ 20

TOC Elevation 639.03 ft Date 9/2/92



(STRATIFIED DRIFT)

Total depth drilled = 44.0 feet

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Log of Boring and Well Completion
EW-22A

(sheet 3 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

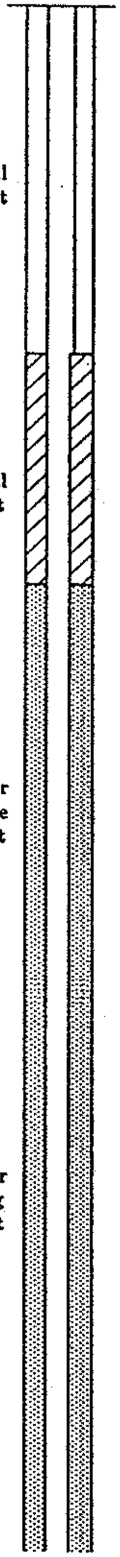
11101/D:

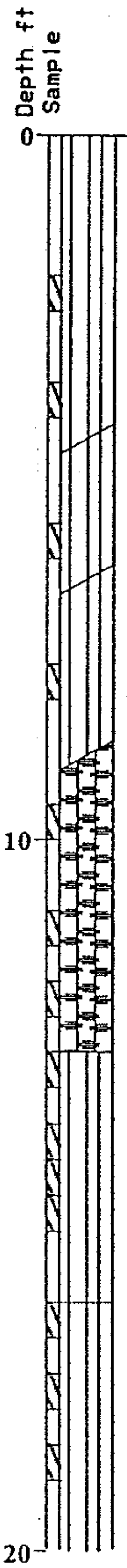
Stickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~14A~~ 21

TOC Elevation 641.04 ft **Date** 9/15/92





SANDY SILT with gravel (ML); light to dark brown; little fine to medium sand; little fine to coarse gravel; dry; trace plywood chips; plastic (FILL)

GRAVELLY SILT with sand (ML); pale brown; some fine to medium gravel; little fine to coarse sand; dry (WEATHERED TILL)

SANDY SILT with gravel (ML); pale brown; little medium to coarse sand; little fine gravel; dry (WEATHERED TILL)

SILTY GRAVEL with sand (GM); moderate brown, fine to medium; little fine to coarse sand; little fines; damp (WEATHERED TILL)

trace olive gray silt

SILT with gravel and cobbles (ML); moderate yellow brown; little fine to coarse gravel; few coarse sand; nonplastic; moist (TILL)

SILT AND SILT with gravel (ML); medium gray; few to little fine to coarse gravel; nonplastic; damp (LACUSTRINE)

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Log of Boring and Well Completion
EW-14A

(sheet 1 of 4)

Cedar Hills Landfill

PLATE

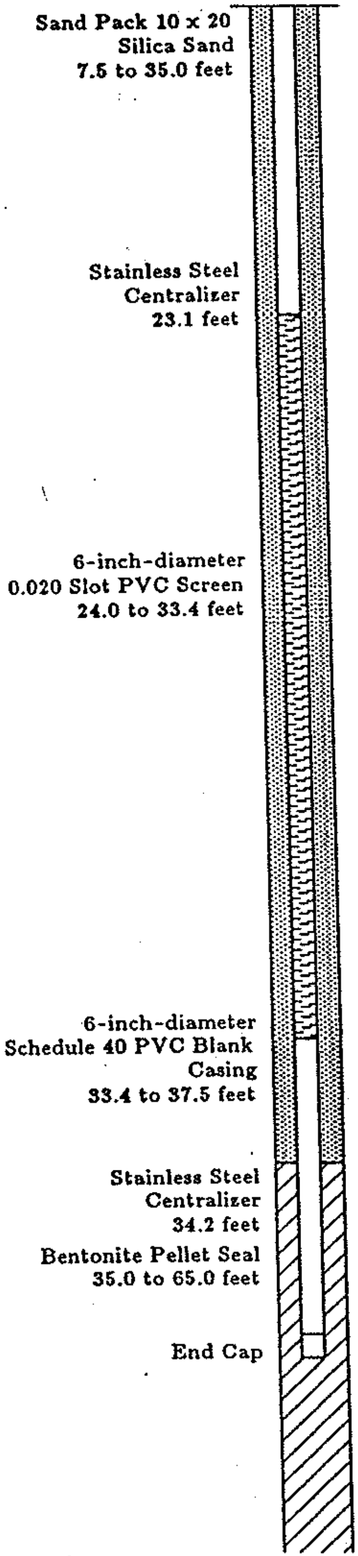
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE

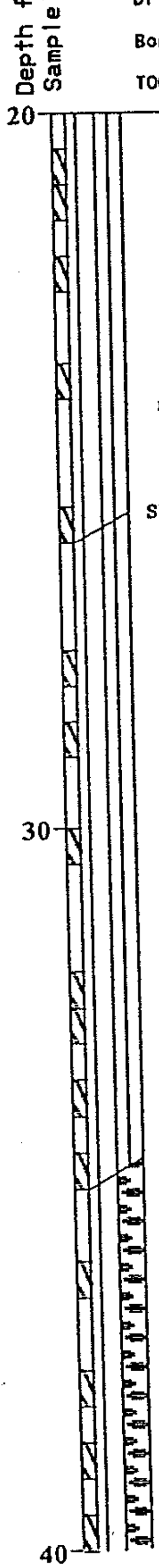
up 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~14A~~ 21

TOC Elevation 641.04 ft Date 9/15/92





moist at 24 feet

SILT with gravel and sand (ML); medium gray; nonplastic; some very fine sand; trace fine gravel; wet (LACUSTRINE)

GRAVELLY SILT to SILTY GRAVEL with sand (ML/GM); medium dark gray; denser silt; fine to coarse gravel; little medium to coarse sand; damp (STRATIFIED DRIFT)

(GM) below 38 feet

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Log of Boring and Well Completion
EW-14A (sheet 2 of 4)
Cedar Hills Landfill

PLATE

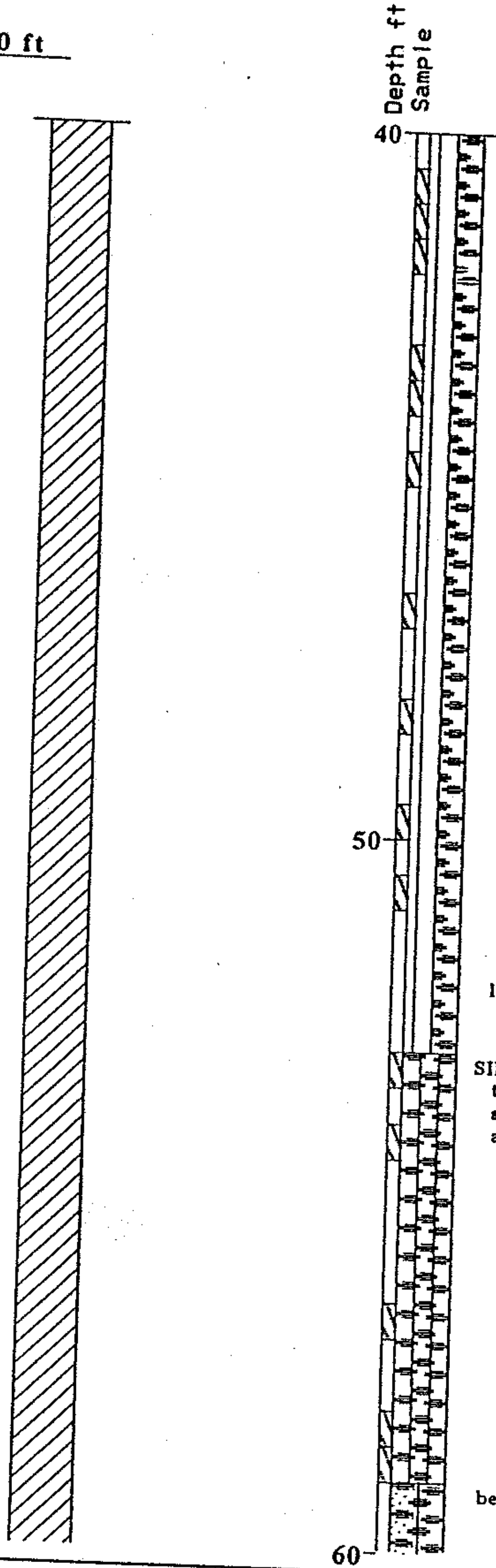
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~14A~~ 21

TOC Elevation 641.04 ft Date 9/15/92



Total depth of replacement well = 41 feet

Original well drilled using water below 34 feet

light brown silt marker bed at 53 feet

SILTY GRAVEL with sand and cobbles (GM); olive to light olive gray; mainly fine to medium gravel; some fine to coarse sand; with little fines; water added (ADVANCE OUTWASH)

becoming (GP-GM) below 59 feet

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Log of Boring and Well Completion EW-14A

(sheet 3 of 4)

Cedar Hills Landfill

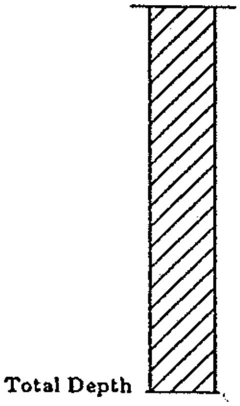
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

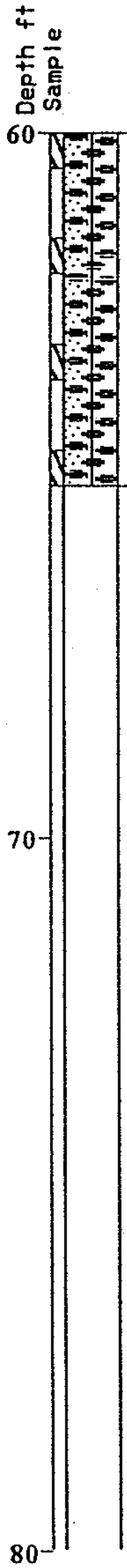
ckup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~14A~~ 21

TOC Elevation 641.04 ft Date 9/15/92





Total depth drilled = 65 feet

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Engineering and Environmental Services

Log of Boring and Well Completion
EW-14A (sheet 4 of 4)
Cedar Hills Landfill

PLATE

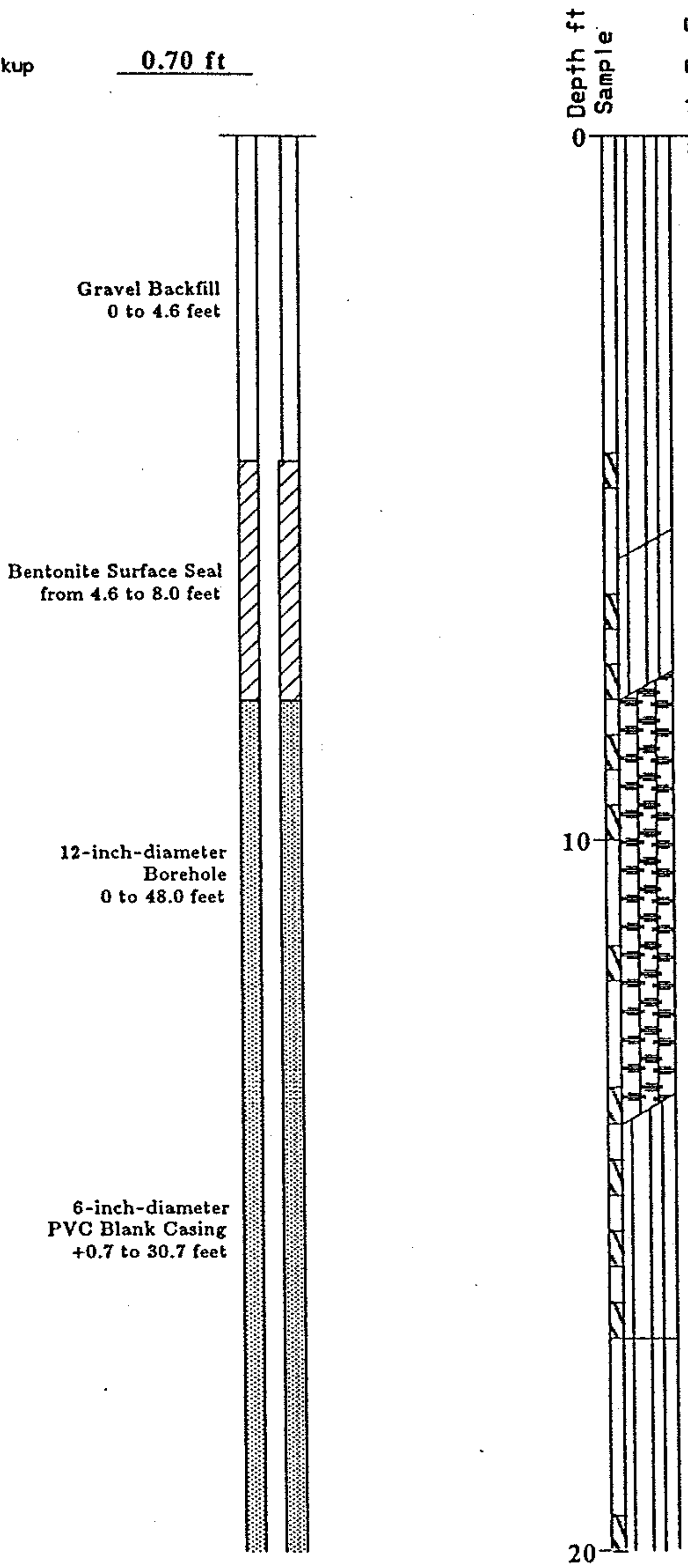
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

ickup 0.70 ft

Drill Method Air Rotary

Boring No. EW-~~20A~~ 23

TOC Elevation 640.65 ft Date 8/28/92



SILT with gravel (ML); moderate brown; few to little fine to coarse gravel; trace organics; dry (FILL)

GRAVELLY SILT with sand (ML); moderate brown; some fine to coarse gravel; little fine to medium sand; dry (WEATHERED TILL)

SILTY GRAVEL with sand (GM); moderate to pale yellowish brown, fine to coarse; some fines; little fine to coarse sand; dry (WEATHERED TILL)

SILT with gravel (ML); pale yellowish brown; little fine to medium gravel; few coarse sand; damp to moist (WEATHERED TILL)

SANDY SILT (ML); medium dark gray; some very fine sand; moist to wet (LACUSTRINE)

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Log of Boring and Well Completion
EW-20A

(sheet 1 of 3)

Cedar Hills Landfill

PLATE

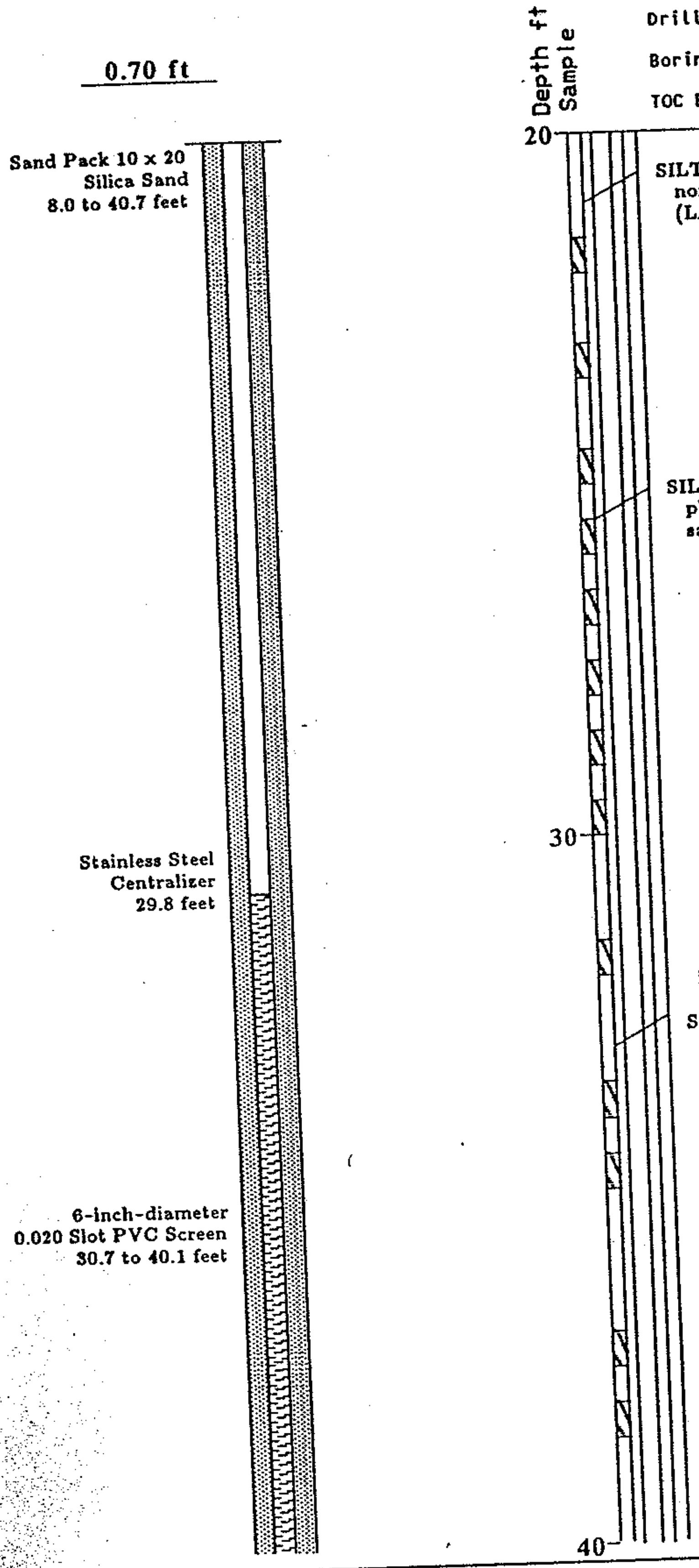
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Drill Method Air Rotary

Boring No. EW-~~20A~~ 23

TOC Elevation 640.65 ft Date 8/28/92

Stickup 0.70 ft



SILT with gravel (ML); medium brownish gray; nonplastic; trace fine gravel and coarse sand; moist (LACUSTRINE)

SILT with gravel (ML); medium gray; dense; slight plasticity; few clay; trace fine gravel and coarse sand; damp (LACUSTRINE)

increase in percent clay content; moderate plasticity

SANDY SILT (ML); medium gray; some very fine sand; wet (LACUSTRINE)

accumulated formation water in borehole overnight - samples below 38.5 feet wet

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Log of Boring and Well Completion
EW-20A

(sheet 2 of 3)

Cedar Hills Landfill

PLAT

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

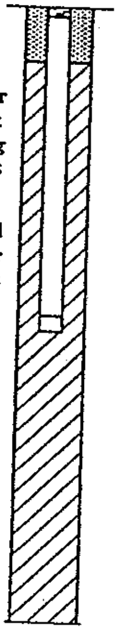
Stickup 0.70 ft

Drill Method Air Rotary

Boring No. EW-~~20A~~ 23

TOC Elevation 640.65 ft

Date 8/28/92



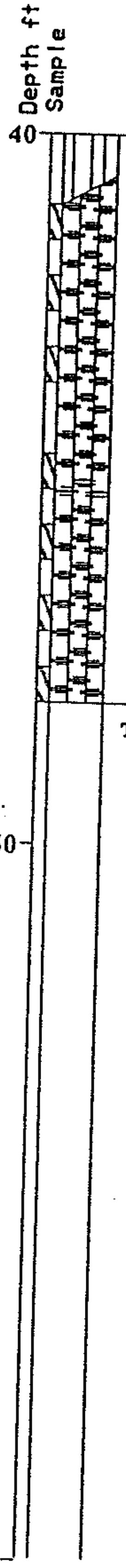
6-inch-diameter Schedule 40 PVC Blank Casing 40.1 to 44.2 feet

Stainless Steel Centralizer 40.9 feet

End Cap

Bentonite Pellet Seal 40.7 to 48.0 feet

Total Depth



SILTY GRAVEL (GM); medium gray, fine to coarse; some fines; few medium to coarse sand; water added below 44 feet

siltier

Total depth drilled = 48 feet

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Log of Boring and Well Completion
EW-20A

(sheet 3 of 3)

Cedar Hills Landfill

PLATE

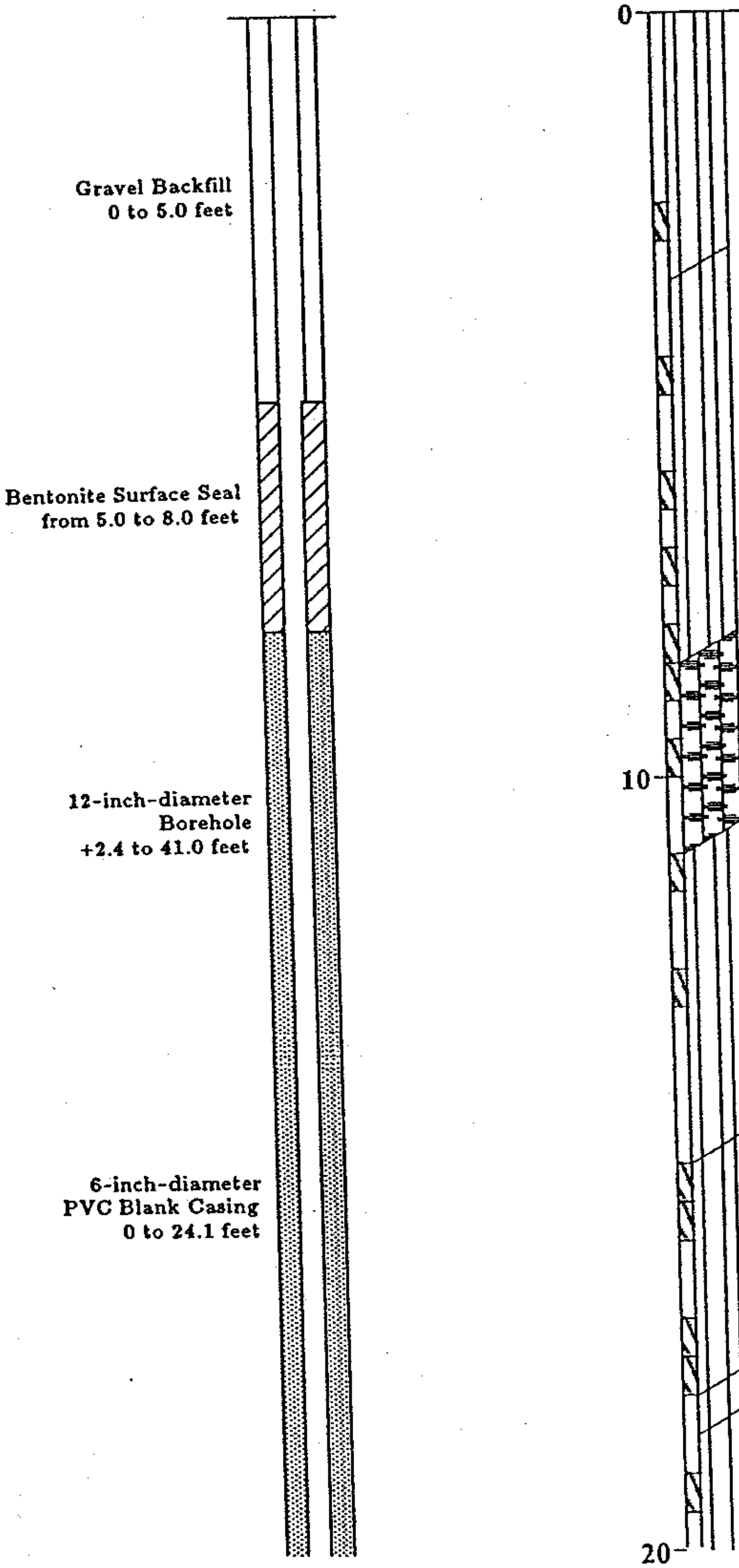
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Drill Method Air Rotary

Boring No. EW-~~27A~~ 24

TOC Elevation 643.11 ft Date 9/16/92

Stickup 2.40 ft



SILT with gravel (ML); brown; few fine to coarse gravel; few fine to medium sand; dry to damp (FILL)

GRAVELLY SILT with sand (ML); brown; little fine to coarse gravel; little fine to coarse sand; dry (WEATHERED TILL)

SILTY GRAVEL with sand and cobbles (GM); medium to light brown; fine to coarse with little fine to coarse sand; some fines; dry (WEATHERED TILL)

GRAVELLY SILT with sand (ML); brown; little fine to coarse gravel and sand; moist (TILL)

SANDY SILT (ML); medium gray to mottled orange; some very fine sand; soft; moist (LACUSTRINE)

SILT with gravel (ML); little fine to medium gravel; denser

SILT (ML); medium gray; nonplastic; dense; damp (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-27A (sheet 1 of 3)
Cedar Hills Landfill

PLATE

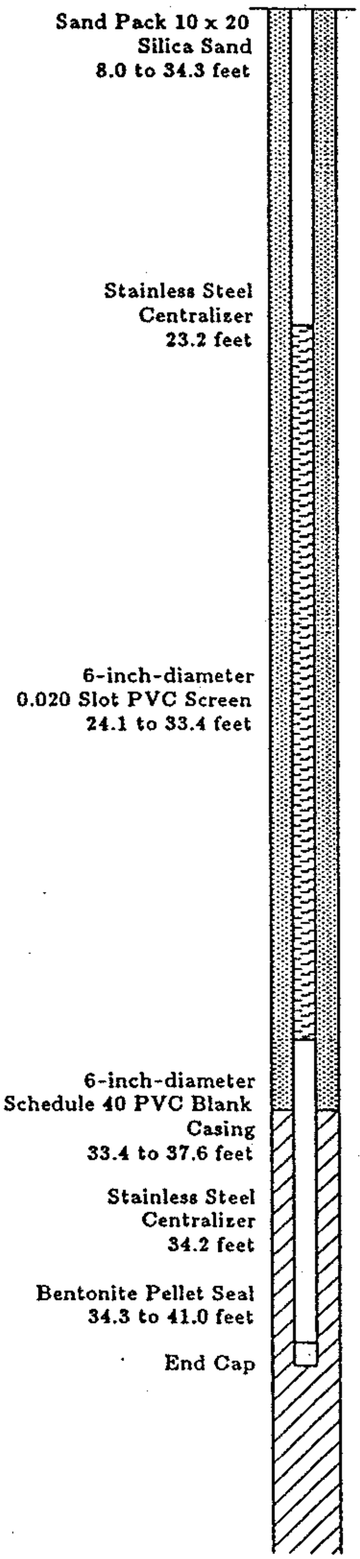
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

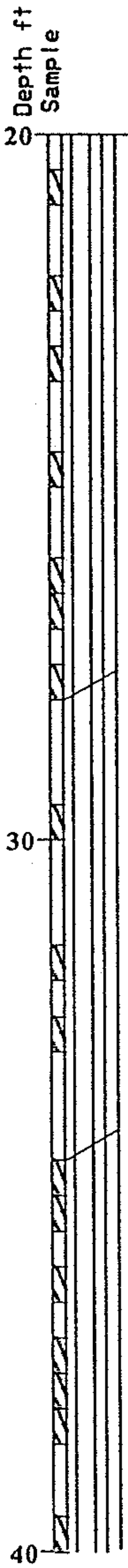
tickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~27A~~ 24

TOC Elevation 643.11 ft Date 9/16/92





few fine to medium gravel

trace coarse sand and fine gravel

SANDY SILT (ML); some very fine sand; soft; damp to wet (LACUSTRINE)

moist

wet

SILT with gravel (ML); medium gray; very dense; trace fine gravels; nonplastic; damp (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-27A (sheet 2 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 2.40 ft

Total Depth ▨

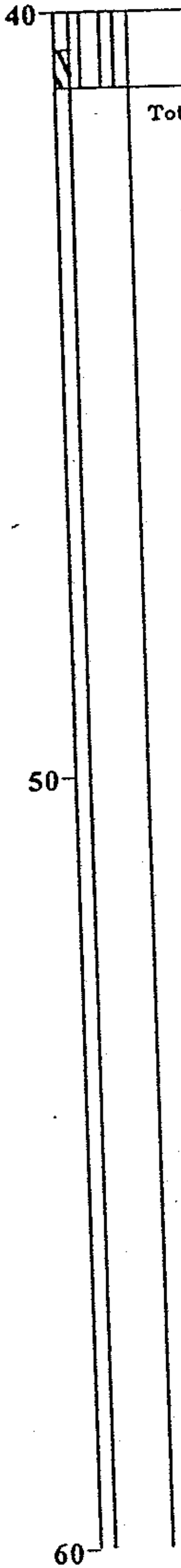
Drill Method Air Rotary

Boring No. EW-~~27A~~ 24

TOC Elevation 643.11 ft Date 9/16/92

Depth ft

Sample



Total depth drilled = 41.0 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-27A

(sheet 3 of 3)

Cedar Hills Landfill

PLATE

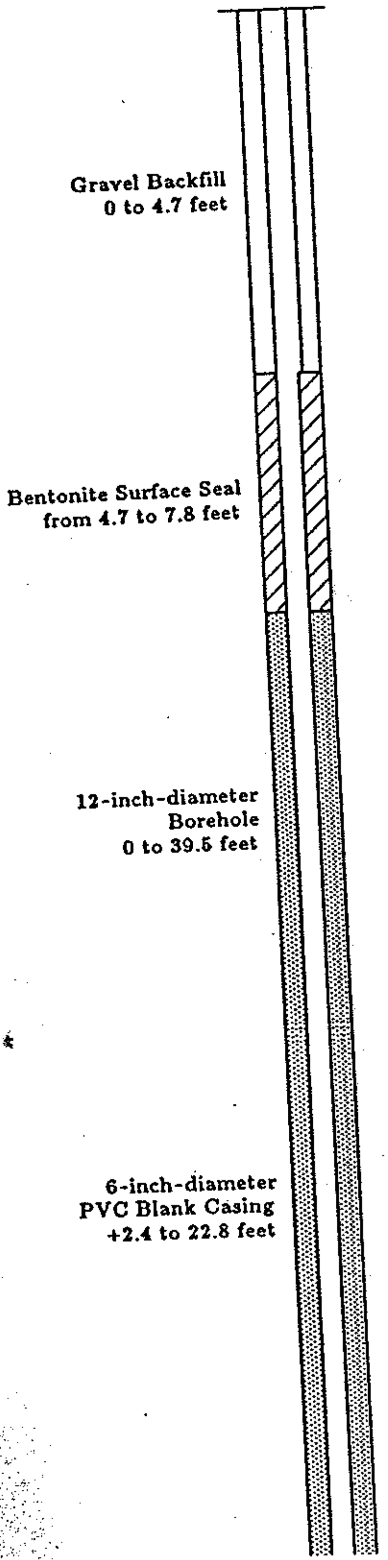
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

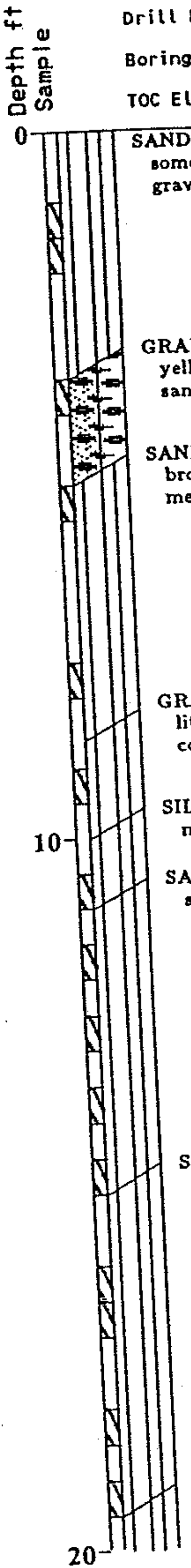
Drill Method Air Rotary

Boring No. EW-~~29A~~ 25

TOC Elevation 643.61 ft Date 10/6/92

Stickup 2.40 ft





SANDY SILT with gravel (ML); medium brown; some fine to coarse sand; little fine to coarse gravel; trace plastic; dry to damp (FILL)

GRAVEL with silt and sand (GW-GM); moderate yellowish brown, fine to coarse; little fine to coarse sand; damp (WEATHERED TILL)

SANDY SILT with gravel (ML); moderate yellowish brown; some fine to coarse sand; little fine to medium gravel; damp (WEATHERED TILL)

GRAVELLY SILT (ML); moderate yellowish brown; little fine to coarse gravel; few to little fine to coarse sand; damp (WEATHERED TILL)

SILT (ML); moderate yellowish brown; nonplastic; moist (WEATHERED TILL)

SANDY SILT (ML); olive brown; some very fine sand; moist to wet (WEATHERED TILL)

SILT with gravel (ML); olive brown; few fine gravel; nonplastic; trace coarse sand and laminated gray silt; moist to damp (WEATHERED TILL)

SILT (ML); medium dark gray; slight to nonplastic; damp (LACUSTRINE)

PLATE

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-29A

(sheet 1 of 2)

Cedar Hills Landfill

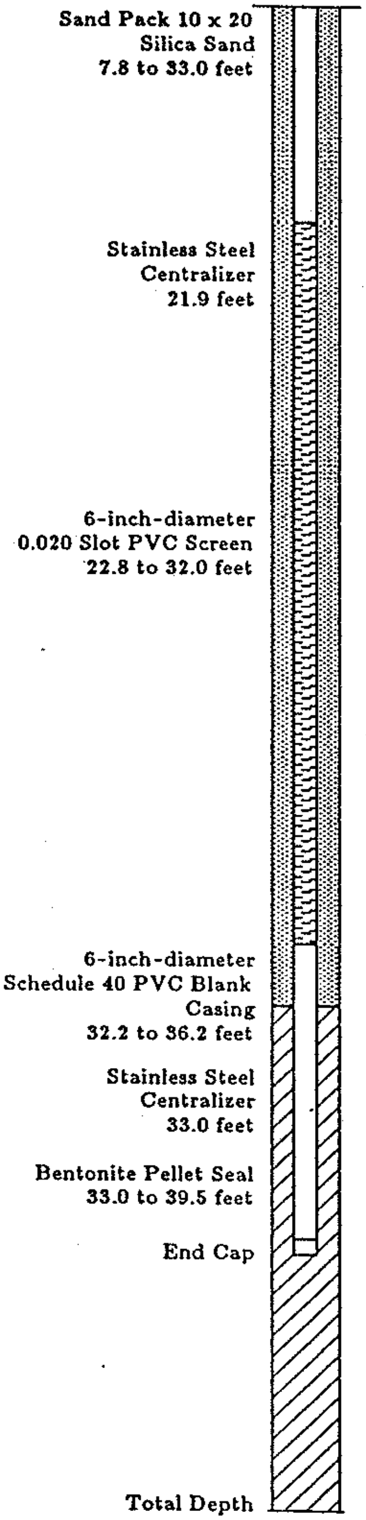
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

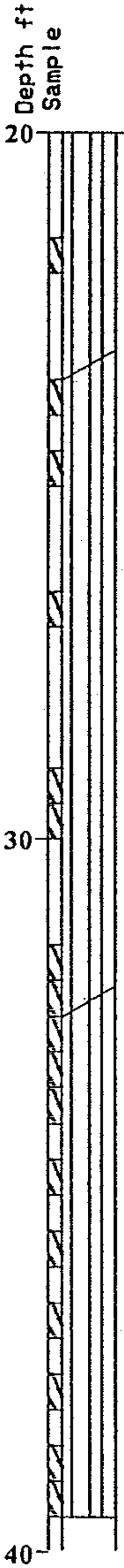
Stickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~29A~~ 25

TOC Elevation 643.61 ft Date 10/6/92





SANDY SILT with gravel (ML); medium dark gray; some very fine sand; trace fine gravel and coarse sand; wet (LACUSTRINE)

SILT with gravel (ML); medium dark gray; trace to few fine gravel; non to slight plasticity; dense (LACUSTRINE)

Total depth drilled = 39.5 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-29A

(sheet 2 of 2)

Cedar Hills Landfill

PLATE

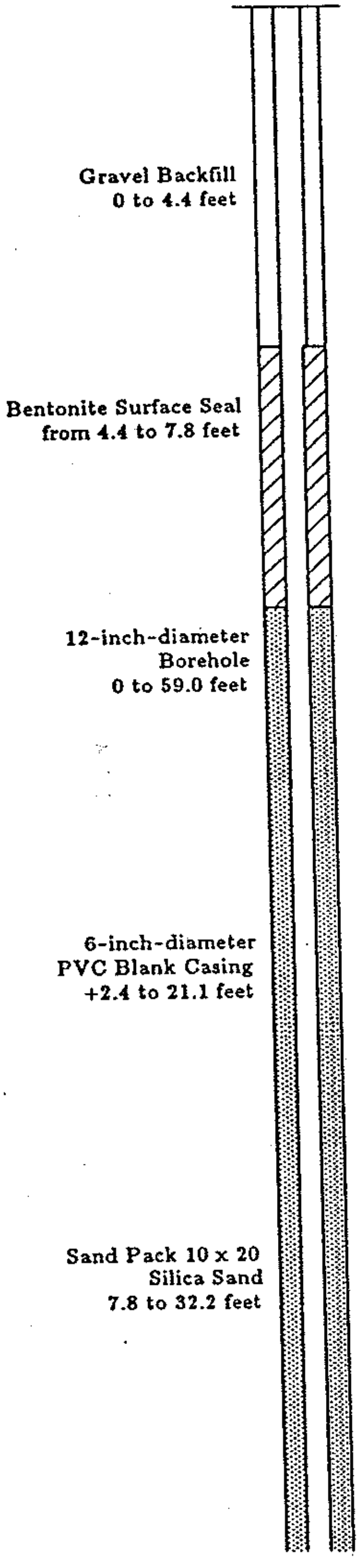
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

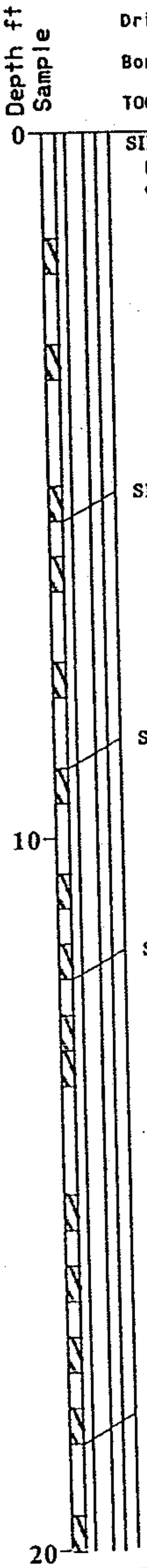
Drill Method Air Rotary

Boring No. EW-~~24A~~ 26

TOC Elevation 642.16 ft Date 9/9/92

ickup 2.40 ft





SILT with gravel and cobbles / GRAVELLY SILT (ML); moderate to dark brown; few to little fine to coarse gravel; trace plastic; dry (FILL)

SILT (ML); mottled orange brown; nonplastic; moist (WEATHERED TILL)

SANDY SILT (ML); mottled orange brown; some very fine sand; trace coarse sand; moist to wet (WEATHERED TILL)

SILT TO GRAVELLY SILT (ML); medium gray; trace to some fine to medium gravel; nonplastic to slight plasticity at base; damp (TILL / LACUSTRINE)

SANDY SILT (ML); medium gray; some very fine sand; damp; moist below 22 feet (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-24A (sheet 1 of 3)
Cedar Hills Landfill

PLATE

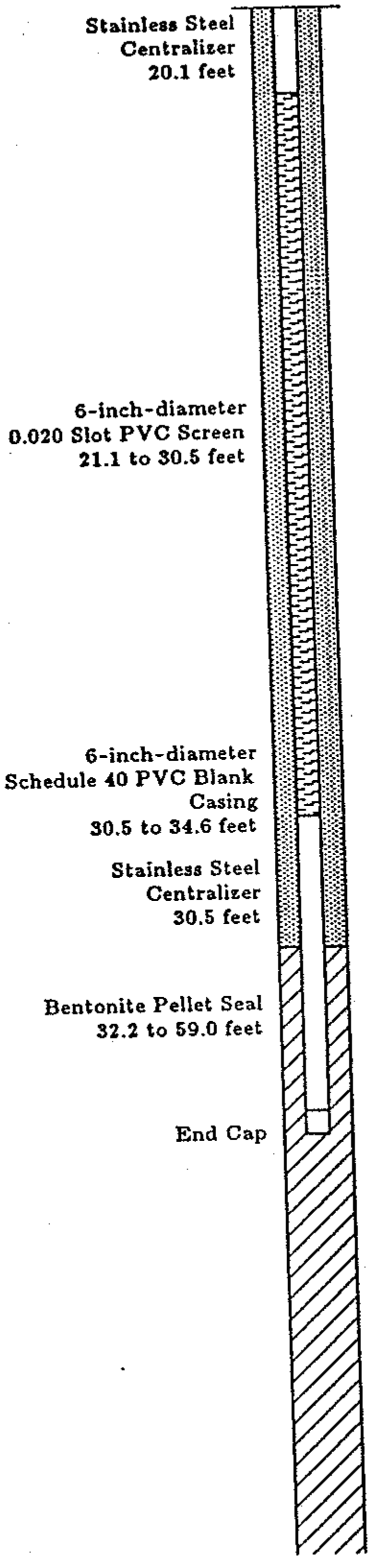
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	11101-042		11/92		

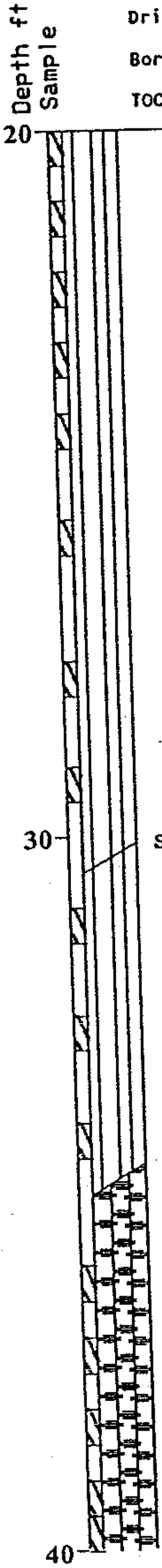
Drill Method **Air Rotary**

Boring No. EW-~~24A~~ 26

TOC Elevation **642.16 ft** Date **9/9/92**

Stickup **2.40 ft**





SILT with gravel (ML); medium gray, denser; moist to damp; slight plasticity; trace fines gravel and coarse sand at base (LACUSTRINE)

SILTY GRAVEL with sand (GM); medium gray, fine to coarse; little fine to coarse sand; some fines; water added below 35 feet (STRATIFIED DRIFT)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-24A

(sheet 2 of 3)

Cedar Hills Landfill

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

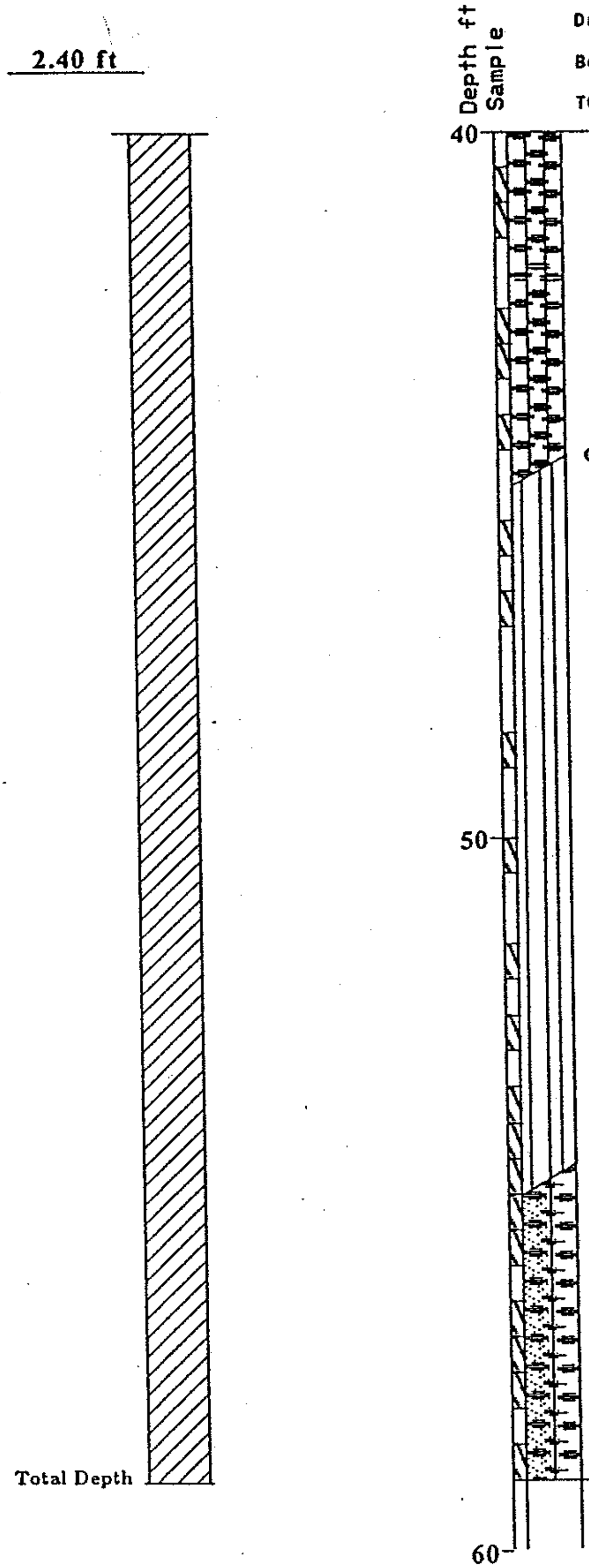
PL

tickup 2.40 ft

Drill Method Air Rotary

Boring No. EW-~~24A~~ 2b

TOC Elevation 642.16 ft Date 9/9/92



GRAVELLY SILT with sand (ML); medium gray; some fine to coarse gravel; little fine to coarse sand; water added (STRATIFIED DRIFT)

GRAVEL with silt, sand, and cobbles (GW-GM); olive to brownish gray; little fine to coarse sand; few cobbles; water added (ADVANCE OUTWASH)

Total depth drilled = 59.0 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-24A (sheet 3 of 3)

Cedar Hills Landfill

PLATE

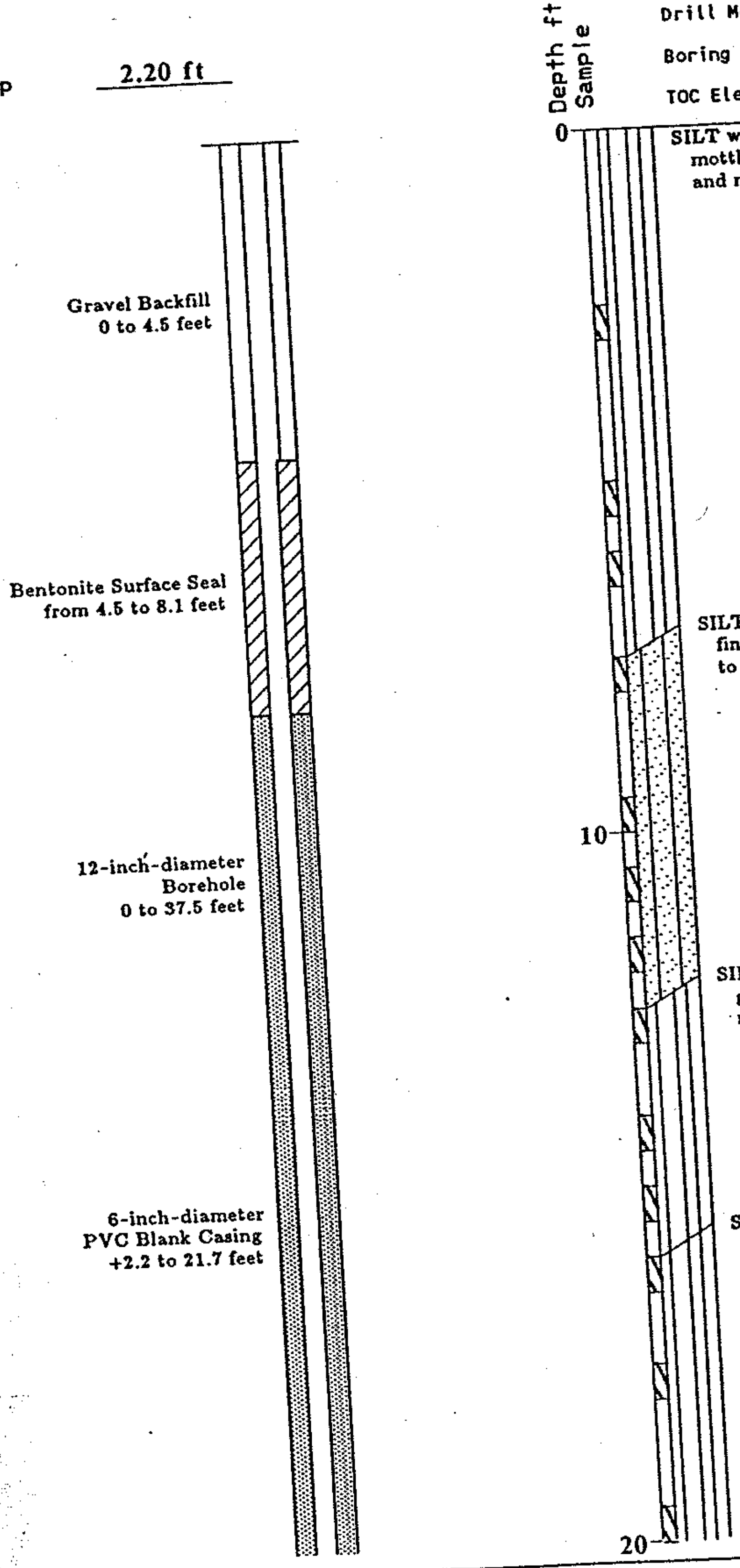
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Drill Method Air Rotary

Boring No. EW-~~30A~~ 27

TOC Elevation 640.63 ft Date 10/6/92

ickup 2.20 ft



SILT with gravel (ML); moderate brown with mottled orange; slight plasticity; trace fine gravel and medium to coarse sand; moist (FILL)

SILTY SAND with gravel (SM); moderate brown, fine to medium; some fines; trace fine gravel; wet to moist

SILT with gravel (ML); mottled moderate brown to gray; little fine to medium gravel; trace fine to medium sand; damp (TILL)

SILT (ML); medium dark gray; dense; nonplastic; trace fine to medium gravel; damp (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-30A

(sheet 1 of 2)

Cedar Hills Landfill

PLATE

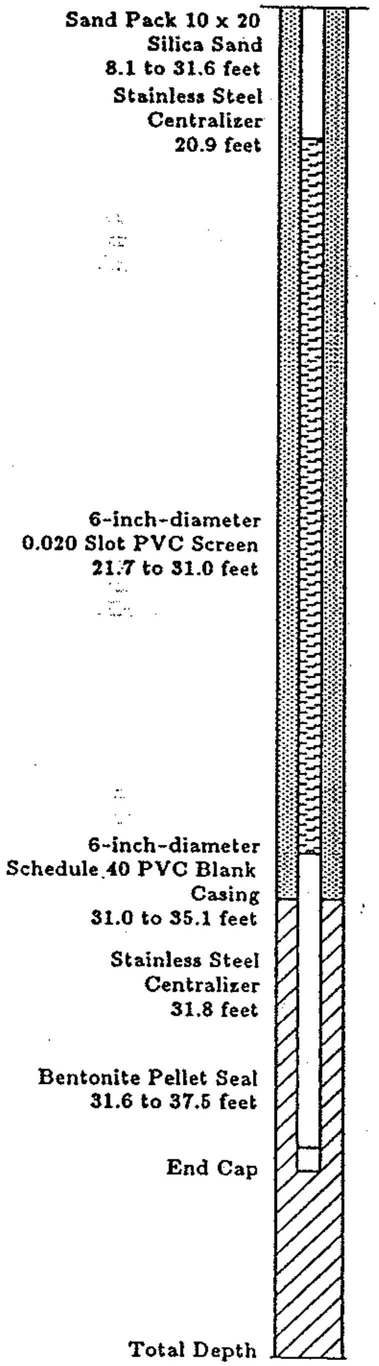
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

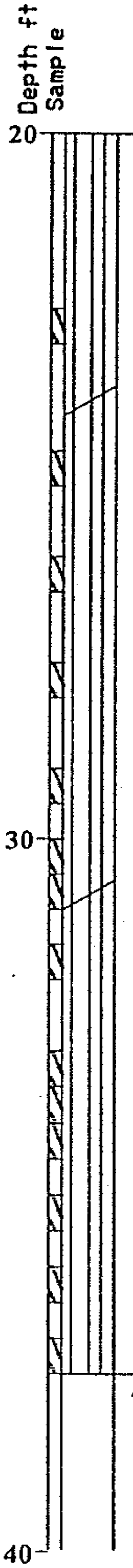
Stickup 2.20 ft

Drill Method Air Rotary

Boring No. EW-~~30A~~ 27

TOC Elevation 640.63 ft Date 10/6/92





SANDY SILT (ML); medium dark gray; some very fine sand; wet to moist (LACUSTRINE)

SILT with gravel (ML); medium dark gray; few to little fine to coarse gravel; dense; damp (LACUSTRINE/STRATIFIED DRIFT)

Total depth drilled = 37.5 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-30A

(sheet 2 of 2)

Cedar Hills Landfill

PLATE

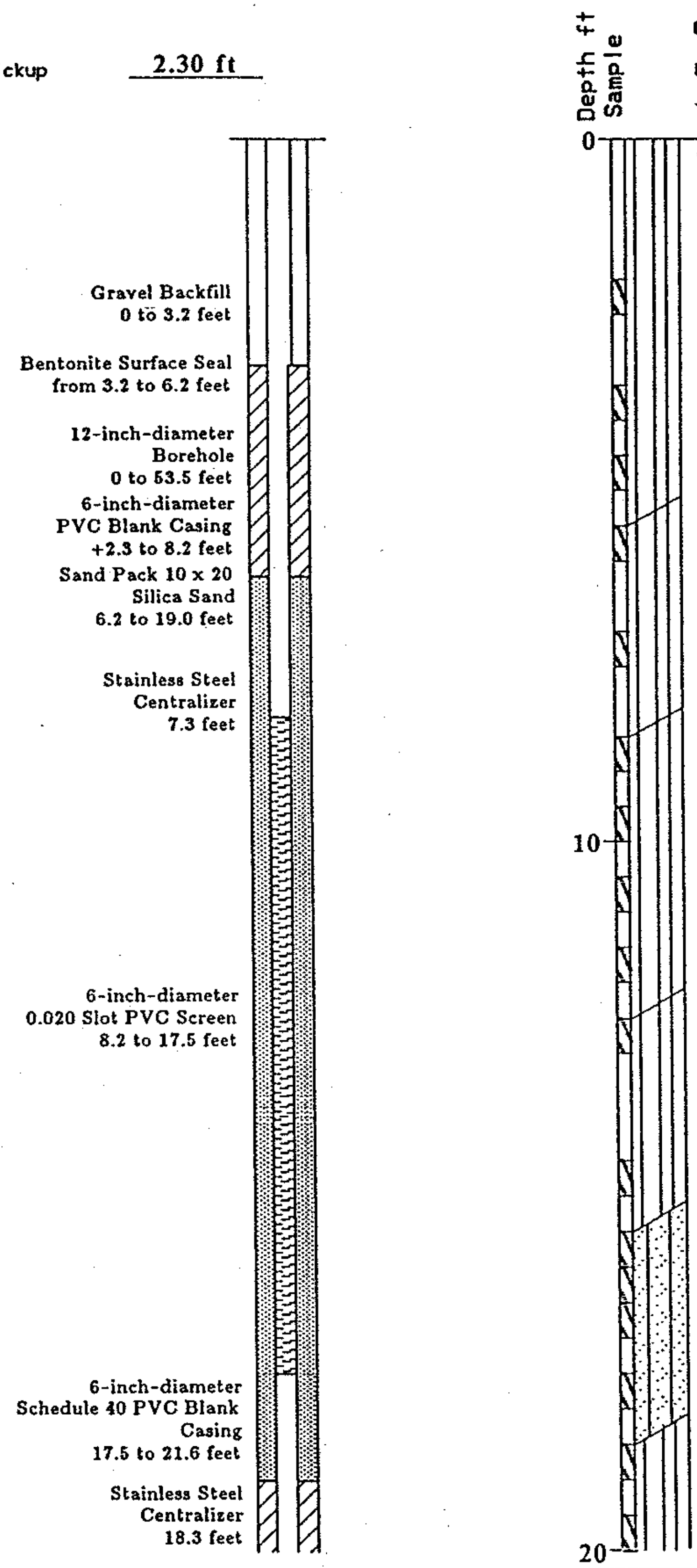
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

Stickup 2.30 ft

Drill Method Air Rotary

Boring No. EW-~~28A~~ 29

TOC Elevation 638.93 ft Date 9/21/92



SILT with gravel (ML); brown; trace fine gravel; dry (FILL)

SILT with gravel (ML); brown; few fine to medium gravel; damp (WEATHERED TILL)

SILT (ML); medium gray and mottled orange; trace fine gravel; nonplastic; damp; moderately dense (WEATHERED TILL)

SILT (ML); mottled orangish gray; few fine to medium gravels; soft; damp (WEATHERED TILL)

SILTY SAND (SM); medium gray, fine to medium with few coarse sand; few fine gravel; some fines; wet (WEATHERED TILL)

SILT (ML); medium gray; few fine to medium gravel; denser; damp (TILL)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-28A (sheet 1 of 3)
Cedar Hills Landfill

PLATE

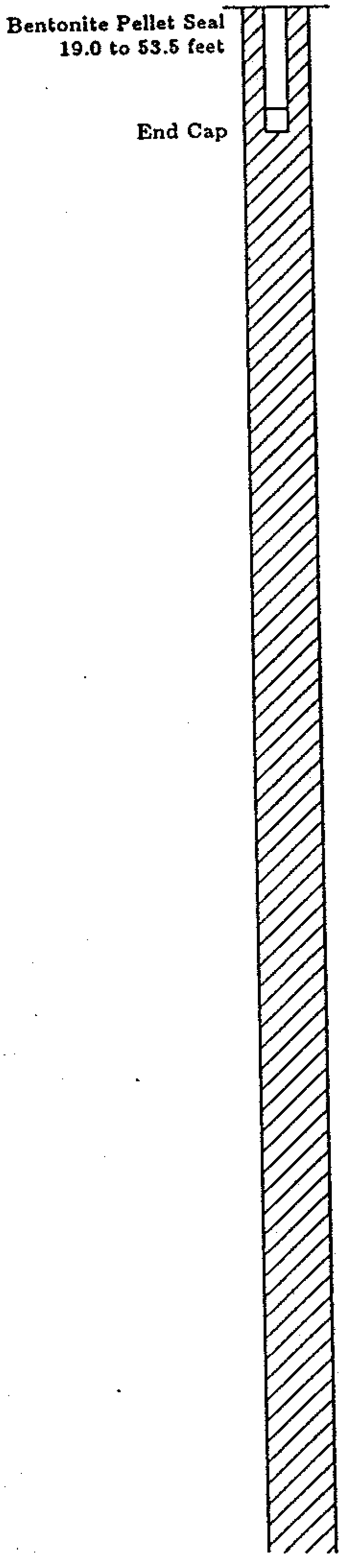
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

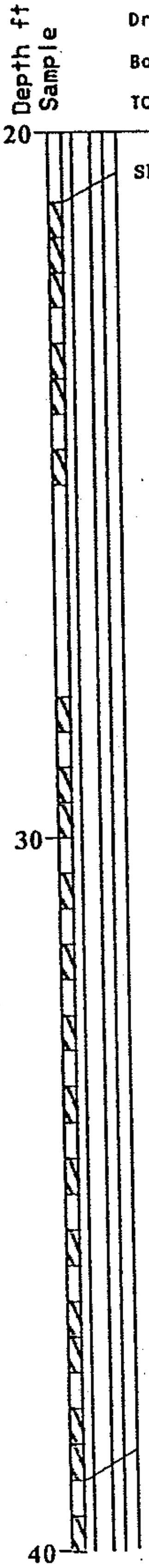
Stickup 2.30 ft

Drill Method Air Rotary

Boring No. EW-~~28A~~ 29

TOC Elevation 638.93 ft Date 9/21/92





SILT (ML); medium gray; slight plasticity; trace clay; damp (LACUSTRINE)

few fine gravel

few fine gravel; trace coarse sand; damp

SILT (ML); medium gray; moderate plasticity; few clay; damp to moist (LACUSTRINE)

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-28A

(sheet 2 of 3)

Cedar Hills Landfill

PLATE

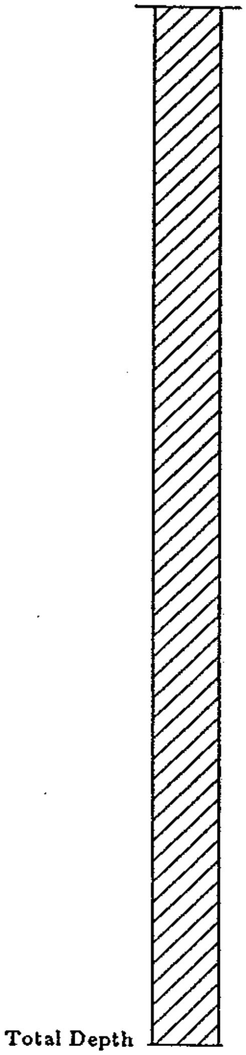
DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

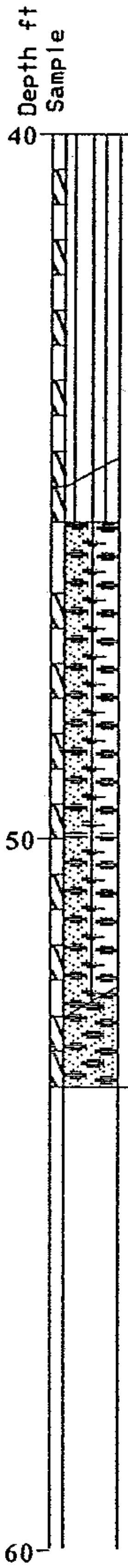
Stickup 2.30 ft

Drill Method Air Rotary

Boring No. EW-~~28A~~ 29

TOC Elevation 638.93 ft Date 9/21/92





light brown silt

SILTY GRAVEL with sand / GRAVEL with silt, sand, and cobbles (GM/GW-GM); olive to light olive gray, fine to coarse; some fine to coarse sand; little to few fines; water added to clean hole (STRATIFIED DRIFT)

GRAVEL with sand (GW); grayish brown, fine to coarse sand; trace fines; water added (ADVANCE OUTWASH)

Total depth drilled = 53.5 feet

Harding Lawson Associates
Engineering and Environmental Services

Log of Boring and Well Completion
EW-28A

(sheet 3 of 3)

Cedar Hills Landfill

PLATE

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
HK	11101-042		11/92		

PROJECT: King County - Cedar Hills Regional Landfill
16645 228th Avenue SE, Maple Valley, WA

Log of Boring No. E-68

BORING LOCATION: Northing: 169738.56, Easting: 1701596.42

ELEVATION AND DATUM: 656.5 ft above MSL (NGVD29)

DRILLING CONTRACTOR: Terra Engineering & Construction

DATE STARTED: 8/6/10

DATE FINISHED: 8/6/10

DRILLING METHOD: Bucket auger

TOTAL DEPTH (ft.): 33.0

MEASURING POINT: Ground surface

DRILLING EQUIPMENT: Lynx AF-120

DEPTH TO WATER (ft.) FIRST COMPL.

SAMPLING METHOD: Bucket auger [36"]

LOGGED BY: H. Shanmugam

HAMMER WEIGHT: NA

DROP: NA

RESPONSIBLE PROFESSIONAL: H. Shanmugam

REG. NO. PE 45890

DEPTH (feet)	SAMPLES Sample No.	SAMPLES Sample	SAMPLES Blows/ 6 inches	OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
1					Landfill cover material consisting of vegetation overlying brown silty sand and gravel	
2						
3					Geotextile fabric	
4					HDPE cover	
5						
6						
7						
8						
9						
10					Refuse (dry)	
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22					Refuse (moist)	
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34					Bottom of boring at 33.0 feet.	
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
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47						
48						
49						
50						

OAKBOREV (REV. 8/2007)

PROJECT: King County - Cedar Hills Regional Landfill
16645 228th Avenue SE, Maple Valley, WA

Log of Boring No. E-69

BORING LOCATION: Northing: 170118.01, Easting: 1701297.77

ELEVATION AND DATUM: 697.3 ft above MSL (NGVD29)

DRILLING CONTRACTOR: Terra Engineering & Construction

DATE STARTED: 8/9/10

DATE FINISHED: 8/9/10

DRILLING METHOD: Bucket auger

TOTAL DEPTH (ft.): 51.0

MEASURING POINT: Ground surface

DRILLING EQUIPMENT: Lynx AF-120

DEPTH TO WATER (ft.) FIRST: COMPL.:

SAMPLING METHOD: Bucket auger [36"]

LOGGED BY: H. Shanmugam

HAMMER WEIGHT: NA

DROP: NA

RESPONSIBLE PROFESSIONAL: H. Shanmugam

REG. NO. PE 45890

DEPTH (feet)	SAMPLES			OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter. Surface Elevation:	REMARKS
	Sample No.	Sample	Blows/ 6 inches			
1					Landfill cover material consisting of vegetation overlying brown silty sand and gravel	
2						
3					Geotextile fabric	
4					HDPE cover	
5						
6						
7						
8						
9					Refuse (dry)	
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22					Refuse (moist)	
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42					Refuse (moist)	
43						
44						
45						
46						
47						
48						
49						
50						

PROJECT: King County - Cedar Hills Regional Landfill
16645 228th Avenue SE, Maple Valley, WA

Log of Boring No. E-69 (cont'd)

DEPTH (feet)	SAMPLES			OVM READING (ppm)	DESCRIPTION NAME (USCS): color, moist, % by wt., plast. density, structure, cementation, react. w/HCl, geo. inter.	REMARKS
	Sample No.	Sample	Blows/ 6 inches			
51						
52					Bottom of boring at 51.0 feet.	
53						
54						
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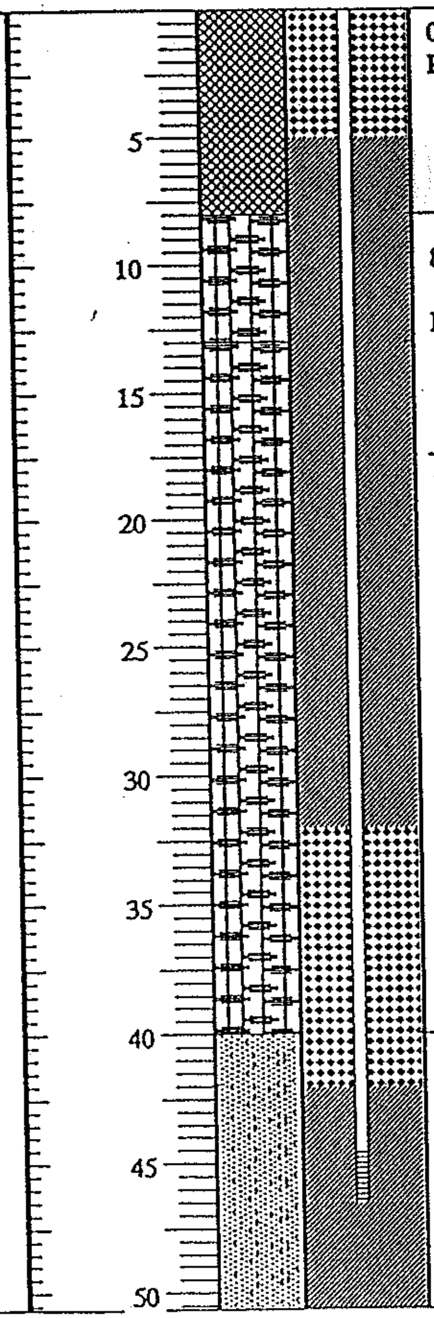
OAKBOREV (REV. 8/2007)

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-8
PAGE 1 OF 2
REFERENCE ELEV. 640.00'
TOTAL DEPTH 60.00'
DATE COMPLETED 4/30/88

GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOLOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION



0.0 - 8.0 feet: FILL (FILL)
Re-worked soil and wood fragments (not garbage)

8.0 - 13.0 feet: GRAVELLY SAND AND SILT (GM)
Brown, fine to coarse sand; medium to coarse gravel; up to 30% silt. Moderately graded, moderately dense, well rounded grains.
WEATHERED GLACIAL TILL

13.0 - 40.0 feet: GRAVELLY SANDY SILT (GM)
Gray, fine to coarse sand and gravel; 50% very fine sand/silt matrix; 10% cobbles/boulders. Poorly graded, dense, rounded gravels, increase in gravels below 30 feet.
GLACIAL TILL

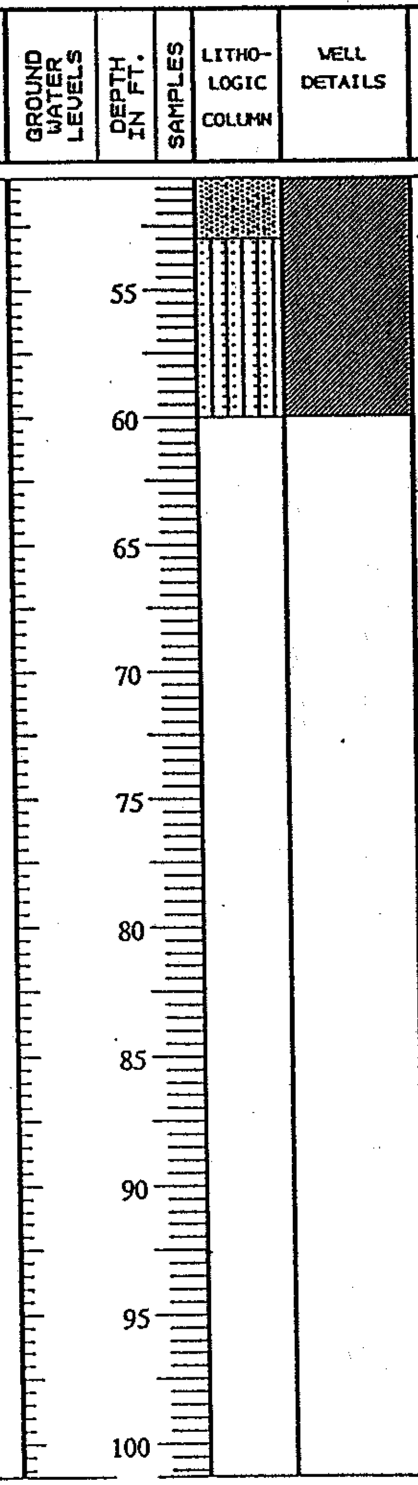
40.0 - 53.0 feet: SAND AND GRAVEL (SW)
Gray to brown, fine to coarse sand and gravel; occasional cobble\boulder. Stratified, well graded, moderately dense.

REMARKS
Boring back filled with a mixture of drill cuttings and bentonite chips

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-8
PAGE 2 OF 2
REFERENCE ELEV. 640.00'
TOTAL DEPTH 60.00'
DATE COMPLETED 4/30/88



LITHOLOGIC DESCRIPTION

40.0 - 53.0 feet: continued from previous page.

53.0 - 60.0 feet: SILTY SAND AND GRAVEL (SM)

Brown, fine to coarse sands and gravels; 25% very fine sand/silt; occasional cobble / boulder. Poorly graded, stratified, moderately dense, dry.

GLACIAL ADVANCE OUTWASH

Total depth 60.0 feet.

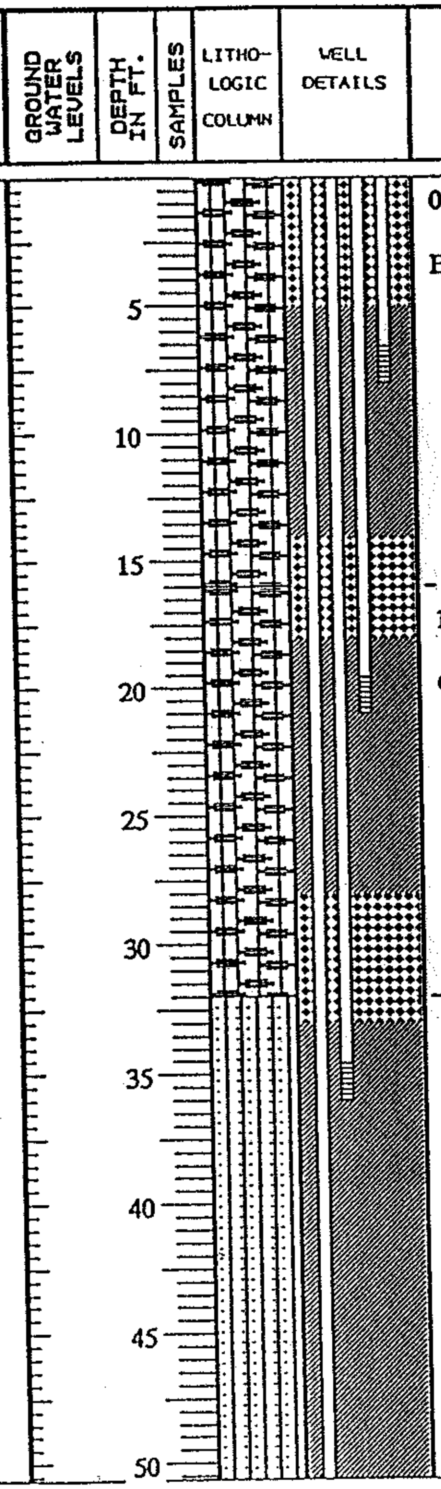
REMARKS

Boring back filled with a mixture of drill cuttings and bentonite chips

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-15
PAGE 1 OF 2
REFERENCE ELEV. 618.00'
TOTAL DEPTH 89.00'
DATE COMPLETED 4/11/88



LITHOLOGIC DESCRIPTION

0.0 - 16.0 feet: GRAVELLY SAND AND SILT (GM)

Brown, fine to coarse sand; medium to coarse gravel; up to 30% silt. Moderately graded, moderately dense, well rounded grains. Saturated at 14 feet.

WEATHERED GLACIAL TILL

16.0 - 32.0 feet: GRAVELLY SANDY SILT (GM)

Gray, fine to coarse sand and gravel in a very fine sand/silt matrix (50%); 10% cobbles/boulders. Poorly graded, dense, rounded gravels, saturated at 32 feet.

GLACIAL TILL

32.0 - 78.0 feet: SILTY SAND AND GRAVEL (SM)

Gray to brown, fine to coarse sand and gravel; silt interbeds; occasional cobble\boulder. Stratified, well graded, moderately dense, saturated in sand and gravel horizons ?

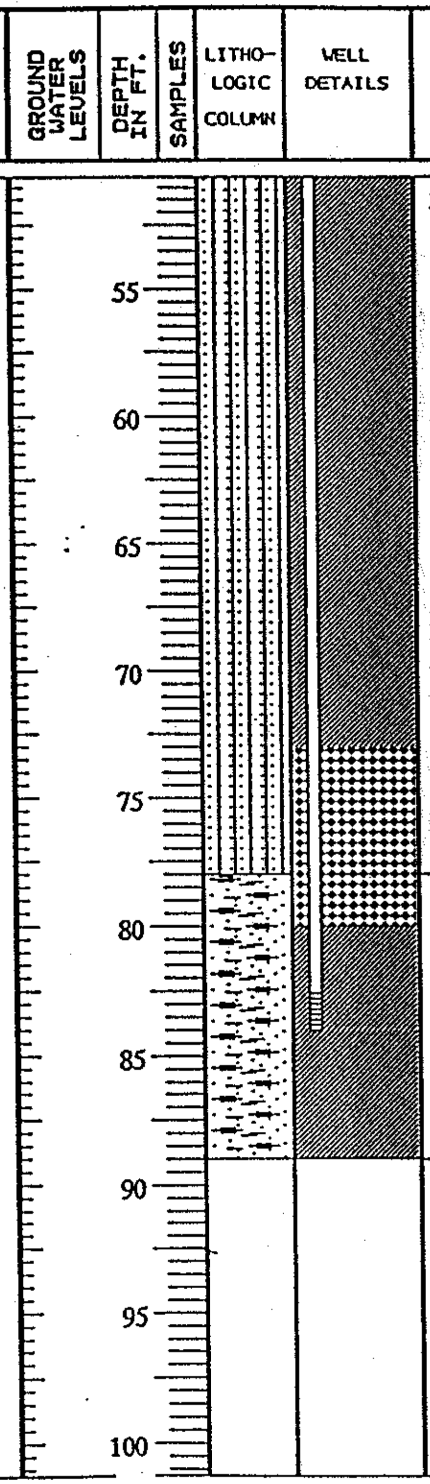
GLACIAL DRIFT

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-15
PAGE 2 OF 2
REFERENCE ELEV. 618.00'
TOTAL DEPTH 89.00'
DATE COMPLETED 4/11/88



LITHOLOGIC DESCRIPTION

32.0 - 78.0 feet: continued from previous page.

Increase in silt below 68 feet

78.0 - 89.0 feet: GRAVELLY SAND (GW)
Brown to gray, fine to coarse gravel sand; trace of silt. Bedded, well graded, well-rounded grains, moderately loose, dry.
GLACIAL ADVANCE OUTWASH

Total depth 89 feet.

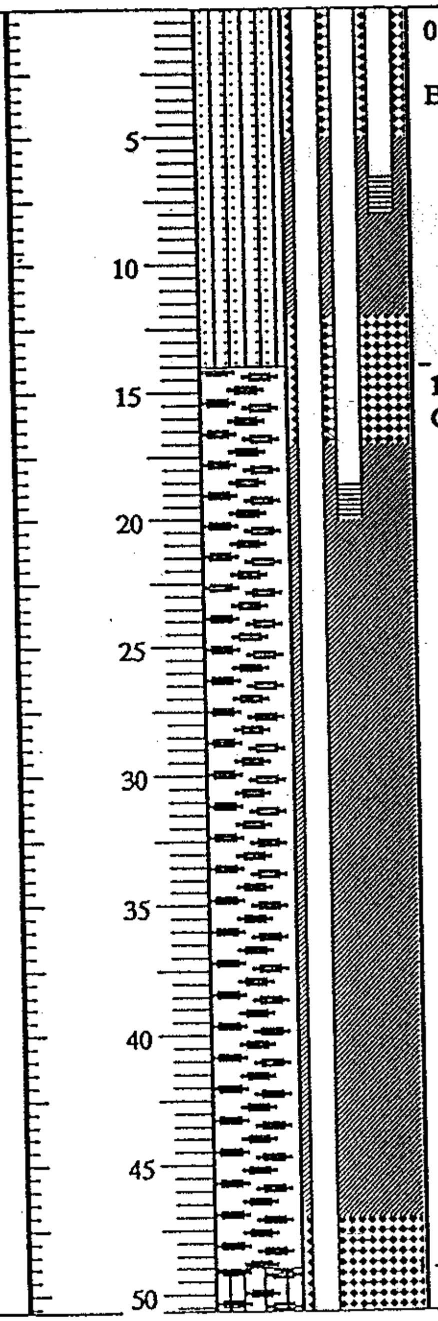
REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-16
PAGE 1 OF 2
REFERENCE ELEV. 627.00'
TOTAL DEPTH 70.00'
DATE COMPLETED 4/13/88

			GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-LOGIC COLUMN	WELL DETAILS	LITHOLOGIC DESCRIPTION



0.0 - 14.0 feet: SILTY SAND AND GRAVEL (SW)
Brown, fine to coarse sand and gravel; up to 30% silt; 10% cobbles. Moderately graded, moderately dense, well rounded grains.
WEATHERED GLACIAL TILL

14.0 - 49.0 feet: GRAVELLY SILT (GP)
Gray, fine to coarse sand and gravel; 50% very fine sand/silt matrix; 10% cobbles/boulders. Poorly graded, dense, rounded gravels.
GLACIAL TILL

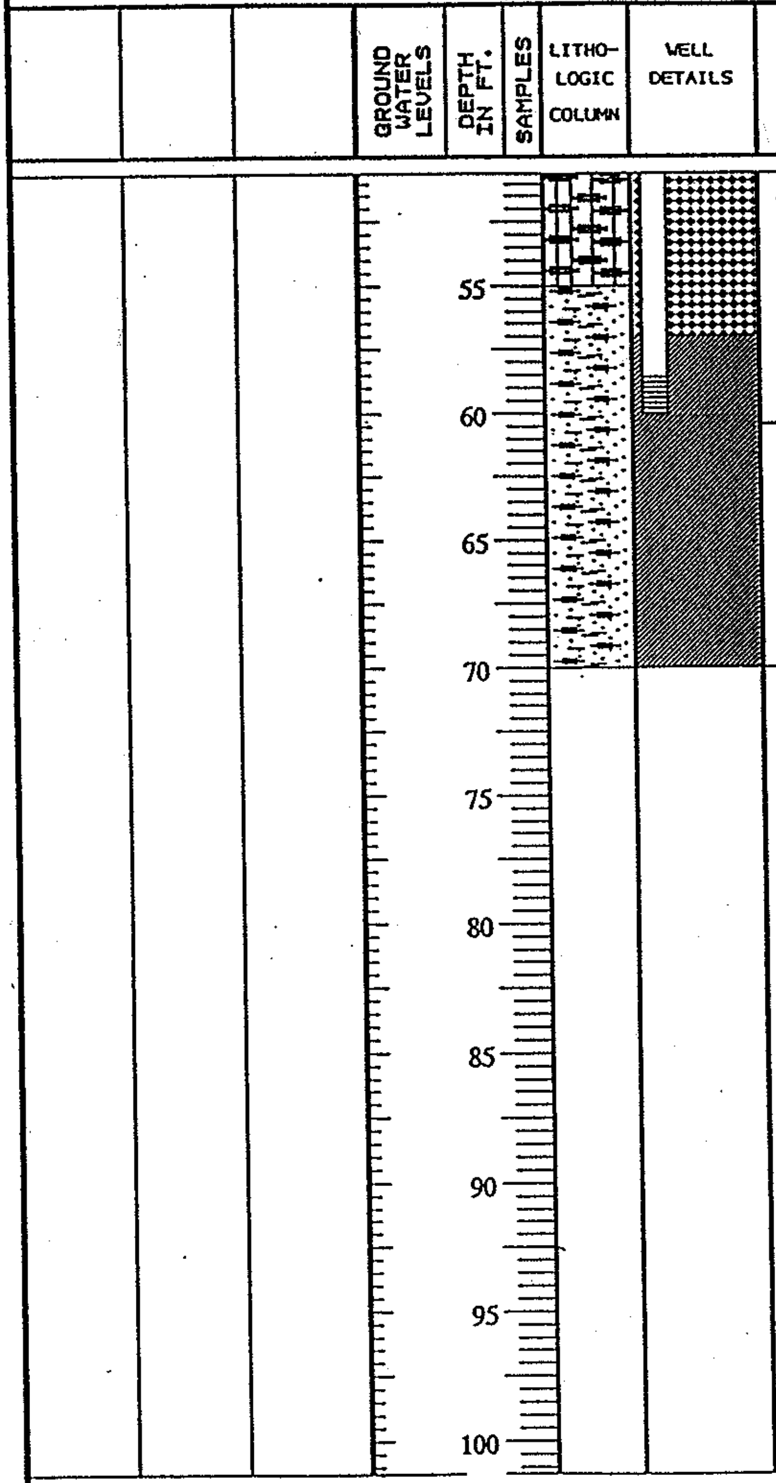
49.0 - 50.0 feet: DESCRIPTION on next page.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-16
PAGE 2 OF 2
REFERENCE ELEV. 627.00'
TOTAL DEPTH 70.00'
DATE COMPLETED 4/13/88



LITHOLOGIC DESCRIPTION

49.0 - 55.0 feet: SILTY SAND AND GRAVEL (GM)
Gray, fine to coarse sand and gravel; silt interbeds; occasional cobble\boulder. Stratified, well graded, moderately dense, saturated in sand and gravel horizons.
GLACIAL DRIFT

55.0 - 70.0 feet: GRAVELLY SAND (GW)
Brown, fine to coarse gravel and sand. Bedded, well graded, well-rounded grains, moderately loose, dry.
GLACIAL ADVANCE OUTWASH

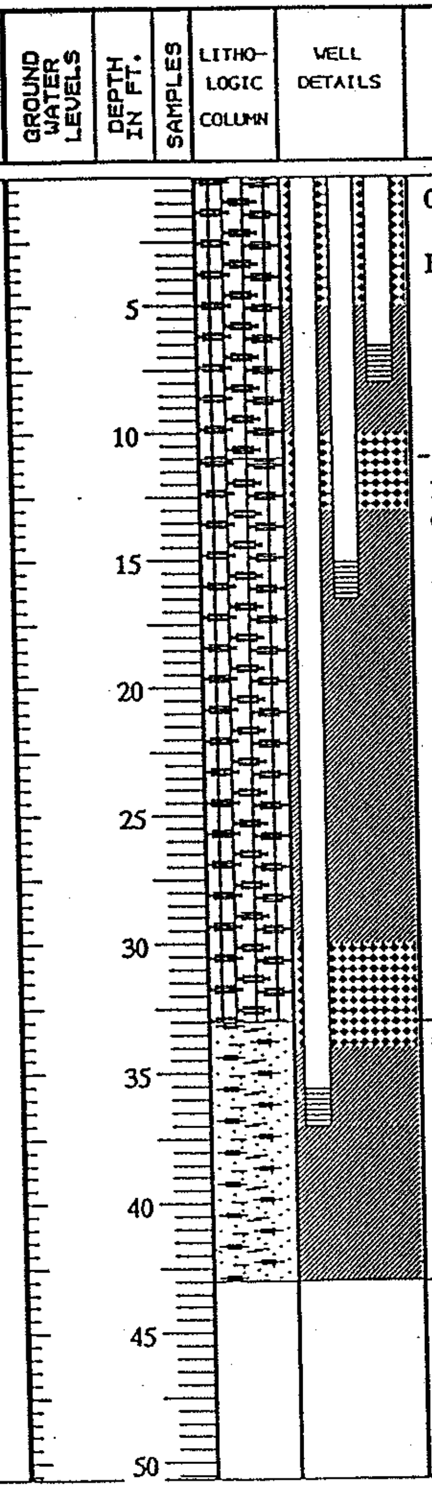
Total depth 70 feet.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY T.P.& D
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-17
PAGE 1 OF 1
REFERENCE ELEV. 622.00'
TOTAL DEPTH 43.00'
DATE COMPLETED 3/30/88



LITHOLOGIC DESCRIPTION

0.0 - 11.0 feet: GRAVELLY SAND AND SILT (GM)
Brown, fine to coarse sand and gravel; up to 30% silt; 10% cobbles. Moderately graded, moderately dense, well rounded grains, dry.
WEATHERED GLACIAL TILL

11.0 - 33.0 feet: GRAVELLY SILT (GM)
Gray to brown, fine to coarse sand and gravel in a very fine to fine sand matrix; 10% cobbles/boulders. Poorly graded, dense, rounded gravels, dry.
GLACIAL TILL

33.0 - 43.0 feet: GRAVEL AND SAND (GW)
Brown to gray, fine to coarse gravel and sand; 10%silt; 10%. cobbles. Bedded, well graded, well-rounded grains, moderately dense, dry.
GLACIAL ADVANCE OUTWASH

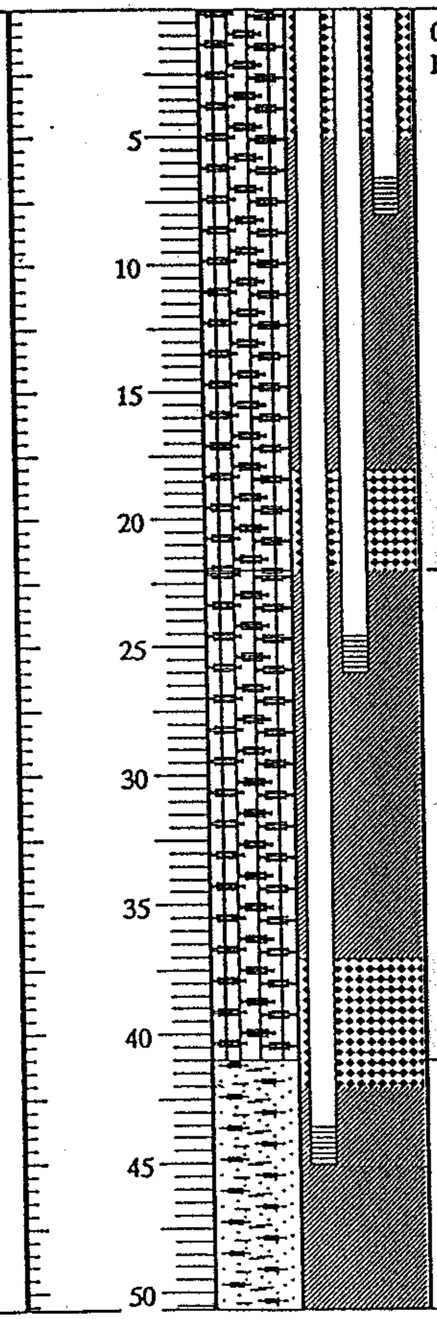
Total depth 43 feet.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME	Cedar Hills Landfill: Gas Probe Installations	BORING NO.	GP-18
LOCATION		PAGE	1 OF 2
DRILLED BY	Tacoma Pump & Drill	REFERENCE ELEV.	585.00'
DRILL METHOD	Air Rotary	TOTAL DEPTH	58.00'
LOGGED BY	P. J. Rowland	DATE COMPLETED	3/28/88

GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHO-LOGIC COLUMN | WELL DETAILS | LITHOLOGIC DESCRIPTION



0.0 - 22.0 feet: GRAVELLY SILT (GM)
Brown, fine to coarse gravel; up to 20% sand; 50% silt; 10% cobbles. Moderately graded, moderately dense, well rounded grains, dry.
WEATHERED GLACIAL TILL

22.0 - 41.0 feet: GRAVELLY SILT (GM)
Gray, fine to coarse sand and gravel in a very fine to fine sand matrix; 10% cobbles/boulders. Poorly graded, dense, rounded gravels, dry.
GLACIAL TILL
Increase in cobbles and boulders below 33 feet.

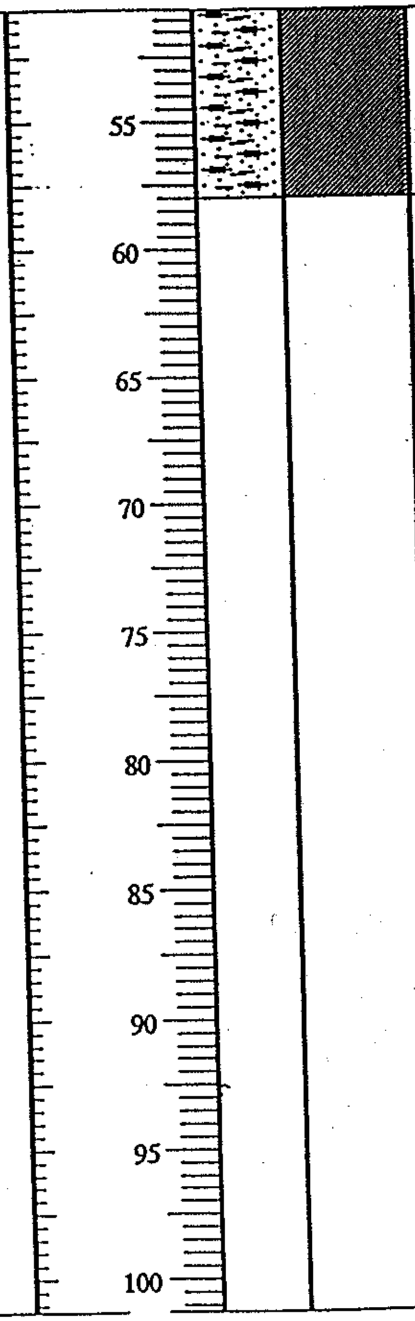
41.0 - 58.0 feet: GRAVEL AND SAND (GW)
Brown to gray, fine to coarse gravel and sand; 10% silt; 10% cobbles. Bedded, well graded, well-rounded grains, moderately dense, dry.
GLACIAL ADVANCE OUTWASH

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME	Cedar Hills Landfill: Gas Probe Installations	BORING NO.	GP-18
LOCATION		PAGE	2 OF 2
DRILLED BY	Tacoma Pump & Drill	REFERENCE ELEV.	585.00'
DRILL METHOD	Air Rotary	TOTAL DEPTH	58.00'
LOGGED BY	P. J. Rowland	DATE COMPLETED	3/28/88

GROUND WATER LEVELS | DEPTH IN FT. | SAMPLES | LITHO-LOGIC COLUMN | WELL DETAILS | LITHOLOGIC DESCRIPTION



41.0 - 58.0 feet: continued from previous page.

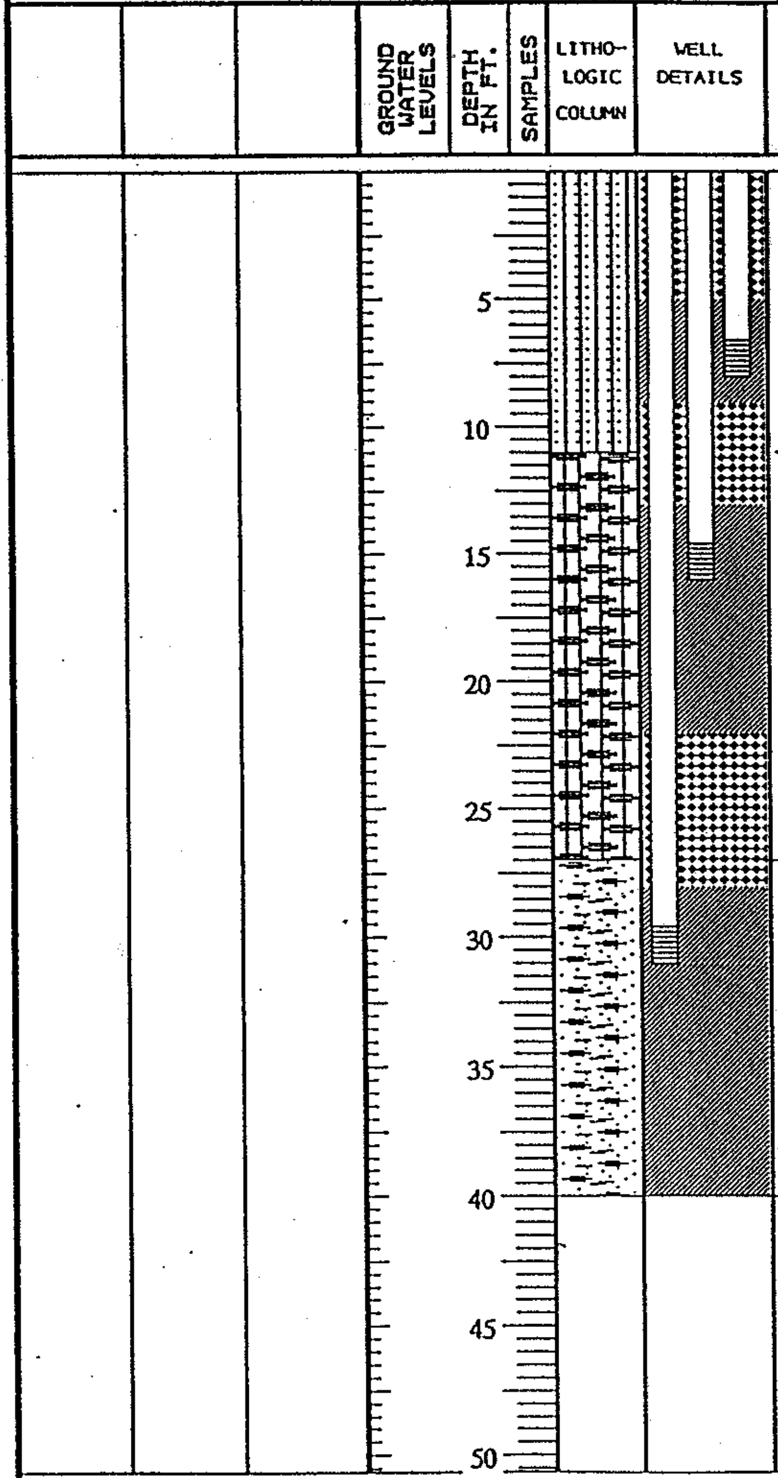
Total depth 58 feet.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-19
PAGE 1 OF 1
REFERENCE ELEV. 525.00'
TOTAL DEPTH 40.00'
DATE COMPLETED 3/26/88



LITHOLOGIC DESCRIPTION

0.0 - 11.0 feet: SILT, SAND AND GRAVEL (SM)
Brown, up to 50% fine to coarse sand and gravel; up to 50% silt; trace of clay. Moderately graded, moderately dense, well rounded grains, saturated at 8.0 feet.
WEATHERED GLACIAL TILL

11.0 - 27.0 feet: SANDY, GRAVELLY SILT (GM)
Gray, fine to coarse sand and gravel; up to 50% silt; 10% cobbles/boulders. Poorly graded, dense, rounded grains, dry ?, increase in gravel toward base.
GLACIAL TILL

27.0 - 40.0 feet: GRAVEL AND SAND (GW)
Brown, fine to coarse gravel and sand; 10%silt; Bedded, well graded, well-rounded grains, moderately dense, dry.
GLACIAL ADVANCE OUTWASH

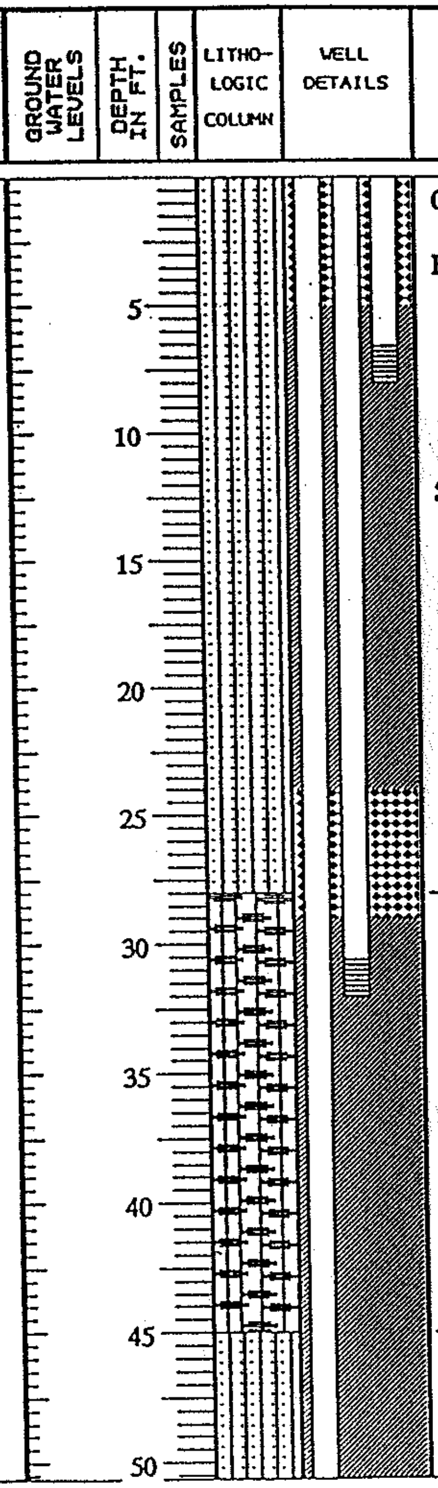
Total depth 40 feet.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-20
PAGE 1 OF 2
REFERENCE ELEV. 493.00'
TOTAL DEPTH 95.00'
DATE COMPLETED 3/29/88



LITHOLOGIC DESCRIPTION

0.0 - 28.0 feet: SILTY SAND AND GRAVEL (SM)

Brown, fine to coarse sand; medium to coarse gravel; up to 50% silt; 10% cobbles. Moderately graded, moderately dense, sub-rounded.

WEATHERED GLACIAL TILL

Slightly damp at 12 feet.

Saturated at 26 feet

28.0 - 45.0 feet: GRAVELLY SILT (GM)

Gray, fine to coarse gravels in a very fine sand/silt matrix; 10% cobbles/boulders. Poorly graded, dense, rounded gravels, saturated in places ?

GLACIAL TILL

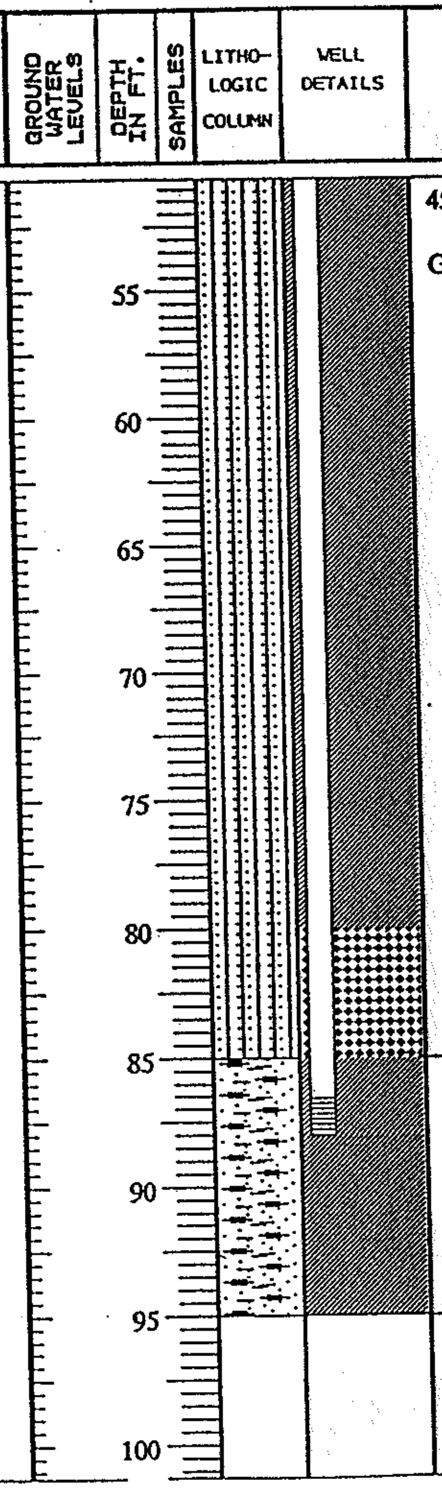
45.0 - 85.0 feet: DESCRIPTION on next page.

REMARKS

LOG OF EXPLORATORY BORING

PROJECT NAME Cedar Hills Landfill: Gas Probe Installations
LOCATION
DRILLED BY Tacoma Pump & Drill
DRILL METHOD Air Rotary
LOGGED BY P. J. Rowland

BORING NO. GP-20
PAGE 2 OF 2
REFERENCE ELEV. 493.00'
TOTAL DEPTH 95.00'
DATE COMPLETED 3/29/88



LITHOLOGIC DESCRIPTION

45.0 - 85.0 feet: SILTY SAND AND GRAVEL (SM)

Gray, fine to coarse sand and gravel; up to 50% silt in interbeds; 10% cobbles/boulders. Stratified, well graded, moderately dense, saturated in sand and gravel horizons below 70 feet.

GLACIAL DRIFT

85.0 - 95.0 feet: SANDY GRAVEL (GW)

Brown, fine to coarse sand and gravel. Bedded, well graded, sub-angular to sub-rounded grains, moderately loose, dry.

GLACIAL ADVANCE OUTWASH

Total depth 95 feet.

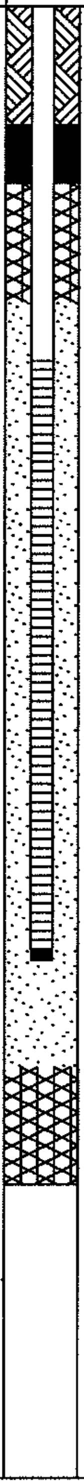
REMARKS

Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	GP-56	1 of 1

Project Name:	East Perched Zone Memorandum	Ground Surface Elev	641.07
Location:	Cedar Hills Regional Landfill, King County, Washington	Top of Casing Elev.	643.57
Driller/Method:	Boart Longyear / Rotary Sonic	Depth to Water (ft BGS)	
Sampling Method:	Continuous Core	Start/Finish Date	10/21/2009



Depth / Elevation (feet)		Borehole Completion	Sample Type/ID	Tests	PID (ppm)	Blows/ 6"	Material Type	Description	Depth (ft)
0		Above ground completion, 8" dia steel monument						**Topsoil**	
1	640	Concrete (0'-2')						**Weathered Till** Medium stiff, slightly moist, red-brown, slightly gravelly, sandy SILT (ML); iron oxide staining.	1
2	639	Bentonite grout (2'-3')						Hard, slightly moist, light brown, slightly sandy, gravelly SILT (ML).	2
3	638	Bentonite chips (3'-5')							3
4	637	1" schedule 40 PVC casing (0-6')						Becomes sandy.	4
5	636	10-20 silica sand (5'-18')							5
6	635							Dry, brown, silty, sandy GRAVEL (GM); fine to coarse sand, fine to coarse gravel.	6
7	634								7
8	633								8
9	632								9
10	631	1" Sch 40 PVC screen, 0.020" slot (6'-16')						Becomes light brown.	10
11	630							Moist, brown SILT (ML); with iron oxide staining, trace sand, trace fine gravel.	11
12	629							Dry, light brown, silty, gravelly SAND (SM).	12
13	628							Slightly moist, brown, slightly gravelly, sandy SILT (SM-ML); some dark brown and iron oxide staining.	13
14	627								14
15	626							**Till** Hard, slightly moist to moist, dark gray SILT (ML).	15
16	625	PVC end cap (16')							16
17	624								17
18	623								18
19	622	Bentonite chips (18'-20')						Becomes very moist.	19
20	621							Bottom of boring (20').	20
21	620								21
22	619								22
23	618								23
24	617								24

Sampler Type:

☐ No Recovery

▥ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level

▽ Water Level (ATD)

Logged by: JTL

Approved by: EWM

Figure No. A- 21

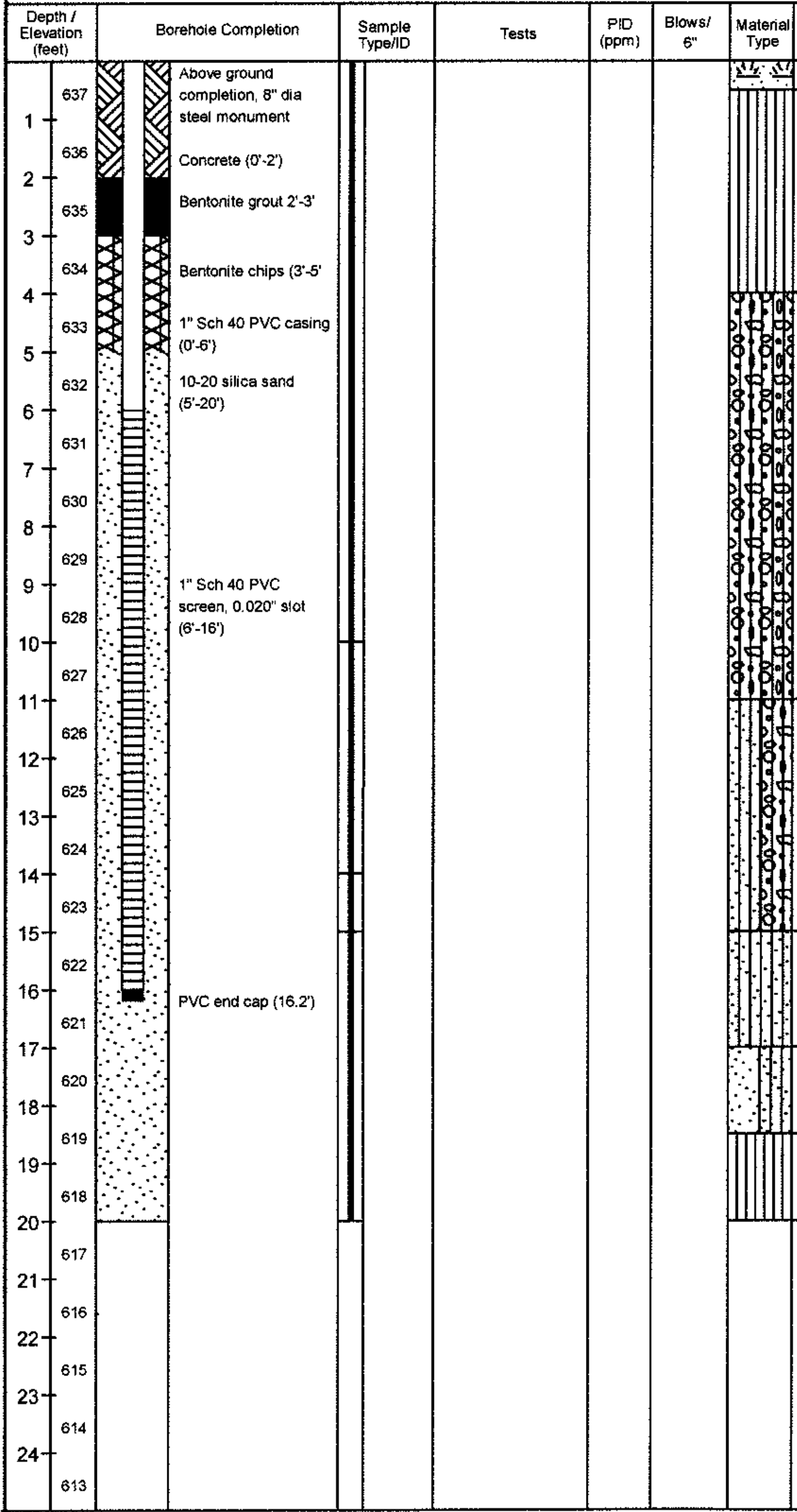
Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	GP-58	1 of 1

Project Name: East Perched Zone Memorandum
Location: Cedar Hills Regional Landfill, King County, Washington
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev 637.56
Top of Casing Elev. 639.81
Depth to Water (ft BGS)
Start/Finish Date 10/20/2009



Description

Topsoil

Fill

Slightly moist, dark brown to brown, ,slightly sandy, very gravelly SILT (ML); mostly fine gravel, fine to coarse sand.

Weathered Till

Slightly moist to moist, gray to dark gray, sandy, silty GRAVEL (GM); fine to coarse sand, fine to coarse gravel.

Becomes moist and dark gray (8').

Dark brown silt, scattered roots and organics (9-10').

Boulder (10-11').

Slightly moist, olive gray to brown, silty, sandy GRAVEL to very gravelly SAND (GM-SM); fine to coarse sand, fine gravel to cobbles.

Boulder (14-15').

Till

Moist, olive gray, silty, gravelly SAND (SM).

Moist to wet, olive gray to brown, slightly silty, gravelly SAND (SP-SM) mostly fine sand, some coarse sand.

Wet and silty.

Moist, brown, slightly sandy SILT (ML); trace gravel, mostly fine sand.

Bottom of boring (20').

Depth (ft): 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Sampler Type:
▯ No Recovery
▥ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

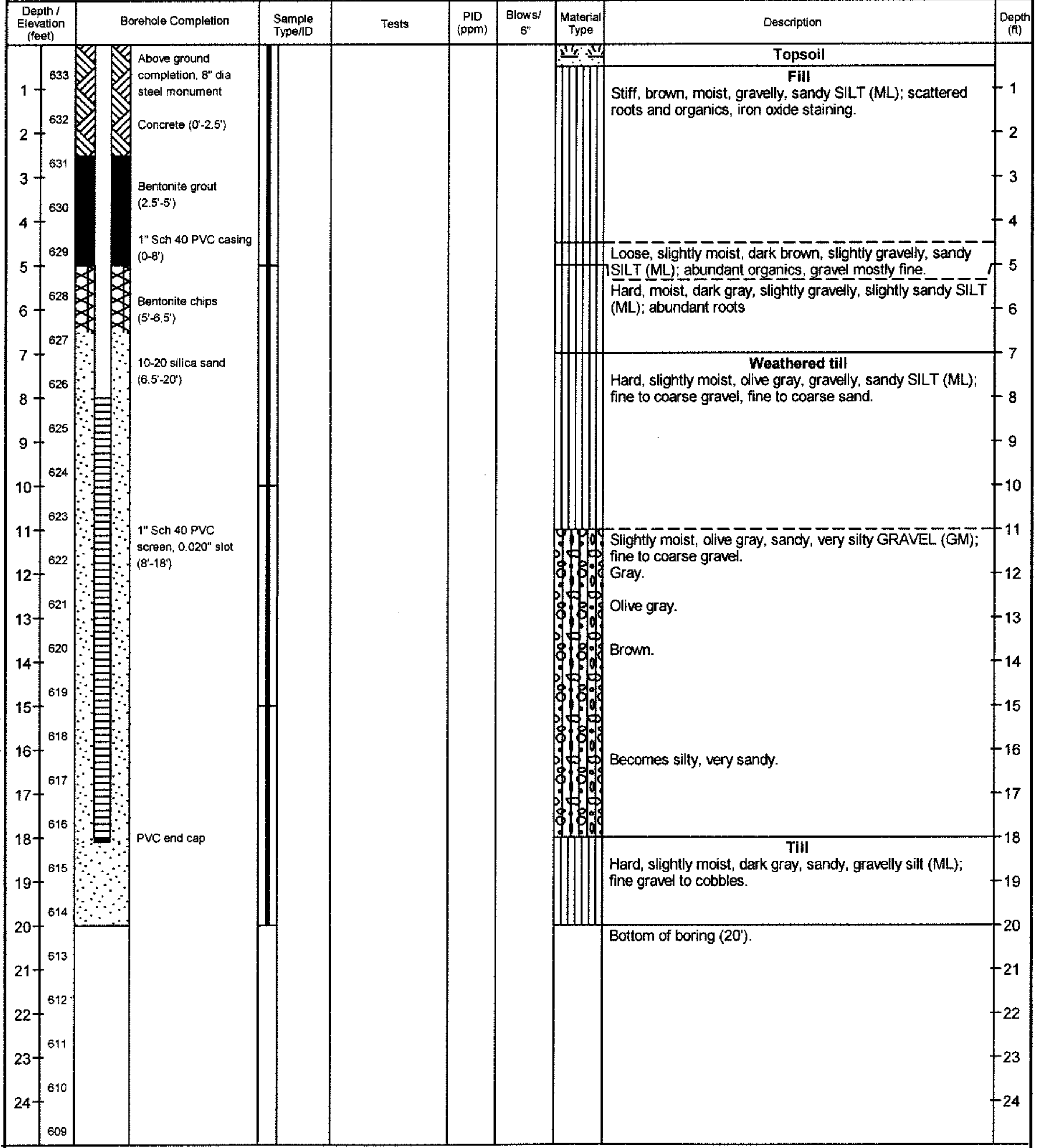
Logged by: JTL
Approved by: EWM
Figure No. A- 23

Aspectconsulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	GP-60	1 of 1

Project Name:	East Perched Zone Memorandum	Ground Surface Elev	633.68
Location:	Cedar Hills Regional Landfill, King County, Washington	Top of Casing Elev.	635.84
Driller/Method:	Boart Longyear / Rotary Sonic	Depth to Water (ft BGS)	
Sampling Method:	Continuous Core	Start/Finish Date	10/23/2009



Topsoil

Fill

Stiff, brown, moist, gravelly, sandy SILT (ML); scattered roots and organics, iron oxide staining.

Loose, slightly moist, dark brown, slightly gravelly, sandy SILT (ML); abundant organics, gravel mostly fine.

Hard, moist, dark gray, slightly gravelly, slightly sandy SILT (ML); abundant roots

Weathered till

Hard, slightly moist, olive gray, gravelly, sandy SILT (ML); fine to coarse gravel, fine to coarse sand.

Slightly moist, olive gray, sandy, very silty GRAVEL (GM); fine to coarse gravel.

Gray.

Olive gray.

Brown.

Becomes silty, very sandy.

Till

Hard, slightly moist, dark gray, sandy, gravelly silt (ML); fine gravel to cobbles.

Bottom of boring (20').

Sampler Type:

▯ No Recovery

▮ Continuous Core

PID - Photoionization Detector (Headspace Measurement)

▼ Static Water Level

▽ Water Level (ATD)

Logged by: JTL

Approved by: EWM

Figure No. A- 25

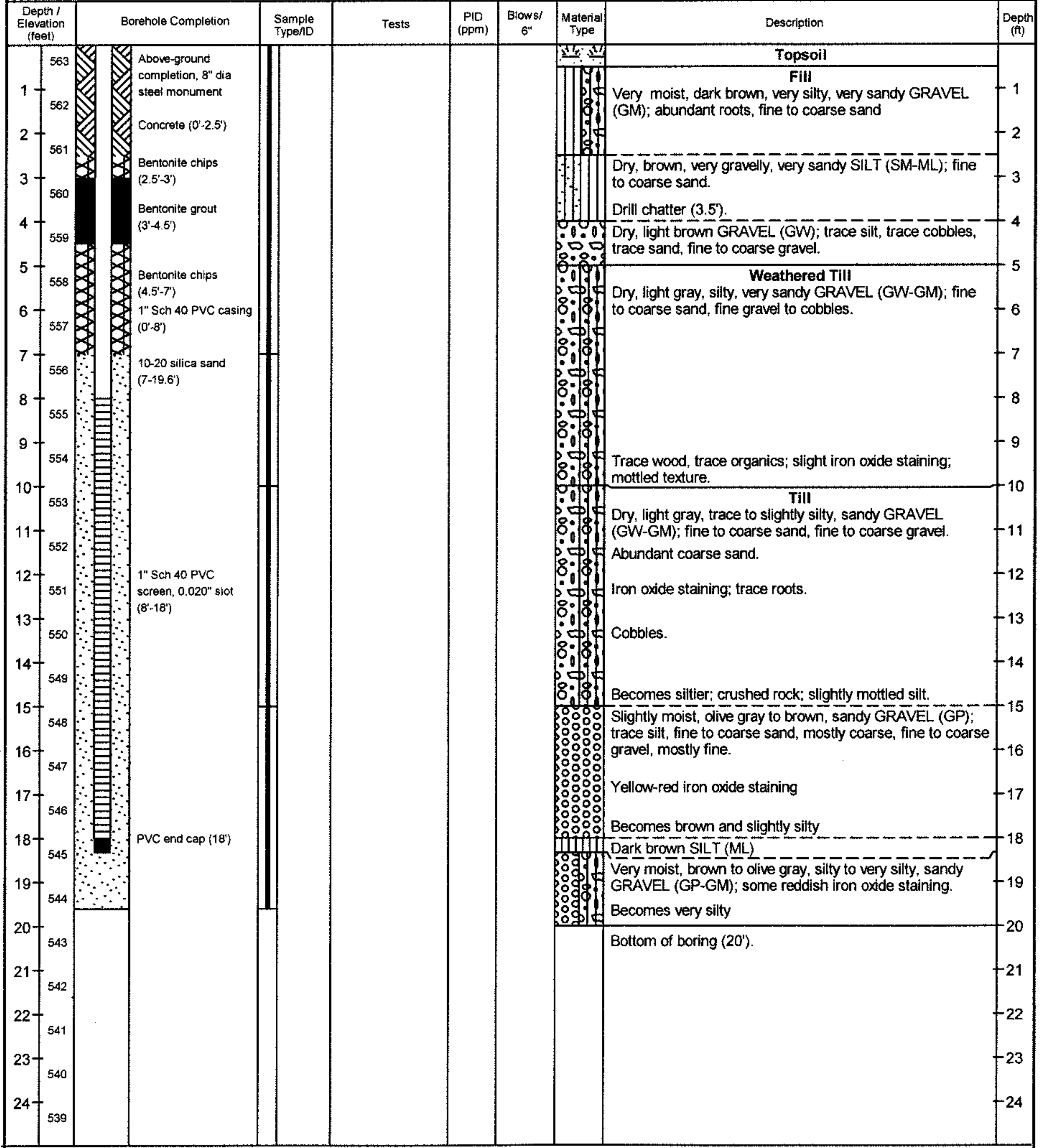
Aspect consulting
earth + water

Monitoring Well Construction Log

Project Number	Well Number	Sheet
040122	GP-62	1 of 1

Project Name: East Perched Zone Memorandum
Location: Cedar Hills Regional Landfill, King County, Washington
Driller/Method: Boart Longyear / Rotary Sonic
Sampling Method: Continuous Core

Ground Surface Elev 563.35
Top of Casing Elev. 565.28
Depth to Water (ft BGS)
Start/Finish Date 10/21/2009



Above-ground completion, 8" dia steel monument
Concrete (0'-2.5')
Bentonite chips (2.5'-3')
Bentonite grout (3'-4.5')
Bentonite chips (4.5'-7')
1" Sch 40 PVC casing (0'-8')
10-20 silica sand (7-19.6')
1" Sch 40 PVC screen, 0.020" slot (8'-18')
PVC end cap (18')

Topsoil

Fill

Very moist, dark brown, very silty, very sandy GRAVEL (GM); abundant roots, fine to coarse sand

Dry, brown, very gravelly, very sandy SILT (SM-ML); fine to coarse sand.

Drill chatter (3.5').

Dry, light brown GRAVEL (GW); trace silt, trace cobbles, trace sand, fine to coarse gravel.

Weathered Till

Dry, light gray, silty, very sandy GRAVEL (GW-GM); fine to coarse sand, fine gravel to cobbles.

Trace wood, trace organics; slight iron oxide staining; mottled texture.

Till

Dry, light gray, trace to slightly silty, sandy GRAVEL (GW-GM); fine to coarse sand, fine to coarse gravel.

Abundant coarse sand.

Iron oxide staining; trace roots.

Cobbles.

Becomes siltier; crushed rock; slightly mottled silt.

Slightly moist, olive gray to brown, sandy GRAVEL (GP); trace silt, fine to coarse sand, mostly coarse, fine to coarse gravel, mostly fine.

Yellow-red iron oxide staining

Becomes brown and slightly silty

Dark brown SILT (ML)

Very moist, brown to olive gray, silty to very silty, sandy GRAVEL (GP-GM); some reddish iron oxide staining.

Becomes very silty

Bottom of boring (20').

Sampler Type:
☐ No Recovery
▥ Continuous Core

PID - Photoionization Detector (Headspace Measurement)
▼ Static Water Level
▽ Water Level (ATD)

Logged by: JTL
Approved by: EWM
Figure No. A- 27

MONITORING WELL CEDAR HILLS PERCHING INVESTIGATION -REVISED DENSITY.GPJ April 19, 2010

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT Cedar Hills - A.T.C. Gas Probes

Page 1 **of** 1

Location South of South dormitory

Boring No. GP-ATC-5

Surface Elevation

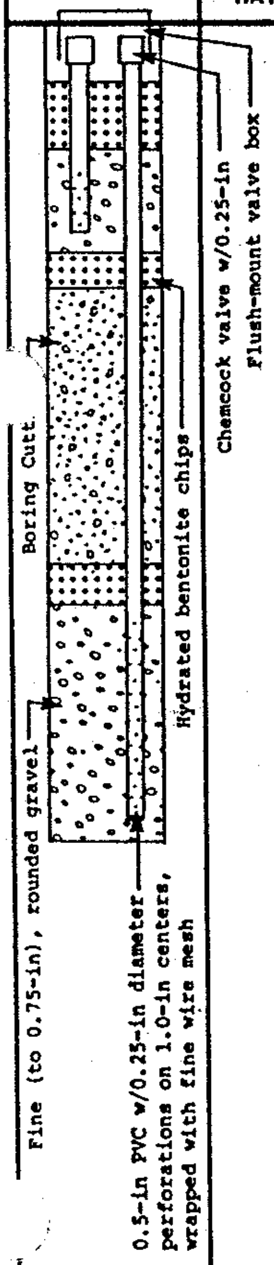
Drilling Method Air Rotary

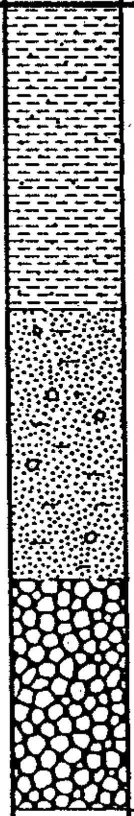
Total Depth 21 feet

Drilled By Hayes Well Drilling

Date Completed 10/7/86

Logged By D.E. Mills





WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
							0'-8' Fine sandy SILT (ML), brown, moist. Variable contents of fine sand; trace coarse sand. Trace fine gravel (to 0.75 in.), subangular.	
		5	1	Grab				
							8'-15' Gravelly silty fine SAND (SM), brown, moist. Gravel to 0.75in., rounded Trace medium to coarse sand.	
		10	2	Grab				
		15	3	Grab			15'-21' Silty fine SAND (SM), brown to grey-brown at 21', moist. Trace fine, rounded gravel. Trace coarse sand. (WEATHERED TILL)	
		20	4	Grab				
							Bottom at 21 feet	
		25						

Sweet, Edwards & Associates, Inc.

BORING LOG

PROJECT Cedar Hills - A.T.C. Gas Probes

Page 1 **of** 1

Location North of Administration Building

Boring No. GP-ATC-7

Surface Elevation

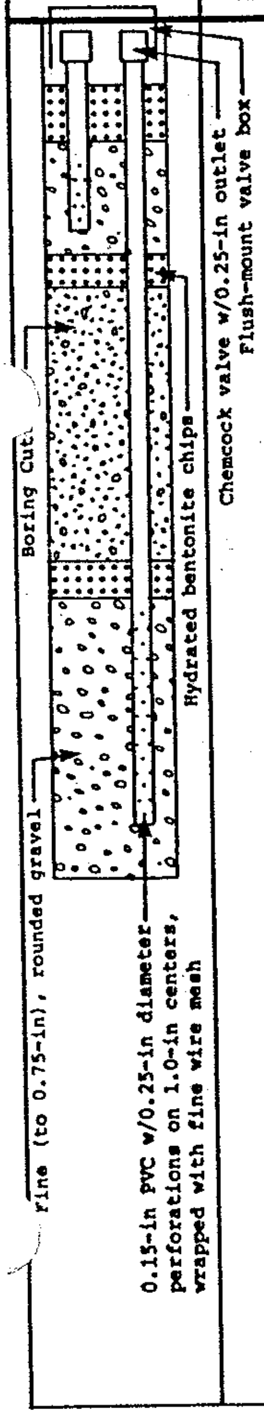
Drilling Method Air Rotary

Total Depth 22 feet

Drilled By Hayes Well Drilling

Date Completed 10/7/86

Logged By D.E. Mills

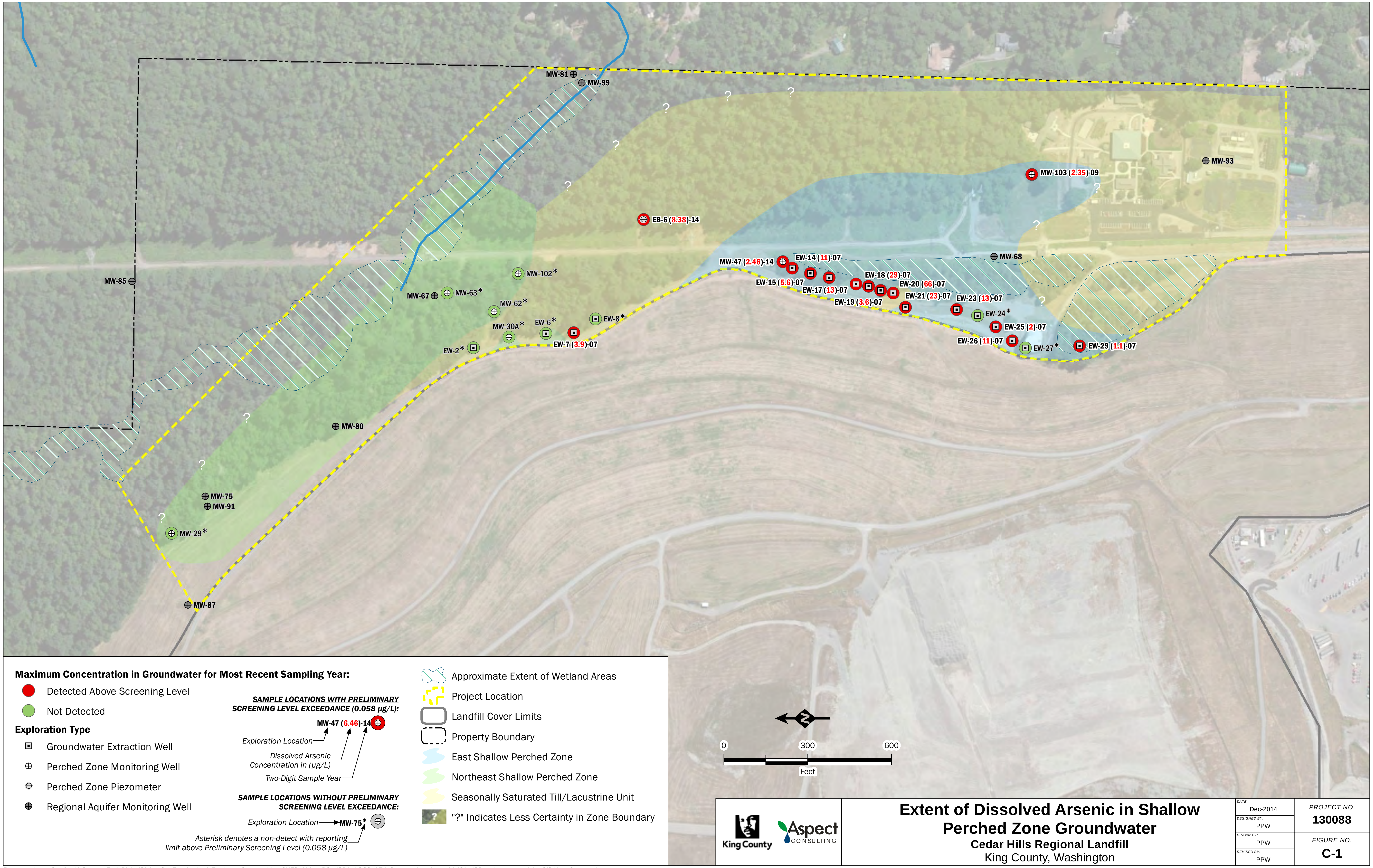
WELL DETAILS	PENETRATION TIME/ RATE	DEPTH (FEET)	SAMPLE NO.	SAMPLE TYPE	PERMEABILITY TESTING	SYMBOL	LITHOLOGIC DESCRIPTION	WATER QUALITY
		5					0-10' Silty fine to medium SAND (SM), orange-brown, moist. Trace fine gravel (to 0.5 in. diameter), subrounded.	
		10					10-13' Slightly silty gravelly fine SAND (SP-SM) grey-brown, moist. Gravel fine to medium rounded. (WEATHERED TILL).	
		15					13-19' Slightly silty gravelly fine SAND (SP-SM) grey, moist. Gravel fine to medium (to 1-in.), rounded.	
		20					19-22' Fine sandy SILT (ML) blue-grey, wet. Trace fine gravel. (UNWEATHERED TILL)	
		25					Bottom at 22 feet.	

APPENDIX B

Site Analytical Data (as CD)

APPENDIX C

Individual Constituent Extent Maps



King County
Aspect CONSULTING

Extent of Dissolved Arsenic in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

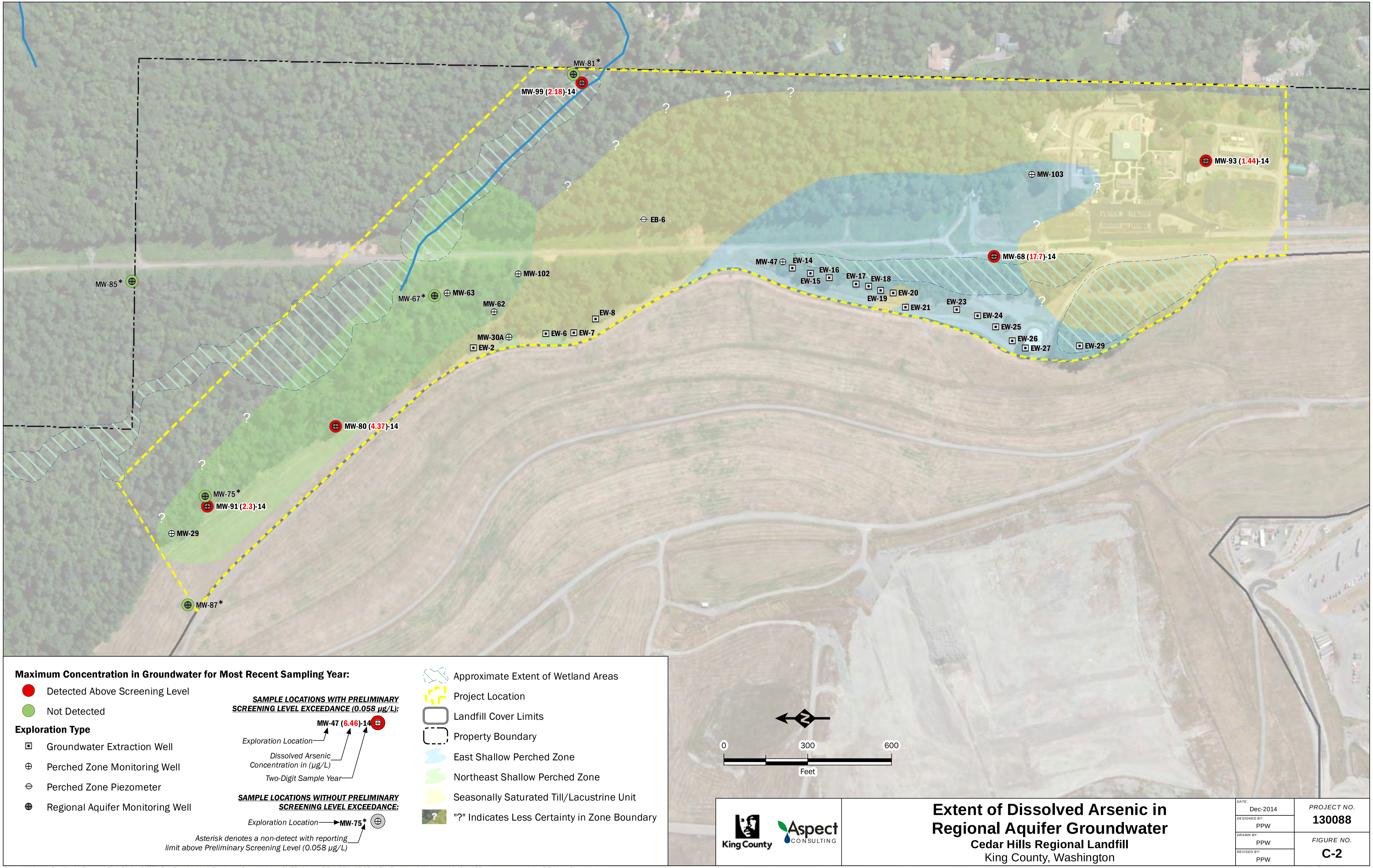
King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-1

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



King County

Aspect CONSULTING

Extent of Dissolved Arsenic in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

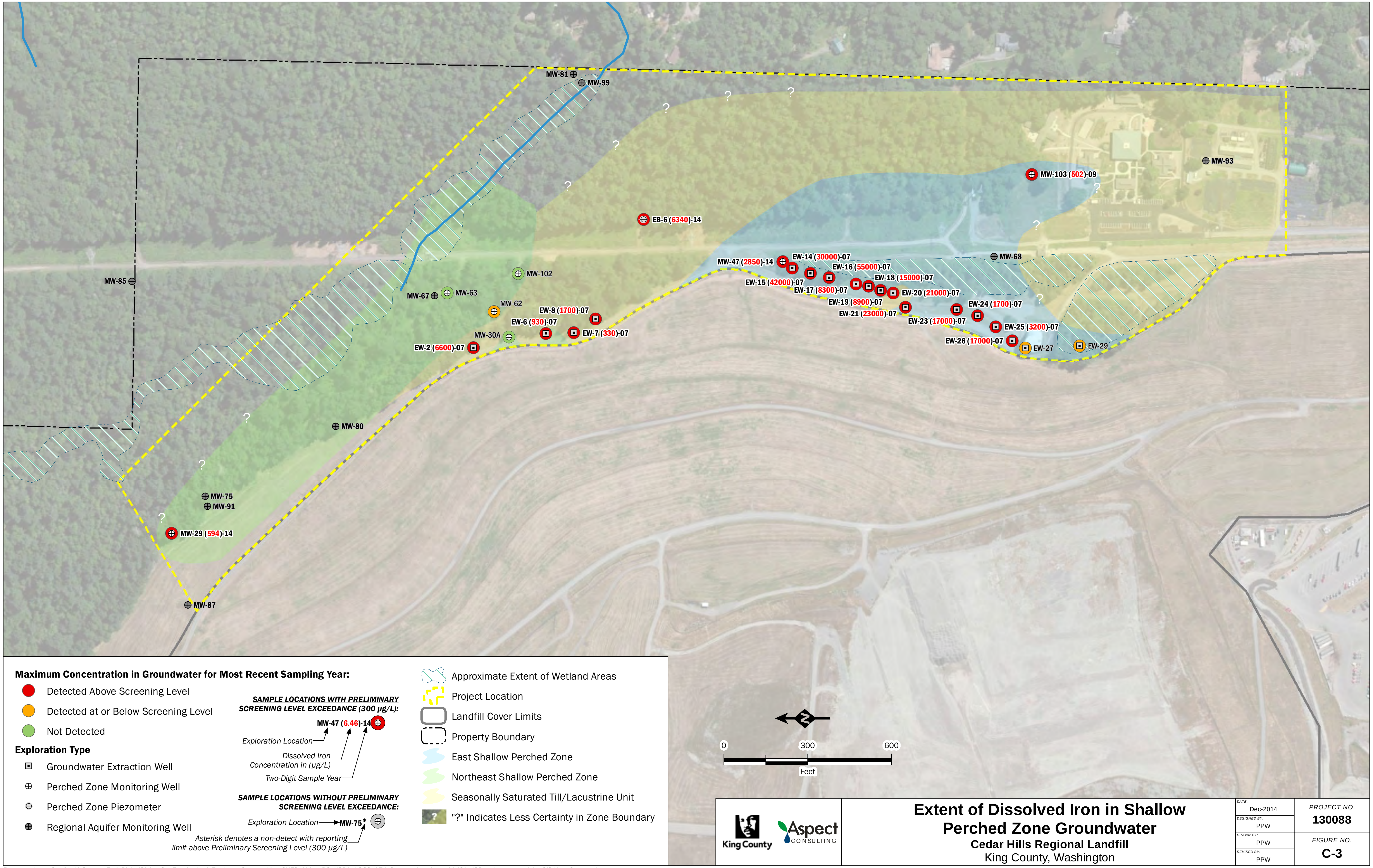
King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-2

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County

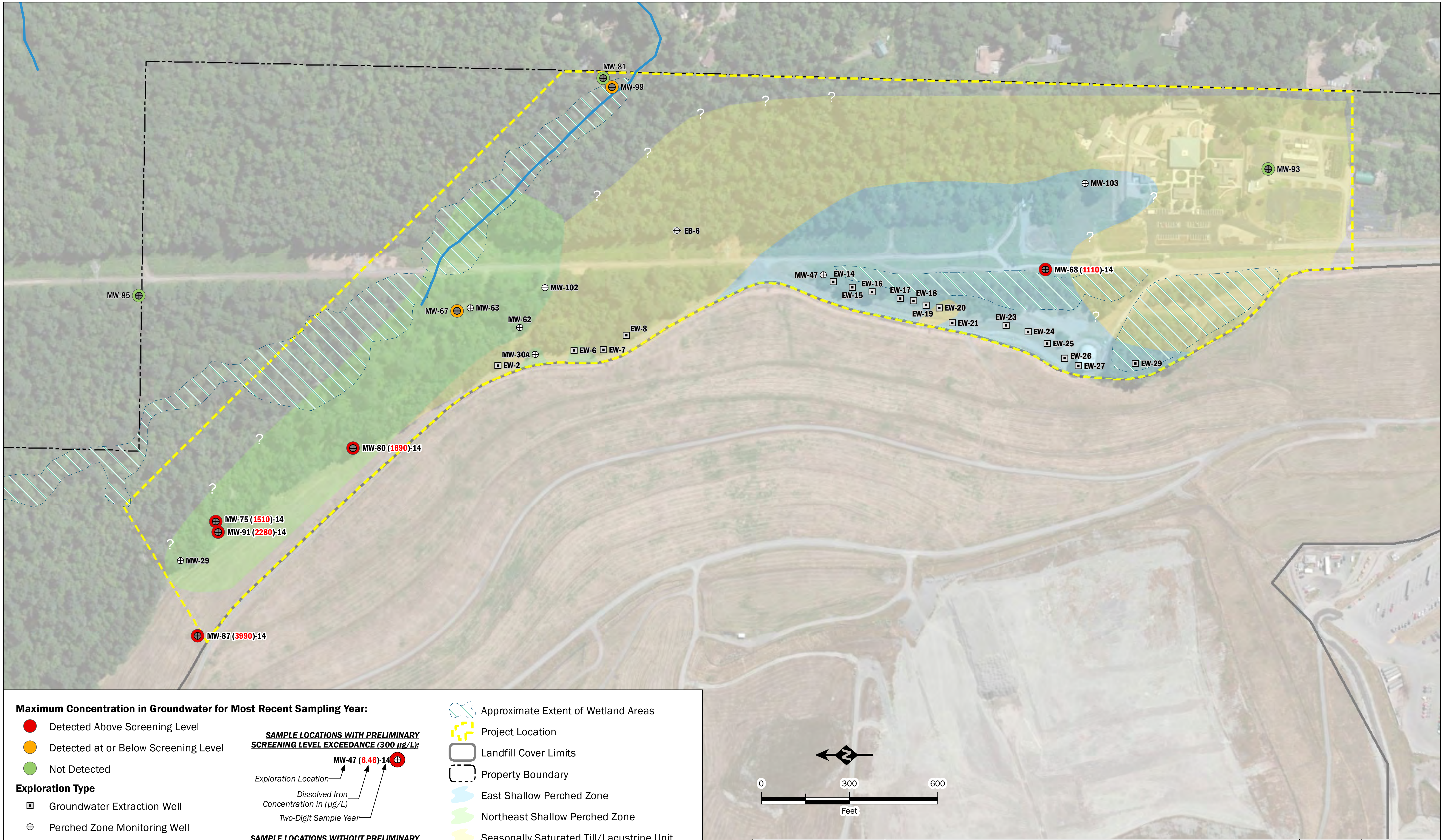
Aspect CONSULTING

Extent of Dissolved Iron in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-3



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- ● Detected Above Screening Level
- ● Detected at or Below Screening Level
- ● Not Detected

Exploration Type

- ⊡ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (300 µg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

Dissolved Iron Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → MW-75* ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (300 µg/L)

- ▨ Approximate Extent of Wetland Areas
- ⬚ Project Location
- ▢ Landfill Cover Limits
- ⬚ Property Boundary
- 🟦 East Shallow Perched Zone
- 🟩 Northeast Shallow Perched Zone
- 🟨 Seasonally Saturated Till/Lacustrine Unit
- ? "?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

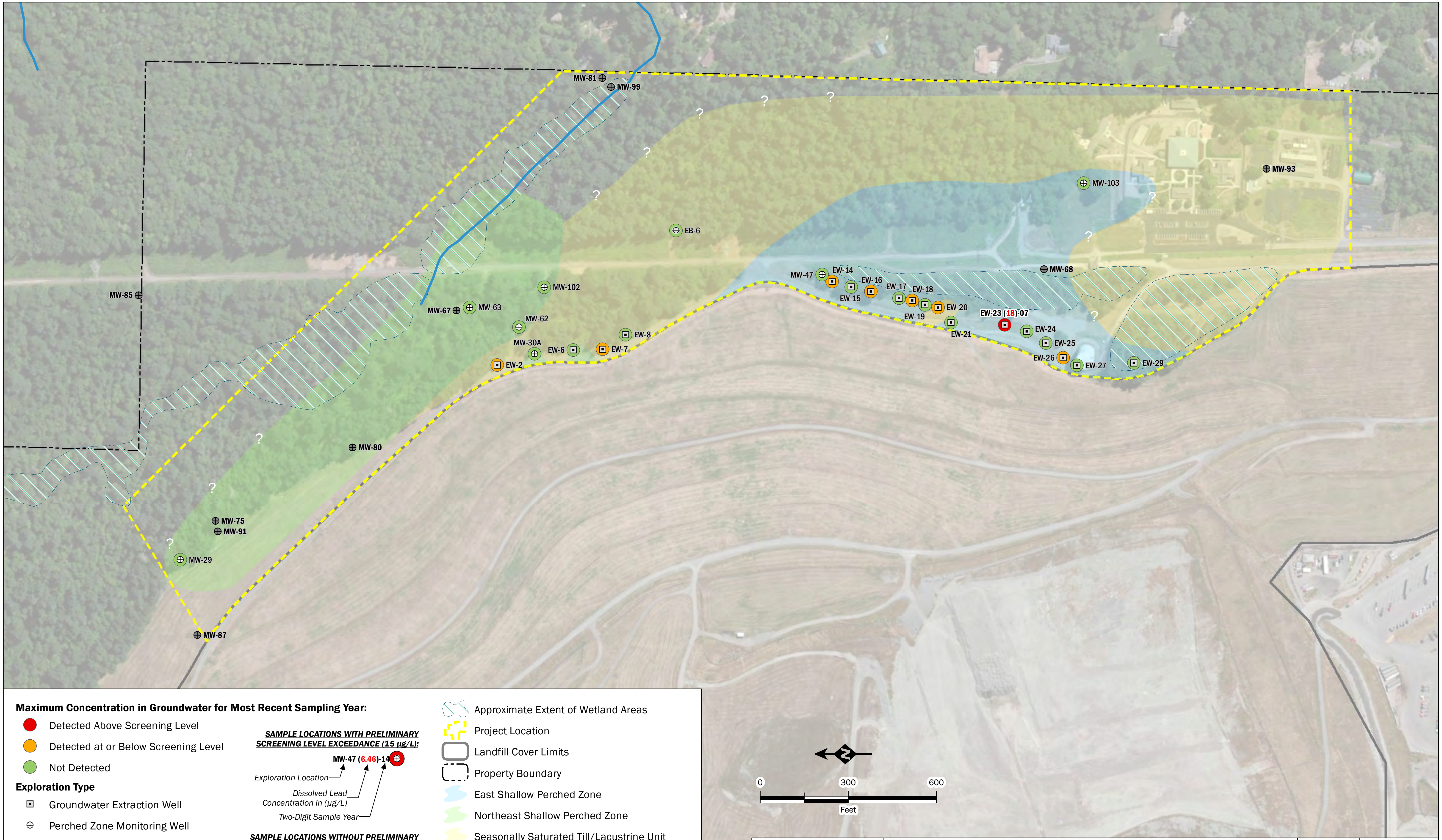
Extent of Dissolved Iron in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-4

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🔴 Detected Above Screening Level
- 🟠 Detected at or Below Screening Level
- 🟢 Not Detected

Exploration Type

- ▣ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (15 µg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

Dissolved Lead Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → **MW-75*** ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (15 µg/L)

- Approximate Extent of Wetland Areas
- Project Location
- Landfill Cover Limits
- Property Boundary
- East Shallow Perched Zone
- Northeast Shallow Perched Zone
- Seasonally Saturated Till/Lacustrine Unit
- "?" Indicates Less Certainty in Zone Boundary

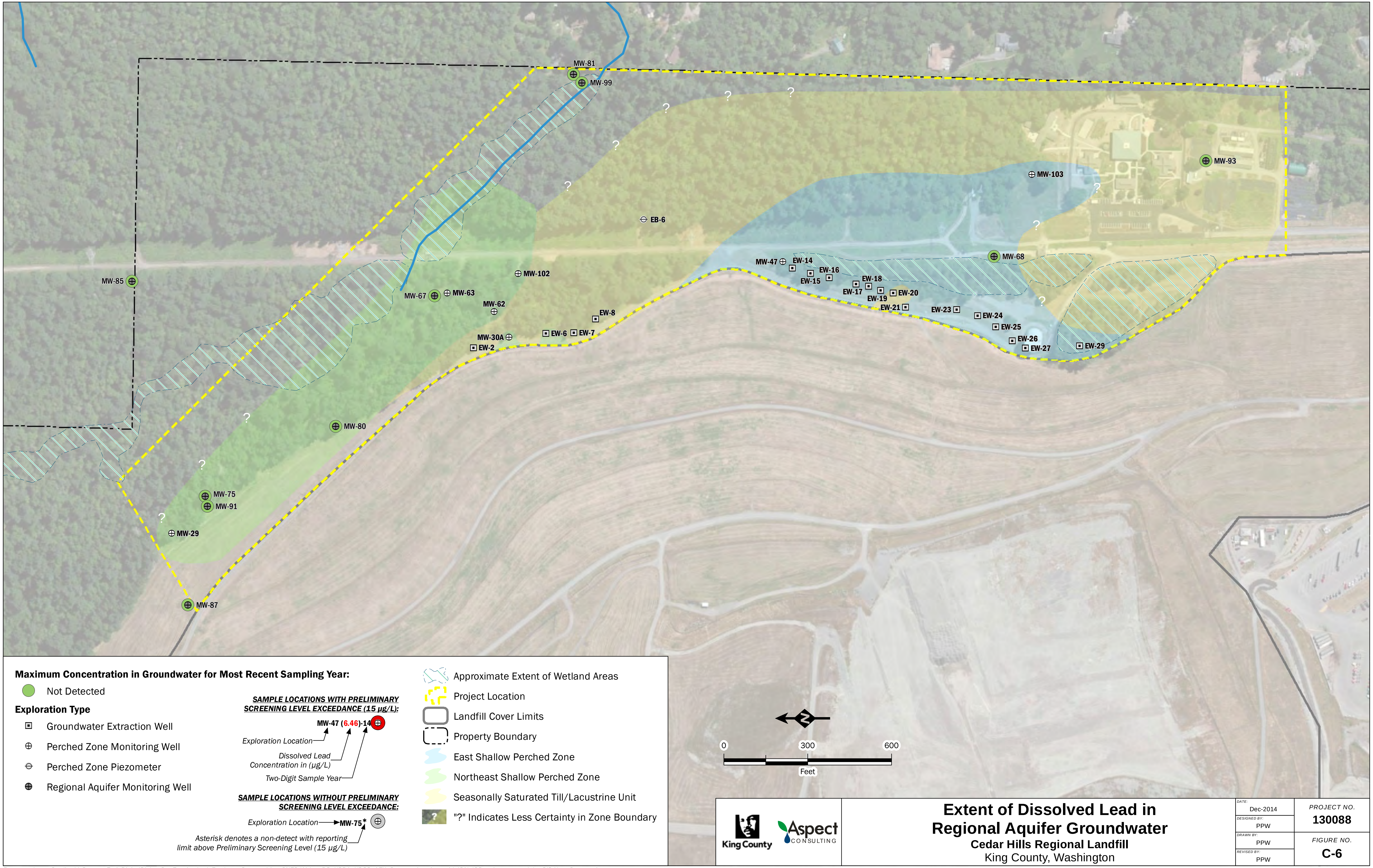
Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County
Aspect CONSULTING

Extent of Dissolved Lead in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill
King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-5



Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

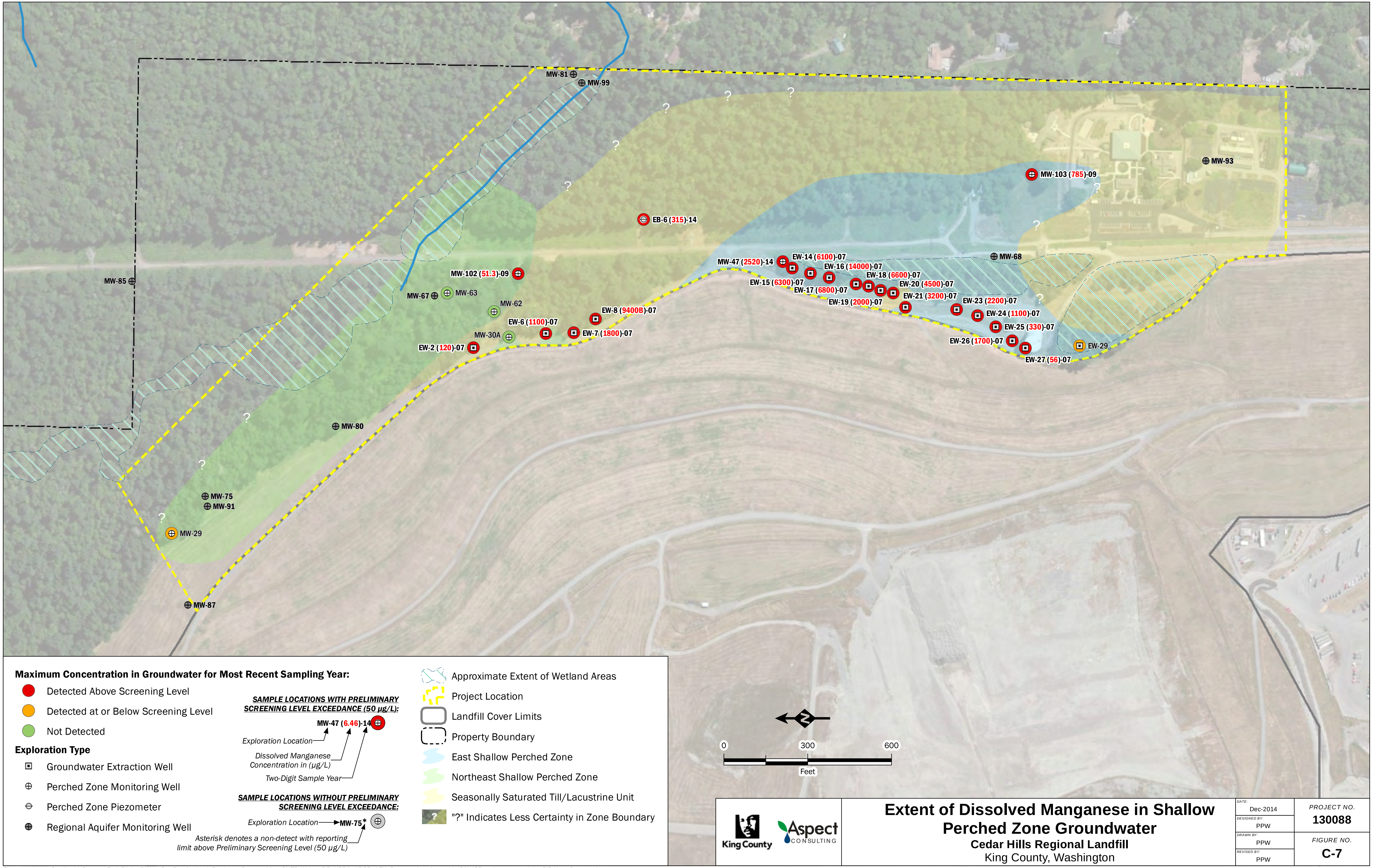
King County
Aspect CONSULTING

Extent of Dissolved Lead in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-6



Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County

Aspect CONSULTING

Extent of Dissolved Manganese in Shallow Perched Zone Groundwater

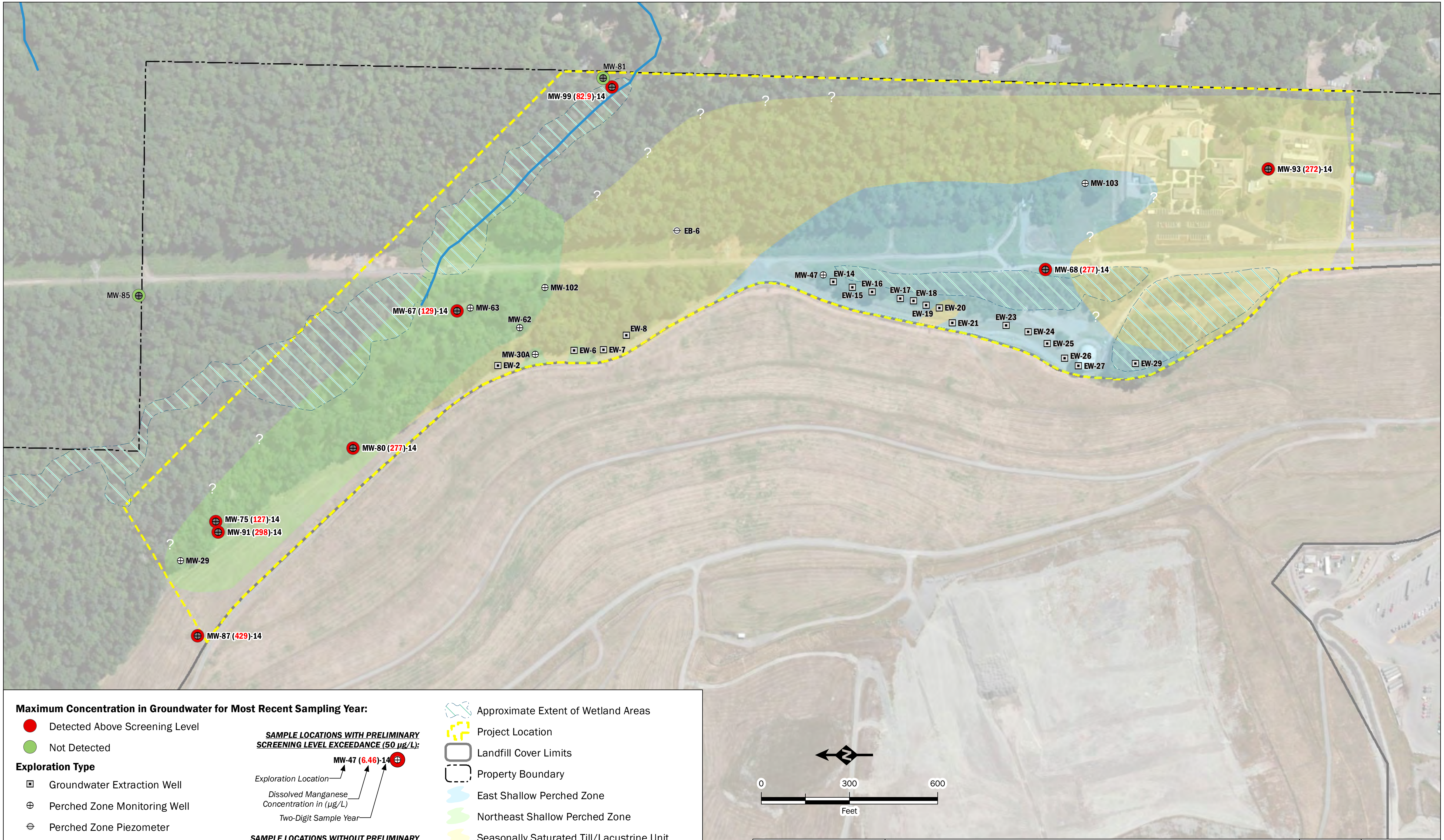
Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-7



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🔴 Detected Above Screening Level
- 🟢 Not Detected

Exploration Type

- ▣ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (50 μg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

Dissolved Manganese Concentration in (μg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → MW-75* ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (50 μg/L)

- ▨ Approximate Extent of Wetland Areas
- ▢ Project Location
- ▢ Landfill Cover Limits
- ▢ Property Boundary
- ▢ East Shallow Perched Zone
- ▢ Northeast Shallow Perched Zone
- ▢ Seasonally Saturated Till/Lacustrine Unit
- ? "?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

Extent of Dissolved Manganese in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

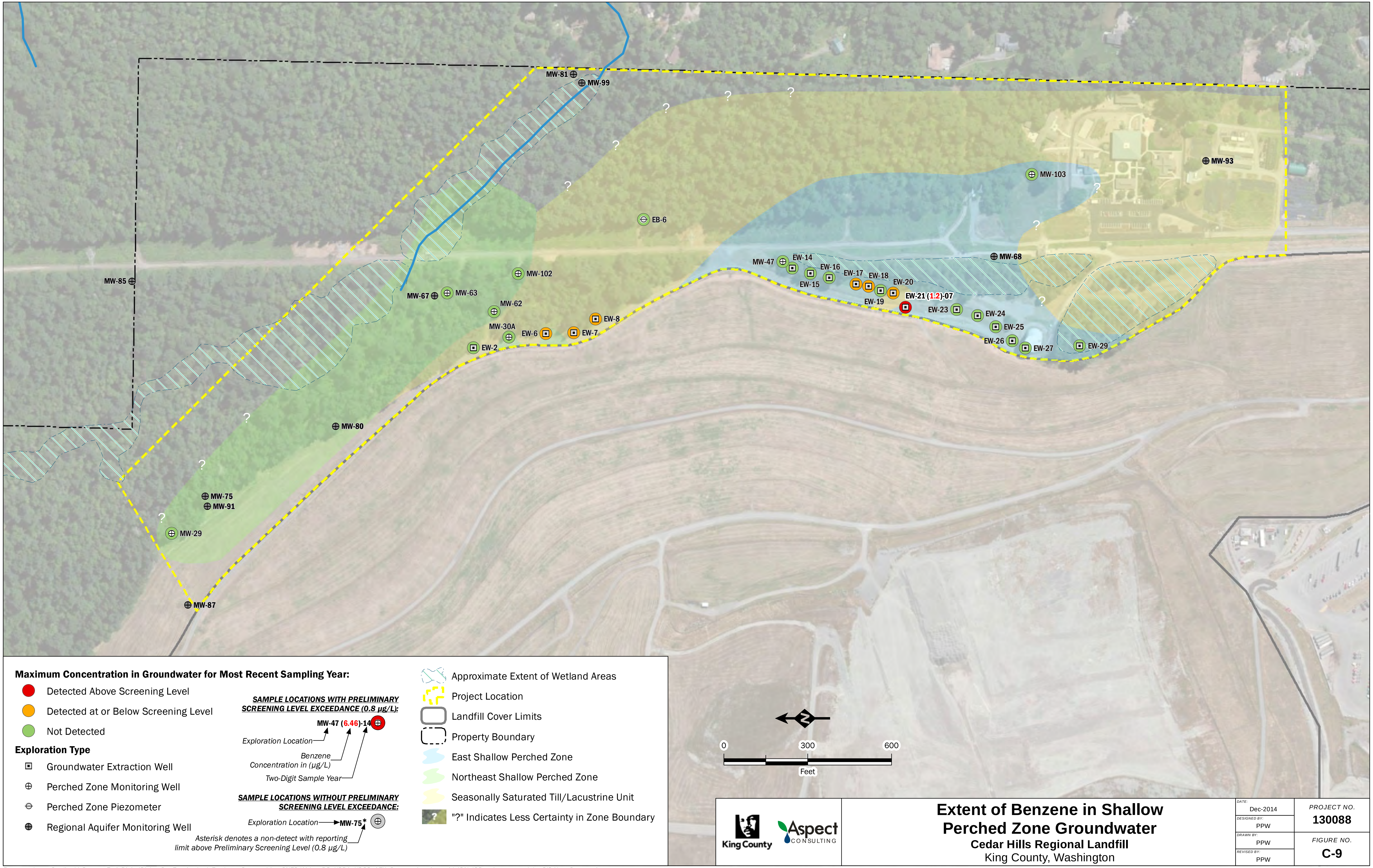
King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-8

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



King County
Aspect CONSULTING

Extent of Benzene in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

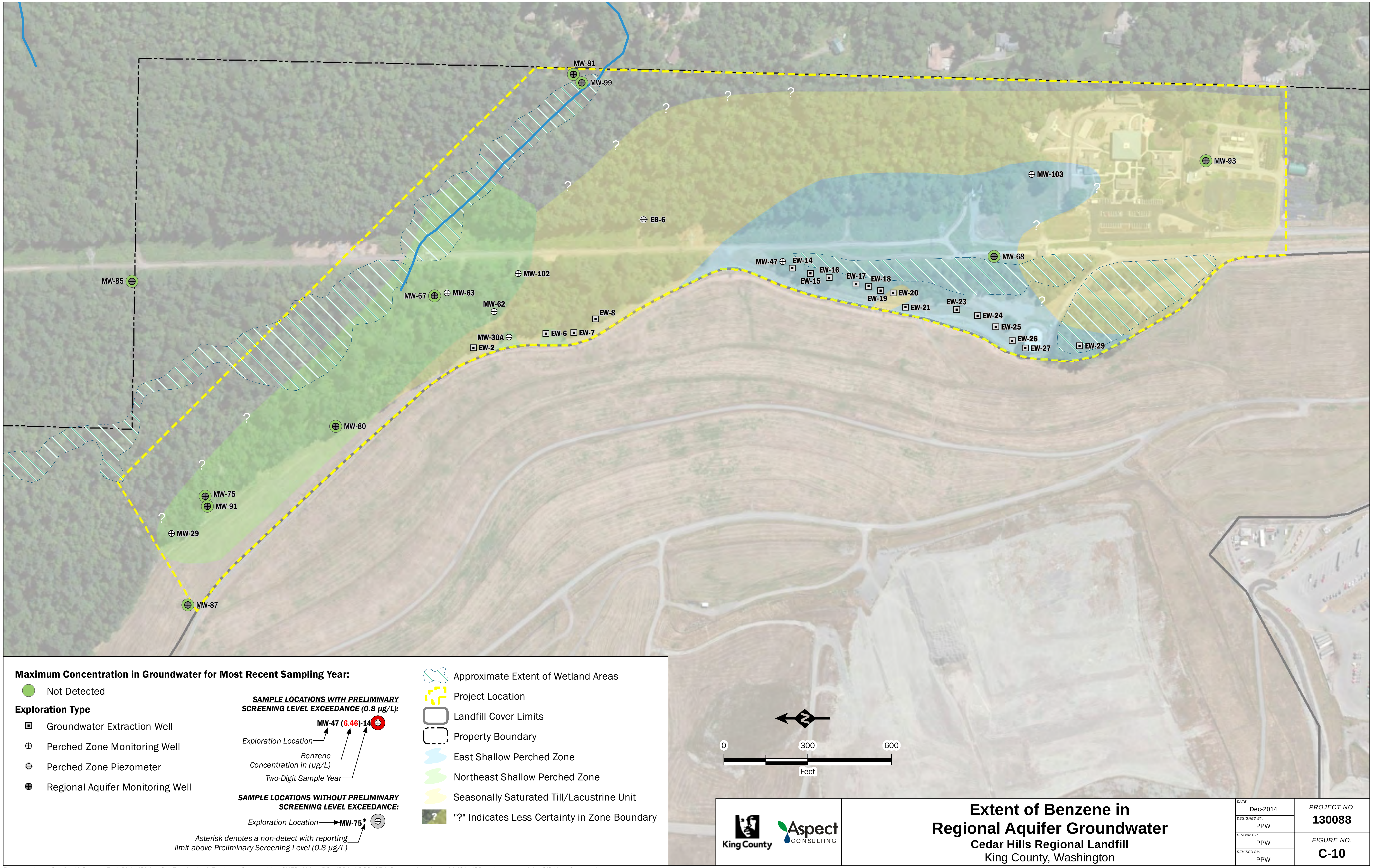
King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-9

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County

Aspect CONSULTING

Extent of Benzene in Regional Aquifer Groundwater

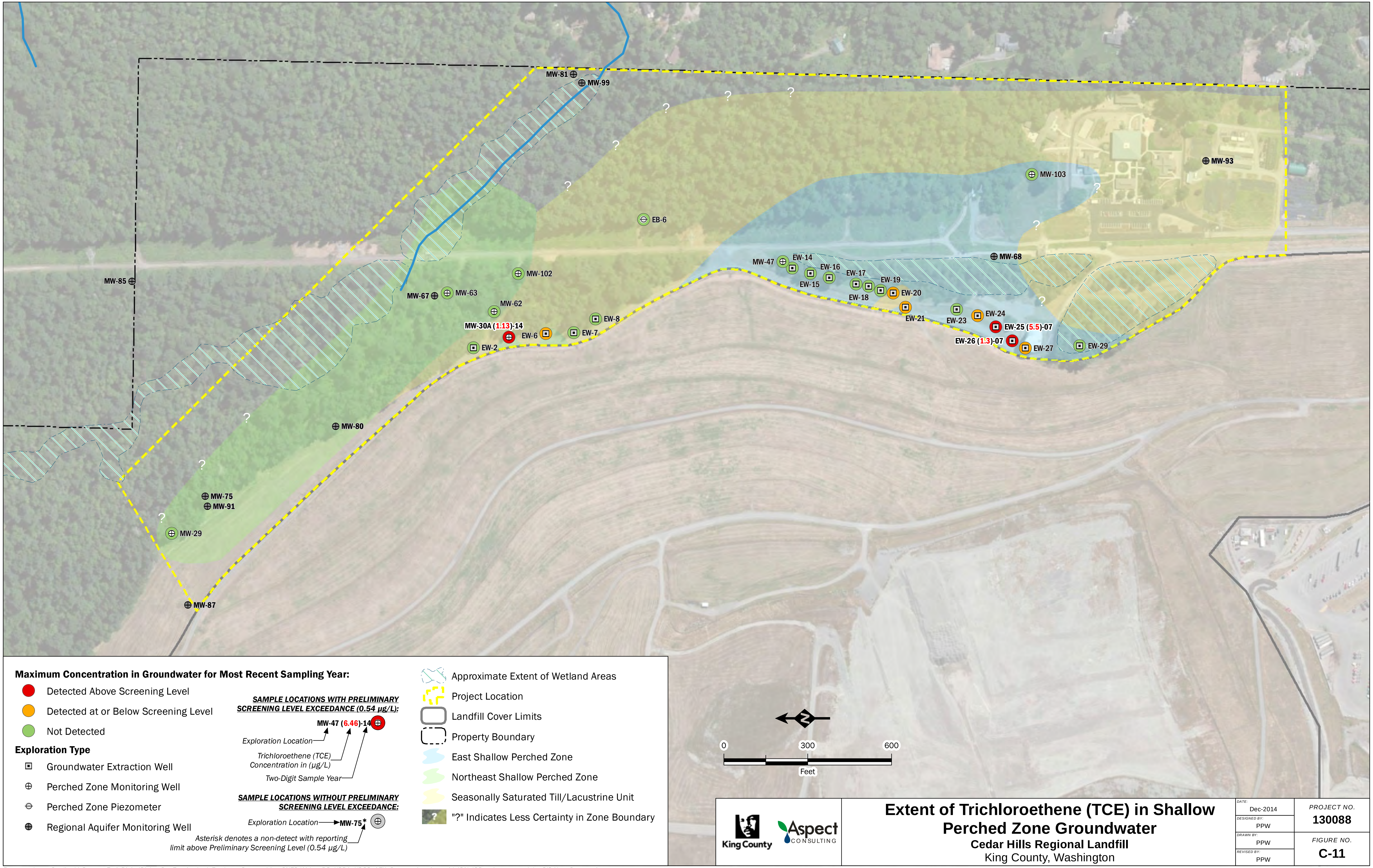
Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-10



King County

Aspect CONSULTING

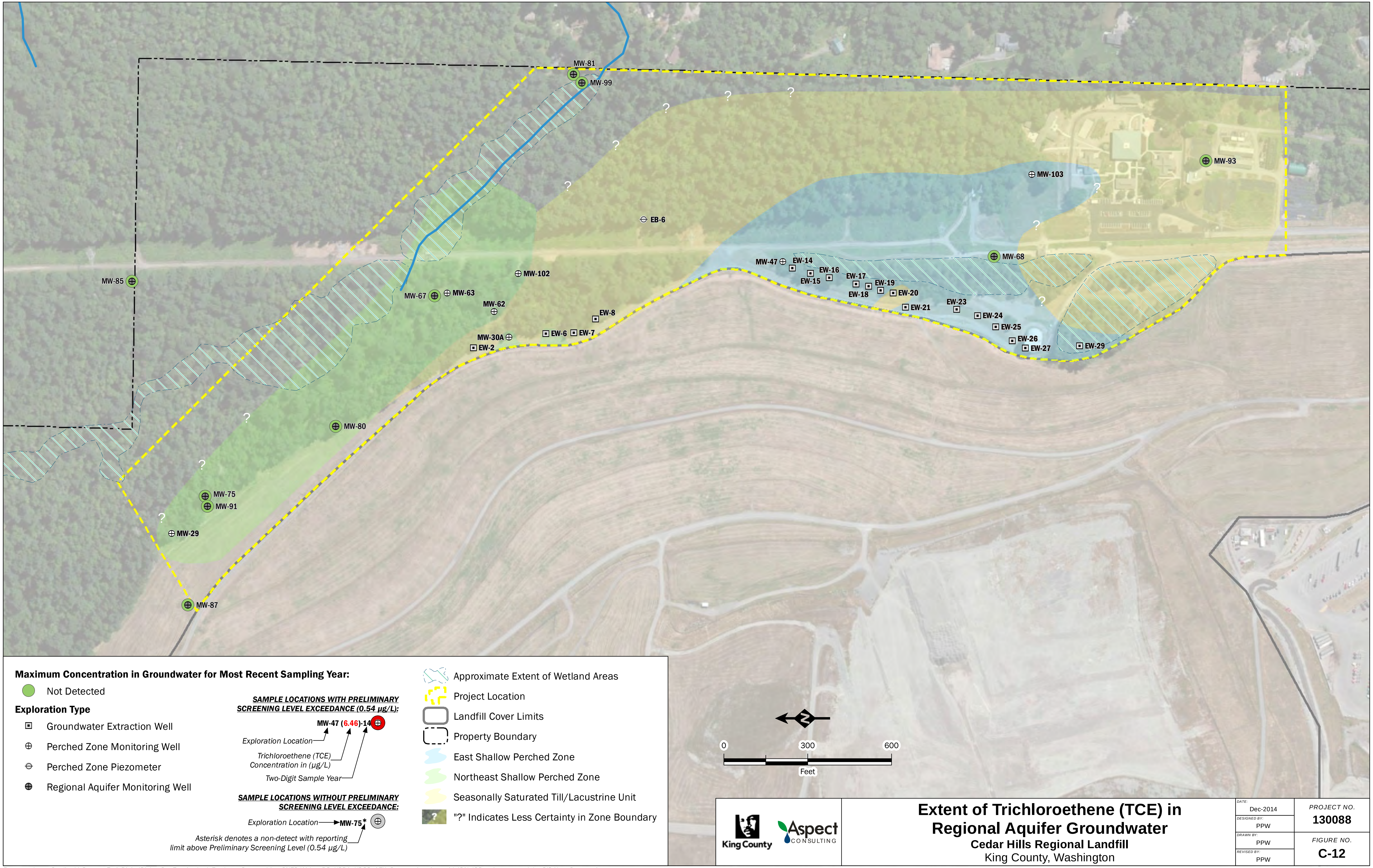
Extent of Trichloroethene (TCE) in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-11

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🟢 Not Detected

Exploration Type

- ⊡ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (0.54 µg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

Trichloroethene (TCE) Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → MW-75* ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (0.54 µg/L)

- ▨ Approximate Extent of Wetland Areas
- ⬚ Project Location
- ▢ Landfill Cover Limits
- ⬚ Property Boundary
- East Shallow Perched Zone
- Northeast Shallow Perched Zone
- Seasonally Saturated Till/Lacustrine Unit
- ? "?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

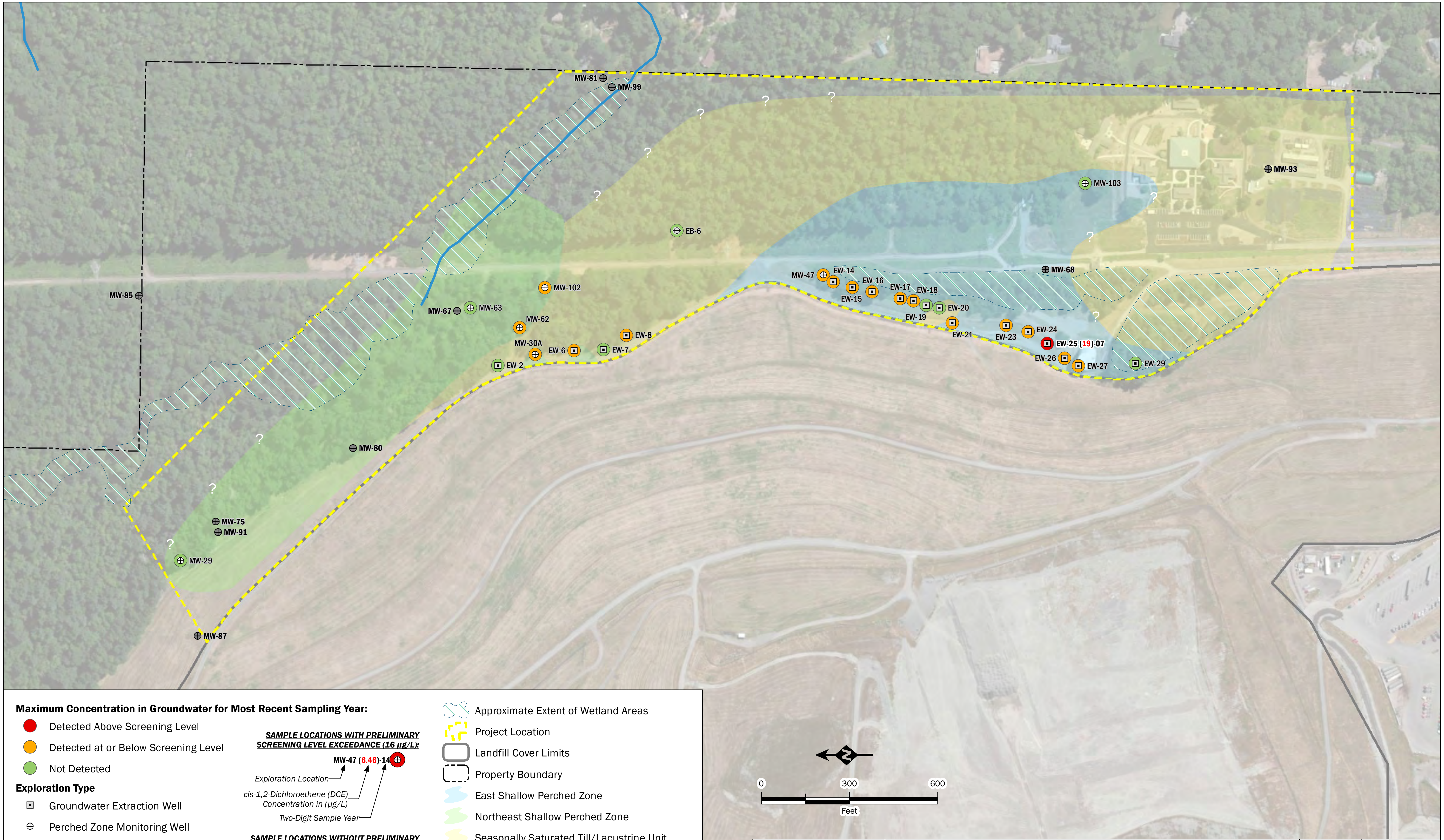
Extent of Trichloroethene (TCE) in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-12

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🟥 Detected Above Screening Level
- 🟧 Detected at or Below Screening Level
- 🟩 Not Detected

Exploration Type

- ▣ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (16 µg/L):

MW-47 (6.46)-14

Exploration Location

cis-1,2-Dichloroethene (DCE) Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → **MW-75***

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (16 µg/L)

- Approximate Extent of Wetland Areas
- Project Location
- Landfill Cover Limits
- Property Boundary
- East Shallow Perched Zone
- Northeast Shallow Perched Zone
- Seasonally Saturated Till/Lacustrine Unit
- "?" Indicates Less Certainty in Zone Boundary

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County

Aspect CONSULTING

Extent of cis-1,2-Dichloroethene (DCE) in Shallow Perched Zone Groundwater

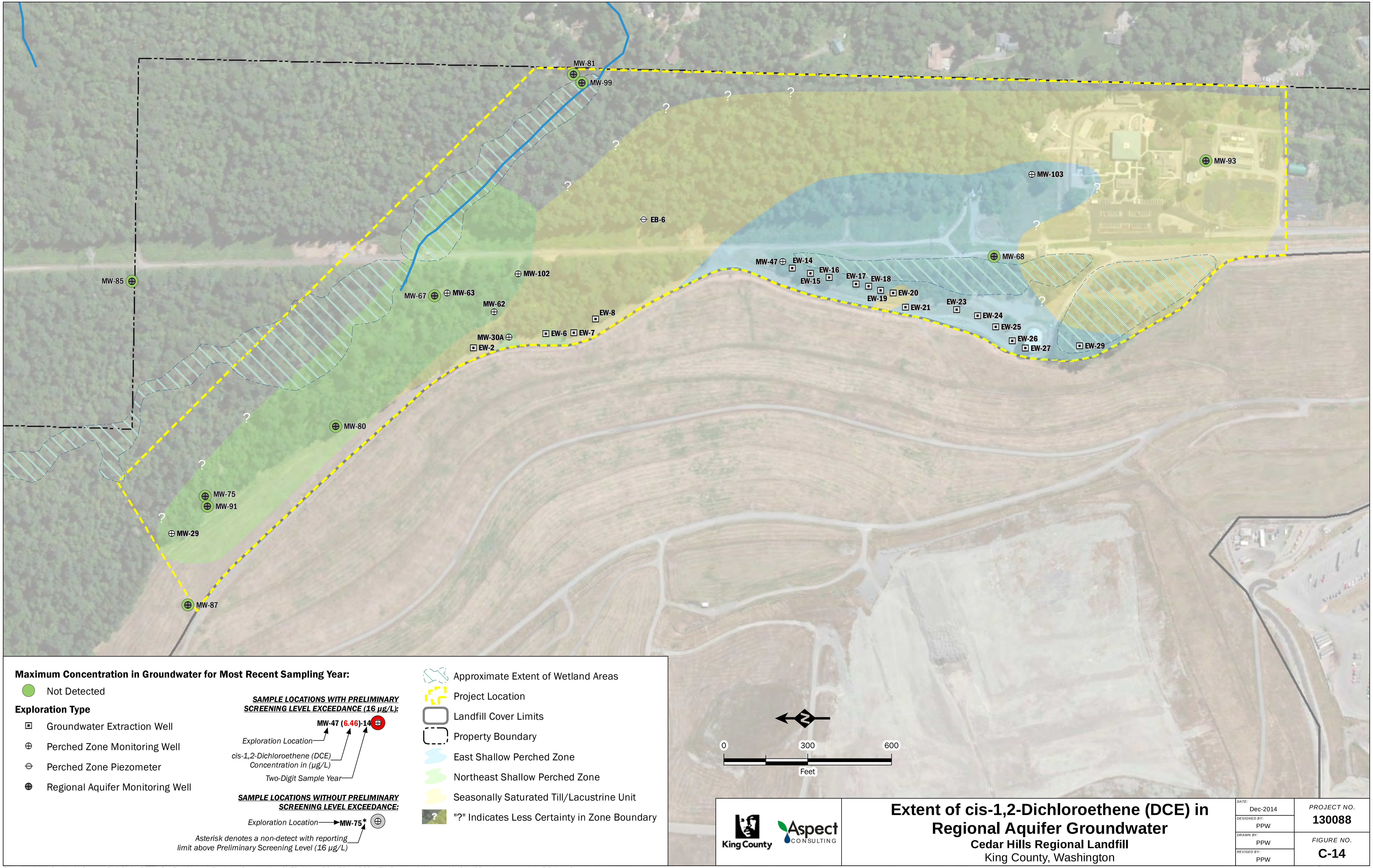
Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-13



King County

Aspect CONSULTING

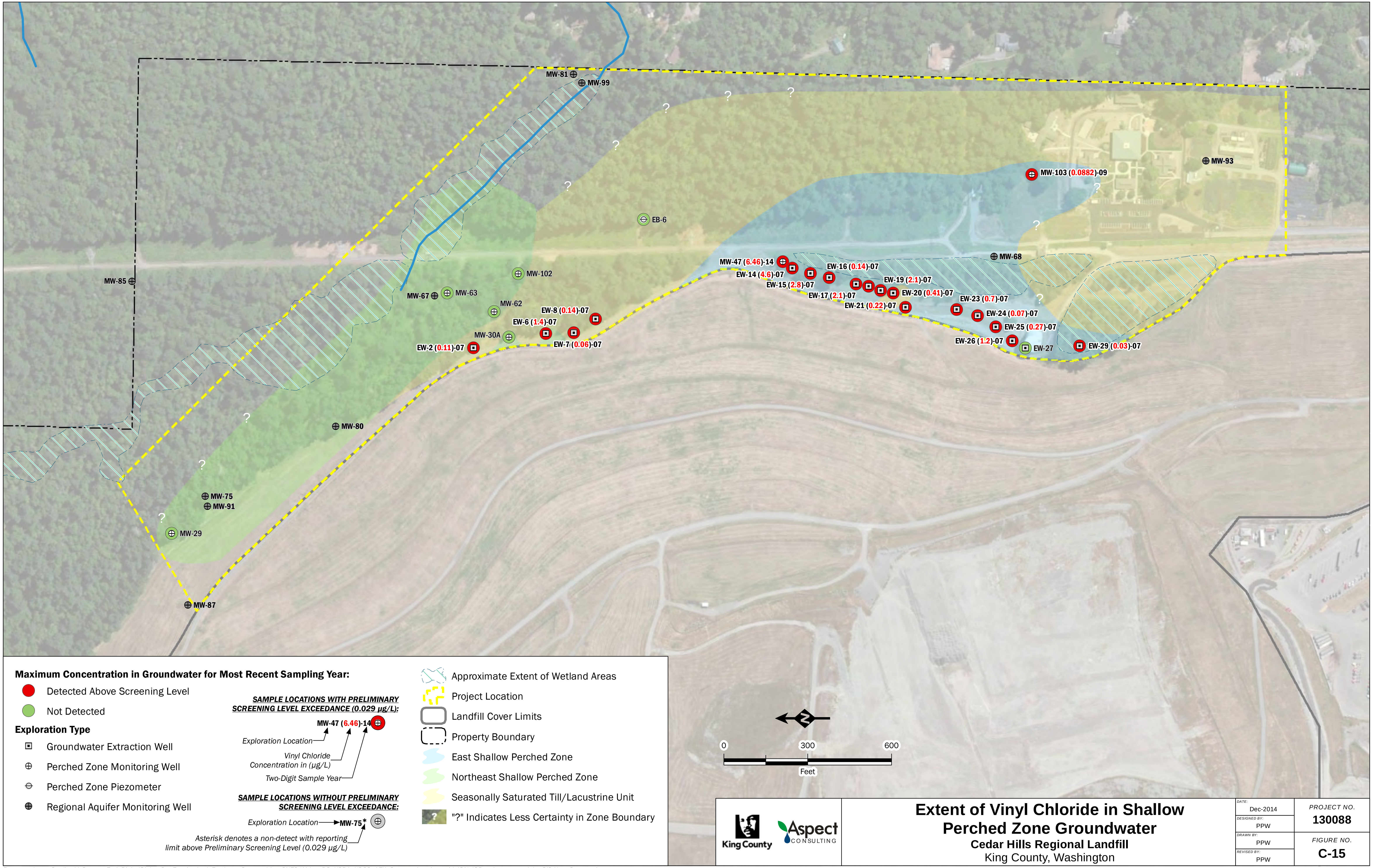
Extent of cis-1,2-Dichloroethene (DCE) in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-14

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



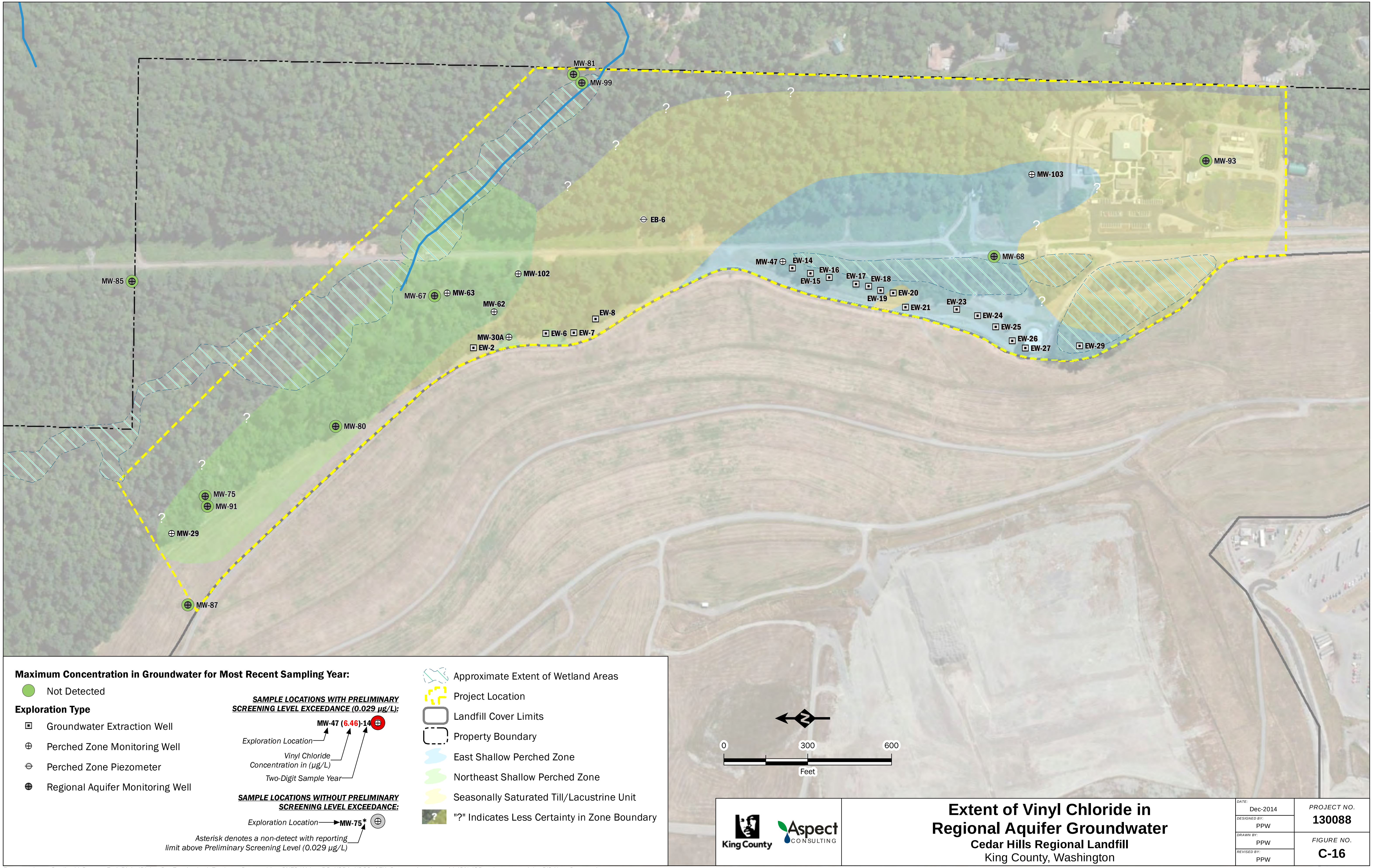
Extent of Vinyl Chloride in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-15

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



King County
Aspect CONSULTING

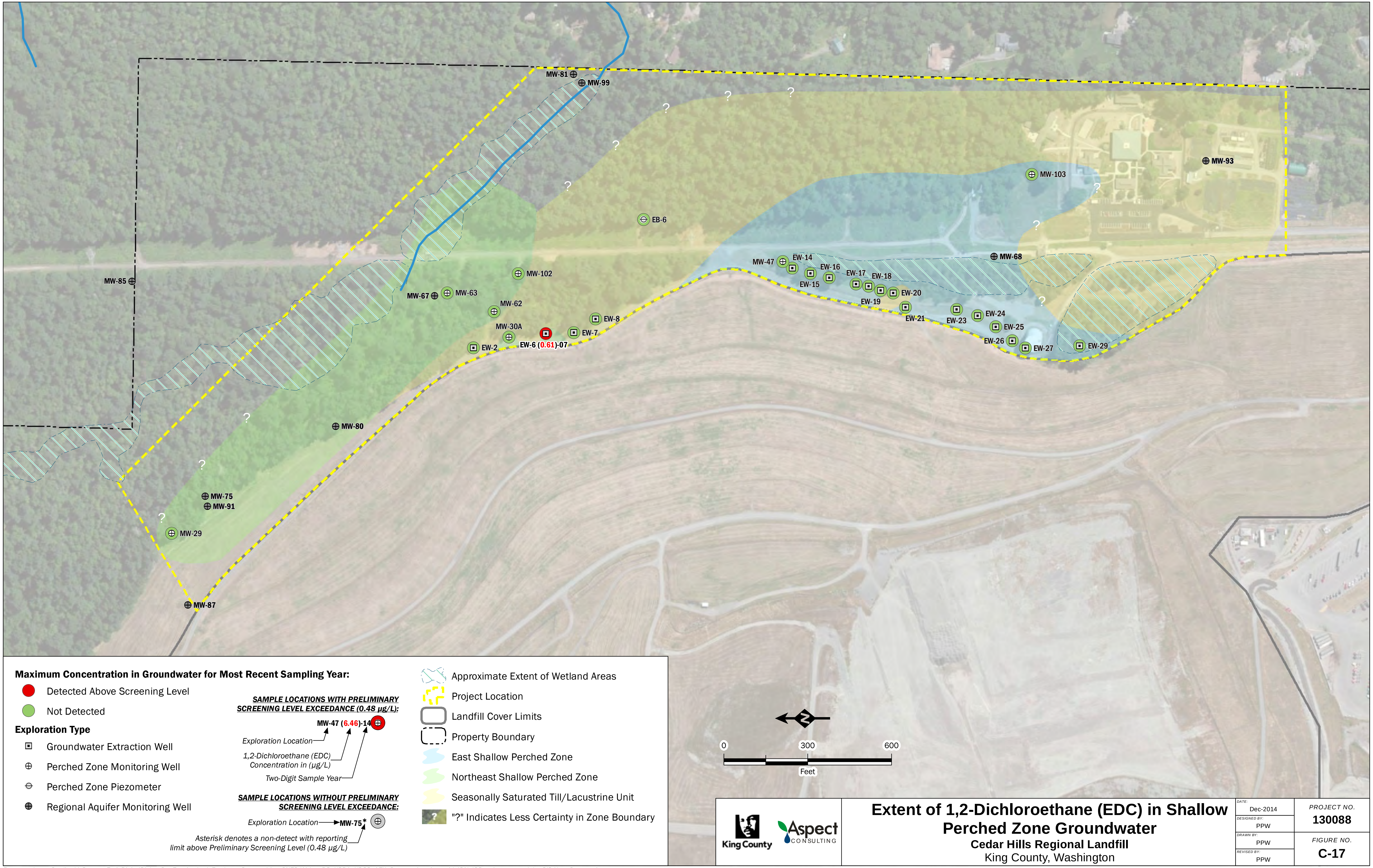
Extent of Vinyl Chloride in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW
PROJECT NO. 130088
FIGURE NO. C-16

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🔴 Detected Above Screening Level
- 🟢 Not Detected

Exploration Type

- ⊡ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (0.48 µg/L):

MW-47 (6.46)-14

Exploration Location

1,2-Dichloroethane (EDC) Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → MW-75*

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (0.48 µg/L)

- Approximate Extent of Wetland Areas
- Project Location
- Landfill Cover Limits
- Property Boundary
- East Shallow Perched Zone
- Northeast Shallow Perched Zone
- Seasonally Saturated Till/Lacustrine Unit
- "?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

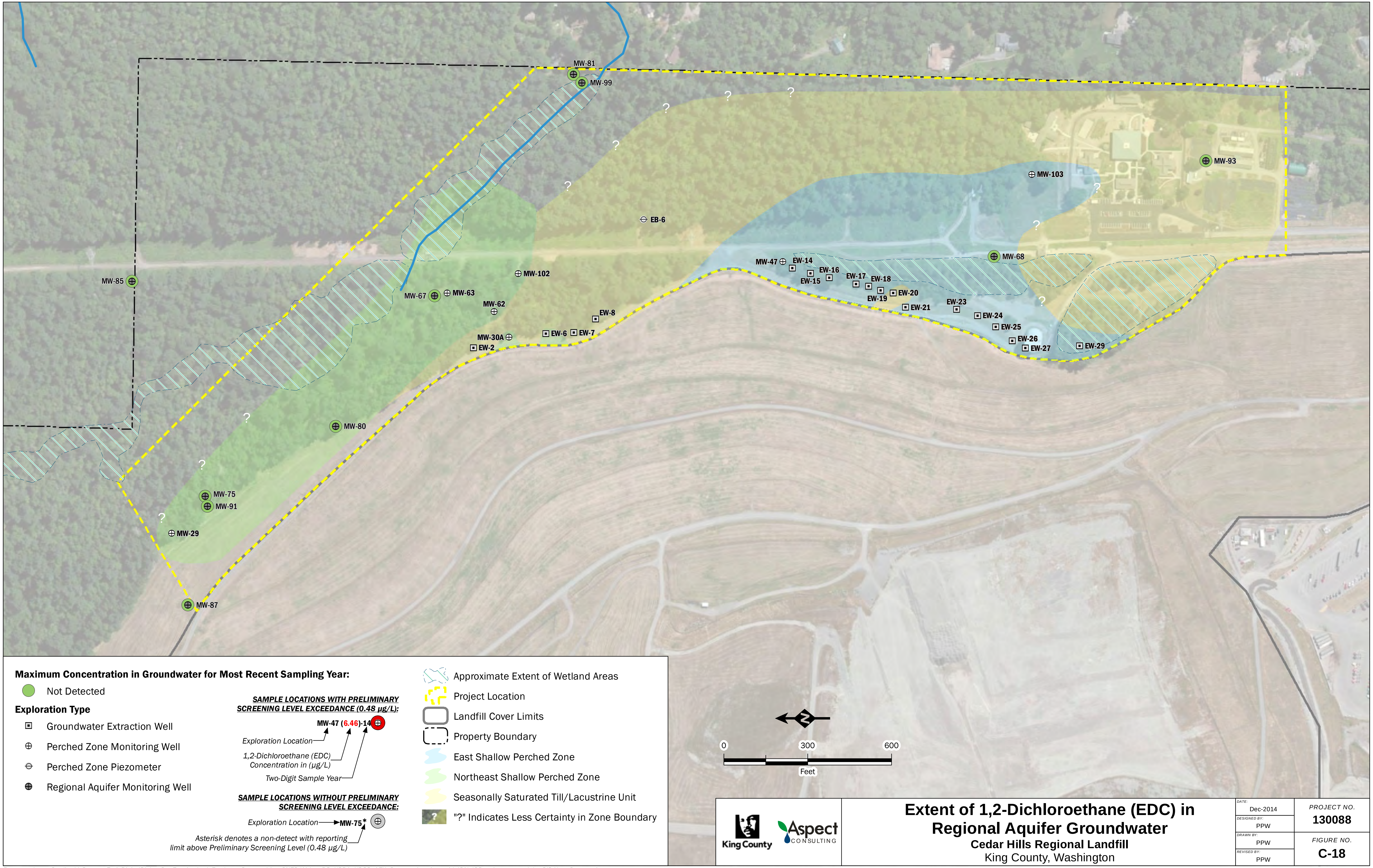
Extent of 1,2-Dichloroethane (EDC) in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014	PROJECT NO. 130088
DESIGNED BY: PPW	
DRAWN BY: PPW	FIGURE NO. C-17
REVISED BY: PPW	

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

●	Not Detected

Exploration Type

▣	Groundwater Extraction Well
⊕	Perched Zone Monitoring Well
⊖	Perched Zone Piezometer
⊕	Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (0.48 μg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

1,2-Dichloroethane (EDC) Concentration in (μg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → **MW-75*** ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (0.48 μg/L)

▨	Approximate Extent of Wetland Areas
⬚	Project Location
▢	Landfill Cover Limits
⬚	Property Boundary
🟦	East Shallow Perched Zone
🟩	Northeast Shallow Perched Zone
🟨	Seasonally Saturated Till/Lacustrine Unit
?	"?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

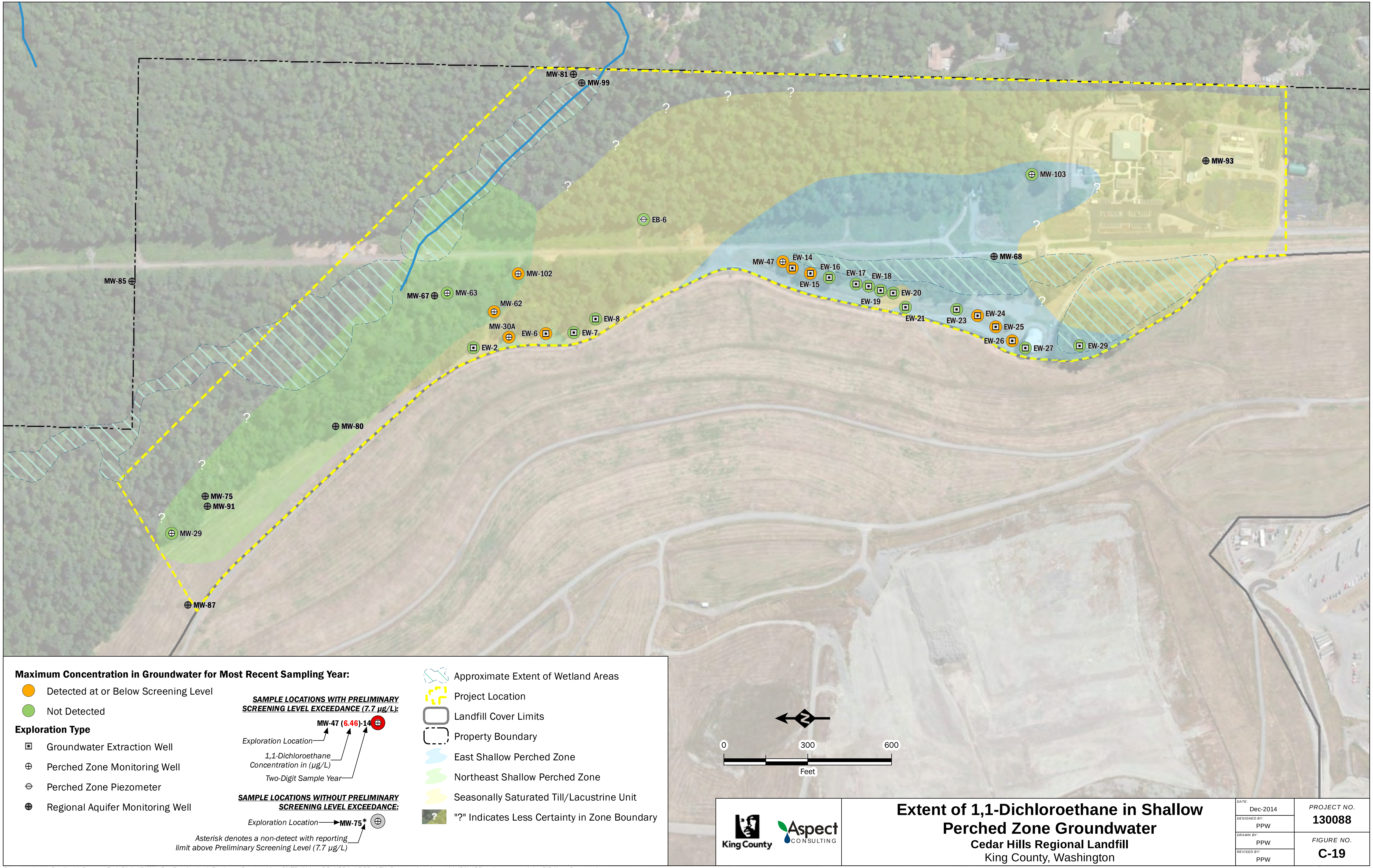
Extent of 1,2-Dichloroethane (EDC) in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE:	Dec-2014
DESIGNED BY:	PPW
DRAWN BY:	PPW
REVISED BY:	PPW
PROJECT NO.	130088
FIGURE NO.	C-18

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Maximum Concentration in Groundwater for Most Recent Sampling Year:

- 🟠 Detected at or Below Screening Level
- 🟢 Not Detected

Exploration Type

- ⊡ Groundwater Extraction Well
- ⊕ Perched Zone Monitoring Well
- ⊖ Perched Zone Piezometer
- ⊕ Regional Aquifer Monitoring Well

SAMPLE LOCATIONS WITH PRELIMINARY SCREENING LEVEL EXCEEDANCE (7.7 µg/L):

MW-47 (6.46)-14 ⊕

Exploration Location

1,1-Dichloroethane Concentration in (µg/L)

Two-Digit Sample Year

SAMPLE LOCATIONS WITHOUT PRELIMINARY SCREENING LEVEL EXCEEDANCE:

Exploration Location → **MW-75*** ⊕

Asterisk denotes a non-detect with reporting limit above Preliminary Screening Level (7.7 µg/L)

- Approximate Extent of Wetland Areas
- Project Location
- Landfill Cover Limits
- Property Boundary
- East Shallow Perched Zone
- Northeast Shallow Perched Zone
- Seasonally Saturated Till/Lacustrine Unit
- "?" Indicates Less Certainty in Zone Boundary

King County

Aspect CONSULTING

Extent of 1,1-Dichloroethane in Shallow Perched Zone Groundwater

Cedar Hills Regional Landfill

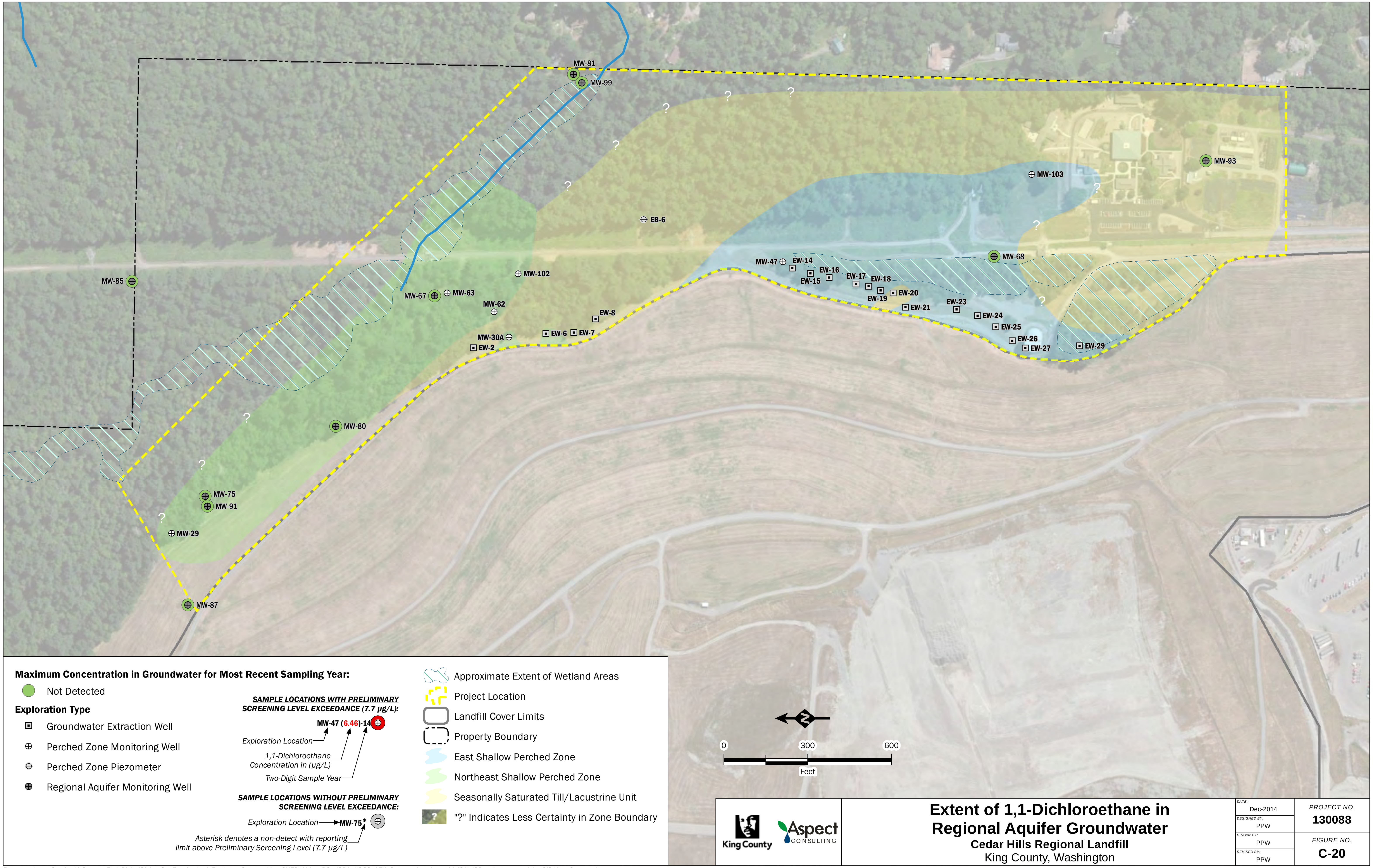
King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. **130088**

FIGURE NO. **C-19**

Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



Basemap Layer Credits || Source: Esri, DigitalGlobe, GeoEye, i-cubed, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

King County

Aspect CONSULTING

Extent of 1,1-Dichloroethane in Regional Aquifer Groundwater

Cedar Hills Regional Landfill

King County, Washington

DATE: Dec-2014
DESIGNED BY: PPW
DRAWN BY: PPW
REVISED BY: PPW

PROJECT NO. 130088

FIGURE NO. C-20

APPENDIX D

Time Series Concentration Plots for Select Monitoring Wells

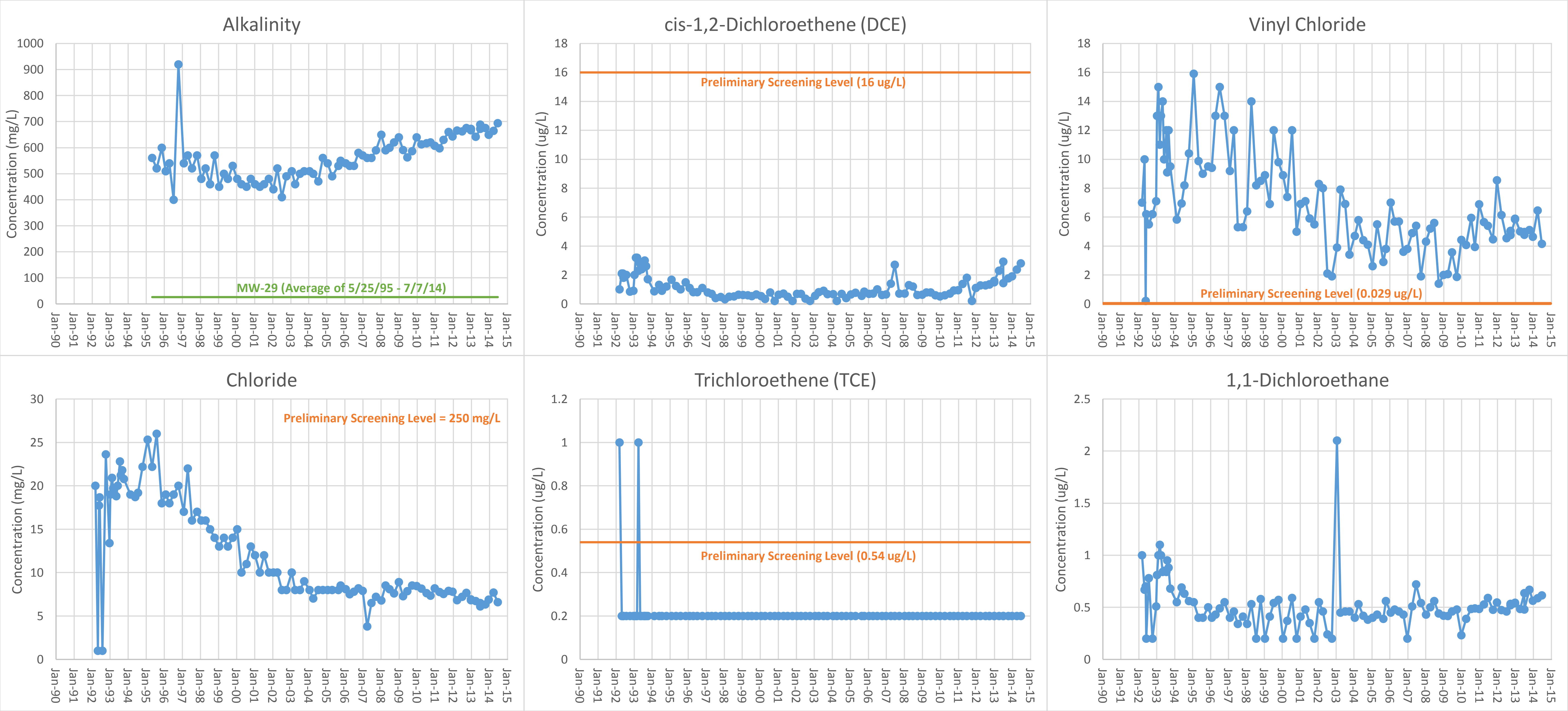
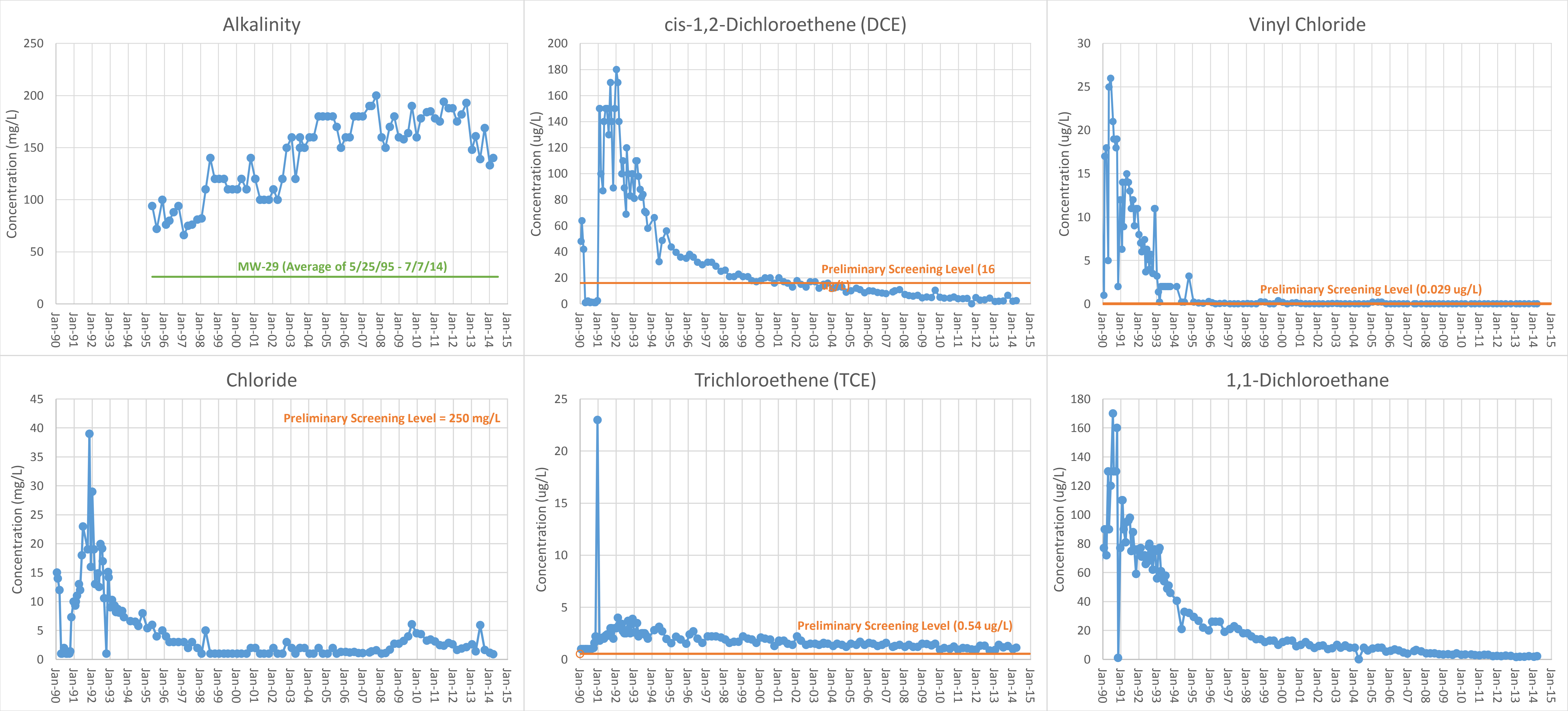


Figure D-1 - Select VOCs, Alkalinity, and Chloride Time Series - MW-47



Aspect Consulting
April 2015

Figure D-2 - Select VOCs, Alkalinity, and Chloride Time Series - MW-30A

RI/FS Work Plan
Cedar Hills Regional Landfill, King County, Washington

APPENDIX E

Existing Infrastructure

This Appendix provides subsurface utility maps developed by Aspect (Aspect, 2010) for subsurface utility lines. The user of these maps is referred to Aspect, 2010 for discussion on data sources and compilation methods for these drawings.

Legend

MW-63 ⊙	Perched Zone Monitoring Well
MW-80 ◎	Regional Aquifer Monitoring Well
EB-3 ⊗	Perched Zone Piezometer
EPZ-BH-1 ⊠	Borehole / Geoprobe
GP-ATC-8 ⊗	Gas Probe (Letters denote individual probes in boreholes with multiple completions.)
E-35 ⊕ SE-3 △	Gas Extraction Well
EW-15 ●	Groundwater Extraction Well
SG-5 ✖	Staff Gage with Piezometer
SW-E1 ✳	Surface Water Monitoring Station
— · · · —	Approximate route of stream flow
▭	Approximate extent of wetland area from KCSWD (2000) maps
―	Landfill cover limits
W	Water line
NPW	Water line (Non-potable)
SS	Sanitary Sewer line
- - -	Sanitary Sewer drainfield line
LPG	Liquefied Petroleum Gas
— · · · —	Lines added to KCSWD CAD drawing based on original plans

N

0 200 400 800

Feet

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King County

Water, Non-Potable Water and Sanitary Sewer Map

Cedar Hills Regional Landfill

King County, Washington

DATE:	OCT 2014
DESIGNED BY:	JSL
DRAWN BY:	PMB
REVISED BY:	EWM/SCC
PROJECT NO.	040122
FIGURE NO.	E-1

Legend

MW-63 ⊙	Perched Zone Monitoring Well
MW-80 ◎	Regional Aquifer Monitoring Well
EB-3 ⊗	Perched Zone Piezometer
EPZ-BH-1 ⊠	Borehole / Geoprobe
GP-ATC-8 ⊗	Gas Probe (Letters denote individual probes in boreholes with multiple completions.)
E-35 ⊕ SE-3 △	Gas Extraction Well
EW-15 ◐	Groundwater Extraction Well
SG-5 ✖	Staff Gage with Piezometer
SW-E1 ✳	Surface Water Monitoring Station
— · · · —	Approximate route of stream flow
▭	Approximate extent of wetland area from KCSWD (2000) maps
—	Landfill cover limits
—L—	Leachate line - solid
— —L— —	Leachate line - line type not specified
- - -L- - -	Leachate line - perforated

N

0 200 400 800

Feet

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King County

Leachate System Map

Cedar Hills Regional Landfill
King County, Washington

DATE:	OCT 2014
DESIGNED BY:	JSL
DRAWN BY:	PMB
REVISED BY:	EWM/SCC
PROJECT NO.	040122
FIGURE NO.	E-2

Legend

MW-63 ⊙	Perched Zone Monitoring Well
MW-80 ◎	Regional Aquifer Monitoring Well
EB-3 ⊗	Perched Zone Piezometer
EPZ-BH-1 ⊠	Borehole / Geoprobe
GP-ATC-8 ⊗	Gas Probe (Letters denote individual probes in boreholes with multiple completions)
E-35 ⊕ SE-3 △	Gas Extraction Well
EW-15 ◐	Groundwater Extraction Well
SG-5 ✖	Staff Gage with Piezometer
SW-E1 ✳	Surface Water Monitoring Station
─··─··─	Approximate route of stream flow
▭	Approximate extent of wetland area from KCSWD (2000) maps
───	Landfill cover limits
──G──	Landfill Gas line
─··─··─	Lines added to KCSWD CAD drawing based on original plans

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Landfill Gas System Map

Cedar Hills Regional Landfill
King County, Washington

DATE:	OCT 2014
DESIGNED BY:	JSL
DRAWN BY:	PMB
REVISED BY:	EWM/SCC
PROJECT NO.	040122
FIGURE NO.	E-3