Appendix D

Well Installations

D.1 *Work Plan: Hand Augering, Sediment Sampling, and Monitoring Well Installation, Development & Sampling Activities.* 2009.

D.2 *Technical Memorandum: Hand Augering, Sediment Sampling, and Monitoring Well Installation, Development & Sampling Activities*. 2010.

D.3 Well Installation Pictures

Appendix D.1

Work Plan: Hand Augering, Sediment Sampling, and Monitoring Well Installation, Development & Sampling Activities. 2009.

WORK PLAN

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

June 23, 2009

FINAL

King County

Department of Natural Resources and Parks
Water and Land Resources Division
Science and Technical Support Section
King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104
http://www.kingcounty.gov/environment/wlr

Work Plan:

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

Prepared for:
Landfill and Environmental Monitoring
Engineering Services
Solid Waste Division
King County Department of Natural Resources and Parks

Submitted by:

Hydrologic Services Group
Water Quality and Quantity Unit
Scientific and Technical Support Section
Water and Land Resources Division
King County Department of Natural Resources and Parks

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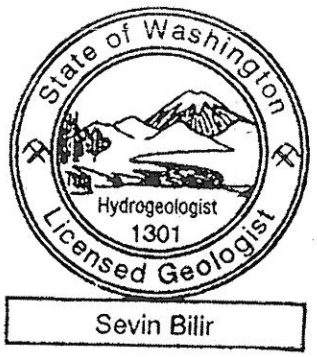
Work Plan: Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

This document was prepared under the supervision and direction of the undersigned whose seal as licensed hydrogeologist is affixed below:



Signature available on hard copy only

Sevin Bilir, L. HG. (WA)

King County
Department of Natural Resources and Parks
Water & Land Resources Division

June 23, 2009

Date

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1.0. INTRODUCTION

This document presents the work plan for hand augering, sediment sampling, and well installation for investigation activities on the hillslope to the west of the Vashon Island Closed Landfill & Transfer Station (VICLTS). It has been prepared for King County Department of Natural Resources & Parks-Solid Waste Division (KCSWD) and the work supports KCSWD's efforts to:

- Characterize lithologic units,
- Investigate hydrogeologic physical and chemical conditions, and
- Install three new monitoring wells

Results of site investigations performed prior to 2004 and existing site data were summarized and presented in *Vashon Island Closed Landfill Environmental Evaluation* (B&H et al., 2006).

This work plan presents a detailed approach for investigating the subsurface on the hillslope west of the VICLTS, as recommended in *Vashon Island Landfill Hillslope: Report for Scope of Work #1* (KCWLRD, 2006a). This work plan was submitted to Public Health – Seattle & King County (Public Health) for review (August 28, 2008). Public Health was assisted in their review by the Washington State Department of Ecology (Ecology) and comments were sent to KCSWD on February 4, 2009. Responses to comments are incorporated in this report.

Tasks proposed in this work plan are based on the results and recommendations from work presented in *Vashon Island Landfill Hillslope: Report for Scope of Work #1* (KCWLRD, 2006a). There are five monitoring wells (MW-4, MW-8, MW-9, MW-14, and MW-19) installed to the west of the Westside Highway, west of the VICLTS. Figure 1 shows the locations of these wells with respect to the landfill and the hillslope to the west. All of these wells are located at the top of the hillslope, at the same elevation as the Westside Highway. The three proposed wells will be designed to meet the resource protection well construction requirements prescribed in WAC 173-160 (WA, 2007. Variances will be sought from Ecology prior to work start and as necessary in the field due to varying site conditions. All site work will be performed under a site health and safety plan issued separately from this work plan.

1.1 Work Plan Organization

This work plan is organized into five chapters. A brief description of each chapter is presented below:

- **Chapter 1, Introduction.** Chapter 1 contains an introduction to the project, the scope of work, and a review of the work plan organization.
- **Chapter 2, Field Activities Preparation.** Chapter 2 presents a description of tasks to be performed prior to the field investigation: obtaining permits and preparing a health & safety plan.

- **Chapter 3, Field Investigations.** Chapter 3 presents a description of the tasks to be performed, including include augering, lithologic description, monitoring well activities, decontamination & handling procedures, residuals management, field instrumentation, and field supervision.
- **Chapter 4, Surveying.** Chapter 4 presents surveying requirements.
- **Chapter 5, Information Management.** Chapter 5 describes recordkeeping, sample management and data reporting procedures for the field investigation. In addition, it summarizes report production related to this event.
- **Chapter 6, References.**

1.2 Work Timeline

The following is the proposed schedule for completing the field investigation program.

Month 1
- Begin augering.
- Install wells.
- Measure groundwater quality.

Month 2
- Complete well development.
- Complete surveying.
- Sample wells.

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1.3 Field Investigation Objectives

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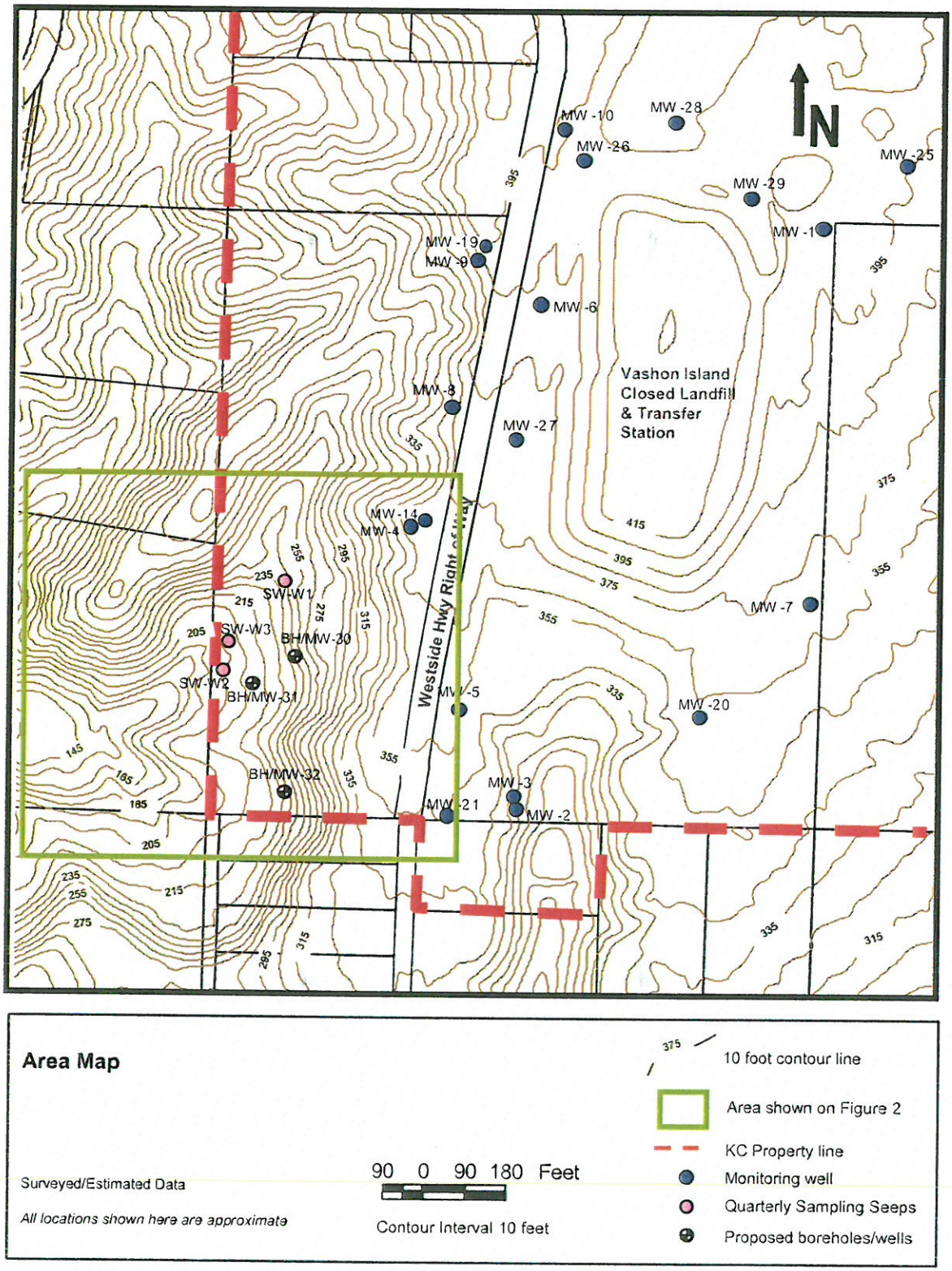
- Identi y t e o urren e o oarse grained units C and C and t e ine grained unit C at t e ore ole lo ations in luding t e elevation o unit onta ts.
- Identi y t e dept to and preliminary geo emi al ara teristi s p spe i i ondu tivity and temperature o groundwater in t e wells i any .
- Colle t and analy e groundwater samples rom newly installed and developed wells.

Figure 1. Area Map



1.4 Scope of Work

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o ations o proposed ore oles and wells are presented in igures and . e rationale or oring lo ations is summari ed in a le .

Table 1. Rationale for Well Locations

orin	Well	Rationale
BH-30	MW-30	Monitoring of water levels and quality in the Cc2 unit prior to seepage out of the west hillslope.
BH-31	MW-31	Monitoring of water levels and quality in the Cc3 unit prior to seepage out of the west hillslope.
BH-32	MW-32	Monitoring of water levels and quality in the Cc2 unit prior to seepage out of the west hillslope on the southern corner of the KC property.

Figure 2. Borehole & Well Location Map

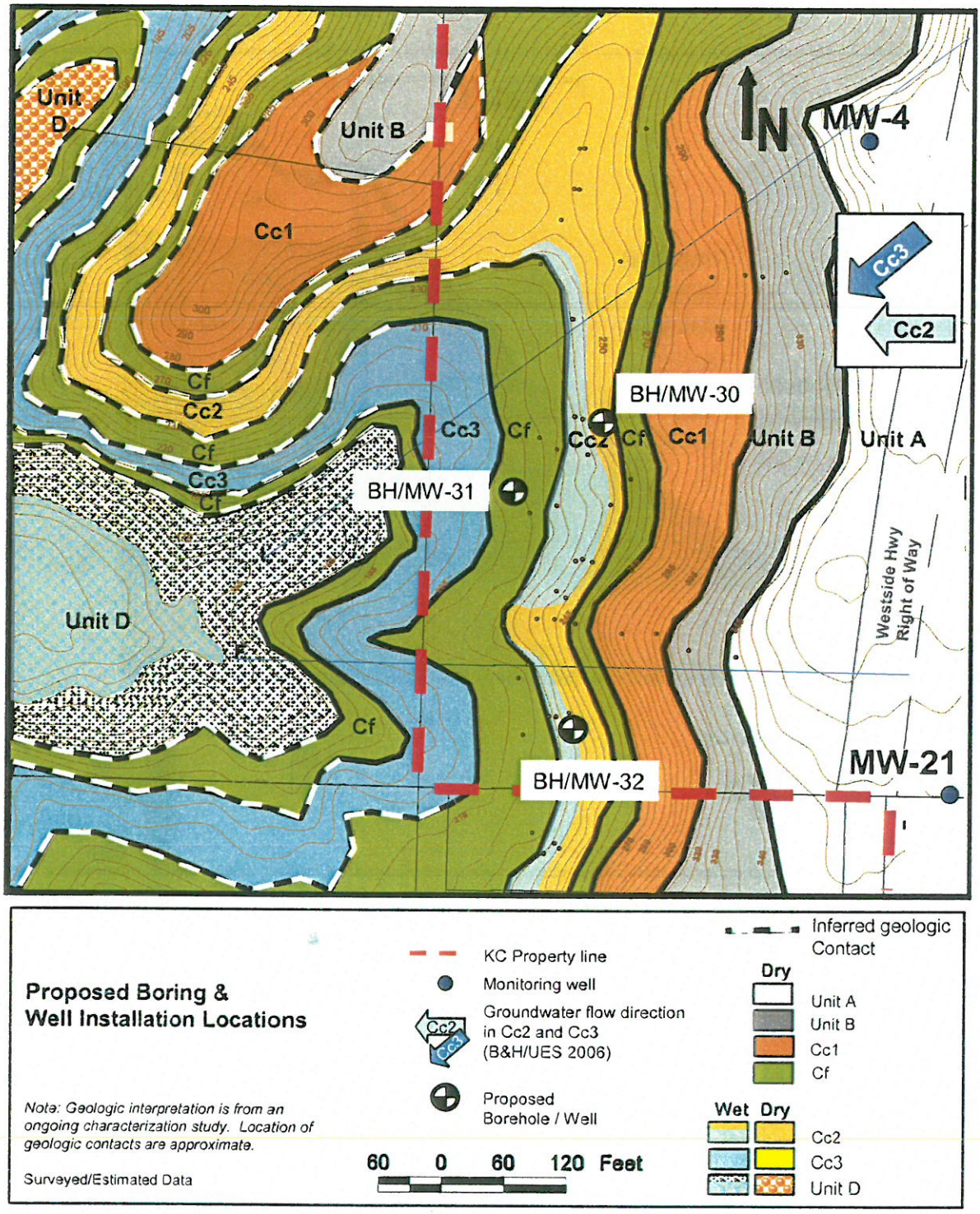
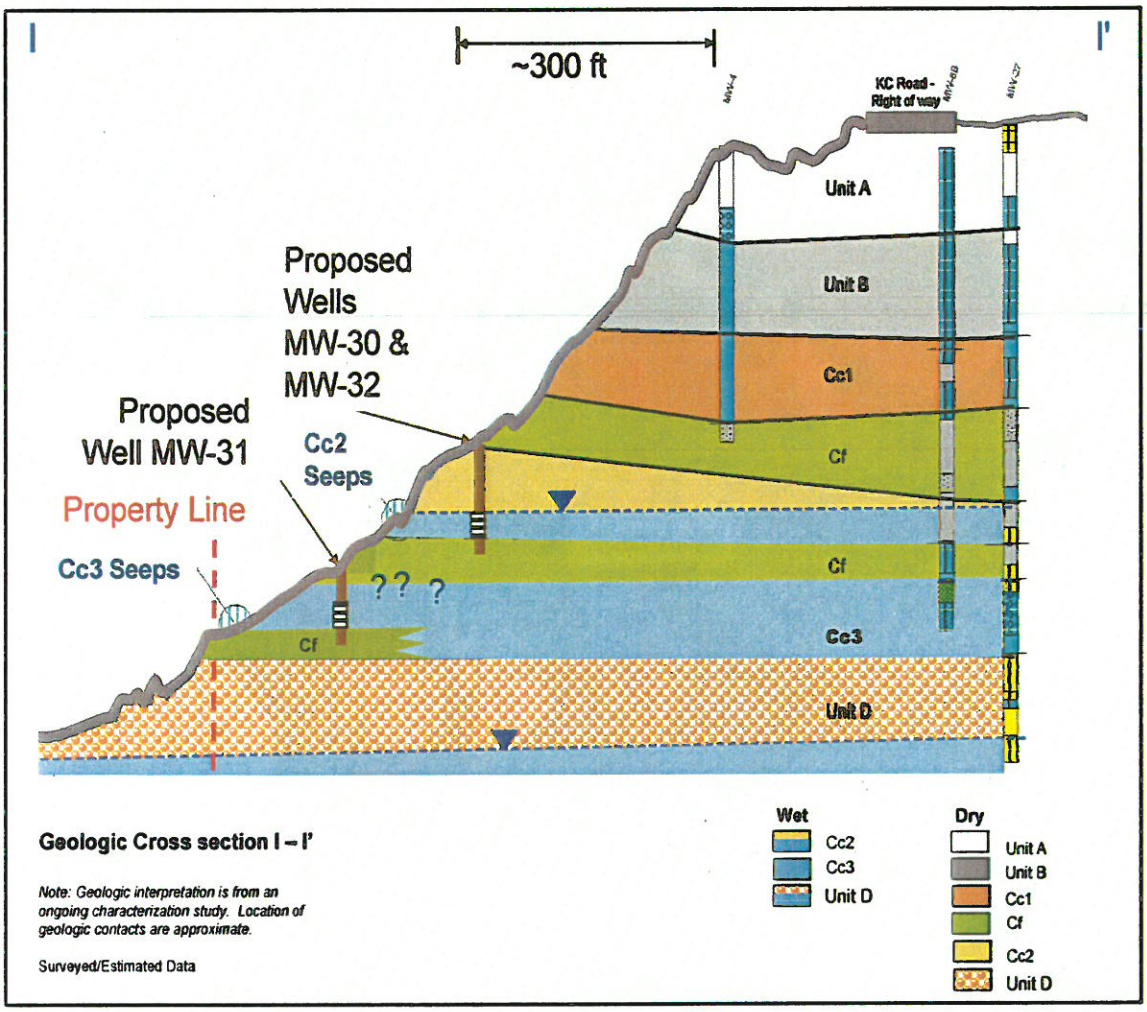


Figure 3. Representative Geologic Cross-Section



2.0. FIELD ACTIVITIES PREPARATION

This chapter presents descriptions of tasks to be performed prior to the field activities.

2.1 Health & Safety Plan

A site specific Health & Safety Plan (HSP) will be prepared by the field supervisor and approved of by the KCSWD Safety Officer. The contents will include:

- Project Information
- Facility Description & Background
- Waste Type (s) / Characteristics
- Hazard Evaluation
- Operations Plan
- Safety & Equipment Procedures
- Key Project Personnel
- Emergency Procedures

Prior to the start of work, the HSP will be shared with all related parties. Site workers and visitors will be required to review the document. During site investigations, the field supervisor will be responsible for conducting daily safety talks with site workers at the start of each field day. In addition, the field supervisor will respond to all health & safety concerns that arise during the field work. Air monitoring of the work site and borehole will be conducted as per the HSP. A copy of the HSP will be on site at all times during the field investigation. Appendix A is a draft copy of the HSP for the work to be conducted in this work plan.

2.2 Permits & Variances

Permits will be obtained from Ecology for the augering and well construction activities prior to work start. Due to field observations, variances will be requested prior to and possibly during field investigations. A copy of the permit and records of variance requests and approvals will be on site at all times during the field investigation. Appendix B is a draft copy of the permit variance request to Ecology that will be submitted prior to work start.

3.0. FIELD INVESTIGATIONS

This chapter presents descriptions of field investigations that will be performed. Field investigations include augering, lithologic description, monitoring well activities, decontamination & handling procedures, residuals management and field instrumentation, field supervision.

3.1 Augering & Lithologic Description

Three borings will be advanced using an AMS Signature Series stainless steel hand auger with an outside diameter (O. D.) of 3.25-inches. Figure 4a shows three types of augers that may be used to advance the borehole, depending on sediment conditions. Previous site experience indicates that soils are expected to be fine-grained sands and/or peat-like organic material, and underlying sediments include bedded, sands and silts with some gravelly zones (Cc1, Cc2, Cf and Cc3).

Driven sediment samples will be collected using an AMS Signature Series soil core sampler with slide hammer (Figure 4b). Samples will be collected in a stainless steel 2-inch O. D. sample tube. Representative portions of sediment samples will be stored in labeled plastic bags for lithologic review purposes only. Samples will be labeled to identify the boring and depth interval sampled. An example of the labeling of a sample collected from a depth of 5.0 to 6.5 feet below ground surface (ft bgs) from boring BH-**30 would be labeled** "BH-30 5-6.5 ft".

Figure 4. Augering & Sampling Equipment

(a) **3.25" O. D. mud, regular and sand augers.** (b) Soil core sampler with stainless steel drive barrel and reusable stainless steel tube

Sediments discharged during advancement of the auger and collected from the soil core sampler will be reviewed for lithologic description. The visual and manual methods described in ATSM Method D-2488-06 (ASTM, 2006) will be used for soil classification.

Augering and lithologic review will continue through the targeted coarse-grained sand unit (Cc2 or Cc3) until reaching the targeted underlying fine-grained unit (Cf). Based on conditions encountered while boring, monitoring well designs will be prepared.

3.2 Presence of Saturation

Previous site experience indicates that perched groundwater is expected to be encountered in boreholes BH-30 and BH-32, screening the upper coarse-grained unit (Cc2) (Figure 3). The groundwater in this unit is expected to be at about 10 ft bgs (~230-235 ft MSL) at these locations on the hillslope. When groundwater is encountered, depth to water will be recorded.

During advancement of borehole BH-31, groundwater in the lower coarse-grained unit (Cc3) may be confined. Reports from previous investigations at the landfill indicated confining pressure in the coarse-grained unit, Cc3, beneath and adjacent to the landfill. Based on recent observations of the saturation on the west hillslope, it is not clear that what appears to be water seeping from Cc3 outcrop is from a perched or confined Cc3 aquifer, or if it is actually surface water flowing downslope from the perched aquifer of Cc2 (Figure 3). Special care to note moisture will be taken while augering at borehole BH-31. The depth to the contact for fine-grained unit, Cf, and the underlying coarse-grained Cc3 will be recorded. Depth to this contact is expected to be at about 5 ft bgs (~215 ft MSL) at the planned location for borehole BH-31. When groundwater is encountered, the borehole will be allowed to equilibrate. In the unlikely event that confining pressures are observed, it is expected to be minor due the proximity and observations of the seepage areas downslope of the auger site for BH-31. Based on conditions encountered while boring, a monitoring well design will be prepared.

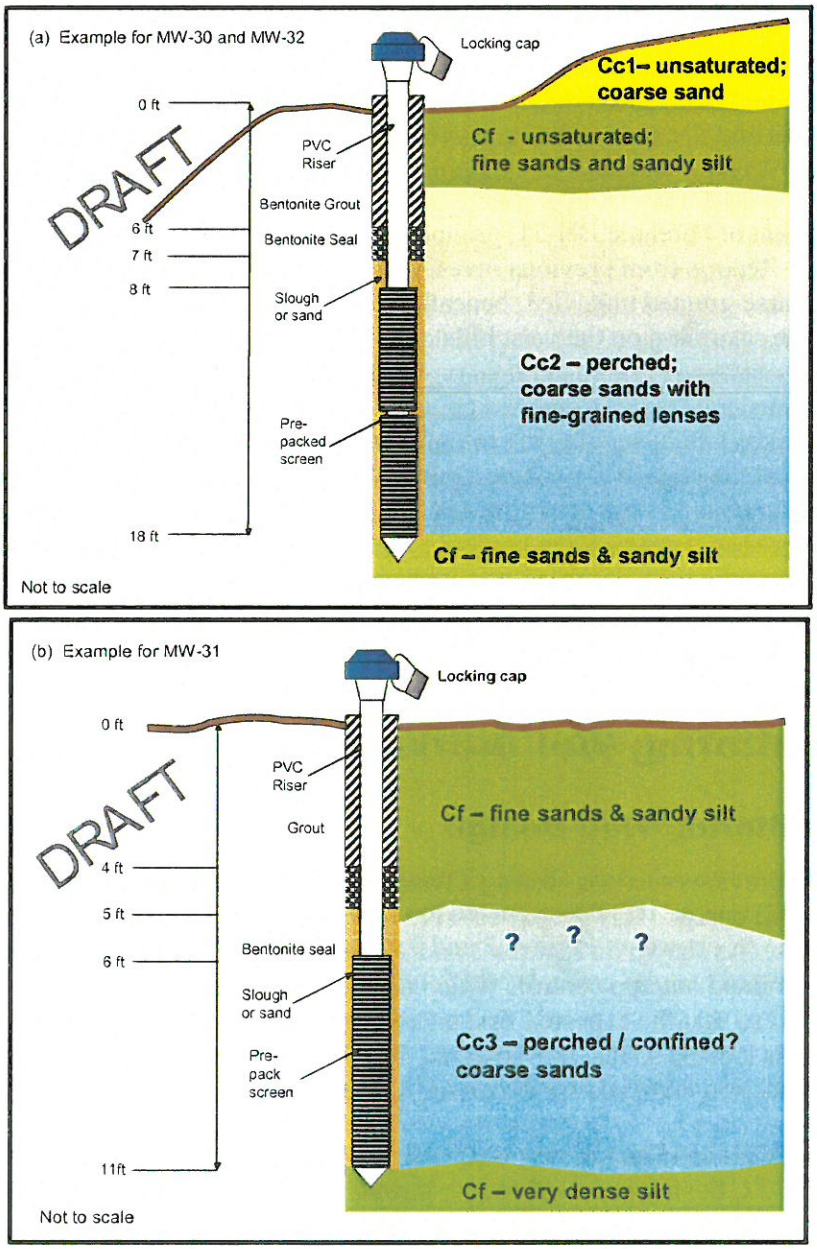
3.3 Monitoring Well Activities

3.3.1 Monitoring Well Design

As mentioned in previous sections, during advancement of the borings, decisions will be made with respect to well design. It is not expected to encounter both Cc2 and Cc3 saturated units in the same borehole. As shown on Figures 2 and 3, the placing of the borehole upslope of the targeted coarse-grained outcrop controls which unit will be encountered. Boreholes BH-30 and BH-32 are located so that the expected first encountered saturated coarse-grained unit is Cc2. Borehole BH-31 is located so that the expected first encountered saturated coarse-grained unit is Cc3. Well construction materials are discussed in the following section.

Figure 5 shows the planned monitoring well designs for each borehole. With regards to wells MW-30 and MW-32, the intention is to auger through the units as depicted in Figure 5a and place the bottom of the well at the interface between Cc2 and the underlying fine-grained unit, Cf. Based on field observations of the underlying Cf unit, it is possible that the fine sediment may be soft and moist. Preliminary field investigations of sediments suggest that the borehole is likely to stay open during augering activities.

Figure 5. Schematic Monitoring Well Designs



Note: These monitoring well designs are schematic and idealized as estimated in Table 2.

Because the lithology in borehole BH-31 will be different, the intention is to auger through the units as depicted in Figure 5b and place the bottom of the well at the interface between Cc3 and the underlying fine-grained unit, Cf. It is unknown as to whether this borehole will stay open during augering activities.

3.3.2 Monitoring Well Construction Materials & Installation

The groundwater monitoring wells will be constructed using nominal 2-inch-diameter flush-threaded Schedule 40 PVC well casing, pre-packed well screens, and well points. The screen assembly will consist of a nominal 5-foot (or two 5-foot) long 0.010-inch machine-slotted section(s). A filter pack consisting of 20x40 Colorado® silica sand is factory installed between the well screen casing and a 65 mesh stainless steel screen. Figure 6 shows the construction of a smaller diameter well with the same pre-packed well screen material and the preparation of a 2-inch diameter casing well with a pre-packed well screen.

Figure 6. Pre-packed Well Screens

(left) 0.75 –inch pre-packed well screen. (right). Preparation of a 2-inch pre-packed screen & casing (Kram et al, 2001)

If the borehole depth exceeds the well depth, 20x40 Colorado® silica sand (or equivalent) will be added to raise the bottom of the well screen to the interface between the targeted coarse-grained sand and the underlying fine-grained unit, Cf. Upon installation of the well, additional filter material will be added to extend at least to one foot above the uppermost screen slot. A bentonite seal of at least one foot will be installed above the filter pack using #8 fine pellets. This bentonite seal may be extended to the surface seal, or the remaining annular space may be backfilled with bentonite grout. Potable water will be used for hydrating pellets or mixing grout.

The well will be held in the center of the borehole manually during placement of any additional annular silica sand backfill, bentonite seal, and grout to the surface, if necessary. Estimated conditions for each borehole are presented in Table 2.

Table 2. Estimated Conditions

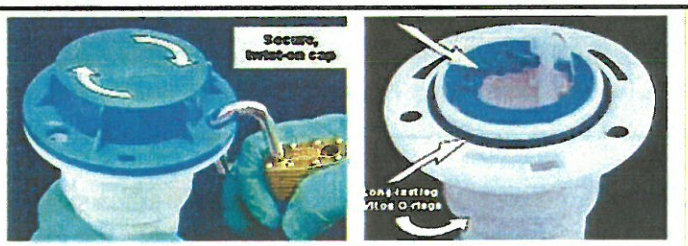
Boring / Well	Ground Surface Elevation (ft MSL)	~Depth to First Water ATA (ft bgs)	Bentonite Grout (ft bgs)	Bentonite Seal (ft bgs)	Screened Unit / Screen and Pre-Packed Filter Interval (ft bgs)	Sand Interval (ft bgs)	BHTD (ft bgs)
BH-30 / MW-30	245	10	0 -6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18
BH-31 / MW-31	220	5 ?	0 - 5	5 - 6	Cc3 – Perched ? / 6 - 11	5 - 11	11 ?
BH-32 / MW-32	240	10	0 - 6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18

Notes: bgs = below ground surface MSL= mean sea level BHTD = borehole total depth
ft = feet ATA = at time of augering

Due to current site conditions and the likely differences at each drilling location, it may be necessary to adjust borehole depths, sand and screen intervals depths, and obtain variances from Ecology for well completion details. Authorized field personnel will be in contact with the Northwest Regional Office Ecology Well Coordinator during the field event. A Washington state licensed driller will perform the work and will file all required paperwork with Ecology, as noted in Section 5.0.

Due to the isolation and rugged terrain at the well sites, a locking well cap (the ProHydro, Inc. Snap Sampler™ well cap (Figure 7)) will be attached with stainless steel screws to the casing in order to prevent unauthorized access to the well. The site well identification number (e.g., MW-30) and state well tags will be attached to each new well casing. The well will be secured using a lock supplied by KCSWD.

Figure 7. Proposed Locking Well Cap



Snap Sampler™ Well Cap: http://www.prohydroinc.com/prohydrowellcap.html

3.3.3 Field Water Quality Parameter Testing

Following well completion, if possible, one casing volume will be purged from each well. Groundwater will be collected using a peristaltic pump with new tubing. If the diameter of the well does not allow for the peristaltic pump sampler, a small diameter new disposable PVC bailer will be used. If using a bailer, it will be fitted with a bottom-emptying device and nylon or polyethylene rope or cord. Collected groundwater will be transferred directly into a clean container for measurement of field water quality parameters such as pH, specific conductance, and temperature. Descriptions of visual qualities (e.g., brown with fine sand and silt) will be recorded.

3.3.4 Monitoring Well Development

Each completed monitoring well will be developed to ensure hydraulic continuity between the well, well screen, and formation materials. Well development will consist of surging using a surge block, bailing and/or pumping using a peristaltic pump. Three casing volumes of groundwater will be removed during development, if possible. The pH, specific conductivity,

and temperature of purged groundwater will be measured at the start of development and periodically thereafter until stabilization is reached.

3.3.5 Monitoring Well Sampling

During the next planned sampling event on the west hillslope, the new monitoring wells will be sampled as per procedures according to the *KCSWD DRAFT Environmental Monitoring Sampling and Analysis Plan and Quality Assurance Project Plan for Vashon Island Closed Landfill* (KCSWD-ESS, 2006). Samples will be submitted to Pace Analytical Services, Inc. for analysis of the VICLTS standard groundwater suite analysis (termed VAGW by KCSWD). Chain-of-Custody Forms will be submitted to ensure correct sample delivery.

3.4 Decontamination & Handling Procedures

All down-hole equipment will be new or cleaned using a cleaning detergent followed by a triple-rinse with potable water before and after each boring. In addition, reusable sampling tubes will be washed and rinsed between each sample collection.

The site workers handling the equipment and samples will wear new, clean nitrile gloves during sample collection and processing. In addition, the appropriate personal protective equipment required by the HSP will be worn.

3.5 Residuals Management

Residuals generated during the field investigation include drill cuttings (sediments), wastewater, and solid waste. Records of the waste management will be noted on field sheets.

3.5.1 Auger Cuttings

Auger cuttings generated during this investigation will be stored on site pending characterization. During storage, the cuttings will be protected from precipitation, run-on, and run-off. If tests of auger cuttings confirm that the cuttings are not dangerous or hazardous waste, then the cuttings will be transported to Cedar Hills Regional Landfill and disposed of in the active fill area. If tests of characterization samples indicate that the cuttings are dangerous or hazardous waste, then appropriate treatment or disposal will be arranged in consultation with Public Health.

Testing parameters and methods will be completed in accordance with Public Health requirements.

3.5.2 Wastewater & Solid Waste

Water generated from the cleaning of augering and sampling equipment, well development, and well sampling will be contained and transferred to the VICLTS leachate collection and treatment system. All solid waste will be removed from the hillslope and disposed of properly at the VICLTS.

3.6 Field Instrumentation

Standard field instruments used for this project include:

- pH meter
- Conductivity meter
- Temperature meter
- Electric water level meters / sounder
- Air monitoring meter (as per the Health & Safety Plan (Appendix A))

Equivalent equipment may be substituted for any instrument listed above. Operation manuals for the instruments used will be available on site during field activities. Meters measuring pH and conductivity will be calibrated at the start of the day. Records of calibration events and results will be noted on field sheets.

3.7 Field Supervision

The hydrogeologist will be the field supervisor in charge of site activities and has the authority to limit access of personnel and/or stop activities. The field supervisor will also be responsible for:

- Working with driller to obtaining variances, if necessary;
- Supervising site workers;
- Informing site workers on health & safety issues; and
- Reporting on work progress on a daily basis to KCSWD project manager.

4.0. SURVEYING

This chapter presents a description of surveying requirements. All boreholes will be surveyed by KCSWD after completion of the monitoring wells. Horizontal positions will be surveyed and reported to within the nearest 0.1 foot relative to the KCSWD VICLTS site datum. Vertical ground elevations will be surveyed and reported to within the nearest 0.1 foot relative to the KCSWD VICLTS site datum. The vertical elevation of the marked water level measurement point on the top of the PVC monitoring well casing will be surveyed to within the nearest 0.01 foot. Vertical positions will also be reported relative to the North American Vertical Datum of 1988 (NAVD 1988).

5.0. INFORMATION MANAGEMENT

5.1 Recordkeeping

Field log entries will provide a chronological description of task activities, including names of individuals present, weather conditions, names of visitors, and work activities. Entries will be legible, dated, and initialed. Details of well construction, lithology, sample collection, and field data will be recorded on standardized forms. This information will be maintained in project files.

Standard field forms used to record boring and well completion data, sample data, and observations during field events include:

- Field Activity Sheets
- Boring Log Form
- Groundwater Sampling Form
- Chain-of-Custody Form

Blank samples of forms used for sample and data management are shown in Appendix C. Health & Safety signature sheets will be used to record personnel that access the site and have been briefed on the safety issues, as per the Health & Safety Plan (Appendix A). The driller will have Notice of Intent applications onsite during field activities and submit resulting boring logs to Ecology.

5.2 Sample Management

The sample management system forms the foundation for all other analytical data collection, verification, and validation tasks. Analytical data use may be restricted unless all the proper sample management steps have been carried out. These steps include:

- Proper documentation of sample collection on the field sampling forms
- Filing of all sample-related documents

Each of these steps will be documented and summarized in data validation reports for all samples. Procedures will be as according to the *KCSWD DRAFT Environmental Monitoring Sampling and Analysis Plan and Quality Assurance Project Plan for Vashon Island Closed Landfill* (KCSWD-ESS, 2006).

5.3 Data Reporting

Data will be compiled and presented within three months of field activity completion in a technical memorandum that documents field procedures and presents water quality field data and final boring logs. Results of water quality field data will not be discussed in the technical memorandum. Interpretation of field and lab data is to be included in a final report as part of the

deliverables for the *Vashon Island Landfill & Transfer Station: Hydrogeologic Services Proposed Scope of Work #2* (KCWLRD, 2006b).

6.0. REFERENCES

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Appendix A

Draft Health & Safety Plan

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Appendix B

Draft Permit Variance Request

WASHINGTON STATE DEPARTMENT OF ECOLOGY

VARIANCE REQUEST
MINIMUM STANDARDS FOR WELL CONSTRUCTION

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

Requested by: Sevin Bilir, King County Water & Land Division
Mailing Address: 200 S. Jackson, St., Ste. 700 City Seattle State WA Zip 98104
Daytime Phone: 206-296-8029 Date: MM/DD/2009
Property Owner (if different): King County Solid Waste Division
Site Location: SW ¼ SW ¼ Section 36 Township 23N Range 02 E.
Tax Parcel Number 3623029009
Well Address: 18910 Westside Hwy SW, Vashon Island, WA
Well Driller/Company (if known): ESN Northwest, Inc.
Check one: ☐ Water Well ☒ Resource Protection Well

What construction standard cannot be met? 1) No protective metal casing will be set in concrete around the wells (WAC 173-160-420); 2) three metal posts will not be installed to protect the wells (WAC 173-160- 420); and 3) the borehole annular space will not be a minimum of 4-inches in diameter than the nominal size of the permanent casing (WAC 173-160-450).

Reason why standard cannot be met. Include site map and distances from all known potential sources of contamination if setback variance is being requested. RE: 1&2) The wells will be in a remote area of undeveloped land on a steep hillslope. Due to the rough terrain and the difficult access to the sites, installation of protective steel casing and posts is not warranted. Attachment 1 (a) and 1(b) shows the well locations. RE: 3&4) The wells are being used to capture groundwater prior to seepage from a hillslope. Well locations are upslope from the seeps. Due to the rough terrain, difficult access, and the shallow nature of the groundwater, hand augering was the only method deemed appropriate for obtaining lithologic information and to attempt well installation. Hand augering using a 3.25-inch outside diameter auger will not allow for the required annular space.

Alternative construction method that will provide equal or greater protections than those provided by the minimum standard. The wells will be secured using ProHydro, Inc. Well Caps (Attachment 2). These caps are attached using stainless steel screws and then secured with a padlock. These well caps are difficult to remove without damaging the well casing. Signs of tampering would be evident with damage to the padlock and the cap. Pre-packed screens will be used for well construction. Bentonite seal and grout will be to grade. The well installation procedures, and a site map showing the well locations are attached to this request.

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

Department of Ecology	Department of Ecology	Department of Ecology	Department of Ecology
Northwest Regional Office	Southwest Regional Office	Eastern Regional Office	Central Regional Office
ATTN: Bradly Gilmore	ATTN: Bill Lum	ATTN: Mark Ader	ATTN: Avery Richardson
3190 160th Avenue SE	PO Box 47775	N 4601 Monroe	15 W Yakima Ave #200
Bellevue, WA 98008	Olympia, WA 98504	Spokane, WA 99205	Yakima, WA 98902
425-649-7044	360-407-0281	509-329-3400	509-575-2639
Fax: 425-649-7098	Fax: 360-407-0284	Fax: 509-329-3529	Fax: 509-454-7830
bgil461@ecy.wa.gov	blum461@ecy.wa.gov	made461@ecy.wa.gov	aric461@ecy.wa.gov

Well Installation Procedure

The wells at the Vashon Island Closed Landfill & Transfer Station (VICLTS) will be constructed in the according to the procedures outlined below.

1) Due to the rough terrain and vegetated nature of the hillslope, some site preparation will occur prior to driller arrival. A standing pad will be placed around the borehole opening to preserve shallow surficial soils and sediment features.

2) Three borings will be advanced using an AMS Signature Series stainless steel hand auger with an outside diameter (O. D.) of 3.25-inches.

3) The primary intent of the borehole is to use lithologic data to refine the hydrogeologic model of the same units outcropping on the hillslope and underlying the VICLTS. The secondary intent is to complete the boreholes as wells as part of a scope of work with a planned sampling period of one year. Based on the chemical results and review of Public Health, sampling may continue or the wells may be decommissioned.

4) Observations of moisture during borehole advancement will assist in designing well construction details for each borehole. The following table and the figures in Attachment 3 is a draft view of the most likely outcome at each borehole site.

Boring / Well	Ground Surface Elevation (ft MSL)	~Depth to First Water ATA (ft bgs)	Bentonite Grout (ft bgs)	Bentonite Seal (ft bgs)	Screened Unit / Screen and Pre-Packed Filter Interval (ft bgs)	Sand Interval (ft bgs)	BHTD (ft bgs)
BH-30 / MW-30	245	10	0 -6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18
BH-31 / MW-31	220	5 ?	0 - 4	4 - 5	Cc3 – Perched ? / 6 - 11	5 - 11	11 ?
BH-32 / MW-32	240	10	0 - 6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18

Notes: bgs = below ground surface
BHTD = borehole total depth
MSL= mean sea level
ft = feet
ATA = at time of augering

5) If the borehole depth exceeds the well depth, 20x40 Colorado® silica sand (or equivalent) will be added to raise the bottom of the well screen to the targeted depth.

6) The groundwater monitoring wells will be constructed using nominal 2-inch-diameter flush-threaded Schedule 40 PVC well casing, pre-packed well screens and well points.

Well Installation Procedure (continued)

7) The well will be held in the center of the borehole manually during placement of additional annular sand backfill, bentonite seal, and grout to the surface, if necessary.

8) The screen assembly constructed by GeoInsight Online (GeoInsight PrePak screens), will consist of a nominal 5-foot long (or two 5-foot long sections) 0.010-inch machine-slotted section. A filter pack consisting of 20x40 Colorado® silica sand is factory installed between the well screen casing and a 65 mesh stainless steel screen. The O.D. of the pre-packed screen will be 2.8-inches. The following figures show a close-up of a smaller diameter well with the same pre-packed well screen material and the preparation of a 2-inch diameter casing well with a pre-packed well screen.

(Kram et al, 2001)

9) Upon installation of the well, additional filter material will be added to extend 1- foot above the uppermost screen slot.

10) A bentonite seal of at least 1 foot will be installed above the filter pack using #8 fine pellets and hydrated with potable water.

11) The remaining annular space will be backfilled to grade with bentonite grout.

12) The well casing will be cut-off approximately 2-feet above grade and the well will be sealed and secured with ProHydro, Inc. well caps and locked with padlocks. Attachment 2 shows the design for the caps.

References

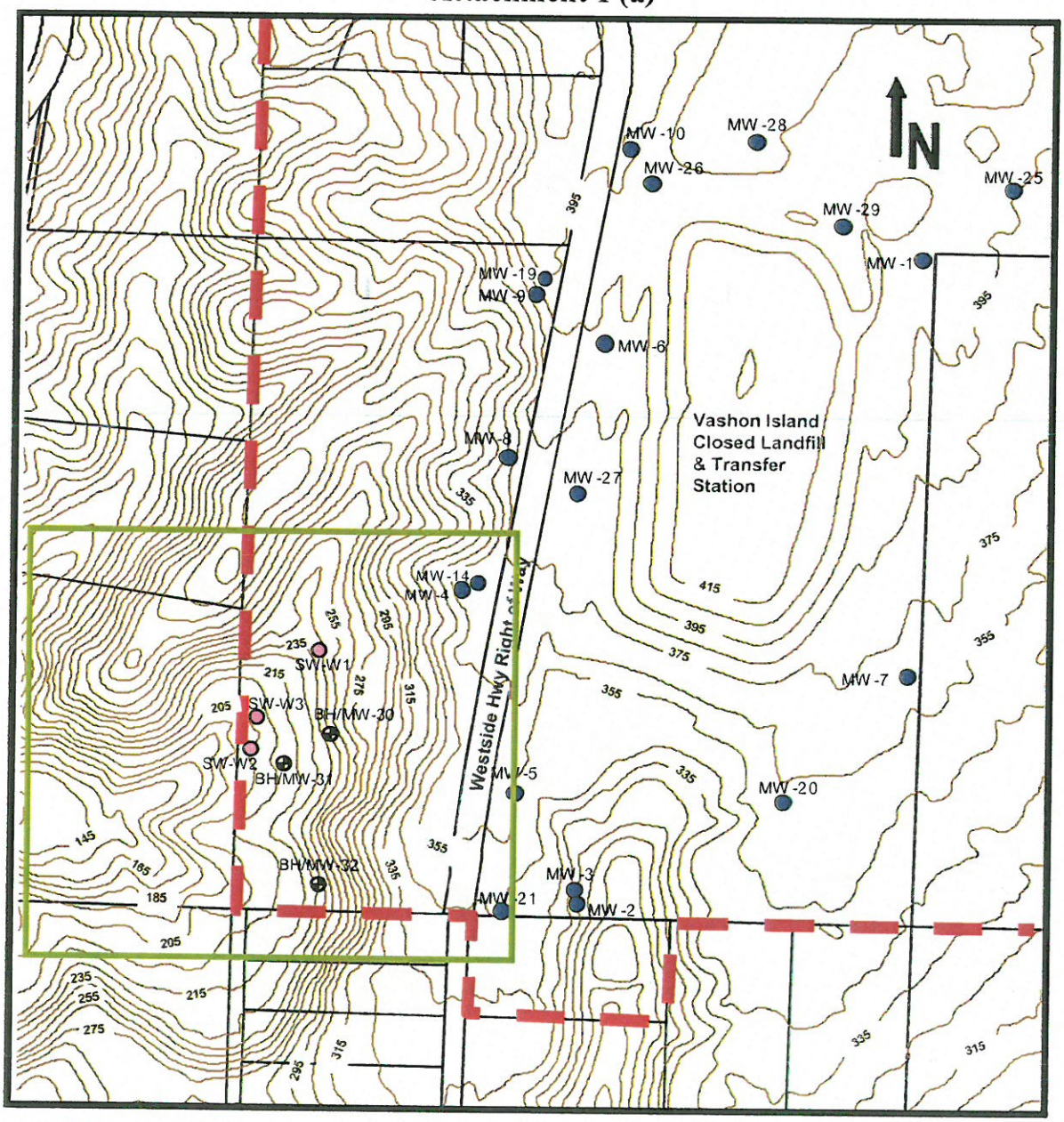
GeoInsight Online PrePak Screens
http://geoinsightonline.com/products/smdiam/intake.html

Kram, M. (NFESC) and D. Lorenzana (Intergraph), J. Michaelsen (UCSB), E. Lory (NFESC). (Kram et al). 2001. *Performance Comparison: Direct-Push Wells Versus Drilled Wells*, NFESC Technical Report TR-2120-ENV, Facilities Engineering Command, Washington DC 20374-5065. January.
http://geoinsightonline.com/pdfs/hue1.pdf

ProHydro, Inc. (ProHydro). 2007. ***Standard Operating Procedure for the Snap Sampler™ Passive Groundwater Sampling Method.*** January. http://www.snapsampler.com/images/SnapSOP_01-07.pdf
http://www.prohydroinc.com/prohydrowellcap.html

Washington State (WA). 2007. Chapter 173-160. *Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).* February 22. (Latest Update).

Attachment 1 (a)



Area Map

375 10 foot contour line

Area shown on Figure 2

KC Property line

Monitoring well

Quarterly Sampling Seeps

Proposed boreholes/wells

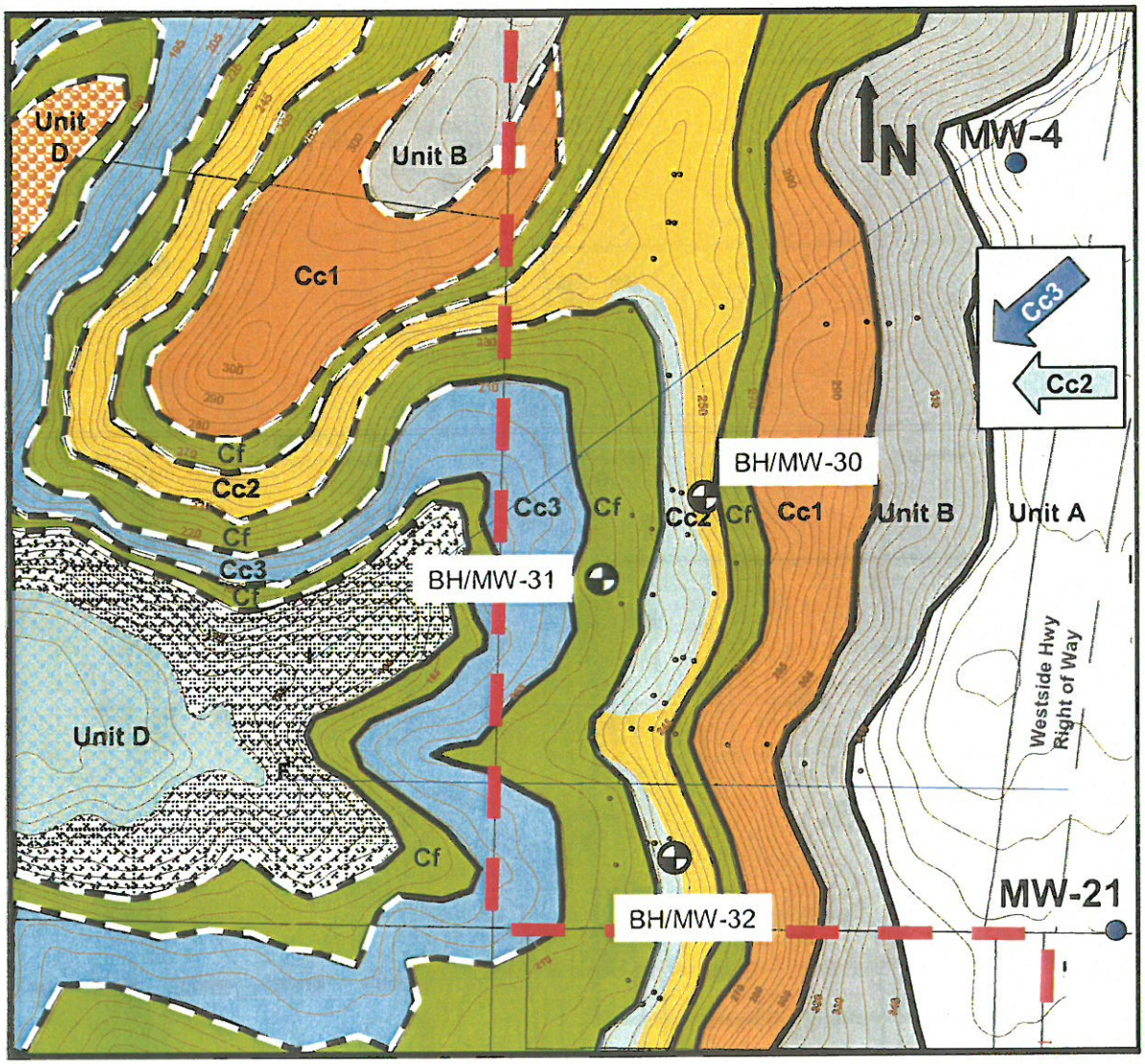
90 0 90 180 Feet

Contour Interval 10 feet

Surveyed/Estimated Data

All locations shown here are approximate

Attachment 1 (a)



Proposed Boring & Well Installation Locations

Note: Geologic interpretation is from an ongoing characterization study. Location of geologic contacts are approximate.

Surveyed/Estimated Data

KC Property line

Monitoring well

Groundwater flow direction in Cc2 and Cc3 (B&H/UES 2006)

Proposed Borehole / Well

60 0 60 120 Feet

Inferred geologic Contact

Dry

Unit A

Unit B

Cc1

Cf

Wet Dry

Cc2

Cc3

Unit D

Attachment 2

Snap Sampler Well Cap

Features, Pricing, and Installation Instructions

- Snap Sampler Well Caps are available in 2-inch (5cm) and 4-inch (10cm) sizes and will fit most standard PVC well casings.
- Snap Sampler Well Caps are made of Delrin, a high-quality thermoplastic polymer—durable, resistant to chlorinated solvents, fuels, grease, ozone, and many other chemical classes.
- O-ring seals are made of Viton, a high-quality fluorocarbon elastomer—durable, long-lasting, ozone resistant, chemical resistant.
- The Well Cap base is securely attached with screws to the top of the PVC casing. The attachment screws are covered when the Cap is closed.
- Attaching screws are 410 stainless steel for corrosion resistance and magnetic to help avoid dropping.
- The Well Caps can be securely locked and can't be pulled off or out like other well caps available on the market.
- A post on the underside of the Cap can be fitted with an available eye bolt to hang equipment.
- A seat on the Well Cap base allows use of an available Dock Ring to hang equipment.
- Well head top-of-casing (TOC) elevation is leveled when the Well Cap is installed, allowing consistent depth to water measurements from any point on the circumference.
- Well elevation is leveled with installation of this cap. Elevation change can be measured without resurvey, or previous top of casing can still be used.
- Clearance required around the well casing is approximately 1 inch horizontally and 1.5 inches vertically.

Caps with Support Rings: $32 for 2" / $42 for 4"; Eye bolts: $2

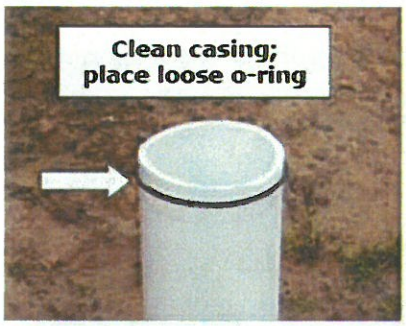
Call to order (585) 385-0023

PROHYDRO, INC.
WWW.PROHYDROINC.COM WWW.SNAPSAMPLER.COM

http://www.prohydroinc.com/images/Well_Cap_Installation_Web.pdf

Attachment 2 (continued)

Installation Instructions

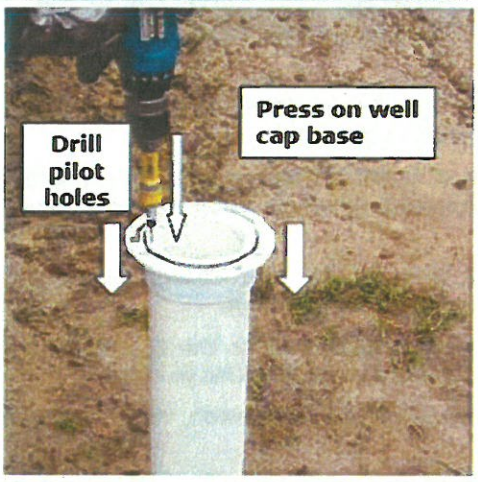


Snap Sampler Well Caps come with:

- **(1) White well cap base with o-ring**
- **(1) Blue well cap cover**
- **(3) attaching screws**
- **(1) loose o-ring to place on well casing**
- **Equipment support ring (optional)**
- **Eye bolt (optional)**

TO INSTALL:

> Clean outside of casing
> Place o-ring at top of casing



> Press well cap base onto wellhead

> Drill three (3) ***vertical*** pilot holes ***straight*** into center of casing wall using ***7/64" bit***

> ***If top of casing is not level, place one of the screw holes at the highest point of the casing.***

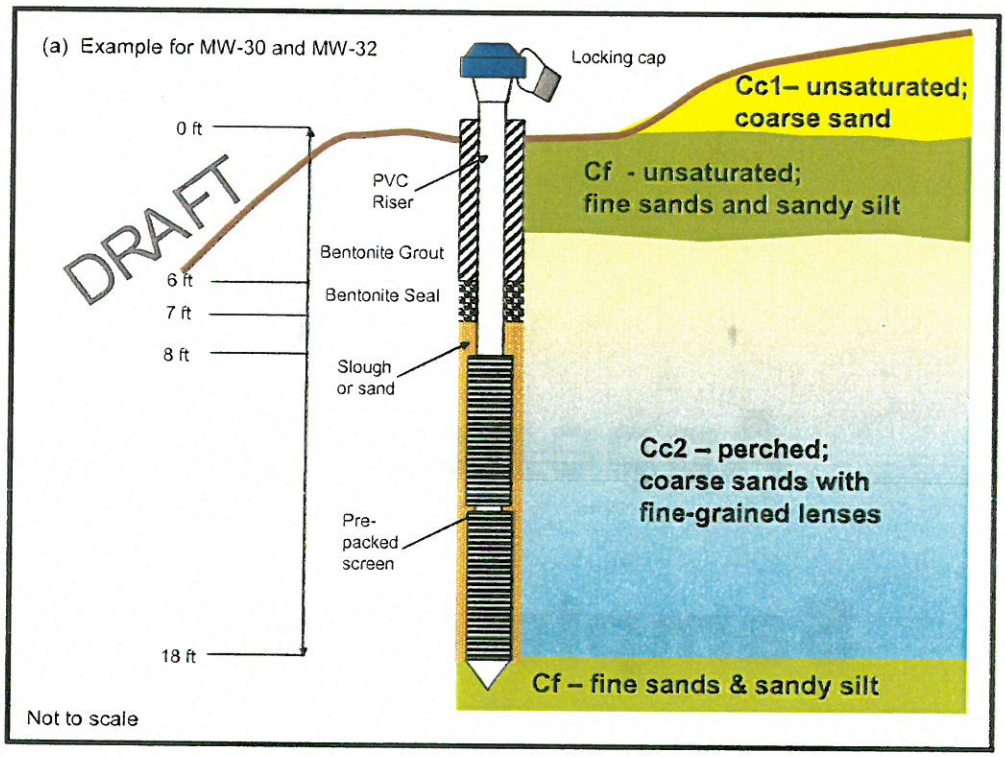
> ***Lightly*** tighten screws
DO NOT OVERTIGHTEN!

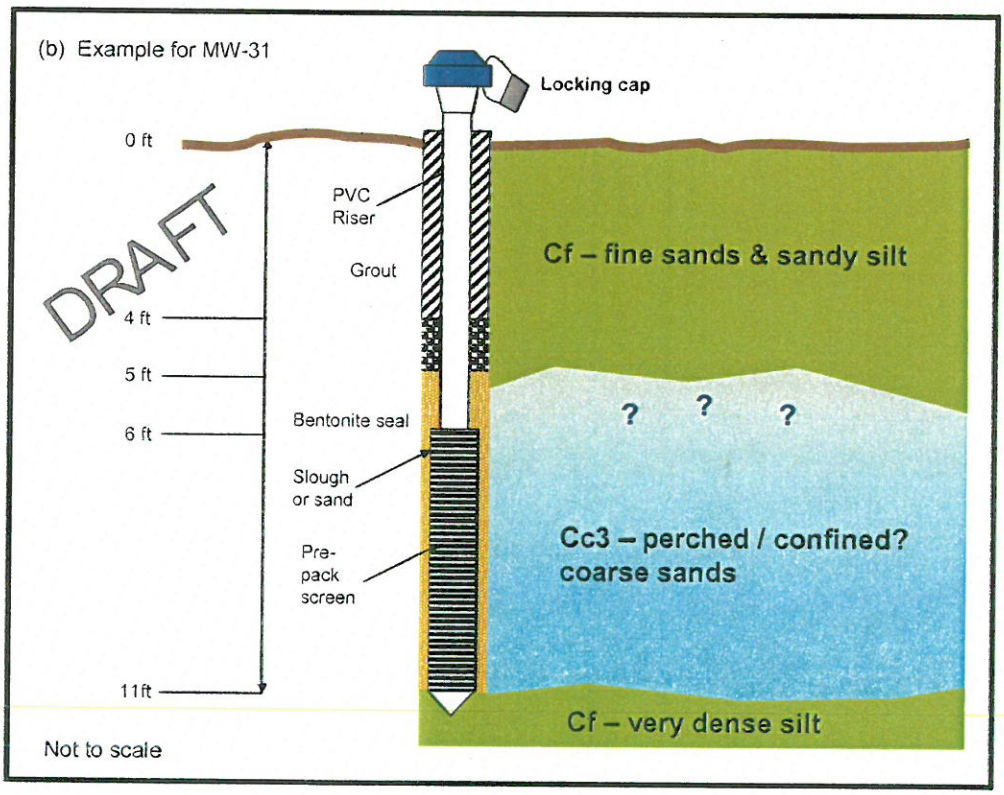
> ***If casing is not level, tighten only first screw at highest point on casing. Do not cinch down other screws***—tighten only to touch screw seat. Over-tightening will torque base and cap will not seal correctly; screw seat may crack.

New top of casing measurement point will be level at approximately 0.03 ft (7mm) higher than high point on the casing

http://www.prohydroinc.com/images/Well_Cap_Installation_Web.pdf

Attachment 3





Note: These monitoring well designs are schematic and idealized.

Appendix C

Sample Forms

FIELD ACTIVITY SHEET

Project _____ Date _____

Site _____ Weather _____

Arrival Time _____ Site Supervisor/Logger _____

Departure Time _____ Personnel present _____

Planned Activity _____

Contractor _____

Health & Safety Talk? Y N Time _____

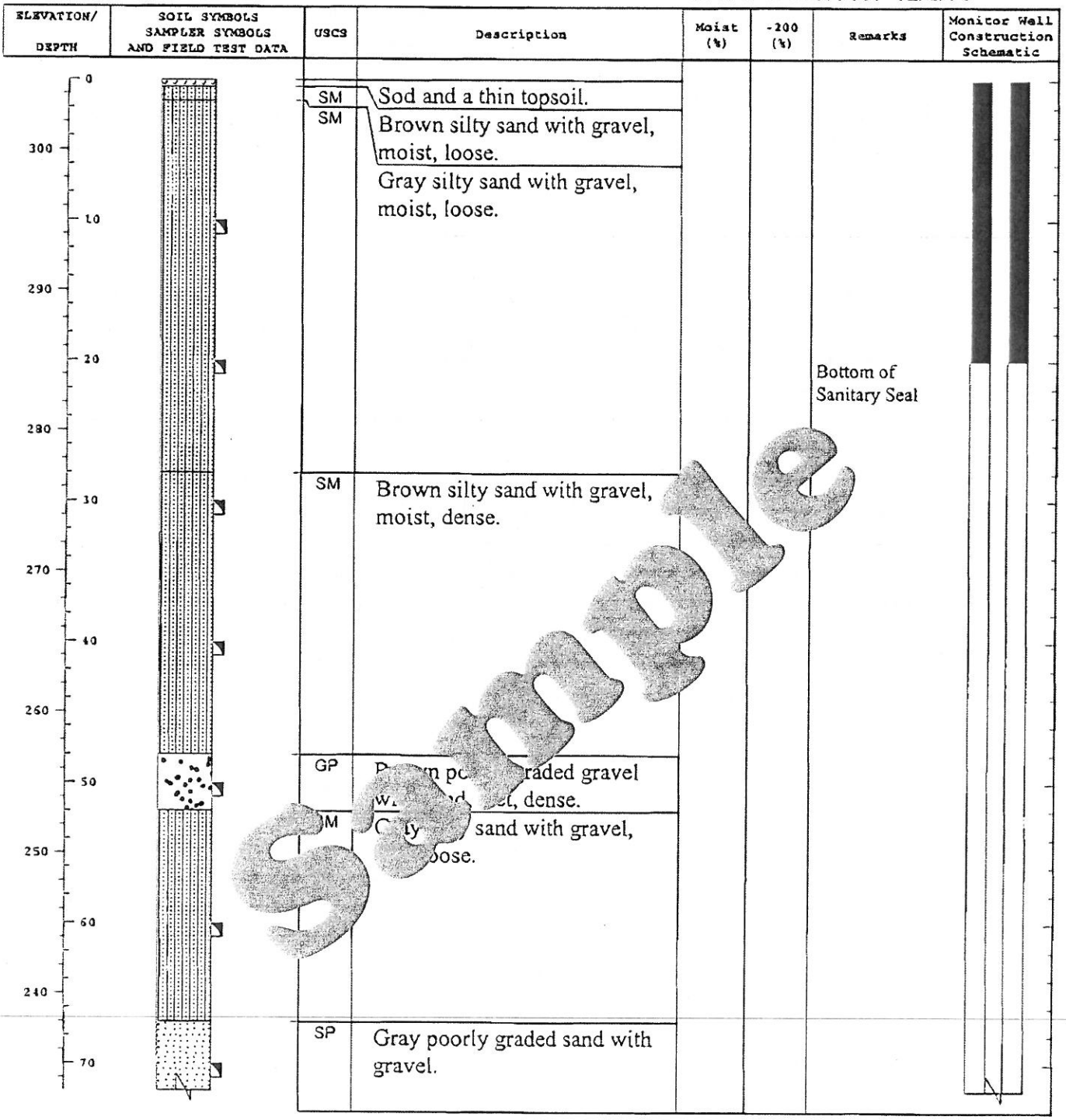
Equipment Calibration notes _____

TIME	ACTIVITY

LOG OF MONITOR WELL INSTALLATION

PROJECT:
BORING LOCATION:
DRILL METHOD: **Air Rotary 6 inch casing**
DRILLER:
DEPTH TO - Water: **82 ft**

DATE: **November 30, 2005**
START:
FINISH:
LOGGER:
DATE CHECKED: **12/2/05**



KING COUNTY
SOLID WASTE DIVISION

VASW-1 (43)

VASHON-1 SURFACE WATER FIELD RECORD

FIELD SAMPLING DATA

Station: _____
Date/Time: _____
Weather: _____
Location: _____

SAMPLING DATA

SAMPLE ID # _____

SAMPLE TYPE	DATE TIME	METHOD	VOLUME (mL)	CONTAINER TY	FILTERED (YES, NO)	PRESERVATIVE	ICED YES NO
TSS	/	GRAB	1000	[illegible]	NO	NONE	YES
COND/pH/ALK	/	GRAB	500	[illegible]OPE	NO	NONE	YES
TDS/TOTS	2009	GRAB	500	[illegible]	NO	NONE	YES
NH_3/NO_3	:	GRAB	250	WM	NO	NONE	YES
Cl/SO,	a.m.	GRAB	125	[illegible]	NO	NONE	YES
TOC		GRAB	2	[illegible] GLASS	NO	H_3PO_4	YES
METALS, d		GRAB	[illegible]	[illegible] Washed HDPE	YES	NONE	YES
VOA		GRAB	[illegible]	GLASS	NO	HCl	YES

RE[illegible]ER [illegible] [illegible]E DISSOLVED METALS BOTTLE "FIELD FILTERED"

FIELD WATE[illegible] ARAMETERS

TURBIDITY USED _____
METER READING _____

INSTR. # _____ _____ _____ _____

SAMPLE	SPEC COND (µmhos/cm)	pH VALUE	REDOX mV	TEMPERATURE (°C)	DISSOLVED OXYGEN (mg/L)	TURBIDITY NTU	TIME
1							

NOTES:

INSTRUMENTS CALIBRATED PRIOR TO USE? YES ☐ NO ☐ BUFFERS: 4, 7, 10

3 VTRPs TURNED IN? YES ☐ NO ☐. VTRP09 DATE:

BUBBLES? YES ☐ NO ☐. BUBBLE DIAMETERS:

NO QC BOTTLES

CUSTODY RECORD:

PERSONNEL	SIGNATURE	DATE/TIME
		/ / :
		/ / :

TOTAL NUMBER OF BOTTLES THIS SET 12

Chain of Custody Record

Environmental Monitoring Program Date ____________

King County · Department of Natural Resources and Parks · Solid Waste Division

№ 09657

Name: King County Solid Waste Division
Address: 201 South Jackson Street, Suite 701
Seattle, WA 98104-3855
Attention: Sendy P. Jimenez 206-296-4411
Authorization: KCEL Lab Services to KCSWD
Project Test Site: ____________

Project Site Test Reference

Category	Sub-group	Code	Description	No.
GROUNDWATER		CHGW	Cedar Hills GW Qtrly	2
GROUNDWATER		CHGW-V	C. Hills GW VOAs Only	3
GROUNDWATER		CHGW-AP	Cedar Hills GW Non-Potable	37
GROUNDWATER		CHGW-QS	C. Hills GW Qtrly	38
GROUNDWATER		CHGW-E	Cedar Hills GW Eqpt Blank	41
GROUNDWATER		CHGW-O	Cedar Hills GW Grndw? Blank	50
GROUNDWATER		CFGW	Cedar Falls GW Qtrly	5
GROUNDWATER		DUGW	Duvall GW Qtrly	6
GROUNDWATER		ENGW	Enumclaw GW Qtrly	7
GROUNDWATER		HOGW	Hobart GW Qtrly	8
GROUNDWATER		HTGW	Houghton GW Qtrly	9
GROUNDWATER		PUGW	Puyallup GW Qtrly	10
GROUNDWATER		VAGW	Vashon GW Qtrly	12
SURFACE WATER		CHSW-Q	Cedar Hills SW Quarterly	14
SURFACE WATER		CHSW-M	Cedar Hills SW Monthly	15
SURFACE WATER		CHSW-P	Cedar Hills SW Permit	16
SURFACE WATER		CHSW-P2	Cedar Hills SW South Lagoon	46
SURFACE WATER		CHSW-AS	Cedar Hills Area 5 Top Deck	42
SURFACE WATER		CFSW	Cedar Falls SW Qtrly	17
SURFACE WATER		DUSW	Duvall SW Qtrly	18
SURFACE WATER		VASW	Vashon SW Qtrly	21
SURFACE WATER	HILL	VASW-1	Vashon Hilltop SW Qtrly	43
SURFACE WATER	HILL	VASW-2	Vashon Hilltop SW Qtrly	44
SURFACE WATER	HILL	VASW-3	Vashon Hilltop SW Qtrly	45
LEACHATE/WASTEWATER		CHLS-M	Cedar Hills Leachate Mthly	23
LEACHATE/WASTEWATER		CHTW	Cedar Hills Truckwash	24
LEACHATE/WASTEWATER	PERMIT	CHLS-P	Cedar Hills 1 Union Permit	25
LEACHATE/WASTEWATER	PERMIT	ALLS	Algona WW Permit	26
LEACHATE/WASTEWATER	PERMIT	ENLS	Enumclaw WW Permit	27
LEACHATE/WASTEWATER	PERMIT	FALS	Factoria WW Permit	28
LEACHATE/WASTEWATER	PERMIT	SNTS	Shoreline WW Permit	29
LEACHATE/WASTEWATER	PERMIT	HTLS	Houghton WW Permit	30
LEACHATE/WASTEWATER	PERMIT	RELS	Renton WW Permit	31
LEACHATE/WASTEWATER	PERMIT	VALS-P	Vashon Leachate Permit	32
LEACHATE/WASTEWATER		VALS-Q/M	Vashon Leachate Qtrly/Mthly	34
LEACHATE/WASTEWATER		CHSW-E	Cedar Hills Emergency Spill	49
			Number of Containers	

Lab No.	Sample I.D	Date	Time	Remarks

Sample

Relinquished By Sampler	Date	Received By		Observations/Comments/Special Instructions:	Total # of Bottles:
Sampler Signature		Signature			
Sampler Printed Name: KCSWD	Time	Printed Name			
Company		Company			
Relinquished By	Date	Received By	Date		
Signature		Signature			
Printed Name	Time	Printed Name	Time		
Company		Company			

Instructions:

1. Complete in ballpoint pen. Draw one line through errors and initial.
2. Receiving lab is to sign in the shaded box.
3. Check off pre-printed Project Site Test Reference to be performed for each sample, or provide specific instruction if not listed.
4. KCSWD personnel are to retain white and canary pages, receiving lab is to keep pink and goldenrod pages.
5. If KCSWD personnel request, please provide a name and telephone number of your contact person.

Distribution: White and Canary – KCSWD Pink and Goldenrod – Receiving Laboratory

Appendix D.2

Technical Memorandum: Hand Augering, Sediment Sampling, and Monitoring Well Installation, Development & Sampling Activities. 2010.

TECHNICAL MEMORANDUM

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

February 10, 2010

DRAFT

King County

Department of Natural Resources and Parks
Water and Land Resources Division
Science and Technical Support Section
King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104
http://www.kingcounty.gov/environment/wlr

Technical Memorandum:

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

Prepared for:
Landfill and Environmental Monitoring
Engineering Services
Solid Waste Division
King County Department of Natural Resources and Parks

Submitted by:

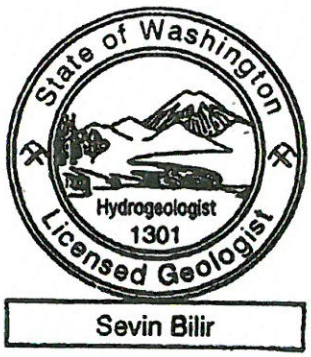
Hydrologic Services Group
Water Quality and Quantity Unit
Scientific and Technical Support Section
Water and Land Resources Division
King County Department of Natural Resources and Parks

King County
Department of Natural Resources and Parks
Water and Land Resources Division
201 S. Jackson St., Ste. 600
Seattle, WA 98104
(206) 296-6519

Technical Memorandum: Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

This document was prepared under the supervision and direction of the undersigned whose seal as licensed hydrogeologist is affixed below:



Signature available on hard copy only

Sevin Bilir, L. HG. (WA)

King County
Department of Natural Resources and Parks
Water & Land Resources Division

February 10, 2010

Date

Table of Contents

Figures

Tables

Appendices

1.0. INTRODUCTION

This document presents the results for hand augering, sediment sampling, and well installation for investigation activities on the hillslope to the west of the Vashon Island Closed Landfill & Transfer Station (VICLTS). It has been prepared for King County Department of Natural Resources & Parks-Solid Waste Division (KCSWD) and the work supports KCSWD's efforts to:

- Characterize lithologic units,
- Investigate hydrogeologic physical and chemical conditions, and
- Install three new monitoring wells

This technical memorandum presents results from augering activities into the subsurface on the hillslope west of the VICLTS, as recommended in the work plan *Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities(June 23, 2009)* submitted to Public Health – Seattle & King County (Public Health) for review.

Tasks proposed in the work plan were based on the results and recommendations from work presented in *Vashon Island Landfill Hillslope: Report for Scope of Work #1* (KCWLRD, 2006a). There are five monitoring wells (MW-4, MW-8, MW-9, MW-14, and MW-19) installed to the west of the Westside Highway, west of the VICLTS. Figure 1 shows the locations of these wells with respect to the landfill and the hillslope to the west. All of these wells are located at the top of the hillslope, at the same elevation as the Westside Highway.

1.1 Scope of Work

The field investigation program was designed to be as flexible as possible to allow field adjustments for conditions encountered as the investigation proceeds. The tasks listed below were performed during the field investigation.

1) Hand auger one boring (BH-30) and complete as monitoring well MW-30
2) Hand auger one boring (BH-31) and complete as monitoring well MW-31
3) Hand auger one boring (BH-32) and complete as monitoring well MW-32
4) Descriptions were made of lithology of encountered sediments.
5) Developed each groundwater monitoring well and conducted field water quality parameter testing (temperature, pH, and specific conductivity).
6) Collected groundwater samples and submitted to King County Environmental Laboratory for the VICLTS standard groundwater suite analysis (termed VAGW by KCSWD).

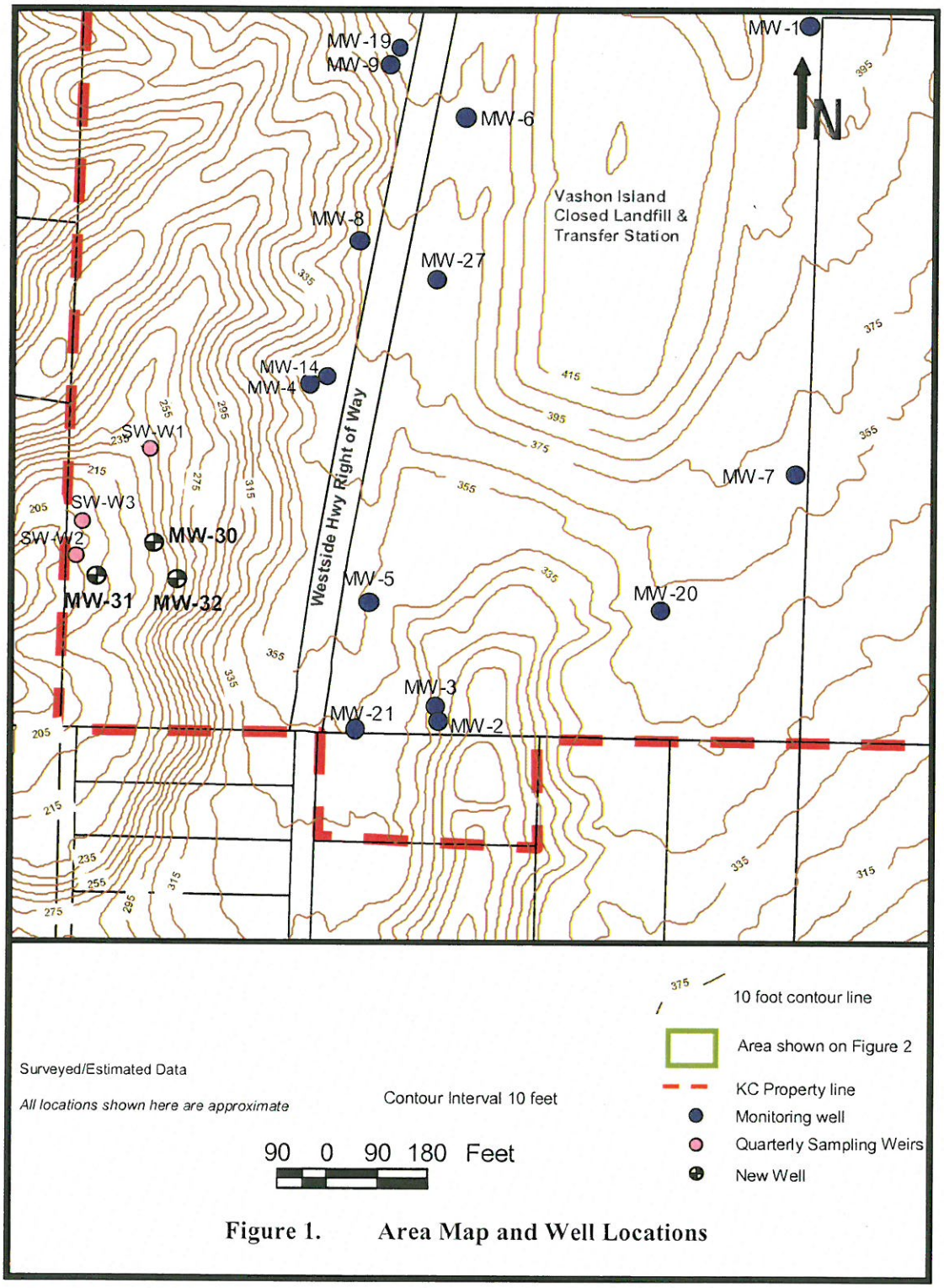


Figure 1. Area Map and Well Locations

2.0. FIELD ACTIVITIES

This section presents brief descriptions of field activities performed, as well as activities conducted as preparation for the field activity, such as preparing a health and safety plan and obtaining permits. Field investigations included borehole site preparation, augering, lithologic description, monitoring well activities, decontamination & handling procedures, residuals management and field instrumentation, field supervision. Field activities were recorded in the field activity sheets (Appendix C-2).

2.1 Health & Safety Plan

A site specific Health & Safety Plan (HSP) was prepared by the field supervisor and approved of by the KCSWD Safety Officer and Project Manager. All site work was performed under the HSP. The contents included:

- Waste Type (s) / Characteristics
- Hazard Evaluation
- Operations Plan
- Safety & Equipment Procedures
- Emergency Procedures

Prior to the start of work, the HSP was shared with all related parties. Site workers were required to review the document. During site investigations, the field supervisor conducted daily safety talks with site workers at the start of each field day. There were no health & safety concerns that rose during the field work. Air monitoring of the work site and borehole was conducted as per the HSP. A copy of the HSP was on site at all times during the field investigation. Appendix A contains a copy of the HSP.

2.2 Permits & Variances

The three new wells were designed to meet the resource protection well construction requirements prescribed in WAC 173-160 (WA, 2007). A Notice of Intent/Start Card was obtained from Ecology for the augering and well construction activities prior to work start. Due to field observations, variances were requested and obtained prior to field investigations. A copy of the permit and records of variance requests and approvals were on site at all times during the field investigation. Appendix B contains copies of all permit and variance related documents.

2.3 Augering & Lithologic Description

Three borings were advanced using an AMS Signature Series stainless steel hand auger with an outside diameter (O. D.) of 3.25-inches. Figure 2a shows the auger tip that was used to advance the borehole. Driven sediment samples were collected using an AMS Signature Series soil core sampler with slide hammer (Figure 2b). Samples were collected in a clear plastic 2-inch O. D.

sample tubes. Representative portions of sediment samples were stored in labeled plastic bags for lithologic review purposes only.

(a) 3.25" O. D. auger showing removal of silt (b) Soil core sampler & hammer

Figure 2. Augering & Sampling Equipment

Sediments discharged during advancement of the auger and collected from the soil core sampler were reviewed for lithologic description. The visual and manual methods described in ATSM Method D-2488-06 (ASTM, 2006) were used for soil classification. Where presence of moisture was encountered, depth was recorded on the borehole logging form. Appendices C-1 and C-3 contain the draft descriptions of the lithology.

Augering and lithologic review continued until reached desired depth or the borehole was in danger of caving in and/or extent of equipment used was reached. Monitoring well designs were prepared based on conditions encountered while boring.

2.4 Monitoring Well Activities

2.4.1 Monitoring Well Construction Design & Installation

As mentioned in previous sections, during advancement of the borings, decisions were made with respect to well design. The groundwater monitoring wells were constructed using nominal 2-inch-diameter flush-threaded Schedule 40 PVC well casing and pre-packed well screens. The screen assembly consisted of a nominal 5-foot (or two 5-foot) long 0.010-inch machine-slotted section(s). A filter pack consisting of 20x40 Colorado® silica sand was factory installed between the well screen casing and a 65 mesh stainless steel screen. When the borehole annular space exceeded pre-packed screen, 10/20 Colorado® silica sand was added around the casing and the pre-packed screen. Upon installation of the well, additional sand filter material was added to extend at least to one foot above the uppermost screen slot. A bentonite seal was extended to the surface used for hydrating pellets.

(left) 2–inch pre-packed well mesh around sand. (right). Close up of mesh

Figure 3. Pre-packed Well Screens

The well was held in the center of the borehole manually during placement of the additional annular silica sand backfill, bentonite seal, and grout to the surface, when necessary. Actual conditions for each borehole are presented in Table 1. Appendices C-1 and C-3 show diagrams of the well construction details in the Resource Protection Well Reports and the Borehole and Well Construction Logs.

Table 1. Well Construction Details

Well	Depth to Water (ft bgs)			Stick up*	Bentonite Seal Interval	Screen Interval	Sand Interval	Borehole Total Depth	Well Total Depth
	At time of Drilling (12/14-15/2009)	During Development (12/22/2009)	During 1st Sampling (1/2010)	(ft ags)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)	(ft bgs)
MW-30	4.65	4.65	4.16	1.2	0 – 2.8	3.8 – 8.8	2.8 – 8.8	11.5	9.01
MW-31	8.94	5.7	5.83	2.08	0 - 4	5 - 10	4 - 10	10.5	10.195
MW-32	Dry	Dry	xx	1.93	0 – 8	10 – 20	8 – 20	20	19.96

Notes:
ft ags feet above ground surface
ft bgs feet below ground surface
*Stick up defines the height of the top of casing above the ground surface.
Ground surface in this case is defined by the top of the wooden platforms at each location.

A Washington state licensed driller (ESN Northwest) performed the work and filed the Notice of Intent, obtained a permit to drill and submitted the resource protection well reports with Ecology (Appendix C-1).

Due to the isolation and rugged terrain at the well sites, a locking well cap (the ProHydro, Inc. Snap Sampler™ well cap (Figure 3) was attached with stainless steel screws to the casing in order to prevent unauthorized access to the well. The site well identification number was written on the well cap and the state well tags were attached to each new well casing (Figure 3). The well was secured using a lock supplied by KCSWD. A reflective marker and a King County sign was installed at each well location.

Figure 4. Well Surface Completion

2.4.2 Water Quality & Monitoring Well Development

Each completed monitoring well, with the exception of MW-32 which was dry, was developed to ensure hydraulic continuity between the well, well screen, and formation materials. Well development consisted of pumping using a peristaltic pump with new tubing. Collected groundwater was transferred directly into a clean container for measurement of field water quality. Approximately two casing volumes of groundwater were removed during development.. The pH, specific conductivity, and temperature of purged groundwater were measured at the start of development and periodically thereafter until stabilization was reached. Results are shown in Appendix C-4.

2.4.3 Monitoring Well Sampling

During the following planned sampling event on the west hillslope (first quarter of 2010), the new monitoring wells were sampled as per procedures according to the *KCSWD DRAFT Environmental Monitoring Sampling and Analysis Plan and Quality Assurance Project Plan for Vashon Island Closed Landfill* (KCSWD-ESS, 2006). Samples were submitted to the King County Environmental Laboratory for analysis of the VICLTS standard groundwater suite analysis (termed VAGW by KCSWD). Chain-of-Custody Forms were submitted to ensure correct sample delivery. Paperwork is shown in Appendix C-5. Results are expected in early March 2010.

2.5 Decontamination & Handling Procedures

All down-hole equipment were either new or cleaned using an astringent cleaner followed by a triple-rinse with distilled water before and after each boring.

The site workers wore new, clean nitrile gloves during sample collection and processing and they wore the appropriate personal protective equipment required by the HSP.

2.6 Residuals Management

Residuals generated during the field investigation included auger cuttings (sediments), wastewater, and solid waste.

2.6.1 Auger Cuttings

Auger cuttings generated during this investigation were stored on site pending characterization. During storage, the cuttings were protected from precipitation, run-on, and run-off.

If tests of auger cuttings confirm that the cuttings are not dangerous or hazardous waste, then the cuttings will be transported to Cedar Hills Regional Landfill and disposed of in the active fill area. If tests of characterization samples indicate that the cuttings are dangerous or hazardous waste, then appropriate treatment or disposal will be arranged in consultation with Public Health.

Testing parameters and methods will be completed in accordance with Public Health requirements.

2.6.2 Wastewater & Solid Waste

Water generated from the cleaning of augering and sampling equipment, well development, and well sampling were contained and stored at each well site until they can be transferred to the VICLTS leachate collection and treatment system. All solid waste was removed from the hillslope and disposed of properly at the King Street Center or KCEL.

2.7 Field Instrumentation

Standard field instruments used for this project include: pH meter, conductivity meter, temperature meter, electric water level meters / sounder and an air monitoring meter (as per the HSP (Appendix A)).

Operation manuals for the instruments used were available on site during field activities. Meters measuring pH and conductivity were calibrated at the start of the day. Records of calibration events were noted on field sheets.

2.8 Field Supervision

The hydrogeologist was the field supervisor in charge of site activities. There was no need to limit access of personnel and/or stop activities.

3.0. REPORTING

Data was compiled and presented within three months of field activity completion in this technical memorandum documenting field procedures and presenting water quality field data and final boring logs. Results of water quality field data were not be discussed in the technical memorandum. Interpretation of field and lab data is to be included in a final report as part of the deliverables for the *Vashon Island Landfill & Transfer Station: Hydrogeologic Services Proposed Scope of Work #2* (KCWLRD, 2006b).

4.0. REFERENCES

American Society for Testing and Materials (ASTM). 2006. *ASTM D 2488-06 - Standard Practice for Description and Identification of Soils*, ASTM International. Book of Standards Volume: 04.08. 11 p. www.astm.org

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King County Water & Land Resources Division (KCWLRD), 2006a. *Vashon Island Landfill Hillslope Report for Scope of Work #1.* Final Draft. August.

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ProHydro, Inc. (ProHydro). 2007. *Standard Operating Procedure for the Snap Sampler™ Passive Groundwater Sampling Method.* January. http://www.snapsampler.com/images/SnapSOP_01-07.pdf

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Appendix A

Health & Safety Plan

HEALTH & SAFETY PLAN

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

December 10, 2009

FINAL

King County

Department of Natural Resources and Parks
Water and Land Resources Division
Science and Technical Support Section
King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104
http://www.kingcounty.gov/environment/wl

Health & Safety Plan:

Hand Augering; Sediment Sampling; and Monitoring Well Installation, Development & Sampling Activities

Vashon Island Closed Landfill & Transfer Station: West Hillslope

Prepared for:

Landfill and Environmental Monitoring
Engineering Services
Solid Waste Division
King County Department of Natural Resources and Parks

Submitted by:

Hydrologic Services
Water Quality and Quantity Unit
Scientific and Technical Support Section
Water and Land Resources Division
King County Department of Natural Resources and Parks

King County

Department of Natural Resources and Parks
Water and Land Resources Division
201 S. Jackson St., Ste. 600
Seattle, WA 98104
(206) 296-6519

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1.0. PROJECT INFORMATION

SITE:	Vashon Island Closed Landfill & Transfer Station: West Hillslope		
DATE:	December 10, 2009	**PREPARED BY:**	Sevin Bilir
LOCATION:	West of landfill (18910 Westside Hwy SW)	**PROJECT NUMBER:**	G13580
	Vashon Island, WA	**PROJECT MANAGER:**	Dan, Swope, SWD

PROJECT OBJECTIVES:	Conduct hydrogeologic field investigations on the west hillslope.
SCOPE OF WORK:	Hand auger boreholes, collect sediment samples for lithologic review, install wells at each borehole, develop & sample wells, and prepare waste water/soil for disposal. THIS DOCUMENT DOES NOT COVER ANY CONFINED SPACE ACTIVITIES OR USE OF PASSIVE AND/OR ACTIVE AIR PURIFYING OR SUPPLYING EQUIPMENT.

START DATE:	December 10, 2009	**COMPLETION DATE:**	December 10, 2010

Note: This Health & Safety Plan (HSP) must be re-evaluated and updated annually. In the event of a change in site conditions or scope of work, the HSP will be updated regardless of the annual update.

2.0. FACILITY DESCRIPTION & BACKGROUND

TYPE OF FACILITY: Undeveloped land, west of an inactive municipal solid waste landfill.

SIZE: ~ 140 acres.

BUILDINGS / STRUCTURES: Weirs, seepage samplers & wood walkways

ACCESS: Trail, maintained annually.

TOPOGRAPHY:	Steep to gradual highly vegetated terrain ranging from about 180 to 400 feet above mean sea level.
GENERAL GEOLOGIC/HYDROLOGIC SETTING:	Site soils consist of glacially derived sediments; sand and gravel, silt, and clay. Groundwater occurs as perched saturated zones seeping out of the hillside. water emanates from these seepage areas and flow downhill to the west.
SITE STATUS:	Investigatory.
PREVIOUS HAZARDOUS MATERIALWASTE STORAGE AND DISPOSAL METHOD(S):	N/A
SITE HISTORY:	Hillslope appears to have had illegal dumping of garbage near the road. Site investigations by KC SWD on the hillslope have been ongoing for about 5 years. Trails were constructed in recent years to improve access to sampling weirs. New trail walkways, seepage samplers, and weirs were recently installed within the last year.
SPECIAL CONDITIONS / COMMENTS:	None.

3.0. WASTE TYPE (S) / CHARACTERISTICS

ARE HAZARDOUS SUBSTANCES KNOWN TO HAVE BEEN STORED / SPILLED ON SITE? ☐ YES ☒ NO

SOURCE(S) OF INFORMATION:

- 2006 Annual Groundwater Data Evaluation Report (KC SWD 2007)
- Landfill Monitoring Test Results, March 5, 1998. (UES, 2003).
- SWD Database (SWD, February 2008)

COMPOUNDS POSING HEALTH CONCERN:

	Maximum concentration Encountered or Anticipated in Cc2 and Cc3 Sands			Surface Water
Element/ Compound	Depth (feet below grade)	Groundwater (ppb)	Landfill Gas (%)	(ppb)
Arsenic	126	110 *2 (dissolved)		6.1*3
Methane			36 (in waste)	
Vinyl Chloride	126	13*2		2.8*1

Note: *1 SW-S4 highest result in 2007. *2 MW-5D highest result in 2007. *3 SW-S3 highest result in 2007.

SPECIAL CONSIDERATIONS / COMMENTS:

- Site groundwater and leachate contains arsenic in concentrations exceeding primary drinking water standards.
- Landfill gas contains methane, posing an explosion hazard. Landfill gas will be considered a potential explosion hazard during augering activities in the subsurface.
- Concentrations of volatile organic compounds in landfill gas are not known; therefore, landfill gas will be considered a potential inhalation hazard during augering activities in the subsurface.
- Landfill gas contains carbon dioxide; therefore, all confined or potentially confined spaces will be considered asphyxiation hazards. This document does not cover confined space entry. This document does not cover use of any active and/or air purifying or supplying equipment.

4.0. HAZARD EVALUATION

CHEMICAL:

- Ingestion of arsenic can cause chronic and acute illness.
- Inhalation of landfill gas can cause nausea, acute and chronic illness.
- Methane gas mixed oxygen can cause explosion hazards.
- Vinyl chloride is a class A carcinogen; pathways are absorption, inhalation, and ingestion. Effects can be acute and chronic. Inhalation can cause immediate dizziness and/or nausea.
- Oxygen deficiency can cause asphyxiation.

PHYSICAL:

- Slip, trip, and fall hazards associated with construction sites and working on undeveloped terrain are potential hazards.
- Moving parts on the augering and sampling equipment can be hazardous; workers shall stay clear of moving parts and shall not operate contractor's equipment or equipment they are not trained to use.
- Noise levels near sampling can be high when hitting metal to metal; hearing protection is required when noise levels exceed 85dB-TWA. Equipment used is not anticipated to exceed 85dB-TWA.
- Workers are responsible for being aware of all hazards associated with the worker's typical duties.
- All confined or potentially confined spaces will be considered asphyxiation hazards. This document does not cover confined space entry. This document does not cover use of any active and/or air purifying or supplying equipment.
- Monitor for cold or heat stress when ambient temperatures are below 50 degrees or exceed 75 degrees Fahrenheit, respectively. Due to the expected timing of the job in the winter, cold stress is more likely the issue. A vehicle will be provided as a heat source, if necessary.
- When developing and sampling wells, be careful to not splash water onto exposed skin.

OTHER:

- Be aware of traffic on County roads.
- Check work areas for transient inhabitants.
- Buddy system is preferred. If working alone, worker should report to project personnel of planned activities and when leaving the site, worker should call in to report they are no longer on the hillslope.

5.0. OPERATIONS PLAN

VICINITY MAP / EMERGENCY ROUTE / ROUTE TO HOSPITAL: See Appendix C

SITE SKETCH: See Appendix D

UNDERGROUND UTILITY CLEARANCE PERFORMED ON: Not performed (undeveloped land)

FIELD METHOD(S): Drilling will be performed using hand augering method. Sediment samples (for lithologic review) will be collected using a 15-lb sampler and then placed in plastic bags. Landfill gas will be monitored in the field using hand-held monitoring equipment. Well development will be carried out using a surge tool and a bailer or peristaltic pump. Sampling of wells will follow procedures in the SWD QAPP (KC SWD, 2006).

SPECIAL CONDITIONS Special care with regards to transporting the boring and sampling equipment to the borehole locations should be taken to ensure worker safety. The steepness of the terrain and the soft and/or slippery nature of the soils should be taken into consideration when carrying equipment.

COMMENTS: NO CONFINED SPACE ENTRY SHALL BE PERMITTED UNDER THIS DOCUMENT. NO ACTIVITES REQUIRING USE OF ACTIVE AND/OR AIR PURIFYING OR SUPPLYING EQUIPMENT SHALL BE PERMITTED UNDER THIS DOCUMENT.

6.0. SAFETY & EQUIPMENT PROCEDURES

INITIAL LEVEL OF PROTECTION: ☐ C ☒ D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT: Standard Level D safety equipment. Protective clothing should be used as applicable per activity. For augering activities, personnel will wear appropriate protective footwear, and hearing protection during equipment/rig use. Hearing protection is required if noise levels exceed 85 dB-TWA. The equipment used is not anticipated to cause exceedances of this level. Appendix B for the "Health and Safety Equipment Checklist".

Appropriate clothing should be used for weather conditions. Appendix A contains information for the King County Heat-Related Illness Prevention Program; Worker Safety Tips – Heat Stress; Protective tips for cold environment workers; and the Cold Stress Card.

For activities contracted to non-KC personnel, their proper work and safety procedures contained in their Health & Safety Plan should be followed for the duties they typically perform.

AIR MONITORING EQUIPMENT AND PROCEDURES: Gas-Tech NP-304 or equivalent will be used to monitor concentrations of methane and oxygen in the work space during borehole activities.

ACTION LEVELS: If oxygen levels fall to or beneath 20%, the area will be evacuated. If methane concentrations equal or exceed 5% of the Lower Explosive Limit (LEL), the area will be ventilated. If ventilation cannot increase oxygen levels or reduce methane concentrations, the area will be evacuated and work discontinued pending review and improvement of safety controls by the SWD Safety Officer.

COMMUNICATIONS: Immediately communicate any action level exceedance to all site workers who could be affected; communicate questionable site conditions to project managers and the SWD Safety Officer at earliest reasonable opportunity.

DECONTAMINATION PROCEDURES: Wash face and hands before eating or leaving site.

7.0. KEY PROJECT PERSONNEL

SITE WORK TEAM (name / responsibility)

1.	Sevin Bilir; KC WLRD Hydrogeologist	2.	ESN Northwest, Inc. personnel
3.	King County WLRD personnel	4.	King County SWD personnel
5.	King County Health Dept. personnel	6.	King County DOT personnel
7.	State of WA Dept. of Ecology personnel	8.	

ENTRY BRIEFING DATE: See signature sheet LOCATION: Site

SPECIAL CONDITIONS (e.g., work schedule or limitations): Work is to be conducted during daylight hours. Personnel need to be off the hillslope by 4:30 pm.

Restroom facilities are at the road elevation, about a 5-15 minute walk uphill from the borehole sites.

8.0. EMERGENCY PROCEDURES

ACUTE EXPOSURE SYMPTOMS(S):	FIRST AID:
Eyes – slight to severe irritation.	Flush with water for 15 minutes.
Skin – irritation, redness, edema, drying.	Wash with soap and water.
Respiratory – dizziness, irritation of eyes, nose, throat vomiting, bluish skin, CNS effects.	Remove to fresh air.
Ingestion.	Call physician.

NEAREST HOSPITAL / EMERGENCY MEDICAL CENTER (see Appendix C maps & Table 1)

Highline Medical Center; 16251 Sylvester Rd. S.W., Burien, WA. 98166

EMERGENCY ROUTE: (see attached map in Appendix C)

From the landfill travel north on Westside HWY:

- Turn right onto Thorsen Rd SW.
- Turn left onto Vashon HWY SW. Continue north to ferry terminal. Get onto Ferry to Fauntleroy.
- Turn right onto Fauntleroy Way SW.
- Turn left onto SW Wildwood Pl.
- Turn left at SW Brace Point Dr. Continue on California Ave SW.
- Turn right at SW Barton St.
- Turn Right at 35th Ave SW.
- Turn left at SW Roxbury St.
- Turn right at 16th Ave SW. Bear left at Ambaum Blvd SW; continue on Ambaum Blvd SW.
- Turn right at 4th Ave SW. Bear right at Sylvester Rd SW. The hospital is on the right.

EMERGENCY PHONE NUMBERS (See Table 1 for more numbers)

Ambulance, Police, Fire	911
Hospital (HMC)	206-244-9970
Emergency Dept. at Hospital (HMC) -- (messages checked immediately)	206-431-5314
Fire Department	911

9.0. REFERENCES

King County Solid Waste Division (KC SWD). 1999 (Revised 2005). Quality Assurance Project Plan for Environmental Monitoring for King County Solid Waste Facilities. Prepared by Engineering Services Section. Draft.

King County Solid Waste Division (KC SWD). 2007. Vashon Island Closed Landfill; 2006 Annual Groundwater Data Evaluation Report. April.

Udaloy Environmental Services (UES). 2003. Site Safety Operations Plan (SWD Project Number A25-003.01). Prepared by Anne Udaloy. July 9.

Table 1. List of Emergency Contacts

CONTACT	NAME	TELEPHONE WORK	CELL (C)
Ambulance	Emergency Island Emergency Care Inc. (Non-emergency Vashon Ambulance Service)	911 206-463-9671	
Hospital	Highline Medical Center - Burien	206-244-9970	
Vashon Health Center		206-463-3671	
Poison Control Center		800-222-1222	
Police	King County Sheriff	911	
Fire Department	King County	911	
National Response Center		800-424-8802	
Drilling Contractor	ESN Northwest (Anisa Harden/Mike Korosec - Office)	360-459-4670	
King County Department of Natural Resources and Parks, Solid Waste Division	Dan Swope (PM) Ann Holmes Laura Belt Jim Scarr (Safety Officer)	206-296-8456 206-296-4424 206-296-8485 206-296-0497	206-296-4411 (O) 206-999-5789 (C) 206-296-4411 (O) 206-396-5595 (C) 206-559-5457 (P)
King County Department of Natural Resources and Parks, Water & Land Division	Sevin Bilir (Site Hydrogeologist) Eric Ferguson (Hydrogeologist) Jim Simmonds (Bilir's Supervisor) Reception Desk 6th Floor	206-296-8029 206-263-6512 206-296-1986 206-296-0192	206-437-8616

Appendix A

GENERAL SAFE WORK PRACTICES FOR FIELD PERSONNEL

Field operations for this project shall be conducted in accordance with the minimum safety practices described below required for KC employees.

1. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of materials is prohibited in any area where the possibility of contamination exists.

2. Hands must be thoroughly washed when leaving a contaminated or suspected contaminated area before eating, drinking, or any other activities.

3. Contaminated protective equipment shall not be removed from the site until it has been properly decontaminated or containerized on site.

4. Avoid activities which may cause dust. Removal of materials from protective clothing or equipment by blowing, shaking, or any means which may disperse materials into the air is prohibited.

5. Communications between members must be maintained at all times. Emergency communications shall be prearranged in case unexpected situations arise. Team members should stay close enough to assist each other in the event of any emergency.

6. Personnel should be cautioned to inform each other of subjective symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract.

7. At sites with known or suspected contamination, appropriate work areas for field personnel support, contaminant reduction, and exclusion will be designated and maintained.

8. All KC field vehicles shall contain a first aid kit and multipurpose portable fire extinguisher.

9. Field personnel are specifically prohibited from entering into excavations, trenches, or other confined spaces deeper than 4 feet. Unattended boreholes must be properly covered or otherwise protected.

10. All field personnel will, whenever possible, remain upwind of drilling rigs & boreholes, etc.

11. Subsurface work shall not be performed at any location until the area has been cleared to be free of underground utilities or other obstructions.

12. Field personnel are specifically prohibited from entering into excavations, trenches, or other confined spaces deeper than 4 feet. Unattended boreholes must be properly covered or otherwise protected.

King County

Department of
Natural Resources and Parks
Solid Waste Division

Heat-Related Illness Prevention Program

WAC 296-62-095

The requirements of WAC 296-62-095, Heat-Related Illness in the Outdoor Environment, requires employers to create a written Heat-Related Illness (HRI) Prevention Program.

The following Heat-Related Illness Prevention Program contains at least the **minimal** program elements required under WAC 296-62-095; **additional** elements have been added to protect workers in their specific work situations.

Program Elements ***see page***

POLICY STATEMENT

King County
Department of Natural Resources and Parks
Solid Waste Division

Effective June 5, 2007

Heat-Related Illness Policy:

It is the policy of The King County Solid Waste Division (SWD) that all affected employees are required to comply with this Heat-Related Illness policy and are encouraged to actively participate in identifying ways to reduce the risk of experiencing heat-related illness in the work place.

Supervisors and Leads are responsible for the safety of their employees and as a part of their daily duties must check the workplace for unsafe conditions, monitor the health and safety of their employees, and take prompt action in response to any identified Heat-Related Illness hazards.

Management will initiate and maintain this Heat-Related Illness program.

HAZARD EVALUATION

The Safety Officer for the Solid Waste Division has identified the following HRI environmental hazards at roofing worksites:

- High Heat and elevated humidity may occur during the hot months of June, July, August, and September;
- Lack of access to shade while working outside performing routine tasks;
- Heavy clothing including coveralls, hard hats, boots and gloves, and additional PPE, depending on job duties, to protect workers from various work related hazards, and to protect skin from excessive UV sun exposure; and
- Body harnesses for fall protection, which may restrict air circulation in clothing for cooling.

METHODS OF EVALUATION

The Supervisor and Lead, use the following methods on a day-to-day basis to evaluate each day's heat risks:

- Monitor weather reports for forecasts about expected temperature and humidity;
- Add 10-15º F. to the ambient reported temperature, when workers are routinely working in direct sunlight and wearing required PPE.
- Realize when work levels are typically moderate to heavy and may require additional protection for workers against the potential for heat related illness.

Further, the Supervisor consults the NOAA Heat Stress Index attached to this document and notifies the crew lead when a workday calls for additional awareness about HRI hazards, or for planned hot weather modifications to work activities and/or work schedules.

The heat index for the landfill area can be found at the following NOAA Web Site.

http://www.wrh.noaa.gov/forecast/MapClick.php?site=SEW&lon=-122.918747&rlon=-121.191247&tlat=48.389584&blat=46.662084&smap=1&mp=0&map.x=116&map.y=127

Or the heat Index can be calculated if the temperature and relative humidity is known by using the NOAA Weather Calculator found at the link below.

http://www.erh.noaa.gov/er/box/calculate2.html

EXPOSURE DETERMINATION

The following list shows job classes or duties and work locations or tasks where Division employees are exposed to heat-related illness hazards:

Job Class or Job Duties	***Work locations or Tasks***
Utility Workers	Various outdoor locations and tasks
Utility Worker Assistants	Various outdoor locations and tasks
Carpenters	Various outdoor locations and tasks
Mechanics	When working on heavy equipment on the landfill
Landfill Gas Technicians	Various outdoor locations and tasks
Waste Water Technicians	Various outdoor locations and tasks
Field Engineers	Various outdoor locations and tasks
Any SWD Employee	If working outdoors for a period of time exceeding sixty (60) minutes

PREVENTION ACTIONS

When heat-related illness hazards are present, the Supervisor will notify Lead at the beginning of the workday which of the following prevention actions they need to take with their crews that day, with consideration for the Heat index table below:

Heat Index	General Effect of Heat Index on People in Higher Risk Groups
80-89 *Caution*	Fatigue possible with prolonged exposure and physical activity.
90-104 *Extreme Caution*	Sunstroke, heat cramps, and heat exhaustion possible.
105-129 *Danger*	Sunstroke, heat cramps, and heat exhaustion likely, and heat stroke possible.
130 or higher *Extreme Danger*	Heat stroke highly likely with continued exposure.

1) As a general safety rule, workers will work in shaded areas when the **heat index** is greater that 85°F.
    - Lead will ensure that work to be completed in open (un-shaded) areas will take place in early morning hours.
2) Any new employees starting work on a hot day
    - Will limit their time at moderate to heavy work to 50% of a routine task on that day, and after that day will increase their time at moderate to heavy work by only 10% each day for the next 5 days, assuming the HRI hazards continue during that time.
3) Regular crew members returning to work on a hot day and who have been off work for 2 weeks or more:
    - Will limit their time at moderate to heavy work to 50% of a routine task on that day, and after that day will increase their time at moderate to heavy work by only 10% each day for the next 5 days, assuming the HRI hazards continue during that time.

4) The Lead will use a positive means for the prevention of heat related illness:

- Each employee will be issued a spray water bottle to carry with them as they work, to use to help cool the worker as needed.
- One or more five (5) gallon water container(s) will be provided.
    (a) Enough water must be provided so that there are 2.5 gallons of water for each employee for a 10 hour shift. Shorter shifts require less water, at a rate of 1 quart per person per hour.
    (b) Ice may be added to the water if needed.
    (c) Frequent work breaks will occur and workers encouraged to drink at least a cup (8 oz) of water per break.
        1. Frequencies of breaks will be adjusted upon the various environmental factors at the time. These include, temperature, humidity, job tasks, and level or types of PPE in use.
        2. Lead will notify the crew of the need for the water break.
        3. Frequency is dependant upon the task and location, the crew should decide upon the timing of the breaks with discussion and approval of the Lead or Supervisor.

5) At the start of the day, the Supervisor or Lead will ensure the crew obtains or has available the following heat related illness prevention equipment:

- Water cooler and spray bottles
- Sunscreen lotion (available at stores)
- A 10'X10' shade canopy is available for utility workers and can be set up and used for shade if needed.
    (a) If it is determined that a shade canopy is needed for other workgroups, the supervisor, lead and safety officer will discuss the best options for that workgroup.
    (b) The crew is responsible to set up and take down the canopy.
- Two (2) cooling gel packs for each worker (one to wear and one to swap out for re-cooling).

6) Leads will add at least one additional rest break during the first and second halves of the work shift, and will instruct workers to rest sitting or lying down in a shaded area or under the shade canopy, not standing up or walking around and not in the sun.

7) If temperatures are forecast to be 90° or higher, The Supervisor and Leads will instruct workers to use the buddy system to watch out for each other. Buddy groups can be two or three people. At the start of the day, Leads will review what to look for in themselves and each other to spot heat-illness symptoms.

The Solid Waste Division maintains the following equipment and makes it available to crews according to weather conditions, work site locations, and the work being done:

- A shade canopy
- Spray water bottles
- Cooling gel packs
- Extra water coolers
- Hand-held radios or cell phones are provided at remote sites when needed.

- **If the work site has reliable cell phone coverage**, a cell phone will be assigned to the lead or crew so they can check with a supervisor or call for help directly. Per the SWD emergency response plan, employees should also contact the Cedar Hills Front desk by radio or cell phone when any emergency occurs.
- **If a work site lacks reliable cell phone coverage**, crew members will use 800 MHz radios to stay in touch with supervisors and each other. Per the SWD emergency response plan, employees should also contact the Cedar Hills Front desk by radio or cell phone when any emergency occurs.
- The supervisor, lead, or Cedar Hills Front Desk can call 911 immediately if needed.

Training

All affected Solid Waste Division employees and supervisors will be trained about recognizing and responding to heat-related illness before being exposed to HRI hazards. They will also receive refresher training annually after that. Completion of training will be documented.

Employees are encouraged to review the Training Guide for Heat-Related Illness Helpful Tool provided by DOSH (see the link below). This Helpful Tool provides some of the required training components. Site-specific information will be provided to employees before being exposed to HRI hazards.

http://www.lni.wa.gov/Safety/Topics/AtoZ/HeatStress/files/TrainingHRI.pdf

First Aid Awareness and Actions

The Solid Waste Division will make the following information available on laminated cards and/or posters at each job site when heat-illness hazards are present. Emergency 911 information including job site location and nearest medical facility will be posted at each job site or in the transport vehicle.

Heat-related illness	*Signs and Symptoms*	*First Aid*
Sunburn	- Red, hot skin - May Blister	- Move to shade, loosen clothing - Apply cool compresses or water
Heat Rash	- Red, itchy skin - Bumpy skin - Skin infection	- Apply cool water or compresses - Keep affected area dry - Control itching and infection with prescribed medication
Heat Cramps	- Muscle cramps or spasms - Grasping the affected area - Abnormal body posture	- Drink water or sport drinks - Rest, cool down - Massage affected muscle - Get medical evaluation if cramps persist
Heat Exhaustion	- High pulse rate - Extreme sweating - Pale face - Insecure gait - Headache - Clammy and moist skin -Weakness - Fatigue -Dizziness	- Move to shade and loosen clothing - Initiate rapid cooling - Lay flat and elevate feet - Monitor recovery - Drink small amounts of water - Evaluate metal status (ask who? where? when? questions) - If no improvement call 911
Heat Stroke	- Any of the above but more severe - Hot, dry skin (25-50% of cases - Altered mental status with confusion or agitation - Can progress to loss of consciousness and seizures. - Can be fatal	- **Call 911** - Immediately remove from work - Start rapid cooling - Lay flat and elevate feet - ***If conscious*** give **sips** of water - Monitor airway and breathing – administer CPR if needed

When heat-related illness hazards are present and work will be at a remote site, the Supervisor and Lead will make sure their crews always have open channels of communication, to request breaks, water, or help:

HEAT INDEX f° (c°)													
	RELATIVE HUMIDITY (%)												
Temp.	40	45	50	55	60	65	70	75	80	85	90	95	100
110 (47)	136 (58)												
108 (43)	130 (54)	137 (58)											
106 (41)	124 (51)	130 (54)	137 (58)										
104 (40)	119 (48)	124 (51)	131 (55)	137 (58)									
102 (39)	114 (46)	119 (48)	124 (51)	130 (54)	137 (58)								
100 (38)	109 (43)	114 (46)	118 (48)	124 (51)	129 (54)	136 (58)							
98 (37)	105 (41)	109 (43)	113 (45)	117 (47)	123 (51)	128 (53)	134 (57)						
96 (36)	101 (38)	104 (40)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	132 (56)					
94 (34)	97 (36)	100 (38)	103 (39)	106 (41)	110 (43)	114 (46)	119 (48)	124 (51)	129 (54)	135 (57)			
92 (33)	94 (34)	96 (36)	99 (37)	101 (38)	105 (41)	108 (42)	112 (44)	116 (47)	121 (49)	126 (52)	131 (55)		
90 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	103 (39)	106 (41)	109 (43)	113 (45)	117 (47)	122 (50)	127 (53)	132 (56)
88 (31)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	98 (37)	100 (38)	103 (39)	106 (41)	110 (43)	113 (45)	117 (47)	121 (49)
86 (30)	85 (29)	87 (31)	88 (31)	89 (32)	91 (33)	93 (34)	95 (35)	97 (36)	100 (38)	102 (39)	105 (41)	108 (42)	112 (44)
84 (29)	83 (28)	84 (29)	85 (29)	86 (30)	88 (31)	89 (32)	90 (32)	92 (33)	94 (34)	96 (36)	98 (37)	100 (38)	103 (39)
82 (28)	81 (27)	82 (28)	83 (28)	84 (29)	84 (29)	85 (29)	86 (30)	88 (31)	89 (32)	90 (32)	91 (33)	93 (34)	95 (35)
80 (27)	80 (27)	80 (27)	81 (27)	81 (27)	82 (28)	82 (28)	83 (28)	84 (29)	84 (29)	85 (29)	86 (30)	86 (30)	87 (31)

SEGURI GUÍA en el TRABAJO

Protéjase del

Estrés por calor

Cuando el cuerpo no puede enfriarse mediante el sudor, pueden ocurrir varias enfermedades debido al calor, tales como estrés o fatiga por calor e insolación o golpe de calor, las cuales pueden ser fatales.

Factores que llevan al estrés por calor

Ambiente caluroso y humedad, calor o sol directo, poco viento, trabajo físico pesado, estado físico deficiente, algunas medicinas y poca tolerancia al calor.

Síntomas de agotamiento por calor

- Dolores de cabeza, mareos, vértigo o desmayo.
- Debilidad y piel húmeda.
- Irritabilidad como mal humor o confusión.
- Náuseas o vómitos.

Síntomas de insolación

- Piel seca y caliente sin sudor.
- Confusión mental o pérdida de conocimiento.
- Convulsiones o ataques.

Para evitar el estrés por calor

- Conozca los síntomas de las enfermedades relacionadas al calor; obsérvese usted y a sus colegas.
- Protéjase del sol directo u otras fuentes de calor.
- Utilice ventiladores (abanicos) o aire acondicionado; tome descansos frecuentes.
- Beba mucha agua, al menos 1 taza cada 15 minutos.
- Vístase con ropa ligera, de colores claros y no ajustada.
- Evite el alcohol, bebidas con cafeína o comidas pesadas.

Qué hacer en caso de emergencias por calor

- Llame al 911 (u otro número local para emergencias) inmediatamente.

Mientras llega la ayuda:

- Traslade a la persona a un lugar fresco y sombreado.
- Suéltele o quítele la ropa abrigada.
- Ofrézcale agua fresca para beber.
- Abanique y rocíe con agua a la persona.

Department of LABOR AND INDUSTRIES

Para más información:
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(800) 423-7233

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WORKER SAFETY TIPS

Protect Yourself

Heat Stress

When the body is unable to cool itself by sweating, several heat-induced illnesses such as heat stress or heat exhaustion and the more severe heat stroke can occur, and can result in death.

Factors Leading to Heat Stress

High temperature and humidity; direct sun or heat; limited air movement; physical exertion; poor physical condition; some medicines; and inadequate tolerance for hot workplaces.

Symptoms of Heat Exhaustion

- Headaches, dizziness, lightheadedness or fainting.
- Weakness and moist skin.
- Mood changes such as irritability or confusion.
- Upset stomach or vomiting.

Symptoms of Heat Stroke

- Dry, hot skin with no sweating.
- Mental confusion or losing consciousness.
- Seizures or fits.

Preventing Heat Stress

- Know signs/symptoms of heat-related illnesses; monitor yourself and coworkers.
- Block out direct sun or other heat sources.
- Use cooling fans/air-conditioning; rest regularly.
- Drink lots of water; about 1 cup every 15 minutes.
- Wear lightweight, light colored, loose-fitting clothes.
- Avoid alcohol, caffeinated drinks, or heavy meals.

What to Do for Heat-Related Illness

- Call 911 (or local emergency number) at once.

While waiting for help to arrive:

- Move the worker to a cool, shaded area.
- Loosen or remove heavy clothing.
- Provide cool drinking water.
- Fan and mist the person with water.

Department of LABOR AND INDUSTRIES

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Protective tips for cold environment workers

Issue: *What precautions do you take when you work outside and you need to take from the elements? Also, what can your employer do to protect cold weather workers from these potentially deadly working conditions?*

Answer: Employers are required under the Occupational Safety and Health Act to furnish to each of its employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm to its employees. This includes cold weather working environments. Two serious hazards that employees face from the cold are hypothermia and frost bite.

The Occupational Safety and Health Administration (OSHA) has recognized these hazards and developed a "Cold Stress" card that provides recommendations which can prevent many cold-related injuries and illnesses. OSHA suggests that employers can help protect workers by following these tips:

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries;
- Learn the signs and symptoms of cold-induced illnesses / injuries and what to do to help workers;
- Train workers about cold-induced illnesses and injuries;
- Encourage workers to wear proper clothing for cold, wet and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene);
- Be sure that workers take frequent short breaks in warm dry shelters to allow the body to warm up;
- Try to schedule work for the warmest part of the day;
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm;
- Use the buddy system — work in pairs so that one worker can recognize danger signs;
- Drink warm, sweet beverages (sugar water, sports-type drinks) and avoid drinks with caffeine (coffee, tea, sodas or hot chocolate) or alcohol;
- Eat warm, high-calorie foods such as hot pasta dishes; and
- Remember workers face increased risks when they take certain medications, are in poor physical condition, or suffer from illnesses such as diabetes, hypertension or cardiovascular disease.

If an employer takes these recommendations and applies them to work in cold environments, it should make for safe and healthy working conditions.

For previous helpful issues and answers, go to the new home for all of your safety needs at **safety.cch.com**. Check often for the latest safety news, updates, tools and materials that affect the safety professional.

FROSTBITE

What happens to the body:

Freezing in deep layers of skin and tissue; pale, waxy-white skin color; skin becomes hard and numb; usually affects fingers, hands, toes, feet, ears, and nose.

What to do: (land temperatures)

- Move the person to a warm, dry area. Don't leave the person alone.
- Remove wet or tight clothing that may cut off blood flow to the affected area.
- **Do not** rub the affected area because rubbing damages the skin and tissue.
- Gently place the affected area in a warm water bath (105°) and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast, causing tissue damage. Warming takes 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm.
  Note: If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

HYPOTHERMIA - (Medical Emergency)

What happens to the body:

Normal body temperature (98.6°F/37°C) drops to or below 95°F/35°C; fatigue or drowsiness; uncontrolled shivering; cool, bluish skin; slurred speech; clumsy movements; irritable, irrational, or confused behavior.

What to do: (land temperatures)

- Call for emergency help (ambulance or 911).
- Move the person to a warm, dry area. Don't leave the person alone.
- Remove wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if he is alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) **or alcohol.**
- Have the person move his arms and legs to create muscle heat. If he is unable to do this, place warm bottles or hot packs in the armpits, groin, neck, and head areas. **Do not** rub the person's body or place him in a warm water bath. This may stop his heart.

What to do: (water temperatures)

- Call for emergency help (ambulance or 911). Body heat is lost up to 25 times faster in water.
- **Do not** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **Do not** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses body heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held close.

WINDCHILL TABLE

If you're unprepared for the cold, temperature and wind can put you at risk for hypothermia and frostbite. The table below shows the risk of frostbite on unprotected skin.

Wind (mph)	Temperature (°F)																		
	Calm	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5		36	31	25	19	13	7	1	-5	-11	-16								-63
10		34	27	21	15	9	3	-4	-10	-16								-66	-72
15		32	25	19	13	6	0	-7	-13								-59	-66	-72
20		30	24	17	11	4	-2	-9	-15								-64	-71	-77
25		29	23	16	9	3	-4	-11	-17								-71	-78	-84
30		28	22	15	8	1	-5	-12									-73	-80	-87
35		28	21	14	7	0	-7	-14									-80	-87	-89
40		27	20	13	6	-1	-8	-15									-82	-89	-91
45		26	19	12	5	-2	-9	-16									-84	-91	-93
50		26	19	12	4	-3	-10	-17									-86	-93	-95
55		25	18	11	4	-3	-11										-88	-95	-97
60		25	17	10	3	-4	-11										-91	-98	

Frostbite: 30 minutes | 10 minutes | 5 minutes

Oregon Occupational Safety & Health Division
440-3336E-S (1/06)

CONGELACION PARCIAL

Que le sucede al cuerpo:

La piel y los tejidos se congelan en capas profundas; piel pálida del color de cera blanca; la piel se vuelve dura y entumecida. Por lo general, afecta los dedos, las manos, los dedos de los pies, los pies, las orejas, y la nariz.

Que se debe hacer: (temperaturas en tierra)

- Mueva la persona a un lugar caliente y seco. No deje a la persona sola.
- Remueva cualquier ropa mojada o apretada que pueda cortar la circulación de sangre al área afectada.
- **NO frote** el area afectada porque causa daño a la piel y a los tejidos.
- Suavemente ponga el área en agua tibia (105 °F) y observe la temperatura del agua para calentar los tejidos **gradualmente**. NO vacie agua tibia directamente sobre el área afectada porque esto calentará los tejidos demasiado rápido causándo daño a los tejidos. El calentamiento toma de 25 a 40 minutos.
- Después de ser calentada, el área afectada se puede hinchar y ampollar. En el área afectada se puede sentir una sensación de quemazón o entumecimiento. Cuando regrese la sensación normal, movimiento, y el color de la piel, se debe secar el área afectada y envolverla para mantenerla cálida.

  Nota: Si hay posibilidad de que el área afectada se enfríe otra vez, no caliente la piel. Si la piel se calienta y se enfría otra vez, puede causar daño más severo a los tejidos.
- Busque atención médica lo antes posible.

HIPOTERMIA - (Emergencia Médica)

Que le sucede al cuerpo:

La temperatura normal del cuerpo (98.7 °F/37°C) baja a menos de 95 °F/35°C; fatiga o somnolencia; se tiembla incontroladamente; piel fria y azulada; arrastra las palabras cuando habla; movimientos torpes; comportamiento irritable, irracional, o confuso.

Que se debe hacer: (temperaturas en tierra)

- Llame por ayuda inmediatamente (ambulancia o al 911).
- Mueva la persona a un lugar caliente y seco. No deje a la persona sola
- Remueva cualquier ropa mojada y reponga con ropa cálida y seca o envuelva la persona en mantas.
- Haga que la persona tome bebidas calientes y dulces (agua dulce o bebidas para deportes) si la persona está alerta. **Evite bebidas que contienen cafeína** (café, té, o chocolate caliente) **o alcohol**.
- Haga que la persona mueva sus brazos y pies para crear calentamiento de los músculos. Si la persona no se puede mover, ponga botellas o paquetes calientes en las axilas, la ingle, el cuello, y la cabeza. **No frote** el cuerpo de la persona o ponga la persona en un baño de agua caliente. Esto puede pararle el corazón.

Que se debe hacer: (temperaturas en agua)

- Llame por ayuda inmediatamente (ambulancia o 911). El calor del cuerpo se pierde 25 veces más rápido en el agua.
- **No remueva la ropa.** Abotone, hebille, cierre, y ajuste cuellos, puños, zapatos, y capuchas porque la capa de agua atrapada cerca del cuerpo provée una capa de aislamiento que retarda la pérdida de calor. Mantenga la cabeza fuera del agua y póngase un sombrero o una capucha.
- Salga del agua lo antes posible o súbase a cualquier objeto flotante. **No intente** nadar, a menos que un objeto flotante u otra persona esté próxima porque nadar u otra actividad física usa el calor del cuerpo y reduce el tiempo de sobrevivencia un cincuenta por ciento (50%).
- Si salir del agua no es posible, espere quietamente y conserve el calor del cuerpo cruzando los brazos, mantiendo los muslos juntos, doblando las rodillas, y cruzando los tobillos. Si hay otra persona en el agua, agrúpese pecho a pecho.

TABLA DE INDICE DE VIENTO FRIO

Si no está preparado para el frío, la temperatura y el viento pueden ponerlo a riesgo de la hipotermia y congelación parcial. La tabla que sigue indica el peligro de congelación parcial de la piel que está al descubierto.

Viento (mph)	Temperatura (°F)																	
Calm-ado	40	35	30	25	20	15	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45
5	36	31	25	19	13	7	1	-5	-11	-16	-22	-28	-34	-40	-46	-52	-57	-63
10	34	27	21	15	9	3	-4	-10	-16	-22	-28	-35	-41	-47	-53	-59	-66	-72
15	32	25	19	13	6	0	-7	-13	-19	-26	-32	-39	-45	-51	-58	-64	-71	-77
20	30	24	17	11	4	-2	-9	-15	-22	-29	-35	-42	-48	-55	-61	-68	-74	-81
25	29	23	16	9	3	-4	-11	-17	-24	-31	-37	-44	-51	-58	-64	-71	-78	-84
30	28	22	15	8	1	-5	-12	-19	-26	-33	-39	-46	-53	-60	-67	-73	-80	-87
35	28	21	14	7	0	-7	-14	-21	-27	-34	-41	-48	-55	-62	-69	-76	-82	-89
40	27	20	13	6	-1	-8	-15	-22	-29	-36	-43	-50	-57	-64	-71	-78	-84	-91
45	26	19	12	5	-2	-9	-16	-23	-30	-37	-44	-51	-58	-65	-72	-79	-86	-93
50	26	19	12	4	-3	-10	-17	-24	-31	-38	-45	-52	-60	-67	-74	-81	-88	-95
55	25	18	11	4	-3	-11	-18	-25	-32	-39	-46	-54	-61	-68	-75	-82	-89	-97
60	25	17	10	3	-4	-11	-19	-26	-33	-40	-48	-55	-62	-69	-76	-84	-91	-98

Congelación Parcial: 30 min. | 10 min. | 5 min.

Oregon Occupational Safety & Health Division
440-3336E-S (1/06)

Appendix B

HEALTH & SAFETY EQUIPMENT CHECKLIST

for

Drilling and Well Installation, Development & Sampling Activities

✧ THE FOLLOWING SAFETY EQUIPMENT IS REQUIRED ON YOUR JOB SITE ✧

☐	Photoionization Detector or Flame Ionization Detector : (If drilling)	
☒	Combustible Gas Detector : (If drilling)	Gas-Tech NP-304
☒	Oxygen Indicator : (If drilling)	Gas-Tech NP-304
☒	Draeger/Sensidyne Pump and Detector tubes : (If drilling)	
☒	Respirator : (If drilling)	Half-face with organic vapor cartridges.
☒	Protective Clothing :	Coveralls, if desired.
☒	Chemical Protective Gloves :	Nitrile, minimum 4-mil.
☒	Decontamination Equipment :	Hand soap, water, paper towels.
☒	Steel-toed Boots :	use when appropriate
☐	Rain Gear	
☒	Hearing Protection :	use when appropriate
☒	Safety Glasses :	use when appropriate
☒	Hard Hat :	use when appropriate
☐	Caution Tape, Traffic Cones, or Barriers	
☐	Emergency Eye Wash Fountain	
☒	Fist Aid Kit :	located in KC field vehicle
☒	Fire Extinguisher :	located in KC field vehicle
☒	Drinking Water	located in KC field vehicle
☐		

PLAN APPROVALS

Field Geologist – Sevin Bilir		12/09/09
SWD Safety Officer – Jim Scarr		12/10/09
Project Manager –Dan Swope		12/10/09
	Signature	Date

Appendix C

HIGHLINE MEDICAL GROUP

10030 SW 210th Street
Vashon, WA 98070

Welcome to VHC

In an Emergency- call 911

Hours & Appointments

Provider Profiles

A History of VHC

Sunrise Ridge

Vashon Health Center

206.463.3671

Hours & Appointments

For urgent Care

VHC's Regular Hours of Operation are:
Monday: 8:30 a.m.--5:00 p.m.
Tuesday: 8:30 a.m.--5:00 p.m.
Wednesday: 8:30 a.m.--7:00 p.m.
Thursday: 8:30 a.m.--5:00 p.m.
Friday: 8:30 a.m.--5:00 p.m.
Saturday: 8:30 a.m.--12:00 a.m., 1:00 p.m.--4:00 p.m.
Sunday: Closed

During Regular Hours
Call 463-3671 to make an appointment.

After Regular Hours
Call 463-3671. Listen to the full recording to hear all your options. There are two consulting nurses, one for Group Health patients, and one for all other patients. You will need to speak with the appropriate consulting nurse for advice.

Urgent Care
Call 463-3671. Listen to the full recording to hear all your options. There are two consulting nurses, one for Group Health patients, and one for all other patients. You will need to speak with the appropriate consulting nurse for advice.

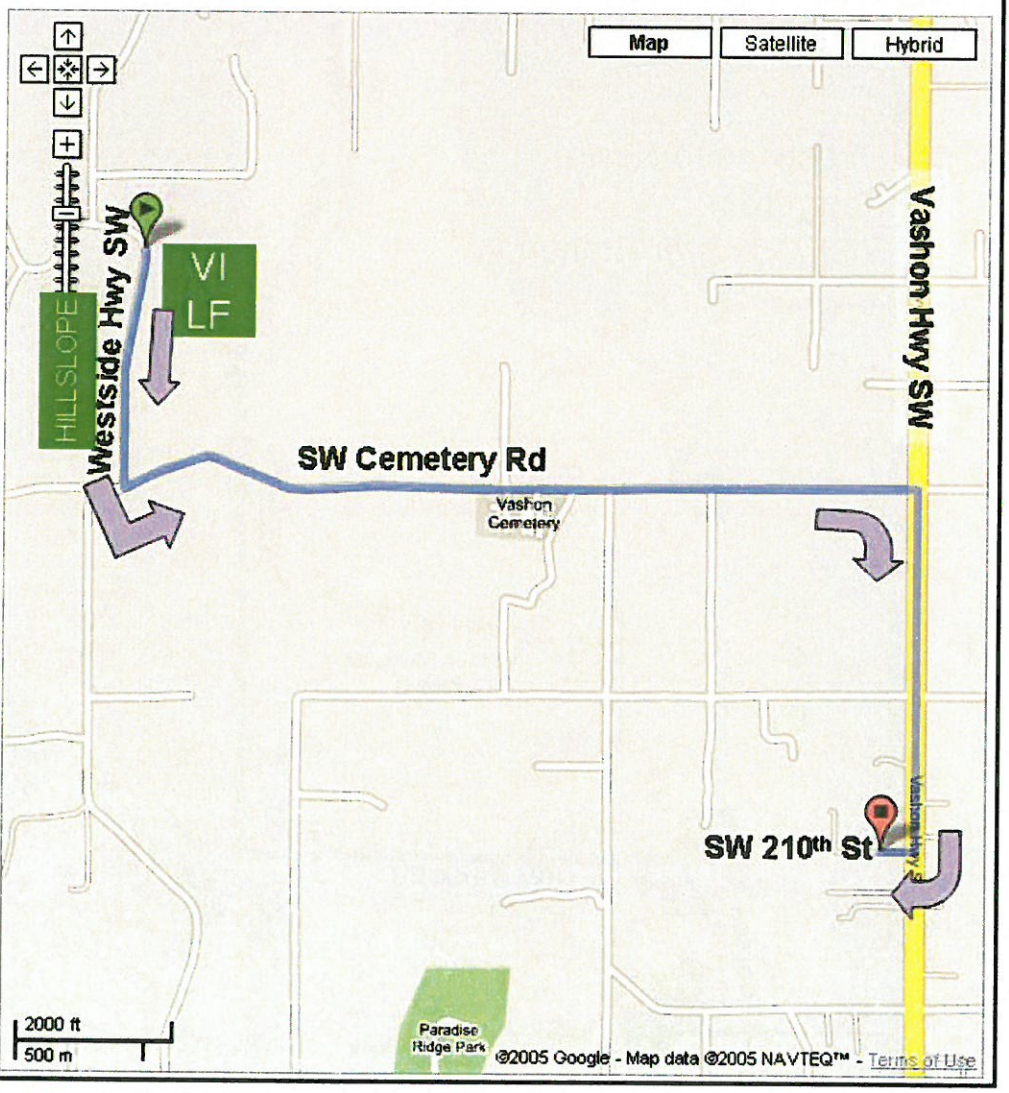
Appendix C (continued)

For urgent Care

Start address:	18910 Westside Hwy SW, Vashon, WA 98070
End address:	10030 SW 210th St Vashon, WA 98070
Distance:	3.5 mi (about 9 mins)

Directions to Vashon Health Center from VILF/Transfer Station

1. **Go south on Westside Hwy SW** - go **0.6 mi**
2. Turn **left** at **SW Cemetery Rd** - go **2.0 mi**
3. Turn **right** at **Vashon Hwy SW** - go **0.9 mi**
4. Turn **right** at **SW 210th St** - go **0.1 mi**



Appendix C (continued)

Start address:	18910 Westside Hwy SW Vashon, WA 98070
End address:	SW Bunker Trl & Vashon Hwy SW, Vashon, WA 98070
Distance:	7.2 mi (about 15 mins)

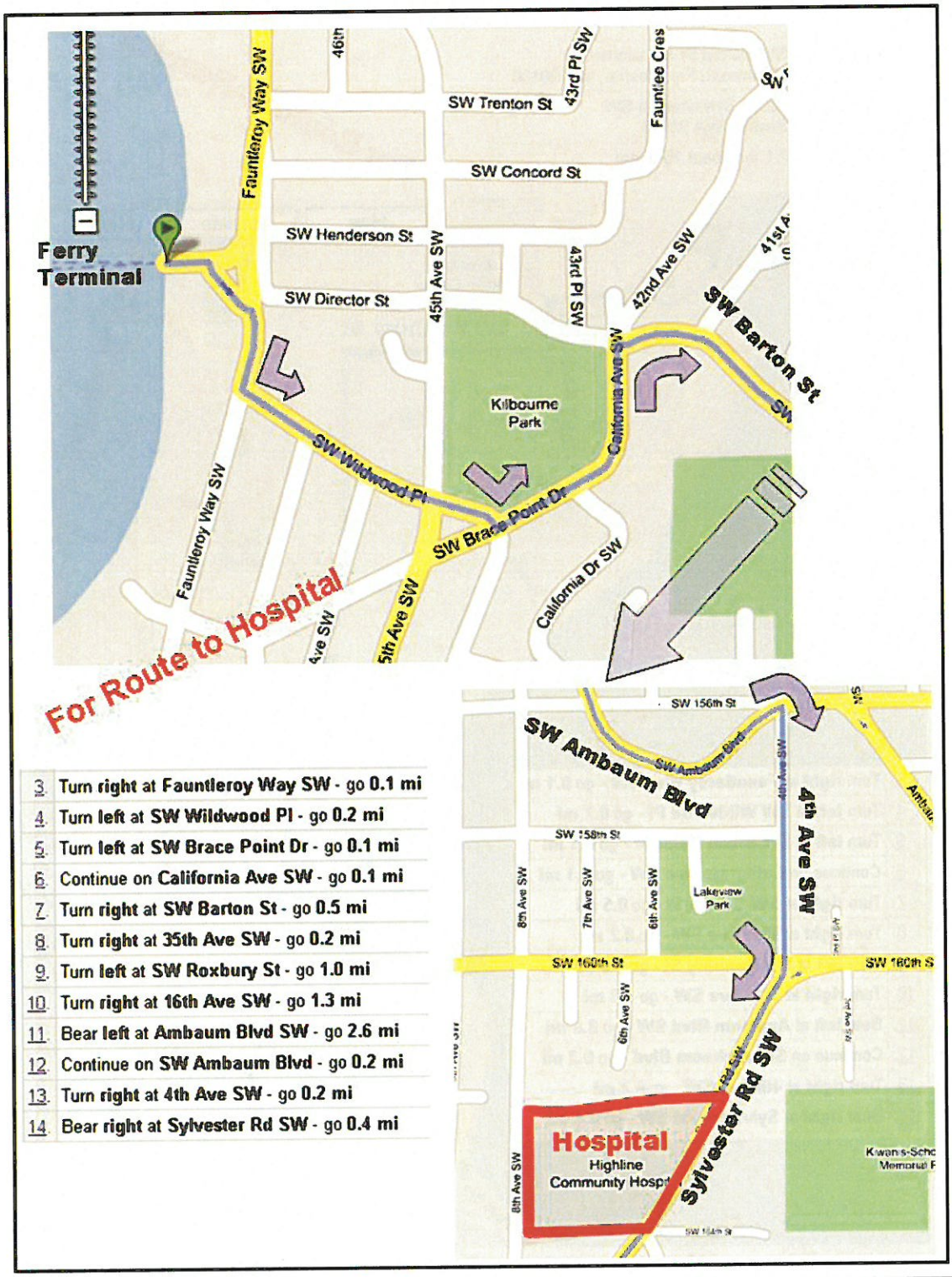
1. **Go north on** **Westside Hwy SW** - go **0.2 mi**
2. Turn **right** at **Thorsen Rd SW** - go **0.6 mi**
3. Continue on **SW Bank Rd** - go **1.9 mi**
4. Turn **left** at **Vashon Hwy SW** - go **4.5 mi**

Appendix C (continued)

Start address:	SW Barton St & Fauntleroy-Southworth Fry, Seattle, WA 98136
End address:	16521 Sylvester Rd SW Seattle, WA 98166
Distance:	7.1 mi (about 15 mins)

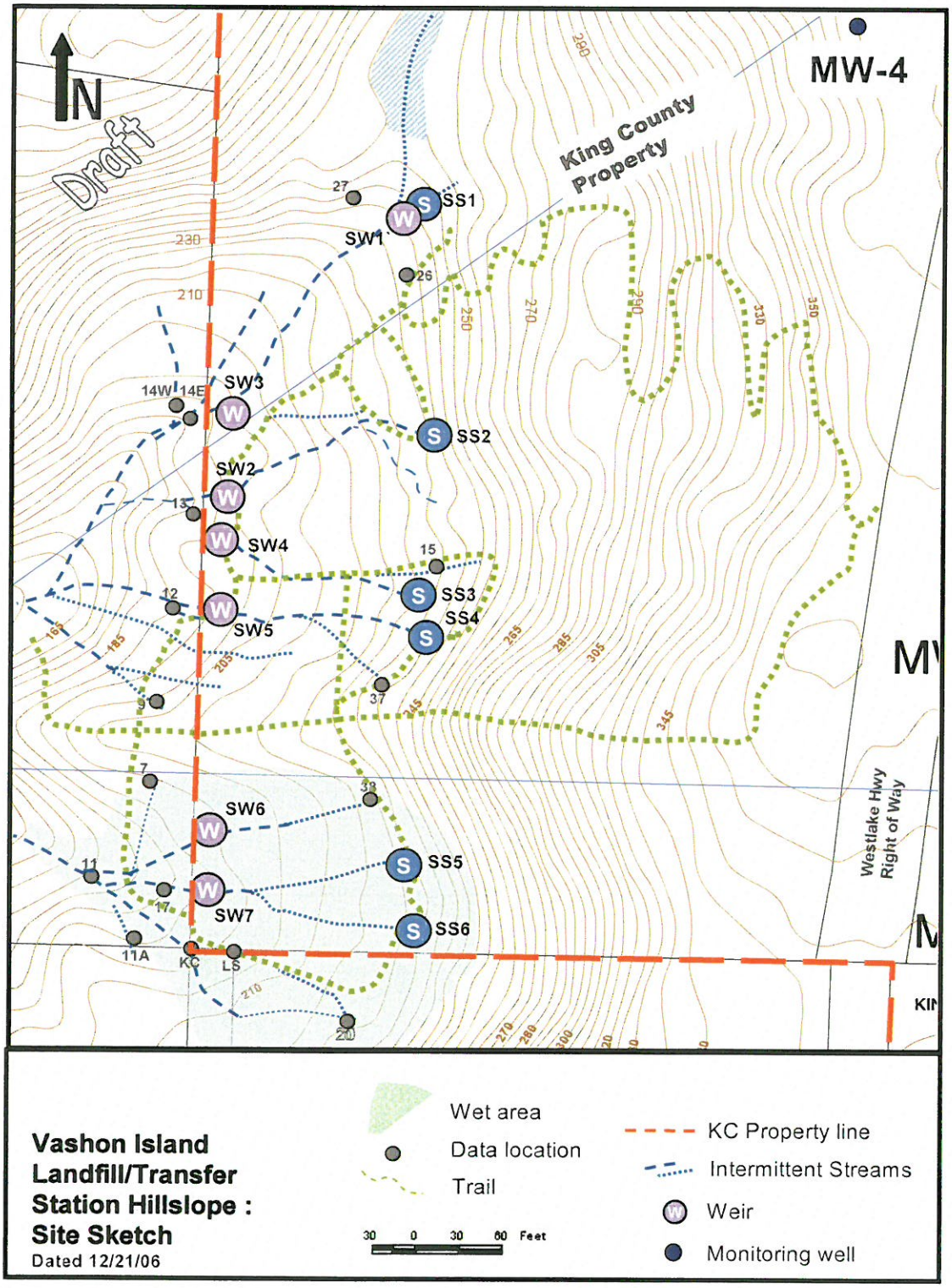
For Route to Hospital

Appendix C (continued)



3.	Turn **right** at **Fauntleroy Way SW** - go **0.1 mi**
4.	Turn **left** at **SW Wildwood Pl** - go **0.2 mi**
5.	Turn **left** at **SW Brace Point Dr** - go **0.1 mi**
6.	Continue on **California Ave SW** - go **0.1 mi**
7.	Turn **right** at **SW Barton St** - go **0.5 mi**
8.	Turn **right** at **35th Ave SW** - go **0.2 mi**
9.	Turn **left** at **SW Roxbury St** - go **1.0 mi**
10.	Turn **right** at **16th Ave SW** - go **1.3 mi**
11.	Bear **left** at **Ambaum Blvd SW** - go **2.6 mi**
12.	Continue on **SW Ambaum Blvd** - go **0.2 mi**
13.	Turn **right** at **4th Ave SW** - go **0.2 mi**
14.	Bear **right** at **Sylvester Rd SW** - go **0.4 mi**

Appendix D


N
Draft
MW-4
King County Property
SS1
SW1
SW3
SS2
SW2
SW4
SS3
SS4
SW5
SW6
SS5
SW7
SS6
Westlake Hwy Right of Way
KC
LS
11A
Vashon Island Landfill/Transfer Station Hillslope : Site Sketch
Dated 12/21/06
Wet area
Data location
Trail
KC Property line
Intermittent Streams
Weir
Monitoring well
30 0 30 60 Feet

Appendix E

SIGNATURE PAGE

SITE:	Vashon Island Closed Landfill & Transfer Station: West Hillslope	PROJECT NUMBER: G13580
NOTE:	All KC personnel are to understand and comply with specific practices and guidelines as described in the Health & Safety Policy Manual regarding field safety and health hazards. This Health & Safety Plan has been developed for the use of KC personnel only. KC makes this plan available for review by other personnel on a work site; however, this plan does not cover the employees of any other employer on the work site. Nor does this cover the hazards from typical activities carried out by KC personnel in their regular job description.	
SIGN-OFF:	I have read and understand the attached Health & Safety Plan and attached General Safe Work Practices (Appendix A), and agree to comply with the requirements described within:	

NAME	TITLE	DATE

Appendix B

WA Department of Ecology Permit Related Documents

B-1 Variance Request: Minimum Standards for Well Construction (sent to WA Department of Ecology)

B-2 Variance Request: Response Letter (sent from WA Department of Ecology)

B-3 Notice of Intent to Construct Monitoring/Resource Protection Well (sent to WA Department of Ecology)

B-1

Variance Request:
Minimum Standards for Well Construction
(sent to WA Department of Ecology)

WASHINGTON STATE DEPARTMENT OF ECOLOGY

VARIANCE REQUEST
MINIMUM STANDARDS FOR WELL CONSTRUCTION

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

Requested by: Sevin Bilir, King County Water & Land Division for Solid Waste Division
Mailing Address: 200 S. Jackson, St., Ste. 700 City Seattle State WA Zip 98104
Daytime Phone: 206-296-8029 Date: 11/14/2009
Property Owner (if different): King County Solid Waste Division
Site Location: SW ¼ SW ¼ Section 36 Township 23N Range 02 E.
Tax Parcel Number 3623029009
Well Address: 18910 Westside Hwy SW, Vashon Island, WA
Well Driller/Company (if known): ESN Northwest, Inc.
Check one: ☐ Water Well ☒ Resource Protection Well

What construction standard cannot be met? 1) No protective metal casing will be set in concrete around the wells (WAC 173-160-420); 2) three metal posts will not be installed to protect the wells (WAC 173-160- 420); and 3) the borehole annular space will not be a minimum of 4-inches in diameter than the nominal size of the permanent casing (WAC 173-160-450).

Reason why standard cannot be met. Include site map and distances from all known potential sources of contamination if setback variance is being requested. RE: 1&2) The wells will be in a remote area of undeveloped land on a steep hillslope. Due to the rough terrain and the difficult access to the sites, installation of protective steel casing and posts is not warranted. Attachment 1 (a) and 1(b) shows the well locations. RE: 3&4) The wells are being used to capture groundwater prior to seepage from a hillslope. Well locations are upslope from the seeps. Due to the rough terrain, difficult access, and the shallow nature of the groundwater, hand augering was the only method deemed appropriate for obtaining lithologic information and to attempt well installation. Hand augering using a 3.25-inch outside diameter auger will not allow for the required annular space.

Alternative construction method that will provide equal or greater protections than those provided by the minimum standard. The wells will be secured using ProHydro, Inc. Well Caps (Attachment 2). These caps are attached using stainless steel screws and then secured with a padlock. These well caps are difficult to remove without damaging the well casing. Signs of tampering would be evident with damage to the padlock and the cap. Pre-packed screens will be used for well construction. Bentonite seal and grout will be to grade. The well installation procedures, and a site map showing the well locations are attached to this request.

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

Department of Ecology	Department of Ecology	Department of Ecology	Department of Ecology
Northwest Regional Office	Southwest Regional Office	Eastern Regional Office	Central Regional Office
ATTN: Noel Philip	ATTN: Bill Lum	ATTN: Mark Ader	ATTN: Avery Richardson
3190 160th Avenue SE	PO Box 47775	N 4601 Monroe	15 W Yakima Ave #200
Bellevue, WA 98008	Olympia, WA 98504	Spokane, WA 99205	Yakima, WA 98902
425-649-7044	360-407-0281	509-329-3400	509-575-2639
Fax: 425-649-7098	Fax: 360-407-0284	Fax: 509-329-3529	Fax: 509-454-7830
nphi461@ecy.wa.gov	blum461@ecy.wa.gov	made461@ecy.wa.gov	aric461@ecy.wa.gov

Well Installation Procedure

The wells at the Vashon Island Closed Landfill & Transfer Station (VICLTS) will be constructed in the according to the procedures outlined below.

1) Due to the rough terrain and vegetated nature of the hillslope, some site preparation will occur prior to driller arrival. A standing pad will be placed around the borehole opening to preserve shallow surficial soils and sediment features.

2) Three borings will be advanced using an AMS Signature Series stainless steel hand auger with an outside diameter (O. D.) of 3.25-inches.

3) The primary intent of the borehole is to use lithologic data to refine the hydrogeologic model of the same units outcropping on the hillslope and underlying the VICLTS. The secondary intent is to complete the boreholes as wells as part of a scope of work with a planned sampling period of one year. Based on the chemical results and review of Public Health, sampling may continue or the wells may be decommissioned.

4) Observations of moisture during borehole advancement will assist in designing well construction details for each borehole. The following table and the figures in Attachment 3 is a draft view of the most likely outcome at each borehole site.

Boring / Well	Ground Surface Elevation (ft MSL)	~Depth to First Water ATA (ft bgs)	Bentonite Grout (ft bgs)	Bentonite Seal (ft bgs)	Screened Unit / Screen and Pre-Packed Filter Interval (ft bgs)	Sand Interval (ft bgs)	BHTD (ft bgs)
BH-30 / MW-30	245	10	0 -6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18
BH-31 / MW-31	220	5 ?	0 - 4	4 - 5	Cc3 – Perched ? / 6 - 11	5 - 11	11 ?
BH-32 / MW-32	240	10	0 - 6	6 – 7	Cc2 – Perched / 8 - 18	7 – 18	18

Notes:
bgs = below ground surface
MSL= mean sea level
ATA = at time of augering
BTD = borehole total depth
ft = feet

5) If the borehole depth exceeds the well depth, 20x40 Colorado® silica sand (or equivalent) will be added to raise the bottom of the well screen to the targeted depth.

6) The groundwater monitoring wells will be constructed using nominal 2-inch-diameter flush-threaded Schedule 40 PVC well casing, pre-packed well screens and well points.

Well Installation Procedure (continued)

7) The well will be held in the center of the borehole manually during placement of additional annular sand backfill, bentonite seal, and grout to the surface, if necessary.

8) The screen assembly constructed by GeoInsight Online (GeoInsight PrePak screens), will consist of a nominal 5-foot long (or two 5-foot long sections) 0.010-inch machine-slotted section. A filter pack consisting of 20x40 Colorado® silica sand is factory installed between the well screen casing and a 65 mesh stainless steel screen. The O.D. of the pre-packed screen will be 2.8-inches. The following figures show a close-up of a smaller diameter well with the same pre-packed well screen material and the preparation of a 2-inch diameter casing well with a pre-packed well screen.

(Kram et al, 2001)

9) Upon installation of the well, additional filter material will be added to extend 1- foot above the uppermost screen slot.

10) A bentonite seal of at least 1 foot will be installed above the filter pack using #8 fine pellets and hydrated with potable water.

11) The remaining annular space will be backfilled to grade with bentonite grout.

12) The well casing will be cut-off approximately 2-feet above grade and the well will be sealed and secured with ProHydro, Inc. well caps and locked with padlocks. Attachment 2 shows the design for the caps.

References

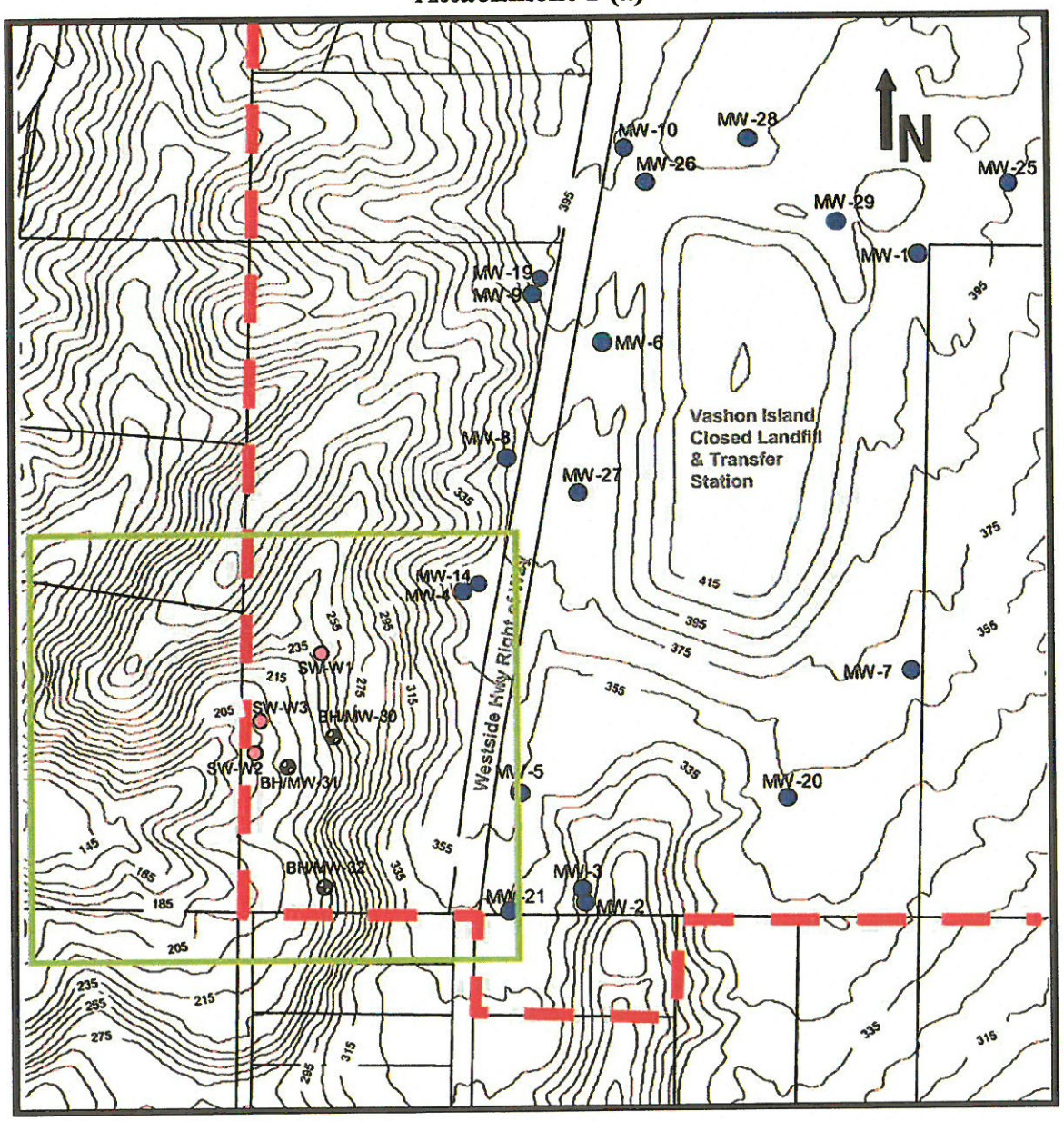
GeoInsight Online PrePak Screens
http://geoinsightonline.com/products/smdiam/intake.html

Kram, M. (NFESC) and D. Lorenzana (Intergraph), J. Michaelsen (UCSB), E. Lory (NFESC). (Kram et al). 2001. *Performance Comparison: Direct-Push Wells Versus Drilled Wells*, NFESC Technical Report TR-2120-ENV, Facilities Engineering Command, Washington DC 20374-5065. January.
http://geoinsightonline.com/pdfs/hue1.pdf

ProHydro, Inc. (ProHydro). 2007. *Standard Operating Procedure for the Snap Sampler™ Passive Groundwater Sampling Method.* January. http://www.snapsampler.com/images/SnapSOP_01-07.pdf
http://www.prohydroinc.com/prohydrowellcap.html

Washington State (WA). 2007. Chapter 173-160. *Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).* February 22. (Latest Update).

Attachment 1 (a)



Area Map

Surveyed/Estimated Data

All locations shown here are approximate

90 0 90 180 Feet

Contour Interval 10 feet

10 foot contour line

Area shown on Figure 2

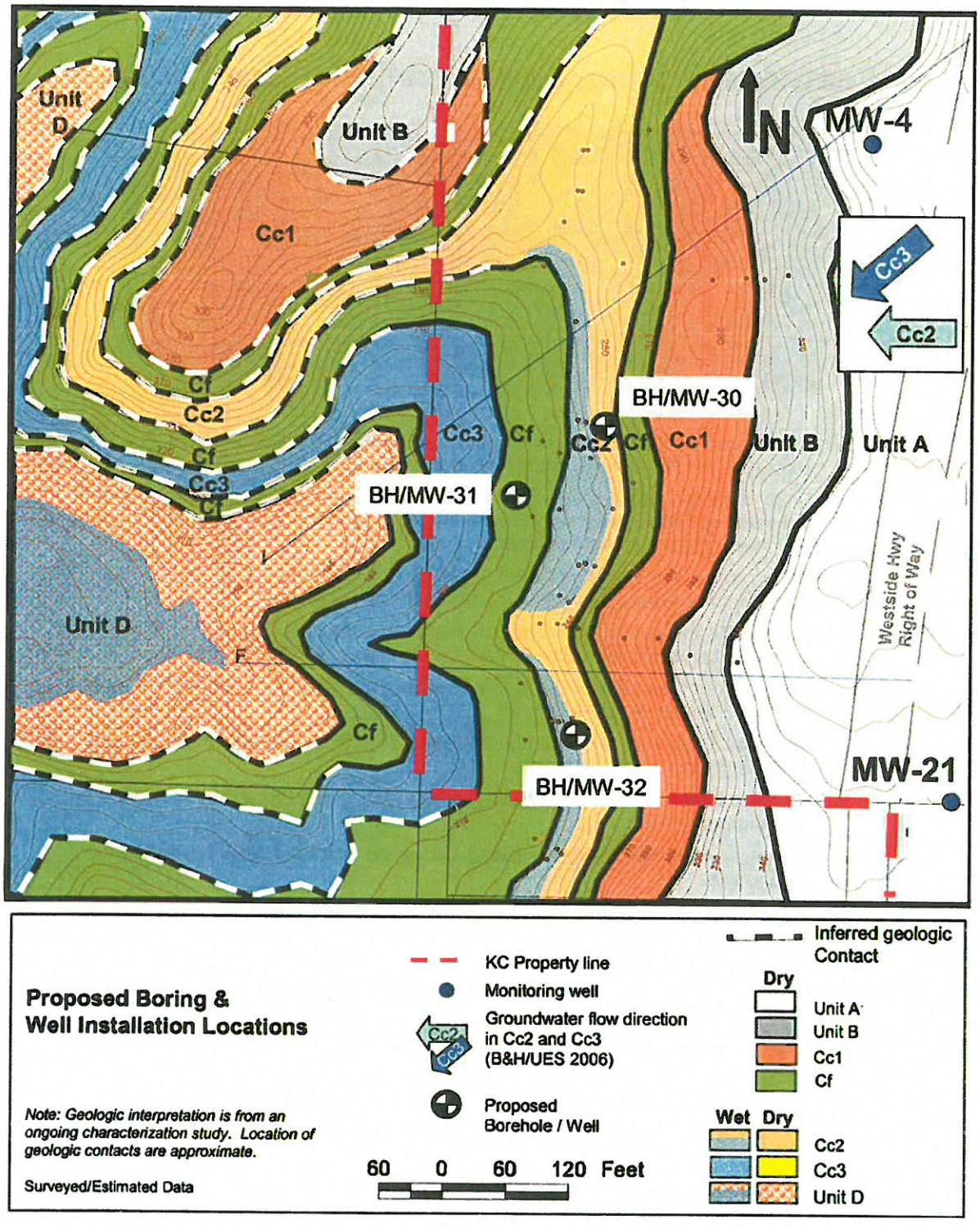
KC Property line

Monitoring well

Quarterly Sampling Seeps

Proposed boreholes/wells

Attachment 1 (a)



Attachment 2

Snap Sampler Well Cap

Features, Pricing, and Installation Instructions

- Snap Sampler Well Caps are available in 2-inch (5cm) and 4-inch (10cm) sizes and will fit most standard PVC well casings.
- Snap Sampler Well Caps are made of Delrin, a high-quality thermoplastic polymer—durable, resistant to chlorinated solvents, fuels, grease, ozone, and many other chemical classes.
- O-ring seals are made of Viton, a high-quality fluorocarbon elastomer—durable, long-lasting, ozone resistant, chemical resistant.
- The Well Cap base is securely attached with screws to the top of the PVC casing. The attachment screws are covered when the Cap is closed.
- Attaching screws are 410 stainless steel for corrosion resistance and magnetic to help avoid dropping.
- The Well Caps can be securely locked and can't be pulled off or out like other well caps available on the market.
- A post on the underside of the Cap can be fitted with an available eye bolt to hang equipment.
- A seat on the Well Cap base allows use of an available Dock Ring to hang equipment.
- Well head top-of-casing (TOC) elevation is leveled when the Well Cap is installed, allowing consistent depth to water measurements from any point on the circumference.
- Well elevation is leveled with installation of this cap. Elevation change can be measured without resurvey, or previous top of casing can still be used.
- Clearance required around the well casing is approximately 1 inch horizontally and 1.5 inches vertically.

Caps with Support Rings: $32 for 2" / $42 for 4"; Eye bolts: $2

Call to order (585) 385-0023

PROHYDRO, INC.
WWW.PROHYDROINC.COM WWW.SNAPSAMPLER.COM

http://www.prohydroinc.com/images/Well_Cap_Installation_Web.pdf

Attachment 2 (continued)

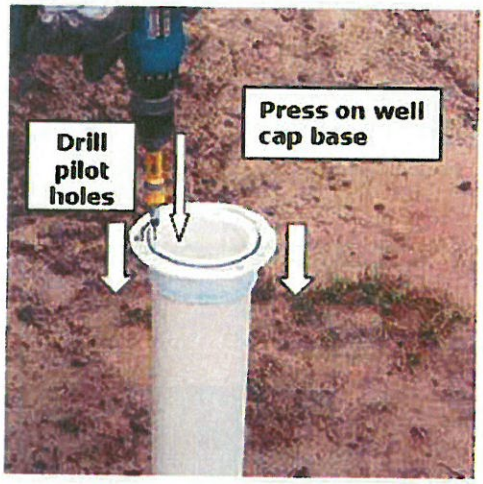
Installation Instructions

Snap Sampler Well Caps come with:

- **(1) White well cap base with o-ring**
- **(1) Blue well cap cover**
- **(3) attaching screws**
- **(1) loose o-ring to place on well casing**
- **Equipment support ring (optional)**
- **Eye bolt (optional)**

TO INSTALL:

> Clean outside of casing
> Place o-ring at top of casing



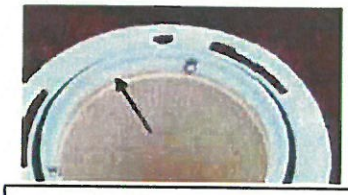
> Press well cap base onto wellhead

> Drill three (3) ***vertical*** pilot holes ***straight*** into center of casing wall using ***7/64" bit***

> *If top of casing is not level, **place one of the screw holes at the highest point of the casing.***

> ***Lightly*** tighten screws
DO NOT OVERTIGHTEN!

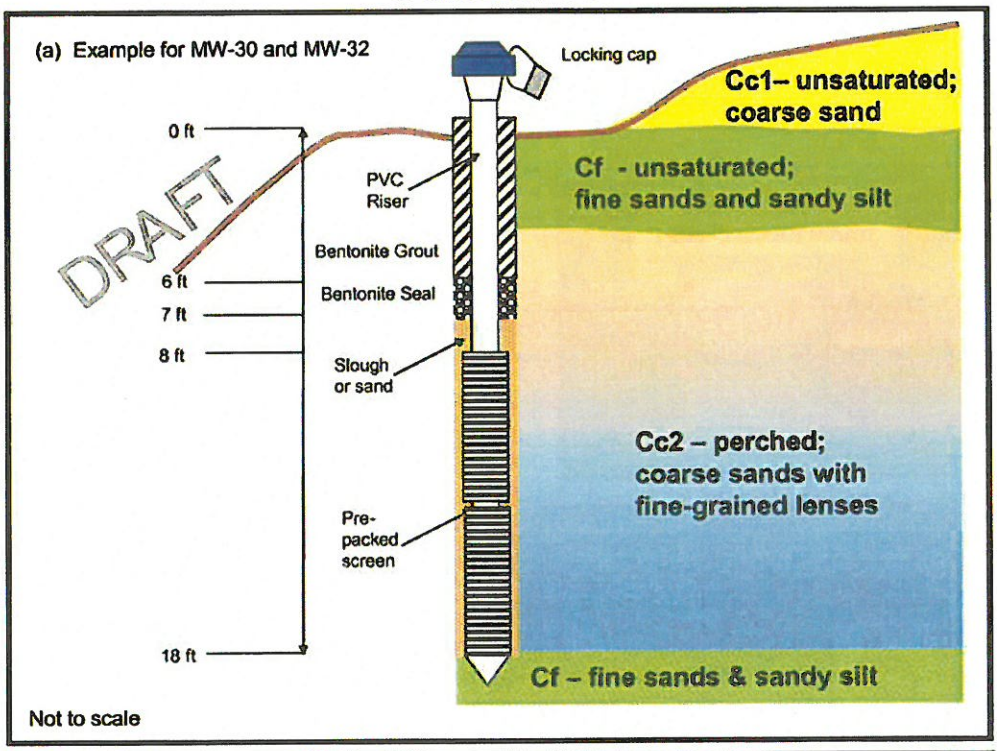
> ***If casing is not level, tighten only first screw at highest point on casing. Do not cinch down other screws***—tighten only to touch screw seat. Over-tightening will torque base and cap will not seal correctly; screw seat may crack.

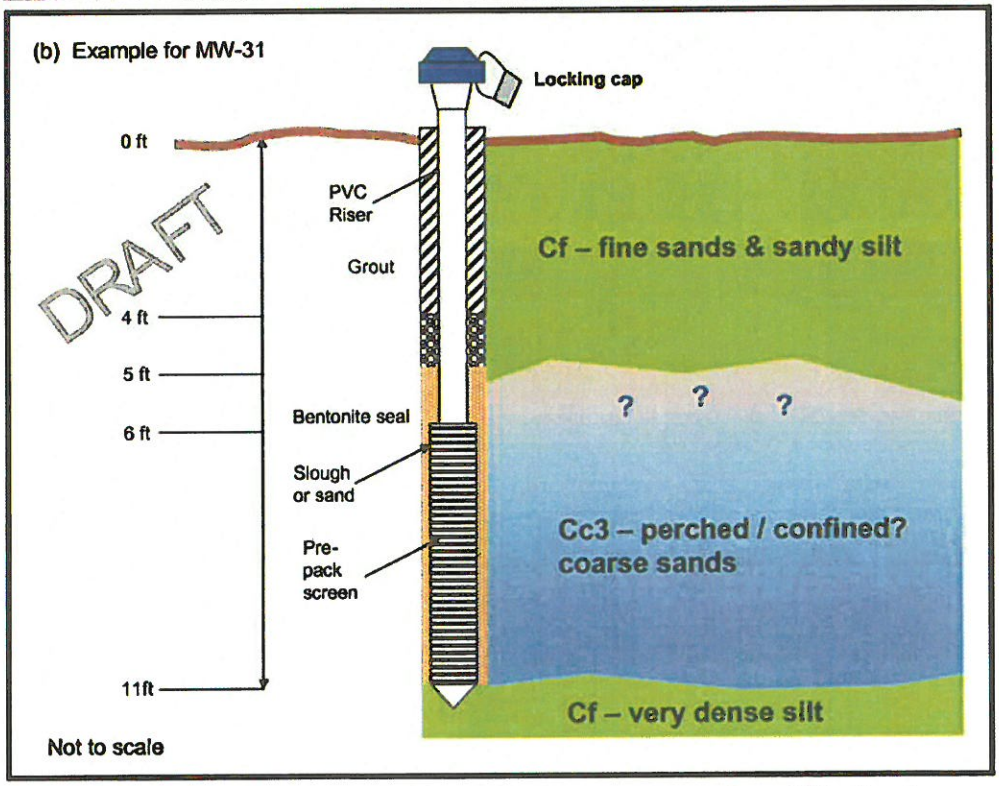


New top of casing measurement point will be level at approximately 0.03 ft (7mm) higher than high point on the casing

http://www.prohydroinc.com/images/Well_Cap_Installation_Web.pdf

Attachment 3





Note: These monitoring well designs are schematic and idealized.

B-2

Variance Request: Response Letter (sent from WA Department of Ecology)

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
Northwest Regional Office • 3190 160th Ave SE • Bellevue, WA 98008-5452 • 425-649-7000
711 for Washington Relay Service • Persons with a speech disability can call 877-833-6341

NOV 18 2009

Mr. Sevin Bilir
Environmental Scientist III
King County Water & Land Division for Solid Waste Division
200 South Jackson Street, Suite 700
Seattle, WA 98104

RE: Variance request for well construction on property located at 18910 Westside Highway SW, Vashon Island, WA, in the SW ¼ SW ¼ of Section 36, Township 23N, Range 02E.

Dear Mr. Bilir:

The Department of Ecology (Ecology) received your variance request on November 16, 2009, from WAC 173-160-420, which requires bollards, and a protective metal casing. You also request a waiver from WAC 173-160-450, requiring an annular space four inches greater than the well casing. Your variance request provides alternate construction and sealing specifications.

A variance is hereby **granted** in accordance with WAC 173-160-106 to construct the wells as you propose, provided:

1. The wells are constructed in the number, locations, and methods described in the variance request by someone licensed to drill resource protection wells in Washington State.
2. A Notice of Intent is submitted to Department of Ecology along with the required fees.
3. A Well Report is submitted within 30 days of well construction.

You have a right to appeal this decision. To appeal this you must:

- File your appeal with the Pollution Control Hearings Board within 30 days of the "date of receipt" of this document. Filing means actual receipt by the Board during regular office hours
- Serve your appeal on the Department of Ecology within 30 days of the "date of receipt" of this document. Service may be accomplished by any of the procedures identified in WAC 371-08-305(10). "Date of receipt" is defined at RCW 43.21B.001(2).

Be sure to do the following:

- Include a copy of this document that you are appealing with your Notice of Appeal.
- Serve and file your appeal in paper form; electronic copies are not accepted.

1. To file your appeal with the Pollution Control Hearings Board

Mail appeal to:		Deliver your appeal in person to:
The Pollution Control Hearings Board PO Box 40903 Olympia, WA 98504-0903	OR	The Pollution Control Hearings Board 4224 – 6th Ave SE Rowe Six, Bldg 2 Lacey, WA 98503

2. To serve your appeal on the Department of Ecology

Mail appeal to:		Deliver your appeal in person to:
The Department of Ecology Appeals Coordinator P.O. Box 47608 Olympia, WA 98504-7608	OR	The Department of Ecology Appeals Coordinator 300 Desmond Dr SE Lacey, WA 98503

3. And send a copy of your appeal to:

Andrew B. Dunn, LG, LHG
Department of Ecology
Northwest Regional Office
3190 160th Ave SE
Bellevue, WA 98008

For additional information visit the Environmental Hearings Office Website: http://www.eho.wa.gov. To find laws and agency rules visit the Washington State Legislature Website: http://www1.leg.wa.gov/CodeReviser

Your attention to these laws and regulations, and cooperation with the Department of Ecology in this matter is appreciated. Please telephone Noel S. Philip at (425) 649-7044 or email him at Noel.Philip@ecy.wa.gov if you have any questions concerning this variance.

DATED this 18th day of November, 2009, at Bellevue, Washington.

Sincerely,

Andrew B. Dunn, LG, LHG
Section Manager
Water Resources Program

ad/np/mc

By certified mail [7008 0150 0003 7623 6473]

cc: Noel S. Philip, NWRO WR

I certify that I mailed this Order, or an identical copy thereof, postage prepaid, to the above addressee(s) this 18th day of November 2009. Michele

B-3

Notice of Intent to Construct Monitoring/Resource Protection Well (sent to WA Department of Ecology)

WASHINGTON STATE DEPARTMENT OF ECOLOGY

Notice of Intent to Construct an Monitoring/Resource Protection Well

Notification Number RE04051

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

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

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

1. Property Owner	King County Water & Waste Division	Phone Number		
Mailing Address	200 S Jackson Street, Ste 7	City Seattle	State WA	Zip Code 98104
2. Agent (if different from above)	King County Solid Waste Divisio	Phone Number		
Mailing Address		City	State WA	Zip Code

3. Well Location

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

County Name					
King					
Well Site Street Address		City	State	Zip Code	
18910 Westside Hwy SW		Vashon Island	WA	98070	
Tax parcel number	¼ -¼ (within 40 acres)	¼ (within 40 acres)	Section	Township	Range
3623029009	SW	SW	36	23	2E

Latitude Degrees	Latitude Time min sec	Horizontal Collection Method
Longitude Degrees	Longitude Time min sec	

4. Approximate Start Date 12/14/2009 Project Name Vashon Island Closed Landfill & Transfer Station

5. Contractor L & I Registration Number

6. Well Drilling Company Name	ESN NORTHWEST	Phone Number (360)459-4670
7. Well Driller Name	DON HARNDEN	Driller License Number 2914

8. **Send the entire form.**

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

Total Number of wells to be constructed

Fee Amount: $40.00 per well

Total Number of wells = 3 x $ 40 each

Total Due and Amount Enclosed $120

This notification number must be provided to your driller:

RE04051

Print Form

Your Notice of Intent has been processed as of 11/19/2009. Your Cash Journal Validation Number is: 461J0788. This message being sent at (12/1/2009 3:50:56 PM)

Appendix C

Field Activity Forms

C-1 Resource Protection Well Report (sent to WA Department of Ecology)
C-2 Field Activty Sheets
C-3 Detailed Borehole and Well Construction Logs
C-4 Well Development Forms
C-5 Well Sampling Forms

Copy
Appen C-1

C-1

Resource Protection Well Report
(sent to WA Department of Ecology)

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE04051

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *("x" in box)*

☒ Construction

☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Consulting Firm King County

Unique Ecology Well IDTag No. APS 048 / MW-32

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Haraden, Don

Driller/Engineer /Trainee Signature

Driller or Trainee License No. 2914

If trainee, licensed driller's Signature and License Number:

Type of Well *("x in box)*

☒ Resource Protection

☐ Geotech Soil Boring

Property Owner King County Water & Waste Management

Site Address 18910 Westside Hwy SW

City Vashon Island

County King

Location SW1/4-1/4 SW1/4 Sec 36 Twn 23 R 02

EWM ☒ or WWM ☐

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Min _____ Sec _____

Long Deg _____ Min _____ Sec _____

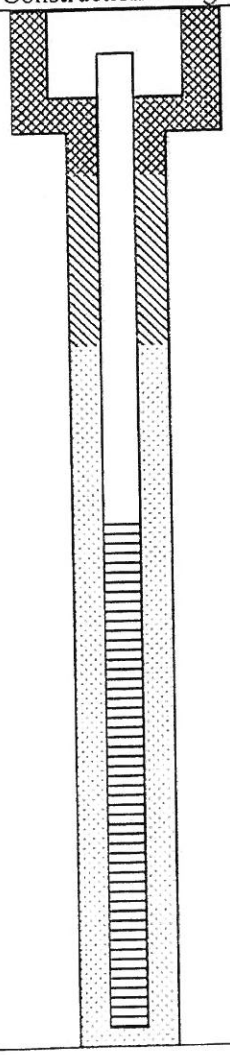
Tax Parcel No. 3623029009

Cased or Uncased Diameter 2" Static Level ~19' bgs

Work/Decommission Start Date 12-14-09

Work/Decommission Completed Date 12-14-09

Construction Design



Well Data

MONUMENT TYPE: N/A - Variance

CONCRETE SURFACE SEAL: N/A - Variance

ANNULAR SPACE: N/A

BACKFILL: 0-8'

TYPE: No. 8 Bentonite Chips

PVC BLANK: +2 - 10' bgs

SCREEN: 10-20'

SLOT SIZE: .010

TYPE: 2" Sched 40 PVC Prepack

SAND PACK: 8-20'

MATERIAL: 10/20 Silica Sand

DRILLING METHOD: Hand Auger

WELL DEPTH: 20'

BORING DIAMETER: 3.25"

Formation Description

0-2' SW/SP Fill - brown/tan

2-5' SM/SC med-coarse Sand w/ Silty Sand. Some fine gravel @ 5'. Wet @ 5'

5-10' SM/SC Silty Sand w/ silt Coarse gravel @ 9'. Iron stain @ 5-10'

10-16.5 SM - med Sand w/ some Silt, Fine Sand @ 13 Iron Stain @ 16. Damp to wet Zones 10-15'

16.5-20' SM - med - Coarse Sand Well sorted w/ tr. Pebbles Damp 16-18, moist 18-18½ wet 19-20

20' Bottom of boring.

SCALE: 1"= N/A PAGE 1 OF 3

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE04051

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission ("x" in box)

☒ Construction

☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Type of Well ("x in box)

☒ Resource Protection

☐ Geotech Soil Boring

Property Owner King County Water & Waste Management

Site Address 18910 Westside Hwy SW

City Vashon Island

County King

Consulting Firm King County

Unique Ecology Well IDTag No. APJ049 / MW-30

Location SW1/4-1/4 SW1/4 Sec 36 Twn 23 R 02

EWM ☒ or WWM ☐

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Min _____ Sec _____

Long Deg _____ Min _____ Sec _____

Tax Parcel No. 3623029009

Cased or Uncased Diameter 2" Static Level 4.65' bgs

Work/Decommission Start Date 12-14-09

Work/Decommission Completed Date 12-14-09

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee

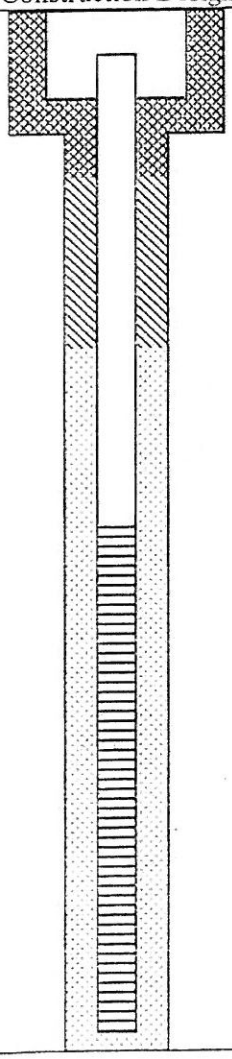
Name (Print Last, First Name) Harnden Don

Driller/Engineer /Trainee Signature _____

Driller or Trainee License No. 2914

If trainee, licensed driller's Signature and License Number:

Construction Design



Well Data

MONUMENT TYPE: N/A - Variance

CONCRETE SURFACE SEAL: N/A - Variance

ANNULAR SPACE: N/A

BACKFILL: 0-3

TYPE: No 8. Bentonite Chips

PVC BLANK: +1.2' - 4.02 bgs

SCREEN: 4.02 - 9.02' bgs

SLOT SIZE: .010

TYPE: 2" sched 40 PVC Prepack

SAND PACK: 3' - 9.02'

MATERIAL: 10/20 Silica

DRILLING METHOD: Hand Auger

WELL DEPTH: 9.02' bgs

BORING DIAMETER: 3.25'

Formation Description

0-2' SW/SP Fill/Tan

2-5' SM/SC med-coarse sand w/silty sand. Fine gravel @ 5'/wet @ 5'

5'-10' SM/SC silty sand w/silt Coarse Gravel @ 9'. Iron staining 6.5-10

Bottom of boring 11' bgs

SCALE: 1"= N/A PAGE 2 OF 3

Please print, sign and return to the Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE04051

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission ("x" in box)

☒ Construction

☐ Decommission

ORIGINAL INSTALLATION Notice of Intent Number:

Consulting Firm King County

Unique Ecology Well IDTag No. APS 050 / MW-31

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee

Name (Print Last, First Name) Harsden, Don

Driller/Engineer /Trainee Signature

Driller or Trainee License No. 2914

If trainee, licensed driller's Signature and License Number:

Type of Well ("x in box)

☒ Resource Protection

☐ Geotech Soil Boring

Property Owner King County Water & Waste Management

Site Address 18910 Westside Hwy SW

City Vashon Island

County King

Location SW1/4-1/4 SW1/4 Sec 36 Twn 23 R 02

EWM ☒ or WWM ☐

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Min _____ Sec _____

Long Deg _____ Min _____ Sec _____

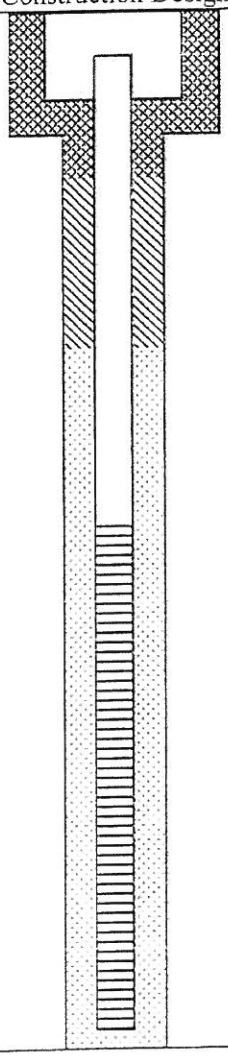
Tax Parcel No. 3623029009

Cased or Uncased Diameter 2" Static Level ~9.02' bgs

Work/Decommission Start Date 12-15-09

Work/Decommission Completed Date 12-15-09

Construction Design



Well Data

MONUMENT TYPE: N/A - Variance

CONCRETE SURFACE SEAL: N/A - Variance

ANNULAR SPACE: N/A

BACKFILL: 0-4

TYPE: #0 8 Bentonite Chips

PVC BLANK: +2-5' BGS

SCREEN: 5-10'

SLOT SIZE: .010

TYPE: 2" sched 40 PVC (Prepack)

SAND PACK: 4-10

MATERIAL: 10/20 silica

DRILLING METHOD: Hand Auger

WELL DEPTH: 10.2' bgs

BORING DIAMETER: 3.25"

Formation Description

0-3 SM/SC silty Sand & Sandy silt

3-6.5 SM silty Sand some med gravel starting @ 5'

6.5-9' SM Med - Coarse Sand w/ some fine sand lenses wet

9-11' SC Very fine Sand & silt moist

SCALE: 1"= N/A PAGE 3 OF 3

C-2

Field Activity Sheets

FIELD ACTIVITY SHEET

Project: KC Vashon LF West hillslope
Site: BH-32, BH-30
Arrival Time: 0730
Departure Time: 1545

Planned Activity: INSTALL MW's

Contractor: ESN NW

Date: 12/14/09
Weather: Rain, Overcast
Site Supervisor/Logger: BILIR
Personnel present: BILIR, SWOPE, KEATING, HARNDON

Health & Safety Talk? (Y) N Time: 0800

Equipment Calibration notes: AIR by Keating

TIME	ACTIVITY
0730	Arrive @ site
	Begin mobe equipment to BH-32
0745	Driller arrive early.
0800	SAfety talk.
0815	Mobe equipment to BH-32
	Prep Site (wait on Keating for AIR Sampling)
0930	Begin air quality Sampling
1200	BHTD @ 20' bgs
1230	WTD @ 20' bgs
	Instal slipcap (replaced by Snap lock cap)
1245	Mobe to BH-30
1300	Setup @ BH-30
1320	Begin air Sample: Auger @ BH-30
1430	BHTD @ 11.5' bgs
1500	WTD @ 8.8' bgs
	install screwcap (replaced w snaplock cap)
	cleanup Site
	Stop work
1520	driller leaves
1545	Leave site

FIELD ACTIVITY SHEET

Project: KC Vashon West Hillslope
Site: BH-31/MW-31/APJ-050
Arrival Time: 0845
Departure Time: 1220

Planned Activity: INSTALL MW-31

Contractor: ESN NW

Date: 12/15/09
Weather: Light rain/overcast
Site Supervisor/Logger: BILIR
Personnel present: BILIR, KEATING, HARNDON

Health & Safety Talk? (Y) N Time: 0900

Equipment Calibration notes: By KEATING (AIR)

TIME	ACTIVITY
0845	Arive site
0900	H+S talk. No issues.
0910	MOBE + PREP TO/AT BH-31
0945	Setup at BH-31
0950	Begin Air Sample + Auger
1040	EOH TD @ 10.5' bgs
1130	WTD @ 10' bgs
	Install Cap (replace 4" snap lock cap)
	Cleanup site
	Driller attach State ID tags to all Wells
1200	Stop Work - driller leaves
1220	Leave site

C-3

Borehole and Well Construction Logs

Department of Natural Resources & Parks
Water & Land Resources Division
Science & Technical Support Section

King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104

King County

Boring and Well Installation Log

Project name/Location: West KC Vashon Landfill Hillslope	Elevation: ~	Drilling Method: Stainless Steel AMS Hand Auger	BH-30 MW-30 APJ-049
		Sampling Method:	
Contractor: ESN NW		Hammer Wt: ~15 lb	
Driller: Don Harndon #2914		Date: 12/14/09	Page
Start Time 1300	Stop time: 1530	Logger: BILIR	1 of 1

Time	Moisture	Core Sample Recovery	Blows	Air Sampling	Depth In Feet	USCS Code	Notes	Well Construction Details
1320	Damp		Auger	20.6 O² 0 methane @BZ	1	SW/SP	FILL/SOIL; multi/variecolored, very loose, fine with medium sand	0
					2	SM/SC	MEDIUM-COARSE SAND with SILTY SAND, varicolored browns, rooting, red ironoxide stains	
1328			14	20.50² @BH 0 methane	3			2.8
			Auger		4		fine gravel @ 5'	3.8
	Moist			20.5 O² @C 0 methane	5	SM/SC	very fine-fine SAND with SILT brownish/gray; black organics, very dense	ATD
	Wet							
1339				20.70² @BH 0 methane	6			
				20.60² 0 methane (sample)	7		reddish brown organics & stains (6.5-8.5)	
					8			
1400				20.60² 0 methane (sample)	9	SM	MEDIUM-COARSE SAND; grayish-brownish-multicolored, very dense, reddish stains (8.5'-10')	2.8
					10			
				20.70² 0 methane (sample)	11			
1430								
1600					12		BHTD = 11.5' bgs	
					13		- snap lock well cap	
					14		- Stick up = 1.2' ags	
					15		- Bentonite pellets = 0-2.8' bgs	
					16		- pre packed screen = 3.8'-8.8' bgs	
					17		- 2" diameter PVC casing	
					18		- flat bottom screw cap	
					19		- borehole caved in = 8.8'-11.5' bgs	
					20		- supplemented 10/20 CO. Sil Sand	
							- Water level ATD = 5.85 BTOC	
							- well depth ATD = 10.21' BTOC	
							(on 12/22/09 DTW = 5.81' BTOC)	
							(on 1/26/10 DTW = 5.76' BTOC)	
							TOC = mark on snap cap	
							GS = wooden platform (top)	

Department of Natural Resources & Parks
Water & Land Resources Division
Science & Technical Support Section

King County

King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104

Boring and Well Installation Log

Project name/Location: Wash KC Vashon Landfill Hillslope	Elevation: ✓	Drilling Method: Stainless Steel AMS Hand Auger	BH-31 MW-31 APJ-050
		Sampling Method:	
Contractor: ESN NW		Hammer Wt: ~15 lb	
Driller: Don Harndon #2914		Date: 12/15/09	Page 1 of 1
Start Time 0945	Stop time: 1200	Logger: BILIR	

Time	Moisture	Core Recovery	Blows	Air Sampling	Depth In Feet	USCS Code	Notes	Well Construction Details
0950	Damp		Auger	20.7 O2, 0 methane @BH		SM/SC	SILTY SANDY SANDY SILT: 2.5Y 4/2 tanish/orangeish; light mica flecks, rooting, loose, med. dense, trace black oxide stains	
					1			
					2			
			14		3	- - -		
			Auger		4	SM	MEDIUM SAND w/ some fine sand variecolored, 2.5Y 7/2 light gray, mica flecks; fining down, red iron oxide stain (5'-6.5')	4
	Moist				5			5
					6			▼ 12/22/09
1000	▼ Wet		27	20.7 O2, 0 methane @BH	7		trace gravels at 6.5'	
			Auger			SM	FINE SAND w/ medium/coarse sand: bluish gray, coarse down, pebbles up to 1 cm (black 5Y 3/1), silty lens (<1cm w/ white quartz), red stains (6.5'-7.5')	0.010
					8			
					9	SC	Very fine sand - silt	▼ ATD
1040				20.8 O2 @BH, 0 methane	10			10
1130					11		BHTD = 10.5' bgs	
					12		-snaplock well cap - stick up = 2.08' ags - Bentonite pellets = 0'-4' bgs	
					13		-prepacked screen = 5'-10' bgs -2" diameter PVC casing	
					14		-flat bottom screw cap - supplemented 10/20 CO. SI sand	
					15		- water level ATD = 11.02' BTOC - well depth ATD = 12.275' BTOC	
					16			
					17		(on 12/22/09 DTW = 7.78 BTOC) (on 1/26/10 DTW = 7.91 BTOC)	
					18			
					19		TOC = mark on snap cap GS = top of wood platform	
					20			

Department of Natural Resources & Parks
Water & Land Resources Division
Science & Technical Support Section

King County

King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104

Boring and Well Installation Log

Project name/Location: KC Vashon Landfill West Hillslope	Elevation: ✓	Drilling Method: Stainless Steel AMS Hand Auger	BH-32 MW-32 APJ-048
		Sampling Method:	
Contractor: ESN NW		Hammer Wt: ~15lb	
Driller: Don Harndon #2914		Date: 12/14/09	Page 1 of 2
Start Time 0930	Stop time: 1245	Logger: BILIR	

Time	Moisture	Core Recovery	Blows	Air Sampling	Depth In Feet	USCS Code	Notes	Well Construction Details
0930	DAMP		Auger	20.7 O² @BH 0 Methane	0	SW/GP	SOIL/FILL; brownish tan, VERY loose	
	↓		↓		1			
	↓		↓		2	SM/SC	Medium-Coarse Sand with silty Sand; 10 YR 4/3 to 2.5 Y 5/4 brown to light olive brown; very loose	
	DRY		7		3			
			Auger		4			
0945	WET		↓	21.0² @BH 0 Methane	5		fine gravels @ 5	
	DAMP		↓		6	S/Y SC	Silty SAND w/ SILT; light brownish gray 2.5 Y 6/2, medium dense, loose; RUSTIRON oxide stains (6.5-10'), roofing (7.5-10')	
	↓		+50/4		7		- dark grayish brown fine sand (7.5-8')	
1002	↓		Auger	20.7 O² @BH 0 Methane	8		coarse gravel at 9'	
	↓		↓		9			
1015	MOIST		↓	20.7 O² @BH 0 methane	10	SM	MEDIUM SAND with some SILT, 2.5 Y 5/1 - 5/2 (gray - grayish brn) light gray MICA (9.5-12)	
	DAMP		+50		11			
	WET		Auger		12			
1035	DAMP WET		↓	20.0² @BH 0 Methane	13		V. FINE Sand @ 13' dense; 2.5 Y 5/2 grayish brown	0.010
	DAMP		↓		14			
1050	WET		↓		15		red iron oxide stain	
1115	DAMP		↓		16		↓	
	↓		+50		17	SM	Med-Coarse Sand; multicolored; V. dense, loose, well sorted; trace pebbles	
1120	↓ MOIST		Auger	20.7 O² 0 Methane @ Sample @ BH 17	18			
	↓ WET		↓		19			
1200	WET		+50	20.7 O² 0 Methane @ 19.75 @ Sample	20			
1230							BHTD = 20' bgs	

Department of Natural Resources & Parks
Water & Land Resources Division
Science & Technical Support Section

King Street Center, KSC-NR-0600
201 South Jackson Street, Suite 600
Seattle, WA 98104

King County

Boring and Well Installation Log

Project name/Location: Vashon Landfill KC West hillslope	Elevation: ✓	Drilling Method: SS AMS Hand AugeR	BH-32 MW-32 APJ-048
		Sampling Method:	
Contractor: ESN NW		Hammer Wt: ~15 lb	
Driller: Don HacNDON #2914		Date: 12/14/09	Page 2 of 2
Start Time 0930	Stop time: 1245	Logger: BILIR	

Time	Moisture	Core Recovery	Blows	Air Sampling	Depth In Feet	USCS Code	Notes	Well Construction Details
					1		Notes:	
					2		- Snap lock wellcap - Stick up = 1.99 ags - Bentonite Pellets 0-8' bgs - prepacked screen = 10-20' bgs - 2" diameter PVC casing - flat bottom screw cap - supplemented 10/20 Co. Sisand - water level ATD: dRY (moist tip) - well depth ATD = 21.89' TOC (on 12/22/09 DTW = DRY) (on 1/ 1/10 DTW =)	
					3			
					4			
					5			
					6			
					7			
					8			
					9			
					10			
					11			
					12			
					13			
					14			
					15			
					16			
					17			
					18			
					19			
					20		TOC = mark on snapCAP GS = top of wood platform	

C-4

Well Development Forms

1st Well Development

King County
Department of Natural Resources and Park

Hydrologic Services Group- WLRD
Field Data Sheet

Project:	Vashon West Hill Slope	Well Name:	MW-30 / APJ-049
Site Id:	MW-30	Sampling Method:	peristaltic pump w/clean tubing
Sampling Team Members	Sevin Bilir	Purge Method:	

Well Specifications

Hole Diameter d_h = 3.25"
Well Casing
Inside Diam d_wID = 2"
Water Level H = 6.0' BTOC
Depth of Well TD = 10.21' BTOC
TD-H = 4.21'

Purge Volume Calculations

Well Volume (ft3)= Vc= p(dwID/2)2(TD-H)= —
Vt = Vc * 7.482 gal/ft3 or Vt = (TD-H) * wcgf
4.21 * 0.163 = 0.69 gal
Minimum Purge Volume (gallons)=
Vp = Vt x 3 = 1/2 1.37 gal
Holding Tank Volume = N/A

Comments:
Water was cloudy with tan colored sediments.

BTOC (below top of casing)

Flow Rate:
1/4-1/2 total of pump

2009 Date	Time	Water Purged (gal)	Cumulative Water Purged (gal)	Cumulative Water Purged Well Vol	Water Characteristics pH	Conductivity (µ mhos/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (° Celsius)	Eh	Removed FT
12/30	1346	0	0	0	—	—	—	—	—	—	0
	1348	0.25	0.25	0.36	6.62	394	3.64	2.46	9.2	+17.7	—
	1352	0.25	0.5	0.72	6.6	282	51.4	2.52	9.6	+13.8	—
	1355	0.1	0.6	0.87	wait to	RISE /		DRY			3.7
	1405	1 FT		RISE							
	1416	2 FT		RISE							
	1427	3 FT		RISE							
	1428	0.2	0.73	1.06	7.08	396	27.8	3.85	8.5	-11.1	4.5
	1433	0.2	0.89	1.29	6.86	299	29.8	4.26	8.9	+0.5	5.5
	1440	0.2	1.05	1.53	6.82	278	45.5	5.13	9.0	+2.6	6.5
	1441	0.1	1.14	1.65							7
	DONE			1.74		(DRY)					7.35

Sampling Date:
Sample Number: N/A
Number of Sample Containers:
Preserve:
Analytical Laboratory: ~~King County Environmental Labs~~
Date Shipped: N/A
Carrier:

Atm Blank Y or N X
Sample Number:

Field Rep Y or N X
Sample Number:

WQ equipment calibration
1040 am
DO 99.7% @ 300'
Tu 6 5.8 / 5.36
Cond 1.23 @ 1920/1416
pH ✓

well casing diameter to gallons per foot of head: wcgf =
8 " = 2.637 6" = 1.468 4" = 0.653 3" = 0.367 2" = 0.163

1st Well Development

King County
Department of Natural Resources and Park

Hydrologic Services Group- WLRD
Field Data Sheet

Project: VASHON WEST HILLSLOPE	Well Name: MW-31 / APT-050
Site Id: MW-31	Sampling Method: Peristaltic pump w/ clean tubing
Sampling Team Members: Sevin Bilir	Purge Method:

Well Specifications

Hole Diameter d_h = 3.25"
Well Casing Inside Diam d_wID = 2"
Water Level H = 8.07' bTOC
Depth of Well TD = 12.275' bTOC
TD-H = 12.275 - 8.07 = 4.21'

Purge Volume Calculations

Well Volume (ft3)= Vc= p(dwID/2)2(TD-H)= ——
Vt = Vc * 7.482 gal/ft3 or Vt = (TD-H) * wcgf
4.21 * 0.163 gal/ft = 0.68 gal
Minimum Purge Volume (gallons)=
Vp = Vt x 2 = 1.37 gal
Holding Tank Volume = N/A

Comments:
Water was cloudy with tan colored sediments until last few minutes/foot of water removed.
bTOC (Below Top of Casing)

Flow Rate:
1/4 - 1/2 total of pump

2009 Date	Time	Water Purged (gal)	Cumulative Water Purged (gal)	Cumulative Water Purged Well Vol	pH	Conductivity (µ mhos/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (° Celsius)	Eh	Removal FT
12/30	1134	0	0	0	—	—	—	—	—	—	0
	1139	0.16	0.2	0.3	7.43	477	56.6	8.82	—	-15.6	1
	1145	0.4	0.6	0.9	6.95	377	370	5.66	—	-3.8	3.5
	1146	wait on water to rise 1 ft					(DRY)				
	1207	0.2	0.7	1.0	7.04	382	679	7.66	—	-57.9	4.5
	1211	wait on water to rise 1 ft					(DRY)				
	1238	0.2	0.9	1.3	7.17	370	298	8.57	8.6	-15.6	5.5
	1241	wait on water to rise 1 ft					(DRY)				
	1311	0.2	1.0	1.5	7.15	230	146	7.44	7.7	-14.5	6.5
	1313	DONE		1.7			(DRY)				7.2

Sampling Date:	Atm Blank Y or N X Sample Number:
Sample Number: N/A	Field Rep Y or N X Sample Number:
Number of Sample Containers:	
Preserve:	
Analytical Laboratory: King County Environmental Labs	WQ equipment calibrated 1040am DO 99.7% @ 300' Turb 5.81/5.36 Cond 1.23x@1420/1416 pH ✓
Date Shipped: N/A	
Carrier:	

well casing diameter to gallons per foot of head: wcgf =
8 " = 2.637 6" = 1.468 4" = 0.653 3" = 0.367 2" = 0.163

1st Well Development

King County
Department of Natural Resources and Park

Hydrologic Services Group- WLRD
Field Data Sheet

Project:	VASHON West Hillslope	Well Name:	MW-32 / APU-048
Site Id:	~~BAR~~ MW-32	Sampling Method:	Peristaltic pump clean tubing
Sampling Team Members	Sevin Bilir	Purge Method:	

Well Specifications			Purge Volume Calculations	
Hole Diameter	d_h =	3.25"	Well Volume (ft3)= Vc= p(dwID/2)2(TD-H)= Vt = Vc * 7.482 gal/ft3 or Vt = (TD-H) * wcgf	N/A
Well Casing Inside Diam	d_wID =	~~2"~~ 2"	Minimum Purge Volume (gallons)= Vp = Vt x 3 =	N/A
Water Level	H =	N/A		
Depth of Well	TD =	21.39' bTOC (below Top of Casing)	Holding Tank Volume =	N/A
Comments: Well (dry) no Reading on sounder. Moisture beads on wall.			**Flow Rate:** N/A	

2009 Date	Time	Water Purged (gal)	Cumulative Water Purged (gal)	Cumulative Water Purged Well Vol	Water Characteristics pH	Conductivity (µ mhos/cm)	Turbidity (NTU)	DO (mg/L)	Temperature (° Celsius)	Eh	FT Removed
12/30	1410	0	0	0	NO	WATER		(DRY)			0

Sampling Date:		Atm Blank Y or N Sample Number:	X
Sample Number:	N/A	Field Rep Y or N Sample Number:	X
Number of Sample Containers:			
Preserve:			
Analytical Laboratory:	***King County Environmental Labs***		
Date Shipped:	N/A		
Carrier:			

well casing diameter to gallons per foot of head: wcgf =
8 " = 2.637 6" = 1.468 4" = 0.653 3" = 0.367 2" = 0.163

C-5

Well Sampling Forms

KING COUNTY
SOLID WASTE DIVISION

VAGW (12)

used for MW-30, -31, and -32 on West Hillslope

VASHON GROUNDWATER SAMPLING FIELD RECORD

FIELD SAMPLING DATA

Well: VMW#30 / APJ-049
Casing Size: 2 inches
Screened Interva 5.2-10.2' below top of casing (BTOC)
Total Depth: 10.21' BTOC (marked)
Pore Volume: PV=(BotScrnTD-DTW=HtW)x0.163)
=(10.2-5.76=4.44)*0.163=0.73 g/pore vol (0.73g * 3.78 l/g ⇒ 2.7l

Date/Time: 01/26/10 0910
Weather: Overcast
Location: West Hillslope
Field Observations:
Stick up = 1.24" ags

HYDROLOGY MEASUREMENTS

DEPTH TO H_2O (FT)	ELEVATION	TOP PVC	TIME	DATE	METHOD USED
5.76' BTOC	n/a	n/a	0930	01/26/10	WLRD sounder

WELL EVACUATION

GALLONS	PORE VOLUMES	METHOD USED	DATE	TIME
~2.1	3	Peristaltic pump	01/26/10	1058

SAMPLE ID # WMV30100126 -

SAMPLE TYPE	DATE TIME	METHOD	VOLUME (mL)	CONTAINER TYPE	DEPTH TAKEN (FEET)	FIELD FILTERED (YES,NO)	PRE-SERVATIVE	ICED YES/NO
TSS	01/		✓1000	WM HDPE	✓10 BTOC	NO	NONE	YES
COND/ALK	26/		✓ 500	WM HDPE		NO	NONE	YES
TDS/TOTS	2010	Peristaltic pump w/ clean tubing	✓ 500	WM HDPE		NO	NONE	YES
NH_3/NO_3			✓ 250	WM HDPE		NO	NONE	YES
CL/SO_4	11:15		✓ 125	NM HDPE		NO	NONE	YES
TOC			✓2,40	AMBER GLASS		NO	H_3PO_4	YES
METALS, d			✓ 500	Acid Washed HDPE		✓ YES	NONE	YES
VOA			✓4,40	GLASS		NO	HCl	YES

LABEL THE DISSOLVED METALS BOTTLE "FIELD FILTERED" ✓

CONTROL BOX SETTINGS 10 / 14

FIELD WATER QUALITY PARAMETERS

INSTR. #		1562	3140044	1562	WLRD sounder		
Dieters SB	PORE VOLUMES	SPEC. COND. (µmhos/cm) ±10%	pH VALUE ±0.1	TEMP DEG. C	DEPTH TO WATER (feet)	TIME
CUM. gals						
0	0	started pump	--	--	5.76	0950
2.7 / 0.7	1	398	6.59	8.6	9.02	1003
2.7 / 1.4	2	378	6.65	7.9	10.32	1024
2.7 / 2.1	3	370	6.72	8.5	10.42	1055
8.1l /	4	BEGIN SAMPLE				
/	5	FINISH SAMPLE				
/	6					

KCSWD VASHON LF
ID VTRP100126R
Date 01/26/2010
Sampler SB

KCSWD VASHON LF
ID WV30100126-
Date 01/26/2010
Sampler SB

NOTES: INSTRUMENTS CALIBRATED TODAY PRIOR TO USE? YES ☒ TIME: 0915 (4,7) BUFFERS: VTRP DATE 01/22/10
VTRPs TURNED IN? YES ☒ NO ☐. VTRP1001 26 R
VTRP BUBBLES? YES ☒ NO ☐. BUBBLE DIAMETERS: 3 @ 3-4mm
NO QC BOTTLES

CUSTODY RECORD:

PERSONNEL	SIGNATURE	DATE/TIME
BILR	SB	01/26/10 11:45

Number of bottles in this set 12+3

Time it took to sample well: 2:35 hrs SB

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KING COUNTY
SOLID WASTE DIVISION

VAGW (12)

used for MW-30, -31, and -32 on West Hillslope

VASHON GROUNDWATER SAMPLING FIELD RECORD

FIELD SAMPLING DATA

Well: VMW#31 / APJ-050
Casing Size: 2 inches
Screened Interval 7.08 - 12.08 below top of casing (BTOC)
Total Depth: 12.27 BTOC (marked)
Pore Volume: PV=(BotScrnTD-DTW=HtW)x0.163)=gal *3.78=L

Date/Time: 01/28/10 1240
Weather: overcast
Location: West Hillslope
Field Observations:
Stick up= 2.5" =2.08' ags

((12.08-7.91) * 0.163] = 0.68 gal = 2.56 L

HYDROLOGY MEASUREMENTS

DEPTH TO H_2O (FT)	ELEVATION	TOP PVC	TIME	DATE	METHOD USED
7.91 BTOC	n/a	n/a	1300	01/28/10	WLRD sounder

WELL EVACUATION

GALLONS	PORE VOLUMES	METHOD USED	DATE	TIME
2 / ~9.2 / 2.43	~3.6	Peristaltic pump	01/28/10	1655

SAMPLE ID # WMV311001 28 -

SAMPLE TYPE	DATE TIME	METHOD	VOLUME (mL)	CONTAINER TYPE	DEPTH TAKEN (FEET)	FIELD FILTERED (YES, NO)	PRE-SERVATIVE	ICED YES/NO
TSS	01/		✓ 1000	WM HDPE	12' BTOC	NO	NONE	YES
COND/ALK	28 /		300/ 500	WM HDPE		NO	NONE	YES
TDS/TOTS	2010	Peristaltic pump w/ clean tubing	300/ 500	WM HDPE		NO	NONE	YES
NH_3/NO_3			✓ 250	WM HDPE		NO	NONE	YES
CL/SO_4	15:30		✓ 125	NM HDPE		NO	NONE	YES
TOC			✓ 2,40	AMBER GLASS		NO	H_3PO_4	YES
METALS, d			✓ 500	Acid Washed HDPE		✓ YES	NONE	YES
VOA			✓ 4,40	GLASS		NO	HCl	YES

✓ LABEL THE DISSOLVED METALS BOTTLE "FIELD FILTERED"

FIELD WATER QUALITY PARAMETERS

CONTROL BOX SETTINGS

INSTR. #			1562	3140044	1562	WLRD sounder		
liters / ~~gals~~	PORE VOLUMES		SPEC. COND. (umhos/cm)	pH <0.1 VALUE	TEMP DEG. C	DEPTH TO WATER (feet)	TIME	
0	0	started pump		--	--	7.91	1305	KCSWD VASHON LF ID VTRP100128T Date 01/28/2010 Sampler SB
~2.5	1		215	6.45	9.3	11.5	1315	...mp stroke (mL)
~2.5	2		233	7.02	9.3	dry	1404	
~1.5	3		245	7.0	9.0	dry	1455	KCSWD VASHON LF ID WV31100128- Date 01/28/2010 Sampler SB
	4	BEGIN	SAMPLE				1515	
~2.7	5	FINISH	SAMPLE			dry	1700	
	6							

NOTES: INSTRUMENTS CALIBRATED TODAY PRIOR TO USE? YES ✓ NO o. TIME: 1250 BUFFERS: (4.7) 10
VTRPs TURNED IN? YES ✓ NO o. VTRP1001 28T VTRP DATE: 01/26/10
VTRP BUBBLES? YES ☐ NO ☒ BUBBLE DIAMETERS: N/A
NO QC BOTTLES

CUSTODY RECORD:

PERSONNEL	SIGNATURE	DATE/TIME
BILIR	[signature]	01/28/10 17:30

Number of bottles in this set 12 +3

Time it took to sample well: ~5 hrs

Chain of Custody Record
Environmental Monitoring Program Date 01/26/10

King County — Department of Natural Resources and Parks — Solid Waste Division

№ 09680

Name: King County Solid Waste Division
Address: 201 South Jackson Street, Suite 701, Seattle, WA 98104-3855
Attention: Sendy P. Jimenez 206-296-4411
Authorization: KCEL Lab Services to KCSWD
Project Test Site: VAGW (12) West Hillslope

Project Site Test Reference (GROUNDWATER: 2–12; SURFACE WATER: 14–45, incl. HILL: 43–45; LEACHATE/WASTEWATER: 23–49, incl. PERMIT: 25–32)

Lab No.	Sample I.D.	Date	Time	CHGW Cedar Hills GW Qtly	CHGW-V C. Hills GW VOAs Only	CHGW-NP Cedar Hills GW-NonPotable	CHGW-OS C. Hills GW Offsite	CHGW-E Cedar Hills GW Eqpt Blank	CHGW-O Cedar Hills GW-OrthoP Blank	CFGW Cedar Falls GW Qtly	DUGW Duvall GW Qtly	ENGW Enumclaw GW Qtly	HOGW Hobart GW Qtly	HTGW Houghton GW Qtly	PUGW Puyallup GW Qtly	VAGW Vashon GW Qtly	CHSW-Q Cedar Hills SW Quarterly	CHSW-M Cedar Hills SW Monthly	CHSW-P Cedar Hills SW Permit	CHSW-P2 Cedar Hills SW South Lagoon	CHSW-A5 Cedar Hills Area 5 Top Deck	CFSW Cedar Falls SW Qtly	DUSW Duvall SW Qtly	VASW Vashon SW Qtly	VASW-1 Vashon Hillslope SW Qtly	VASW-2 Vashon Hillslope SW Qtly	VASW-3 Vashon Hillslope SW Qtly	CHLS-M Cedar Hills Leachate Mtly	CHTW Cedar Hills Truckwash	CHLS-P Cedar Hills L'chate Permit	ALLS Algona WW Permit	ENLS Enumclaw WW Permit	FALS Factoria WW Permit	SRTS Shoreline WW Permit	HTLS Houghton WW Permit	RELS Renton WW Permit	VALS-P Vashon Leachate Permit	VALS-Q / M Vashon Leachate Qtly/Mtly	CHSW-E Cedar Hills Emergency Spill	Number of Containers	Remarks
				2	3	37	38	41	50	5	6	7	8	9	10	12	14	15	16	46	42	17	18	21	43	44	45	23	24	25	26	27	28	29	30	31	32	34	49		
	WV30100126-	01/26 2010	1115													X																								12	
	VTRP100126R	01/22 2010	—																																					3	

Relinquished By Sampler	Date	Received By	Date
[signature]	1/26 2010		
Sampler Signature: Sevin Bilir		Signature:	
Sampler Printed Name: KCSWD	Time: 1345	Printed Name:	Time:
Company		Company	
Relinquished By:	Date:	Received By: [signature]	Date: 1/26/10
Signature:		Signature: Lynne Cox	
Printed Name:	Time:	Printed Name: KCEL	Time: 1345
Company		Company	

Observations/Comments/Special Instructions:

Total # of Bottles: 15

Instructions:
1. Complete in ballpoint pen. Draw one line through errors and initial.
2. Receiving lab is to sign in the shaded box.
3. Check off pre-printed Project Site Test Reference to be performed for each sample, or provide specific instruction if not listed.
4. KCSWD personnel are to retain white and canary pages, receiving lab is to keep pink and goldenrod pages.
5. If KCSWD personnel request, please provide a name and telephone number of your contact person.

0498 (Rev. 3/' Distribution: White and Canary – KCSW' Pink and Goldenrod – Receiving Laboratory

Chain of Custody Record

Environmental Monitoring Program Date 01/29/10

King County — Department of Natural Resources and Parks, Solid Waste Division

№ 09679

Name: King County Solid Waste Division

Address: 201 South Jackson Street, Suite 701, Seattle, WA 98104-3855

Attention: Sendy P. Jimenez 206-296-4411

Authorization: KCEL Lab Services to KCSWD

Project Test Site: VAGW (12) West Hillslope

Project Site Test Reference

Lab No.	Sample I.D.	Date	Time	CHGW Cedar Hills GW Qtly 2	CHGW-V C. Hills GW VOAs Only 3	CHGW-NP Cedar Hills GW-NonPotable 37	CHGW-OS C. Hills GW Offsite 38	CHGW-E Cedar Hills GW Eqpt Blank 41	CHGW-O Cedar Hills GW-OrthoP Blank 50	CFGW Cedar Falls GW Qtly 5	DUGW Duvall GW Qtly 6	ENGW Enumclaw GW Qtly 7	HOGW Hobart GW Qtly 8	HTGW Houghton GW Qtly 9	PUGW Puyallup GW Qtly 10	VAGW Vashon GW Qtly 12	CHSW-Q Cedar Hills SW Quarterly 14	CHSW-M Cedar Hills SW Monthly 15	CHSW-P Cedar Hills SW Permit 16	CHSW-P2 Cedar Hills SW South Lagoon 46	CHSW-A5 Cedar Hills Area 5 Top Deck 42	CFSW Cedar Falls SW Qtly 17	DUSW Duvall SW Qtly 18	VASW Vashon SW Qtly 21	VASW-1 Vashon Hillslope SW Qtly 43	VASW-2 Vashon Hillslope SW Qtly 44	VASW-3 Vashon Hillslope SW Qtly 45	CHLS-M Cedar Hills Leachate Mtly 23	CHTW Cedar Hills Truckwash 24	CHLS-P Cedar Hills L'chate Permit 25	ALLS Algona WW Permit 26	ENLS Enumclaw WW Permit 27	FALS Factoria WW Permit 28	SRTS Shoreline WW Permit 29	HTLS Houghton WW Permit 30	RELS Renton WW Permit 31	VALS-P Vashon Leachate Permit 32	VALS-O/M Vashon Leachate Qtly/Mtly 34	CHSW-E Cedar Hills Emergency Spill 49	Number of Containers	Remarks
	WV31100128-	01/28 2010	1530													X																								12	
	VTRP100128T	01/26 2010	—																																					3	

Groundwater: columns 2–12; Surface Water: columns 14–45 (HILL: 43, 44, 45); Leachate/Wastewater: columns 23–49 (PERMIT: 25–32).

Relinquished By Sampler	Date	Received By	Date
Sampler Signature: Sevin Bilir	1/29 2010	Signature	
Sampler Printed Name: KCSWD (Company)	Time 0740	Printed Name / Company	Time
Relinquished By	Date	Received By: [signature]	Date 1/29/10
Signature		Signature: Benjamin Mendoza	
Printed Name / Company	Time	Printed Name: King County Env. Lab (Company)	Time 0740

Observations/Comments/Special Instructions:

Total # of Bottles: 15

Instructions:

1. Complete in ballpoint pen. Draw one line through errors and initial.
2. Receiving lab is to sign in the shaded box.
3. Check off pre-printed Project Site Test Reference to be performed for each sample, or provide specific instruction if not listed.
4. KCSWD personnel are to retain white and canary pages, receiving lab is to keep pink and goldenrod pages.
5. If KCSWD personnel request, please provide a name and telephone number of your contact person.

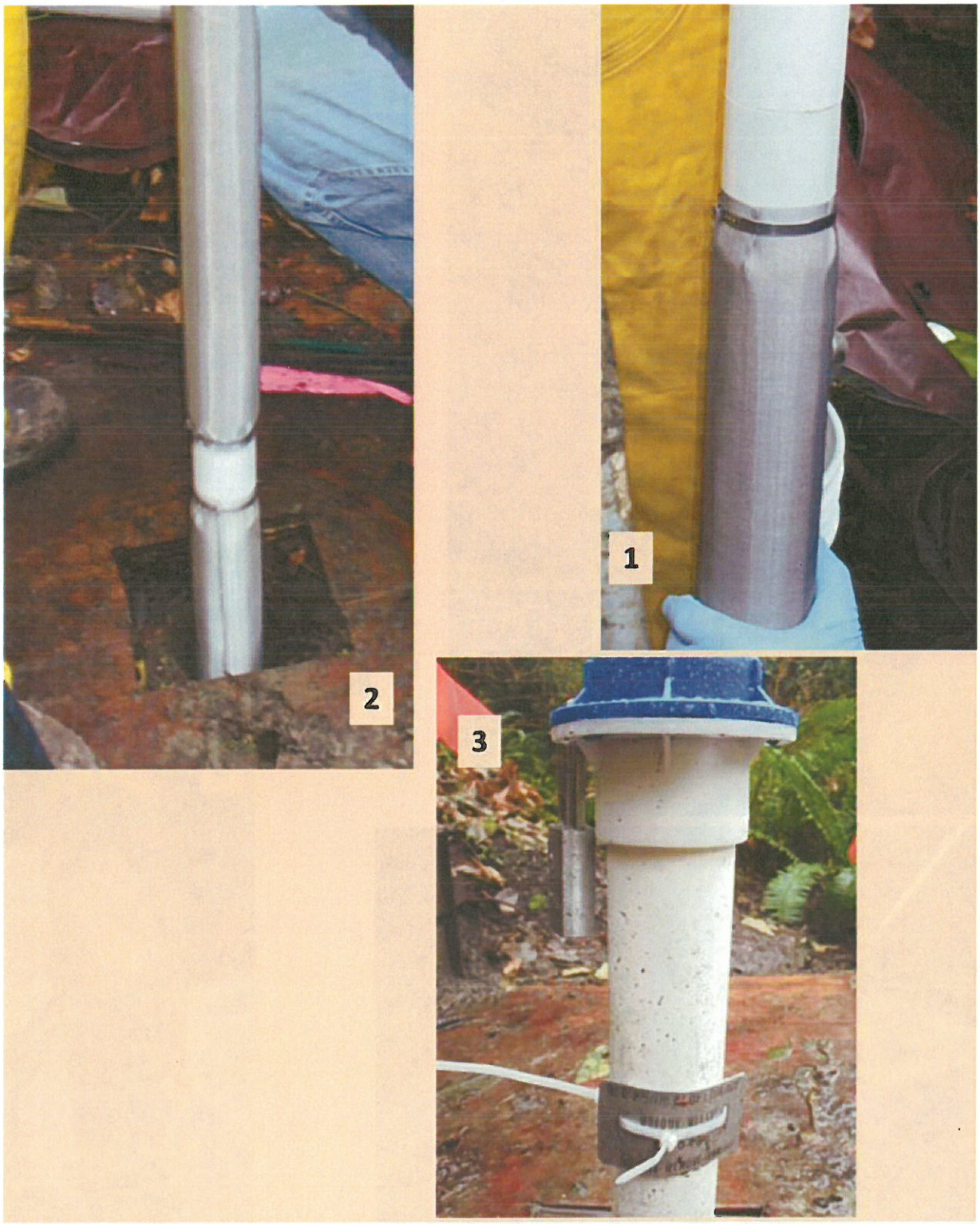
0498 (Rev. 3/09)

Distribution: White and Canary – KCSWD Pink and Goldenrod – Receiving Laboratory

Appendix D.3

Well Installation Pictures

(1) Hand augering through platform access hole (2) Removing coring sediments (3) Saturated sediments in auger bit (4) Driller using soil sampler



(1) Pre-packed screen around 0.010-inch slots on 2-inch PVC tubing (2) Placing two five-foot pre-packed screens (and 0.010-slots) into borehole (3) Well locking cap, lock and state well tag.

(1) Well MW-30 ; DOE Well tag # APJ-049 (2) Well MW-31; DOE Well tag # APJ-050. Both pictures show augering platforms, wastewater discharge bucket, and auger sediment cuttings in plastic wrapping. Wells are locked with locking caps and locks.

(1 & 2) Well MW-32 ; DOE Well tag # APJ-048. Pictures show augering platforms, wastewater discharge bucket, and auger sediment cuttings in plastic wrapping. Well is locked with locking caps and locks.