B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR) Addendum 1

Phase 1 Part 1 Remediation Design Report

Barrier Wall and Interceptor Trench

Appendix 1J
Performance Monitoring Plan

FINAL

B&L Woodwaste Site
Pierce County, Washington

Engineering Design Report (EDR) Addendum 1: Appendix 1J

Performance Monitoring Plan (PMP) Phase 1 Part 1 Cleanup Action

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1.0 Introduction

This Phase 1 Part 1 Performance Monitoring Plan (PMP) has been prepared to document plans for performance and hydraulic monitoring that will be performed following construction of the barrier wall and interceptor trench system. These remedial measures are key components for implementation of the 2008 Cleanup Action Plan (CAP) for the B&L Woodwaste Site (Site). Performance monitoring will be performed to assess the overall performance of the remedy components to confirm that they are performing as designed. The 2008 CAP is being implemented pursuant to Consent Decree No. 08-210610-7 and in accordance with the Scope of Work appended to the Decree. The implementation approach for the 2008 CAP is described in the Groundwater Remediation Work Plan (GRWP; Floyd|Snider/AMEC 2008).

The goals of this PMP are to establish performance standards and performance tests to evaluate performance of the Phase 1 Part 1 remedy components, which include the barrier wall and interceptor trench system. PMP performance standards will be used to evaluate performance based on data collection activities described in the Construction Quality Assurance Plan (CQAP; Appendix 1G) and in this PMP. In addition, this PMP establishes the monitoring network of piezometers and staff gauges and the program for monitoring water levels inside and outside of the barrier wall that will surround the Landfill. This monitoring network will also be used to monitor hydraulic containment of the full remedy described in the 2008 CAP. The hydraulic monitoring network described in this PMP will be used to collect hydrogeologic baseline and design data for future remedy components.

As work proceeds for implementation of the 2008 CAP, additional performance monitoring will be conducted to address construction of additional remediation components. The in-situ remediation program for the End-of-Plume Cleanup Action Area (CAA) will include a specific performance monitoring program to be described in the EDR Addendum 2. A Phase 2 performance monitoring plan will be included with the design for the groundwater extraction and treatment systems in the EDR Addendum 3. Phase 2 performance monitoring will assess the effectiveness of the complete Landfill hydraulic control remedy (i.e., the barrier wall, interceptor trench system, and groundwater extraction system) to control groundwater discharge from the contained and wetlands areas. After performance monitoring for the full remedy specified in the 2008 CAP has been completed, a comprehensive, long-term compliance monitoring plan will be prepared to address groundwater quality and hydraulic monitoring associated with the Site. The long-term compliance monitoring program will be documented in the Operation, Monitoring, Inspection, and Maintenance Plan (OMI&MP) to be prepared after completing Phase 2 construction.

1.1 PHASE 1 PART 1 PERFORMANCE MONITORING OBJECTIVES

This PMP establishes specific metrics by which the performance of Phase 1 Part 1 elements will be assessed. In addition, the PMP will establish a network of piezometers for hydraulic monitoring purposes, and initiate hydraulic measurements of this network. Because the hydraulic containment system will not be completed during Phase 1, no performance standards will be applied to these measurements, which will instead be used to characterize the

hydrogeologic response to the barrier wall and interceptor trench and collect additional design data, as described below.

The barrier wall and interceptor trench systems are key components of the containment remedy specified in the 2008 CAP for the Landfill CAA. When combined with the hydraulic control and groundwater treatment systems that will be implemented during Phase 2 of the 2008 CAP implementation program, the Landfill CAA remedy will provide for the hydraulic control necessary to meet 2008 CAP performance criteria. The comprehensive Landfill CAA remedy will provide complete hydraulic control by establishing and maintaining inward hydraulic gradients across the barrier wall. During the period following Phase 1 Part 1 construction and before commencing Phase 2 groundwater extraction beneath the Landfill, the barrier wall will function as a passive, physical barrier to groundwater flow that will substantially reduce groundwater flow from the contained area.

After Phase 1 Part 1 construction is complete, measurements will be taken to characterize hydrogeologic system behavior in the absence of active hydraulic controls—that is, to characterize how the barrier wall affects groundwater flow near the Landfill without active groundwater recovery. Hydraulic monitoring will allow assessment of seasonal water-level variation, responses to major storm events, and the effect of the interceptor trench system on groundwater levels in the vicinity of the Landfill. These data objectives overlap with those of the Phase 2 Hydrogeologic Study, which is intended to evaluate the effects of the barrier wall and interceptor trench systems on the hydrogeologic regime and support design of the groundwater extraction systems that will be implemented in Phase 2. The work plan for the Phase 2 Hydrogeologic Study will be presented as part of the GRWP Addendum.

The goals of performance monitoring described in this PMP are to:

- evaluate barrier wall performance relative to a hydraulic conductivity performance standard,
- assess the performance of the passive and active interceptor trench system components based on system water levels and pump performance,
- evaluate infiltration pond performance.

The goals of hydraulic monitoring described in this PMP are to:

- collect data to be used for design of the groundwater extraction system,
- collect data to assess groundwater conditions in the vicinity of the barrier wall and landfill interior,
- collect data for design of the hydraulic control monitoring program to be implemented after startup of the groundwater extraction system,
- collect data to support development, in consultation with Ecology, of appropriate hydraulic performance standards for the Landfill CAA containment remedy.

1.2 PERFORMANCE MONITORING STANDARDS AND TESTS

The program described in this PMP will assess the effectiveness of barrier wall materials in limiting groundwater flow, the effectiveness of the interceptor trench system in redirecting groundwater flow, and the capacity of the infiltration ponds to transfer the redirected groundwater back into the subsurface. Phase 1 Part 1 performance standards and associated performance tests are described in this section.

1.2.1 Barrier Wall

Barrier wall performance will be assessed based on testing the hydraulic conductivity of the soil-bentonite mixture used for barrier wall construction. As noted in the EDR, the barrier wall performance specification is a hydraulic conductivity of 10^{-6} cm/sec, measured in representative samples in laboratory permeability testing, in accordance with the CQAP.

Since only passive containment components for the Landfill CAA remedy are being implemented in this phase of the project, hydraulic performance standards cannot be established for containment provided by the barrier wall. Instead, the results of Phase 1 Part 1 hydraulic monitoring will be used as part of ongoing hydrogeologic studies and provide design information for the Phase 2 components that will establish active hydraulic containment of impacted groundwater beneath the Landfill.

1.2.2 Interceptor Trench

The overall performance goal for the interceptor trench is to maintain groundwater levels on the upgradient side of the Landfill at levels that would have occurred in the absence of the barrier wall. The interceptor trench includes active and passive components designed to collect and redistribute groundwater to meet this goal. The performance of active and passive components will be assessed separately, as described below.

1.2.2.1 Passive Drain Performance

For the passive drain component, performance will be based on interconnection of the trenches and infiltration ponds. This interconnection will be evaluated based on the water levels on the upgradient side of the Landfill relative to the downgradient side, as measured during a performance test. The performance standard indicating adequate interconnection via the passive drains will be that the water levels measured in the lift stations and the related infiltration ponds will be within 0.1 feet at the time of the test. The passive drain performance test will be conducted when water levels in the lift stations are above the passive drain invert elevation (14 feet) but below the active drain invert elevation (16.5 feet), and pumps are not activated.

1.2.2.2 Active Drain Performance

For the active drain component, performance will be evaluated based on the ability of the pumps to achieve their rated capacity, as measured during a performance test. The

performance standard will be that the pumps are capable of achieving the rated capacity of approximately 30 gallons per minute (gpm) under test conditions designed to simulate high water conditions. The active drain performance test will be conducted by adding potable water to the lift stations until the pump sensors are triggered and pumping commences. If necessary, valves controlling the passive drain effluents from the lift stations will be closed to avoid draining to the interceptor trenches if potable water is added to the lift stations. Flow meter readings will be used to read pump flow rates and assess the performance standard.

1.2.3 Infiltration Ponds

The performance standard for the infiltration ponds is the combined infiltration rate for both ponds of 12.5 gpm as measured during a performance test. This standard is designed to assess whether the infiltration capacities of the ponds are sufficient to infiltrate water at the estimated rate of groundwater interception under normal wet-season conditions. This rate is based on the calculated maximum (wet season, based on November 2008 groundwater levels) flow of groundwater beneath the Landfill that would occur in the absence of the barrier wall; this is the quantity of groundwater that should be conveyed to the infiltration ponds by the interceptor trenches to avoid surface water impacts upgradient of the Landfill. (Refer to calculations provided in Appendix 1C for this groundwater flow estimate.) Combined infiltration rates for both ponds equal to or greater than this standard are expected to provide adequate infiltration capacity for intercepted groundwater under projected wet-season, non-flooding conditions.

The infiltration test will be conducted when water levels in the infiltration ponds are at an appropriate elevation (between approximately 15 and 18 feet NAVD 88), with sufficient volume in the ponds to allow for infiltration measurements to be conducted over a 24-hour period, and representative (positive) hydraulic gradients relative to groundwater downgradient of the ponds are present. This may require addition of large quantities of potable water to the infiltration ponds. Positive horizontal hydraulic gradients in the downgradient direction are expected to be the normal, non-flooding condition and are necessary for infiltration to occur. Large flood events have been observed, however, that cause water levels downgradient of the infiltration ponds to be equal to or higher than the water levels inside the ponds. The test will not be conducted during these flooding conditions.

At the start of the test, valves at outfalls into the ponds will be closed, and water-level measurements within the ponds will be manually recorded using the staff gauges. Water levels will be monitored over a period of time (approximately 6 to 24 hours) suitable for assessing the rate of infiltration. The volume of water lost (infiltrated and evaporated) in each pond at the end of the test will be calculated based on the water-level changes and shape of the ponds. The rate of water loss will be compared to the performance standard to assess infiltration performance for each pond.

2.0. Performance Monitoring Network

The Performance Monitoring Network consists of the Landfill perimeter and interior piezometers and the staff gauges to be installed in the infiltration ponds. This section provides descriptions of the piezometer network that will be used for hydraulic monitoring of the barrier wall prior to startup of the extraction and treatment systems. This piezometer network may be modified in the EDR Addendum 3 to address changed conditions and/or new information acquired during remedy implementation and to ensure the network is suited for long-term compliance monitoring of the remedy. The staff gauges/stilling wells that will be used for monitoring the infiltration ponds are also described in this section.

2.1. LANDFILL PERIMETER AND INTERIOR PIEZOMETERS

Eight clusters of piezometers will be installed at the Landfill perimeter and five piezometers will be installed in the Landfill interior. These clusters will include paired piezometers on both sides of the barrier wall to monitor hydraulic gradients across the barrier wall, and piezometers in the interior of the Landfill to monitor water levels beneath the multi-acre capped Landfill. Piezometers with deeper screened intervals will also be installed in areas with aquitard gaps to monitor the vertical hydraulic gradients in those locations. (Refer to Figure 1J.1 for the approximate location of the barrier wall alignment, identified aquitard gaps, and the piezometer network.)

2.1.1 Water Level Monitoring Depth Intervals

Because the Upper Sand Aquifer is not separated from the Lower Sand Aquifer in areas where the Lower Silt Aquitard is discontinuous, the following naming convention will be applied for performance monitoring purposes. Depths are based on hollow-stem auger (HSA) borings from the 2008 geotechnical investigation, which provide the most accurate characterization available for subsurface geology at the Landfill perimeter. HSA boring locations are shown on Figure 1J.1 (refer to the EDR Appendix B for results of the geotechnical investigation).

The depth interval corresponding to the Upper Sand Aquifer is referred to as the Upper Interval, and generally corresponds to depths of 0 to 22 feet below ground surface (bgs) measured from the Landfill perimeter road (19 to -3 feet NAVD88). Due to the undulating surface of the Lower Silt Aquitard, the depth of the Upper Interval varies with location. In areas such as the eastern side of the Landfill, the Upper Interval extends only as deep as 12 feet bgs (8 feet NAVD88). In areas such as the western side of the Landfill, the Upper Interval extends as deep as 32 feet bgs or -13 feet NAVD88.

The water-bearing unit at depths corresponding to the Lower Sand Aquifer is referred to as the Lower Interval, and occurs at depths below approximately 18 to 32 feet bgs (1 to -13 feet NAVD88) measured from the Landfill perimeter road. The depth of the Lower Interval varies based on variations in the depth of the Lower Silt Aquitard. Groundwater in the Lower Sand Aquifer typically has a greater head than groundwater in the Upper Sand Aquifer, which would cause upward flow to occur in areas where the aquitard is discontinuous.

2.1.1.1 Upper Interval Piezometers

The Upper Interval piezometers will be used to assess hydraulic containment within the Landfill CAA and to assess the effectiveness of the interceptor trench. It is also expected that Upper Interval piezometers will serve as regular monitoring locations and aquifer pumping test observation wells during Phase 2 Hydrogeologic Study data collection for extraction system design. When groundwater recovery commences and the containment system is complete, hydraulic containment will prevent contaminated groundwater in the Upper Interval beneath the Landfill from horizontally seeping beyond the limits of the barrier wall at the Landfill perimeter and from vertically seeping to the Lower Interval. As indicated in Section 1.2, it is expected that hydraulic containment will be demonstrated by inward hydraulic gradients in which the head measured outside the barrier wall is greater than the head measured inside the barrier wall after groundwater recovery within the contained area has commenced. During the interim monitoring period covered by this PMP, it is not expected that the paired Upper Interval piezometers will demonstrate hydraulic containment.

To provide for head measurements that will allow comparison of conditions inside and outside the barrier wall and assessment of inward hydraulic gradients within the Upper Interval, 16 piezometers will be installed as pairs that will straddle the barrier wall. Refer to Figure 1J.1 for planned piezometer locations.) These 16 piezometers will be installed with the bottom of the screened intervals at the approximate base of the Upper Interval, as determined from the results of the geotechnical investigation (refer to EDR Appendix B). The exterior piezometers will also provide information that will be used to assess the effectiveness of the interceptor trench and the infiltration ponds. Piezometer depth and construction details are presented in Section 2.2 and Table 1J.1.

To provide for head measurements that will allow monitoring of water levels in the interior of the landfill, five piezometers will be installed in the Upper Interval in locations representative of the interior of the Landfill. The locations of interior piezometers are also designed to support aquifer pumping tests anticipated as part of Phase 2 Hydrogeologic Study pre-design activities.

2.1.1.2 Lower Interval Piezometers

As noted above, hydraulic containment would prevent contaminated groundwater in the Upper Interval beneath the Landfill from leaking into the Lower Interval by maintaining upward vertical gradients beneath the Landfill. Where the Lower Silt Aquitard is present, the natural low-permeability layer, in conjunction with upward vertical gradient, would prevent contaminated groundwater from leaking into the Lower Interval. Where the Lower Silt Aquitard is absent, the upward flow of groundwater due to the upward hydraulic gradient would prevent downward migration of contaminants.

Historical data indicate that the natural, upward vertical gradients beneath the Landfill have protected Lower Interval groundwater in the vicinity of the Landfill, even in areas where the Lower Silt Aquitard is absent (Floyd|Snider 2007a and 2007b, Hydrometrics 2001). The Lower Interval must be monitored after construction of the barrier wall and interceptor trench system to confirm that the natural, upward gradients are maintained. Hydraulic monitoring under this PMP

will include continued measurement of the upward vertical gradients in the two areas of aquitard discontinuities.

Three piezometers will be installed to measure head in the Lower Interval. The three Lower Interval piezometers will be clustered with the paired piezometers completed in the Upper Interval at the locations identified with aquitard gaps, as shown on Figure 1J.1. The Lower Interval piezometers include PZ-8c at the eastern gap, and PZ-4c and PZ-5c in the southwest corner gap. These piezometers will be installed with screens extending downward from the elevation near the top of the Lower Interval, as based on the results of the geotechnical investigation (refer to EDR Appendix B). Piezometer construction details are provided in Table 1J.1 and in Section 2.2.

2.1.2 Piezometer Construction

Landfill perimeter and interior piezometers will be installed, developed, and surveyed following the procedures described in the GRWP (Floyd|Snider/AMEC 2008) and standard industry practice, except where noted. Piezometers located outside the barrier wall (PZ-1a through PZ-8a) will be installed between the barrier wall and the groundwater interceptor system components at a distance from the barrier wall that does not result in unacceptable hydraulic interference from barrier wall slurry. The location for the exterior piezometers will be outside the Landfill cap.

Due to the Site configuration (refer to Figure 1J.1 and Drawing C-13 in Appendix 1F), there is limited space for piezometer installation between the stormwater collection ditch/geomembrane anchor trench and the interceptor trench along the south and east sides of the Landfill, and the infiltration ponds on the north and west sides of the Landfill. Where the interceptor trench is present, the piezometers should be placed between the interceptor trench and the barrier wall. In most locations the width of the space available for exterior piezometer placement is 2–3 feet. In general, the exterior piezometers will be located immediately outside the stormwater collection ditch, which will provide about 5 feet of separation from the barrier wall. The exterior piezometers will be affected by the interceptor trenches or the infiltration ponds, depending on the piezometer location, but the piezometers should reflect the actual groundwater elevation outside the barrier wall for use in determining whether an inward-directed hydraulic gradient is present across the barrier wall.

Perimeter piezometers located inside the barrier wall (PZ-1b to PZ-8b, PZ-4c, PZ-5c, and PZ-8c) will be located within about 10 feet from the barrier wall. Interior piezometers will be completed with a PVC boot sealing the well monument to the Landfill cap PVC geomembrane, as shown on Drawing N-2 in Appendix 1F.

As indicated in Table 1J.1, Upper Interval perimeter piezometers will be constructed with 10 feet of well screen, with the bottom of the screen located at the approximate base of the Upper Interval. This design is consistent with standard industry practice and is intended to serve the following objectives:

- Measurement of head that is generally representative of the Upper Interval. Multi-piezometer clusters (with up to 5-foot screens) within the Upper Interval indicate

some variability of head within the Upper Interval. Because the 10-foot screens extend over 40–50 percent of the Upper Interval thickness, they are expected to be sufficiently representative of the average head in the Upper Interval and well suited to assess horizontal gradients across the entire barrier wall depth.

- Measurement of head in the zone that is typically the most transmissive portion of the Upper Interval. Piezometer screens will be located in the generally coarser and more transmissive sand near the base of the Upper Interval, which accounts for most of the groundwater flow.

Screen lengths for Upper Interval interior piezometers may be adjusted upward from 10 feet to approximately 15 feet if necessary to span the Upper Interval. This adjustment is intended to provide maximum utility for aquifer pumping tests. (Refer to Table 1J.1.)

Lower Interval piezometers will be constructed with 5 feet of slotted PVC screen located at the approximate top of the Lower Interval. This screen depth is consistent with the goal of assessing head in the area of greatest concern for containment—immediately below the Upper Interval. The head at this depth interval represents hydraulic conditions at the interface between the Upper and Lower Intervals.

Piezometer construction details are illustrated in Figure 1J.2. Perimeter piezometers will be constructed with 2-inch diameter well casings and 0.020-inch machine-slotted PVC well screens. Interior piezometers will be constructed of 4-inch diameter well casings with 0.020-inch continuous-wrap or machine-slotted PVC well screens. The top-of-casing elevation and the piezometer location will be surveyed by a licensed surveyor after installation is complete.

2.2 INFILTRATION POND STAFF GAUGES

The performance of the infiltration ponds will be assessed by tracking the water elevation in the two infiltration ponds during infiltration pond performance testing. Water elevation in the infiltration ponds will be tracked by manually reading the staff gauges that will be installed in each of the infiltration ponds. If it is determined to be appropriate, transducers may be installed within the staff gauge stand pipes to allow downloading of water-level data. Transducer measurements will be used to supplement monthly manual measurements and may be removed following the attainment of specific data objectives. The staff gauges will consist of 6-inch diameter Schedule 40 PVC stand pipes installed as shown on Drawing C-14 (refer to EDR Addendum 1, Appendix 1F). The staff gauges will be seated in the riprap present in the bottom of the infiltration ponds and will be supported by the walkway located above each trench. The exterior of the stand pipe will be marked with graduations at intervals of 0.1 feet, with number labels at every foot marking. The top of the stand pipe will be surveyed for elevation so that the true water elevation can be determined by measurement of the depth to water. Water levels in existing monitoring wells and staff gauges downgradient of the infiltration ponds will be measured as needed to measure horizontal hydraulic gradients and confirm that non-flooding conditions are present at the time of the test. The staff gauges will also be used during future operations to monitor the water level in the infiltration ponds.

3.0 Performance Monitoring Program

This section decribes the Performance Monitoring Program, which is designed as a discrete monitoring period to assess the performance of Phase 1 Part 1 remedy components. Hydraulic monitoring initiated under this program is expected to continue as part of a Phase 2 hydrogeologic monitoring program, to be presented in the GRWP Addendum. Separate performance monitoring programs to assess the performance of Phase 1 Part 2 and Phase 2 remedy components will be presented in subsequent addenda to the EDR during future phases of the implementation program for the 2008 CAP.

3.1 PERFORMANCE MONITORING

Performance monitoring will consist of the following:

- Evaluation of barrier wall permeability based on testing conducted under the CQAP.
- A passive drain performance test event for the interceptor trenches.
- An active drain performance test event for the interceptor trenches.
- An infiltration pond performance test event.

For hydraulic monitoring along the barrier wall, water-level measurements will be manually collected from Landfill perimeter piezometers using an electronic water-level indicator, from staff gauges by recording observed water levels, and by pressure transducers in selected locations for more frequent data collection, in accordance with the procedures described in the GRWP. Water-level measurements and transducer downloads will be coordinated with regular water-level measurements collected as part of ongoing hydrogeologic study data gathering activities and/or interim compliance monitoring.

To support evaluation of the short-term variability of the head inside and outside the barrier wall during storm events, pressure transducers will be installed in four representative clusters (Piezometers PZ-1, PZ-4, PZ-6, and PZ-8) and two infiltration pond staff gauge stilling wells. These piezometers selected for pressure transducers include Piezometer PZ-4c and PZ-8c which are screened in the Lower Sand Aquifer in the vicinity of the identified aquitard gaps. Transducer measurements will be used to supplement monthly manual measurements and may be removed following the attainment of specific data objectives. Data loggers associated with the transducers will be programmed to monitor water levels on an hourly basis. A barometric transducer will also be used to provide barometric compensation data. Where possible, existing transducers from other site monitoring locations will be relocated to the piezometers described in this PMP and used for hydraulic monitoring. The extent of transducer relocation will depend on the data needs of the Phase 2 Hydrogeologic Study, to be presented in the GRWP Addendum. Pressure transducers may be relocated to other hydraulic monitoring piezometers as appropriate, in consultation with Ecology.

3.2 PERFORMANCE MONITORING REPORTING

Performance monitoring results will be reported in a Phase 1 Part 1 Performance Monitoring Report following the completion of Phase 1 Part 1 performance monitoring. This report will provide an assessment of the performance of the barrier wall and interceptor trench systems relative to the standards described in this PMP.

3.3 PERFORMANCE MONITORING SCHEDULE

The barrier wall permeability testing will be conducted during construction, as described in the CQAP. The passive and active interceptor trench tests will be scheduled to take place soon after construction completion. The schedule for infiltration testing will depend on the water levels in the ponds and flooding conditions following construction. It is expected that this test will be completed in October, 2009.

Hydraulic monitoring will begin as soon as the piezometers and staff gauges have been installed and surveyed. The installation and surveying of the piezometers and staff gauges is planned in conjunction with construction of the Phase 1 major construction elements, including the barrier wall, interceptor trench, and stormwater pond. These elements, and transducer installation, are expected to be completed by October 2009. Hydraulic monitoring is, therefore, expected to begin in November or December 2009.

The Draft Phase 1 Part 1 Performance Monitoring Report will be completed within 90 days of the completion of all performance monitoring tests. The draft report is therefore expected to be completed by January 2010 and included with the Phase 1 Completion Report. This schedule will provide sufficient time for the results to be integrated into the EDR Addendum 3, expected to be completed in draft form in late 2010. The EDR Addendum 3 will include the design for the groundwater extraction and treatment components of the containment system and revisions to the Performance Monitoring Program and/or Network.

At the end of the Phase 1 Part 1 performance monitoring period, monthly water-level measurements of the Landfill perimeter and interior piezometers and staff gauges are expected to continue as part of ongoing measurements under the Phase 2 Hydrogeologic Study. Because several of the goals of the Phase 2 Hydrogeologic Study are shared with those of performance monitoring, the piezometers and staff gauges described in this plan may be added to the Phase 2 Hydrogeologic Study monitoring network at the completion of Phase 1 Part 1 performance monitoring. These shared goals include collection of baseline data for comparison of conditions prior to construction of the barrier wall and interceptor trench and following startup of the groundwater extraction system, collection of design data for the groundwater extraction system, and collection of design data for the Phase 2 Performance Monitoring Program. In addition to regular monitoring, the piezometer network described in this PMP will be used for aquifer pumping tests planned as part of the Phase 2 Hydrogeologic Study to support design of the groundwater extraction system. Phase 2 Hydrogeologic Study activities are expected to begin following the completion of Phase 1 major components and Ecology approval of the GRWP Addendum in the spring of 2010. The Phase 2 Performance Monitoring Program is expected to commence following the startup of the groundwater extraction and treatment systems, which is scheduled to be completed in December 2011.

4.0 References

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Engineering Design Report (EDR) Addendum 1: Appendix 1J

Performance Monitoring Plan (PMP) Phase 1 Part 1 Cleanup Action

Table

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Table 1J.1
Piezometer Installation Details

Piezometer ID	Approximate Total Depth (feet bgs)[1]	Approximate Screened Interval (feet bgs)[1]	Construction[2]
Upper Interval			
PZ-1a	22	12 - 22	2" diameter, 0.020-inch machine-slotted PVC screen
PZ-1b			
PZ-2a	22	12 - 22	
PZ-2b			
PZ-3a	28	18 - 28	
PZ-3b			
PZ-4a	30	20 - 30	
PZ-4b			
PZ-5a	24	14 - 24	
PZ-5b			
PZ-6a	17	7 - 17	
PZ-6b			
PZ-7a	22	12 - 22	
PZ-7b			
PZ-8a	15	5 - 15	
PZ-8b			
PZ-9	54	39 - 54	4" diameter, 0.020-inch continuous-wrap PVC screen
PZ-10	48	38 - 48	4" diameter, 0.020-inch machine-slotted PVC screen
PZ-11	51	41 - 51	
PZ-12	40	30 - 40	
PZ-13	37	27 - 37	
Lower Interval			
PZ-4c	37	32 - 37	2" diameter, 0.020-inch machine-slotted PVC screen
PZ-5c	35	30 - 35	
PZ-8c	25	20 - 25	

Notes:

1 Approximate total depth and screened interval depth are based on contact between Upper Sand Aquifer and Lower Silt Aquitard as determined by previous borings. Actual total depth and screened interval will be based on field confirmation of depth of contact between Upper Sand Aquifer and Lower Silt Aquitard. Where the Lower Silt Aquitard is absent, the approximate depth of the contact in nearby borings will be used.

2 Piezometers will be installed using hollow-stem auger or sonic drilling methods. Refer to Figure 1J.2 for additional piezometer construction information.

Abbreviations:

bgs Below ground surface
PVC Polyvinyl chloride

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Figures

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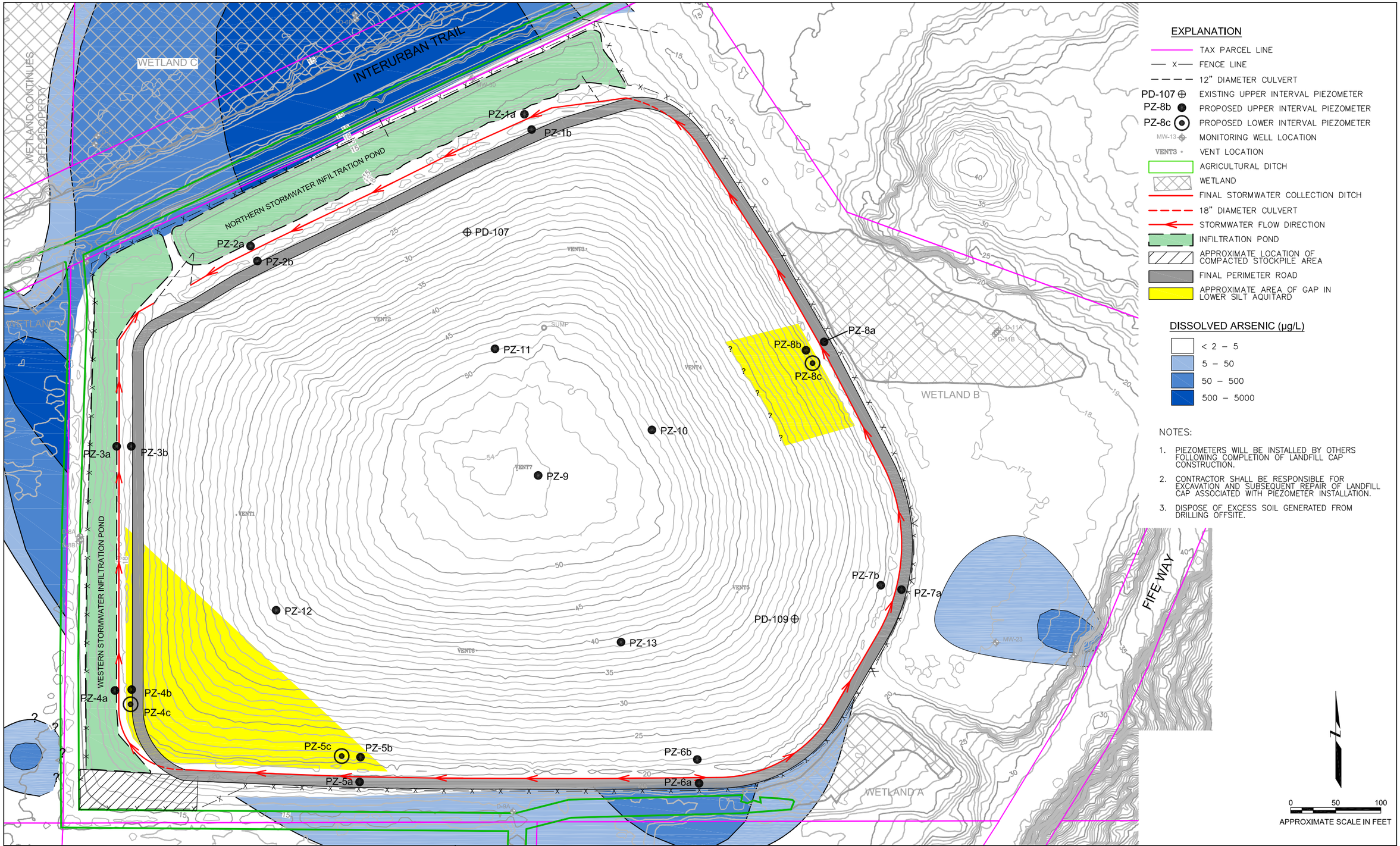

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ADDENDUM 1
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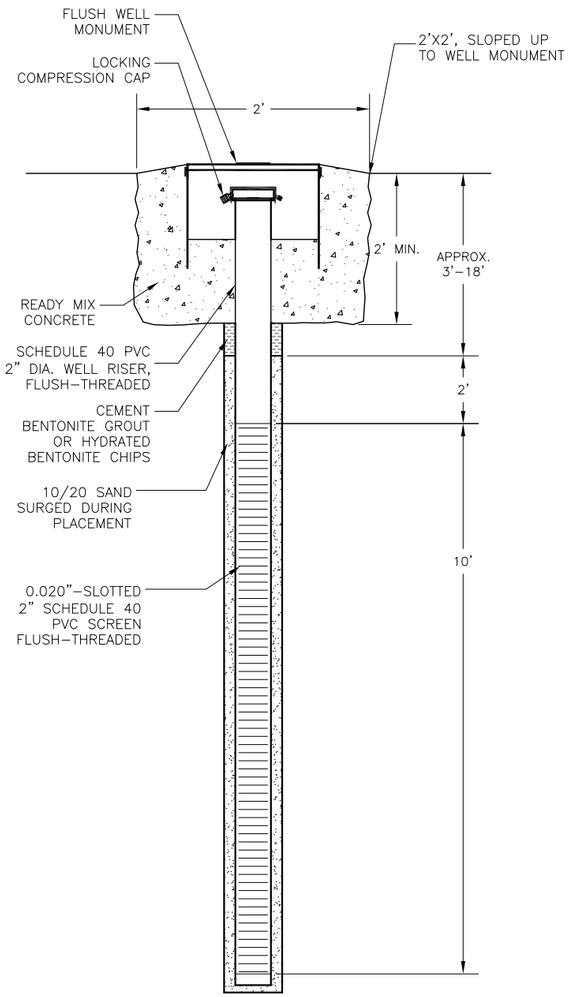
Figure 1J.1
HYDRAULIC MONITORING NETWORK PLAN

DWG NAME: S:\13488\005_EDR Report\FinalConstruction\DRAWING N-1_B-L_072809.dwg
DATE: 7/28/2009 9:44 AM

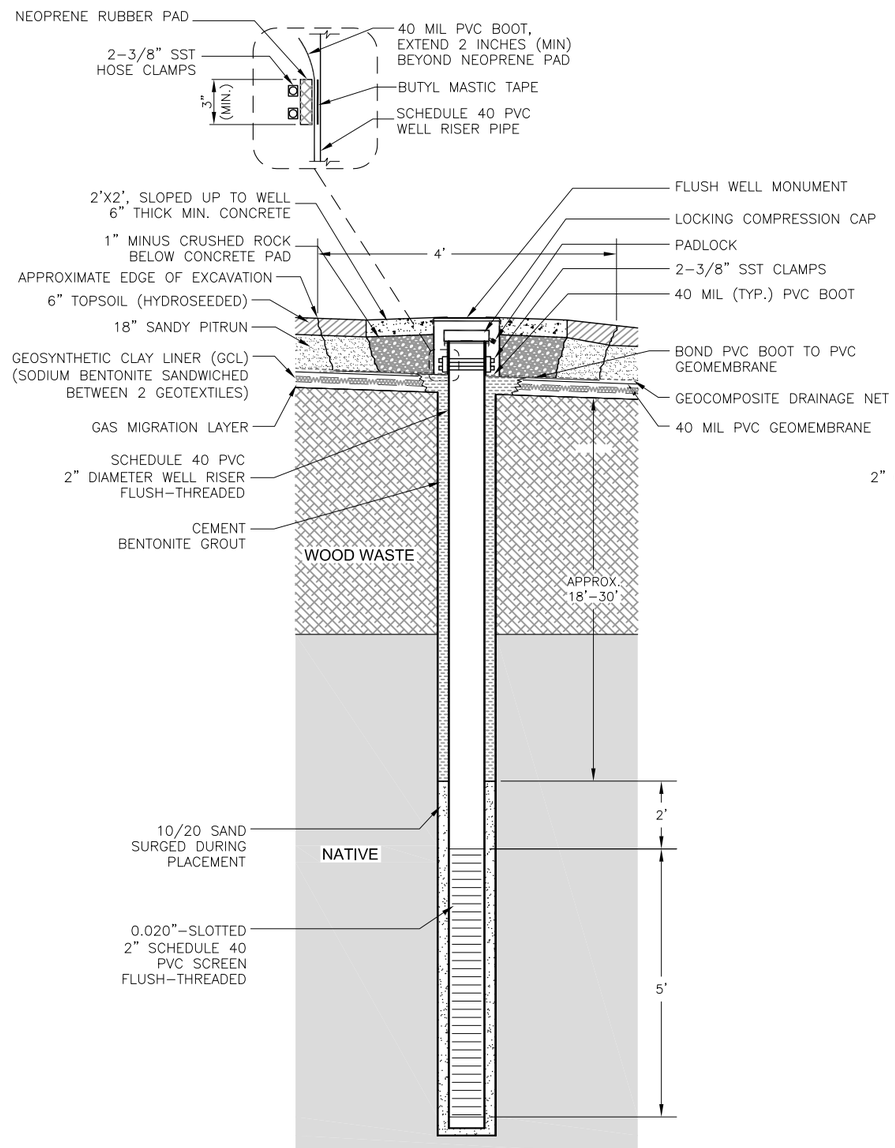
NOTES FOR PIEZOMETERS INSIDE BARRIER WALL

1. HAND–EXCAVATE THE COVER SOIL TO THE EXISTING GEOSYNTHETICS LAYER; APPROXIMATELY 2–FEET DEEP, AND 2–FEET DIAMETER.
2. CUT A 12–INCH DIAMETER OR SQUARE OPENING IN THE GEOSYNTHETICS LAYERS TO THE WOOD WASTE.
3. INSTALL PIEZOMETER AND GROUT THE ANNULAR SPACE UP TO THE GEOSYNTHETICS LAYER IN ACCORDANCE WITH STATE OF WASHINGTON WELL CONSTRUCTION STANDARDS.
4. ENLARGE EXCAVATION TO EXISTING GEOSYNTHETICS LAYER TO 4–FEET DIAMETER.
5. INSTALL A PVC BOOT OVER THE WELL WITH 18–INCHES OF (MIN.) OVERLAP WITH THE EXISTING PVC GEOMEMBRANE. CLEAN THE PVC SURFACES THOROUGHLY AND BOND THE BOOT TO THE GEOMEMBRANE PER THE MANUFACTURER'S RECOMMENDATIONS.
6. INSTALL STAINLESS STEEL HOSE CLAMPS AND MASTIC OVER THE BOOT ON THE WELL PER DETAIL.
7. INSTALL A STEEL, FLUSH, WELL MONUMENT IN GROUT. THE MONUMENT SHALL BE POSITIONED A MINIMUM OF 3–INCHES ABOVE THE GEOMEMBRANE. THE GROUTED AREA SHALL EXTEND AT LEAST 12–INCHES BEYOND THE MONUMENT IN EVERY DIRECTION.
8. BACKFILL THE REMAINDER OF EXCAVATION WITH THE COVER SOIL TO RESTORE TO ITS ORIGINAL CONDITION. ALTERNATIVELY, THE ENTIRE EXCAVATION MAY BE FILLED WITH GROUT.
9. WELL TO BE SURGED DURING PLACEMENT OF SANDPACK TO PREVENT VOIDS IN ANNULAR SPACE.
10. REFER TO TABLE 1J.1 FOR DIAMETER AND SCREEN MATERIALS FOR SPECIFIC PIEZOMETERS.



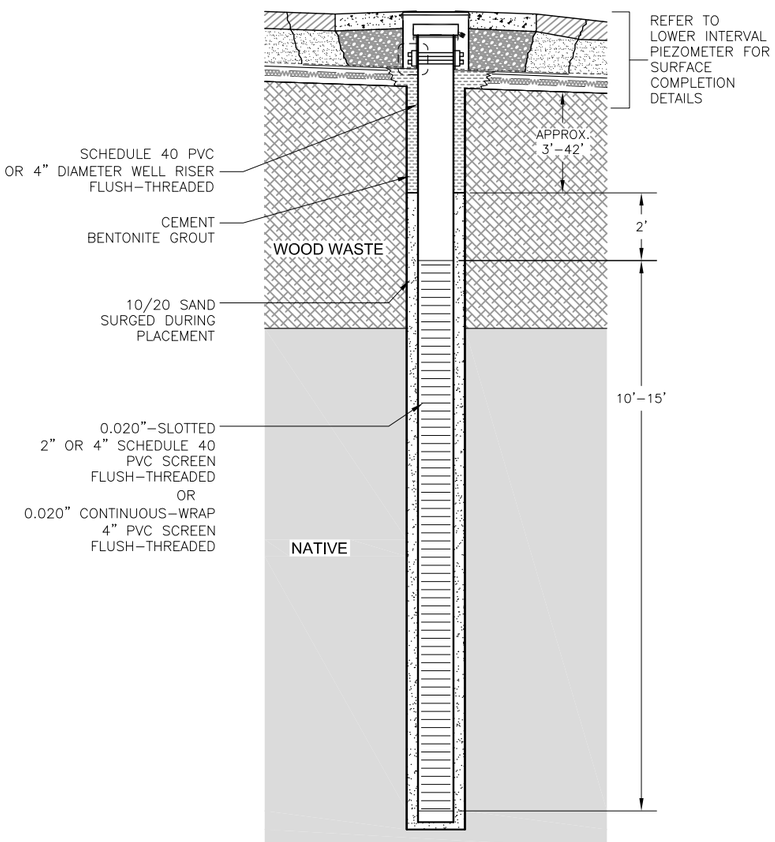
UPPER INTERVAL PIEZOMETER OUTSIDE BARRIER WALL

NOT TO SCALE



LOWER INTERVAL PIEZOMETER INSIDE BARRIER WALL

NOT TO SCALE



UPPER INTERVAL PIEZOMETER INSIDE BARRIER WALL

NOT TO SCALE

FLOYD | SNIDER
AMEC Geomatrix

ADDENDUM 1
B&L Woodwaste Site
Pierce County, Washington

Figure 1J.2

PIEZOMETER CONSTRUCTION DIAGRAMS

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